COST AND DEMAND ELEMENTS

IN THE

INFLATIONARY PROCESS.

by J.D.Pitchford, M.Com.(Tas.).

being a thesis submitted for the degree
of Doctor of Philosophy in the Austral-
ian National University.

Subject to the acknowledgements made no
part of the thesis was the result of
joint investigation.

A handwritten signature in cursive script, reading "Pitchford". The signature is written in dark ink and is positioned above the printed name.

J.D. Pitchford.

(i)

ACKNOWLEDGMENTS.

Professor T. W. Swan and Mr. H. P. Brown supervised my thesis and I gratefully acknowledge my debt to them. Dr. E. Hannan of the Statistics Department, Australian National University and Mr. B. S. Thornton of the Mathematics Department, New South Wales University of Technology both gave advice on the solution of my systems. I am also indebted to Professor J. E. Meade, who commented on an early draft of some of these chapters. Of course discussion with my colleagues in the Australian National University, the New South Wales University of Technology and the University of Tasmania has been of great assistance to me.

Sydney

4th August, 1958.

J. D. Pitchford.

(ii)

PRECIS.

In order to describe an inflationary process it is necessary to have some knowledge of how prices and wages are determined. Conventional economic theory has regarded prices (and wages) as reacting to the level of excess demand or supply in the commodity (labour) market. Investigations have shown, however, that especially in manufacturing industries prices are often determined by applying a profit margin to variable costs. Some wages are also "cost determined", as, for instance, in Australia where until recently the Commonwealth basic wage was adjusted quarterly to changes in the C. Series price index. A realistic analysis of inflation processes should allow for both cost and demand influences in price and wage determination.

The analysis of such a model reveals the fact that even if the system is stable prices may over - or under - shoot equilibrium in the course of an inflationary process. Only if wage earners' and profit earners' income claims (expressed through market mechanisms) are consistent (in the sense that if the claim of one group is, say, 59% of the national product then the claim of the other is 41%) will equilibrium be approached. Aggregate excess demand accompanied by excessive claims (e.g. 59% + 45%) will cause cost inflation in the sense in which I have used the term, and cost inflation results in prices rising to higher levels than would occur if claims were consistent. Towards the end of such a process excess supply will result un-

(iii)

less claims are reduced. Deficient claims accompanied by excess demand cause prices to rise to lower levels than would consistent claims, and these price rises would fail to wipe out the whole of the excess demand.

It would appear at first sight that these results would not hold if profit margins and wage adjustment coefficients (through which real income claims are expressed) were sensitive to excess demand and supply. Thus if profit margins fall when there is excess supply and rise when there is excess demand the only level of prices which can be maintained is the equilibrium level at which excess demand is zero. However, an analysis of the time path of a model possessing flexible claims suggests that in many cases an over-shoot of equilibrium will still take place (although the system eventually returns to equilibrium).

The problem of preventing inflation thus involves not only elimination of excess demand, but also control of claims. Conventional fiscal and monetary policies must then be accompanied by policies designed to reduce ex ante profit margins and wage margins.

The consistency of claims may be disturbed in an open economy, not only by spontaneous or induced changes in profit and wage margins, but as well by disproportionate changes in export and import prices and autonomous domestic demand. A rise in domestic demand with import and export prices unchanged when accompanied by excessive claims may be

(iv)

treated in much the same way as was recommended for the closed economy. A rise in trade goods prices, however, presents problems of a different nature. If domestic demand is manipulated in order to keep the domestic goods price level constant, income earners in these industries will suffer a fall in real income. Prices and wages in domestic goods industries are constant whilst trade goods prices rise. This fall in real income would almost certainly be undesirable and measures to prevent trade goods prices rising relative to domestic goods prices would need to be adopted in conjunction with anti-inflation policies.

(v)

CONTENTS

		<u>page</u>
	Acknowledgments	(i)
	Precis	(ii)
<u>Chapter</u>		
I	Introduction	1
	<u>Part A: The Closed Economy</u>	
II	Inflationary Processes in a Closed Economy	11
III	The Basic Model	19
Appendix A:	The Stability of the Basic Model	39
Appendix B:	The Two Price System	45
IV	Nine Models of Inflationary Processes	50
V	Flexible Profit Margins and Real Wage Claims	73
VI	Anti-Inflation Policy in a Closed Economy	85
	<u>Part B: The Open Economy</u>	
VII	Inflation in an Open Economy - I	97
VIII	Inflation in an Open Economy - II	115
IX	Problems of Policy in an Open Economy	122
	Select Bibliography	128

PART A.

THE CLOSED ECONOMY

CHAPTER I

INTRODUCTION

I take as the definition of inflation that given by Mr. Turvey in the Economic Journal.⁽¹⁾

"...inflation is the process resulting from competition in attempting to maintain total real income, total real expenditure and/or total output at a level which has become physically impossible or in attempting to increase any of them to a level which is physically impossible".⁽²⁾

This wide definition is useful in the discussion which follows for I wish to describe inflationary mechanisms in which excess demand may not play the major role. For this purpose an excess demand definition of inflation, such as that given by Lerner⁽³⁾ is inadequate.

The broad object of this thesis is to explore the mechanisms by which processes of price and wage increases may occur. It is thus essential to be able to formulate hypotheses about the way in which prices and wages are determined. Let us take, first of all, the problem of price determination.

-
- (1) R. Turvey, "Some Aspects of the Theory of Inflation in a Closed Economy." Economic Journal, September, 1951, pp. 534 and 535.
 - (2) Some of the inflationary processes which I shall discuss are not precisely covered by this definition. When there is a disagreement about shares of the national output an increased national product may not solve the problem. The relevance of this point will be apparent in Chapter III.
 - (3) A. P. Lerner, "The Inflationary Process", Review of Economics and Statistics, 1949, p. 194. He defines inflation as "an excess of demand over supply".

If we had precise knowledge of the ways in which businessmen determine their prices we could immediately write down a set of price functions and proceed with our inflation theory. Unfortunately there has not been sufficient conclusive empirical research to enable this to be done. Instead we must first examine the theoretical justifications for and empirical evidence of various types of price determination in order to decide what form our price functions should take. We shall find that there are at least three plausible hypotheses about price behaviour. Thus individual price levels may be determined by considerations of excess demand and supply (demand pricing, or a situation of flexible prices), by a formula based on the level of variable costs (cost pricing) or by some mixture of both demand and cost pricing.

Demand pricing requires prices to be rising whenever there is excess demand and to be falling whenever there is excess supply. Thus, provided the system considered is stable, prices will move so as to eventually make excess demand zero. It is not necessary that the adjustment to excess demand be instantaneous, but only that an adjustment of prices be always made whenever there is excess demand (or supply) and that such adjustment is in the direction necessary to reduce excess demand (or supply). In other words there may well be a lag in the response of prices to excess demand so that demand pricing does not imply a continuous equilibrium with excess demand zero. This, incidentally, means that we cannot take the existence of excess demand as evidence of a non-demand type of pricing.

Movement of prices towards an equilibrium with zero excess demand will be a feature of demand pricing. However, it will be shown in later chapters that cost determined prices

will usually rise (or fall) when there is general excess demand (or supply) in the rest of the system and in special circumstances will approach a level which equates demand and supply.⁽⁴⁾ Thus there appears to be nothing in the market behaviour of demand prices to always distinguish them from cost prices.

The motivation for demand pricing is generally cited as the desire for maximum profits. This argument is usually advanced on the basis of static models, and in such a context is unanswerable. However, if we allow for erratic short period changes in demand, and consider firms operating under some degree of imperfect competition, it may well be unwise for a firm to let its price move with every demand change, especially if many of such changes may be thought to be temporary. A firm in this situation may do better to keep its price fairly stable than to vary it with every change in demand, and thus avoid loss of custom to present or potential rivals. In this way it may maximise its profits over a given future period and profit more than if they were maximised at every point of time. Such a policy may result in a non-demand type of pricing.⁽⁵⁾

Although we have suggested that demand pricing may not be the most profitable policy in the short run this does not imply that it will be profitable for prices to remain out of line with demand and supply conditions for long periods. However our analysis is essentially of a short term nature and if our models are to include demand pricing it is thus

(4) See Chapters III, IV and V.

(5) For a discussion of these points see R.F. Harrod: The Theory of Imperfect Competition Revised, Economic Essays Macmillan & Co., 1952.

necessary to give reasons for some prices to be demand determined in the short run. Perhaps the best evidence for including some demand determined prices in our models is that in some markets it is clear that conditions are present making for an absence of control over prices by individual (or a group of) sellers or buyers. Non-demand pricing involves control over price whereas demand pricing will exist where price determination is left to market forces. This situation is approximated in the case of some primary products; these commodities being sold by a large number of sellers to a large number of buyers.

Empirical studies have shown that prices in some manufacturing industries appear to be determined by a formula based on variable costs.⁽⁶⁾ Thus these prices are arrived at by adding to variable costs a percentage allowance for profits and fixed costs. There have been suggestions that this percentage profit margin is sometimes constant, at least in the short run.⁽⁷⁾ Price determination by such a formula involving a fixed percentage profit margin shall be referred to as cost pricing.

I have already cited references to empirical research which appears to support the hypothesis that some prices are cost determined. Are there any arguments that may be used to reinforce this evidence? In the first place the argument

(6) R.L. Hall and J.H. Hitch: Price Theory and Business Behaviour, Oxford Economic Papers, No.2.

(7) R.L. Hall and J.H. Hitch: Ibid; P.W.S. Andrews: Manufacturing Business, Macmillan & Co., London, 1955; B.M. Cheek: "Economic Theory and Industrial Pricing", Economic Record, August, 1949.

previously mentioned, which related to maximising profits over a given period, rather than at every point of time, suggests that demand pricing may sometimes be rejected. In such circumstances the convenience of a cost based formula may well make it a good candidate to fill the place of the cast-off demand criterion. A cost formula has the advantage that the price so determined will move roughly in line with general excess demand. It is shown in later chapters that when there is general excess demand, and provided there are some demand determined prices or wages in the economy, cost determined prices will move roughly in line with the demand elements in the system. The use of cost pricing will thus avoid the repercussions of fluctuations in demand which are peculiar to the product considered, but will keep the price of the product roughly in line with general demand and supply conditions.

It is by no means definite that cost formulae are always applied in an inflexible manner.⁽⁸⁾ Thus in some cases a seller may wish to combine the convenience of a cost formula with the ability consciously to keep his price related to demand. There are at least two ways in which a producer may vary the rigid cost formula, which have the merit of keeping prices somewhat in line with demand:

- (a) That to the price determined from a cost formula (with a rigid profit margin) is added (or subtracted) an amount varying with excess demand (or supply).
- (b) That the profit margin is flexible and rises when there is excess demand and falls when there is excess supply for the product.

(8) I. Pearce: "A Study in Price Policy", Economica, May, 1956.

Method (a) I regard primarily as a hypothesis to be tested, rather than a price function justifiable on empirical or analytical grounds. Moreover the use of this function enables a simplification of the work of Chapter III, strangely enough without committing us to the acceptance of the function as a plausible method of price determination.⁽⁹⁾ Method (b), however, has often been cited as a variation of the cost formula which will give results closely allied to those of the pure demand formula.⁽¹⁰⁾ Thus if a producer varies his profit margin every time there is excess demand or supply for his product the only price compatible with stability is the one which equates demand and supply. A model based on this type of price function and an analogous type of wage function is examined in Chapter V.

All this suggests that there are not sufficient grounds for rejecting any of the mentioned types of price determination. They may all exist side by side in the economy.

Much the same sort of conclusion can be reached with regard to wage determination. Demand wages involve an upward (or downward) adjustment of wages whenever there is excess demand (or supply) for labour. Cost determined wages are assumed to be based on some concept of wage earners' cost of living, such as a retail price index. The wage adjustment coefficient is assumed to be constant.⁽¹¹⁾

(9) See Chapter III and Appendix B.

(10) I. Pearce: Op.Cit.

(11) Suppose the cost formula is $\text{Wage Rate} = j (\text{Price Level})$. Here "j" is the wage adjustment coefficient. I have also called "j" the wage margin.

Let us look at Australian experience for evidence of various types of wage determination. There may have been both cost and demand wages in Australia in the early post war years. In that period most minimum wages were legally adjusted to "cost of living" (C series retail price index) changes. Some employers paid minimum legal wages, so that there were at least some cost determined wages in the system. However it was well known at the time that "over-award" wages were often paid. These over-award wages had more relation to excess demand for labour than to the cost of living. Thus it is reasonable to include both cost and demand determined wages in our models.

Again two combinations of cost and demand adjustment seem plausible:

- (a) That to the wage determined from a cost formula with a rigid wage adjustment coefficient is added (or subtracted) an amount varying with excess demand (or supply).
- (b) That the wage adjustment coefficient is flexible and rises when there is excess demand and falls when there is excess supply of labour.

Type (a) could be envisaged as a method of paying over-award wages. The producer takes the award wage as a base and adds to it an amount varying with excess demand for labour. Type (b) could arise with some form of collective bargaining, the trade unions attempting to relate wages to the cost of living, but moderating their claims when there is excess supply and raising them when there is excess demand for labour.

We are now in a position to discuss the aim of this work in greater detail. We have established that there are reasonable grounds for believing that in many economies the general price and wage levels both contain cost and demand elements. Inflationary processes in which these conditions are fulfilled will be examined for both closed and open economies. The object of this examination will be to determine whether such inflationary processes are materially different (and thus require different remedy measures) from the processes outlined by accepted theories of inflation.

Chapter II surveys various theories of inflation, touching on those aspects which are relevant to later work. This discussion provides a method of classifying inflation theories, and also demonstrates which combinations of cost and demand elements have not been explored. Chapter III treats processes of inflation in which the aggregate price level and wage level are determined partly by cost and partly by demand considerations. This model may be broken down into nine subsidiary models for different mixtures of cost and demand elements, and it is the task of Chapter IV to examine these nine models.

In Chapter V inflation with flexible profit margins and wage adjustment coefficients is reviewed. To complete part A (the closed economy) Chapter VI discusses the policy questions brought to light by the various inflation models.

Chapters VII and VIII, part B, apply the basic model of Chapter III in the context of an open economy. The problem of anti-inflation policy in an open economy is treated in Chapter IX.

Definitions

The theories will assume that production takes place with labour as the only variable factor of production in the closed economy. In the open case there are, in addition, such factors as exportables and imports.

Consequently we must have a market for commodities and a market for labour in the closed situation, and there may be excess demand or excess supply in either market. There is equilibrium in a market when excess demand is zero in that market.

Another definition relevant to the state of the markets is the situation in which the models predict stationary prices and wages. Prices and wages are said to be at their stationary values when, according to the solutions of the models they cease to move. The wider term asymptotic values is used to cover the case in which exogenous changes are changing the static solution values of the system even though divergences from static solution values are zero. Figure I illustrates convergence to asymptotic values. These stationary or asymptotic values, as will be shown, may not be the same as equilibrium values, in the sense in which I have defined these terms.

Methods of cost pricing involve claims for real income. (12) A condition of complete consistency is said to prevail when the claims of wage earners are such as to leave exactly the right proportion of the product to satisfy entrepreneurs' claims. For instance if wage earners claim 45% of

(12) Taking the cost formula for wage determination of footnote (11) $\frac{\text{Wage Rate}}{\text{Price Level}} = j$. The wage margin "j" is thus a real wage claim.

the national income there is complete consistency of claims only if entrepreneurs claim 55%. Internal consistency is achieved when profit earners' behaviour is such as to imply only one real wage offer. Internal and complete consistency are distinguished in Chapter III, but in later chapters, for simplicity internal consistency is always assumed to hold and we can then use the term consistency to mean complete consistency. It is shown in Chapters III and IV that these consistency conditions can make equilibrium compatible with stationary prices and/or wages. The meanings of these definitions will become clearer when they are applied in later chapters.

CHAPTER II

INFLATIONARY PROCESSES IN A CLOSED ECONOMY

In this chapter I wish to outline and discuss some features of recent developments in the theory of inflationary processes. This discussion will suggest the line of development which is pursued in later chapters. Inflation theory may be divided into two parts: the first explaining why excess demand emerges and the second dealing with the behaviour of prices and wages, given initial excess demand. Thus the emergence of inflation is often discussed as a facet of the trade cycle, of war, or of economic development. In this sense Hick's trade cycle theory⁽¹⁾ (inflation occurring when the boom hits the full employment ceiling) and Harrod's growth model⁽²⁾ (inflation being caused by the actual growth rate exceeding the warranted growth rate) give explanations of why excess demand should occur.

The inflation theories discussed below are of the second type. I have called them theories of the inflationary process. They seek to explain the mechanism by which prices and wages respond to excess demand (and sometimes also to cost changes). Thus they are not primarily concerned with the origin of excess demand, but with the behaviour of prices and wages after an initial shock assumed to come from outside the system. Theories of inflationary processes are usually short-run analyses in which full employment output is considered to be constant, whilst theories of economic development and of the trade cycle are long run analyses in the sense that the time period is too

(1) J.R. Hicks, A Contribution to the Theory of the Trade Cycle, Clarendon Press, London, 1950.

(2) R.F. Harrod, Towards a Dynamic Economics, Macmillan & Co., London, 1948.

long to justify the assumption that the labour force, capital stock, and output are constant.

There are four factors the behaviour of which it is necessary to analyse for a full explanation of an inflation process. These are output, demand, prices, and wages. It is proposed to discuss each factor in turn.

As has been stated it is usual to assume that real output is constant at full employment. This assumption is not unrealistic for many inflationary situations. If output does increase rapidly those prices and wages connected to excess demand will rise at a slower rate and to lower levels.

Either one of two demand functions are generally employed. Demand may be fixed solely in real terms or partly in real and partly in money terms. If demand is fixed in real terms, price and wage rises cannot reduce real excess demand. Therefore, if there is real excess demand with a fixed output, demand determined prices and wages will rise indefinitely. If demand is fixed partly in real and partly in money terms the possibility exists that excess demand will be eliminated by price rises. That is, as prices rise the real value of that part of demand fixed in money terms will fall, and there may be a finite price rise which will reduce the real value of excess demand to zero. Obviously both demand functions are feasible and it depends on the facts of a particular situation as to which should be used. Fixing demand in real terms implies that the author is interested in studying the speed of inflation, but fixing demand partly in real and partly in money terms implies interest in the nature and possibility of an upper limit to inflation as well as in the speed with which prices and wages rise.

Price and Wage Behaviour.

It is convenient to discuss theories of inflationary processes under this heading as the most significant differences occur in the assumptions made about price and wage behaviour.

Keynes analysis of inflation in his pamphlet How to Pay for the War represents the beginning of recent attempts to explain how inflation works.⁽³⁾ Keynes did not use the term "inflationary gap" but he employed the concept which was later given this name. He argued that prices would rise in response to an excess demand for output. When prices rise "workers will press for higher wages, - with at least partial success."⁽⁴⁾ Inflation thus proceeds with prices adjusting to excess demand and wage rises following price rises. Thus prices are assumed to be demand determined and wages to be cost determined.

It became usual to assume in inflation models that prices and wages were determined in the ways suggested by Keynes. Two years after the publication of How to Pay for the War two separate analyses along these lines appeared. They were by Smithies⁽⁵⁾ and Koopmans.⁽⁶⁾

If an upper limit to inflation is possible in these models, given an initial shock, prices will rise to levels which equate demand and supply for commodities. Wages stop

(3) J.M. Keynes, How to Pay for the War, Macmillan & Co., London, 1940, Chapter IX.

(4) Ibid, p.66.

(5) A. Smithies, "The Behaviour of Money National Income Under Inflationary Conditions", Quarterly Journal of Economics, November, 1942.

(6) T. Koopmans, "The Dynamics of Inflation", Review of Economics and Statistics, May, 1942.

rising when prices reach equilibrium. There is then no necessity for wages to equate demand for and supply of labour as their movement has not been directly related to excess demand for labour. Thus equilibrium is approached in the commodity market but not in the labour market.⁽⁷⁾

Duesenberry extended this type of model in 1950 by including cost determined as well as demand determined prices in his theory.⁽⁸⁾ Cost determined prices in a closed economy are adjusted to wages. Wages, as in previous models were assumed to rise and fall with the general price level. In this model Duesenberry found a tendency for prices to under-or over-shoot their demand equilibrium. As before cost adjusted wages do not necessarily move so as to ensure equilibrium in the labour market. If prices do over-shoot their demand equilibrium excess supply will result. Duesenberry thus concluded that there was a possibility of excess supply at the end of an inflation, and that this would result in either a breakdown in methods of price or wage fixation, or both, or that unemployment would develop.

The neglect of excess demand and supply conditions in the labour market was remedied by Bent Hansen.⁽⁹⁾ He formulated the concept of an ex ante factor gap which he defined as planned purchase of factors (labour) less the planned sales of factors. Wages are assumed to respond to this factor gap and prices to the inflationary gap in the commodity market. If an upper

(7) By "equilibrium" is meant a situation in which excess demand is zero.

(8) J. Duesenberry, "The Mechanics of Inflation", Review of Economics and Statistics, May, 1950.

(9) B. Hansen, A Study in the Theory of Inflation, Allen & Unwin, London, 1951.

limit to inflation were possible in such a model prices and wages would tend to levels which ensure no excess demand or supply for either commodities or labour. In this purely demand determined model equilibrium may thus be achieved by both prices and wages. This does not imply any superiority of this model over the others mentioned, because the choice between different price and wage functions must rest on empirical evidence. It does, however, suggest that it is always necessary to examine the stationary values of both prices and wages to see whether or not they satisfy equilibrium conditions.

So far the models dealt with have all included some demand elements so that the primary role in the inflationary process is taken by excess demand. There are several serious attempts to explain inflation with models in which excess demand does not affect prices and wages. In 1945 Polak enunciated a theory of inflation under price and wage control.⁽¹⁰⁾ He legitimately ascribes movements in these variables to changes in costs when prices and wages are controlled on cost bases.

Another such theory is that of Holzman.⁽¹¹⁾ Unlike Polak he deals with a situation of uncontrolled inflation. Inflation, he claims, is basically the result of a process whereby the various income groups try to increase or maintain their share of real national income. Once a displacement occurs prices and wages spiral upwards because profit earners

(10) J.J.Polak, "On the Theory of Price Control", Review of Economics and Statistics, February, 1945.

(11) F. Holzman, "Income Determination in Open Inflation", Review of Economics and Statistics, May, 1950.

and wage earners raise their money incomes in an attempt to prevent a loss of real income from themselves to the other group. Consequently both prices and wages are cost determined, because prices adjust to changes in wages, and wages adjust to general price movements. This theory emphasizes the redistributive aspect of inflation. However it entirely neglects the excess demand aspect except in so far as excess demand may have something to do with the initial shock. It is worth noting that in this case neither prices nor wages approach levels which equate demand and supply in their respective markets, except by accident.

An attempt at classifying the existing theories was made by Turvey in 1951.⁽¹²⁾ He postulated four types of inflation, namely:

	<u>Prices</u>	<u>Wages</u>
1.	Cost	Cost
2.	Cost	Demand
3.	Demand	Cost
4.	Demand	Demand

This classification is inadequate. For instance, it does not include Duesenberry's model. This difficulty arises because Turvey confines himself to general price and wage levels which can be either purely cost or purely demand determined. This excludes a number of important cases in which the general price level or the general wage level contain both cost and demand elements. Thus, for example, it may be argued that in Australia the prices of manufactured products are cost determined and the prices of primary products demand determined.

(12) R. Turvey, "Some Aspects of the Theory of Inflation in a Closed Economy", Economic Journal, 1951.

If provision is made for these mixtures of cost and demand elements nine possibilities emerge:

Table I.

Demand and Cost Elements in the General Price and Wage Levels.

<u>Prices</u>	<u>Wages</u>
1. Demand and Cost	Demand and Cost
2. Cost	Demand and Cost
3. Demand	Demand and Cost
4. Demand and Cost	Cost
5. Demand and Cost	Demand
6. Cost	Cost
7. Cost	Demand
8. Demand	Cost
9. Demand	Demand

Case 8 describes the Keynes, Koopmans, Smithies model; case 4 the Duesenberry model; case 9 the Hansen model; and case 6 the Polak, Holzman model.

Cases 6 - 9 correspond to Turvey's classification of possible situations. Case 9 is the pure demand case and case 6 the pure cost case.

These nine cases exhaust the possible combinations of absence or presence of cost and demand element in the general price and wage levels. Thus if prices and wages are determined either by cost or demand influences, or a combination of both, only nine types of inflation are possible.⁽¹³⁾ In Chapter IV we shall be concerned with models representing each of these nine possible cases. However, it is case 1 which we shall study in detail.

(13) Of course there may be numerous variations within each particular type. Thus, for instance, we have touched on several ways cost and demand influences may be combined.

In the introductory chapter it was stated that one purpose of the thesis was to compare the results of a model in which cost and demand elements are present in both aggregate price and wage determination with those of a model representative of conventional theory. As we have seen authors of inflation theories have used widely differing assumptions about price and wage behaviour. Which of cases 2 to 9 should then be taken as representative of conventional theory? I have selected case 9 (prices and wages flexible) for this purpose. The reasons behind this choice are first that conventional micro-economic theory operates with such a model and secondly that anti-inflation policy frequently is directed at the level of aggregate demand, and so must envisage demand responsive prices and wages.

CHAPTER III

THE BASIC MODEL

We have established that there are nine possible combinations of cost and demand elements in price and wage determination. In this chapter we shall examine a model in which the aggregate price level as well as the general wage level contain both demand and cost elements, that is, a model which satisfies the requirements of case 1, Table I, P.17. It is called a general or basic model because it possesses a maximum of cost and demand elements, and because it is capable of being broken down into subsidiary models for limiting (zero) values of the cost and/or demand components.⁽¹⁾

In Chapter I it was argued that as we could find no empirical or analytical reason for rejecting either cost or demand prices or wages, models containing all these elements warranted examination. It is not difficult to give instances of economies in which such mixtures of cost and demand elements appear. Take, for instance, the Australian economy in the last half of the 1940s. Prices of most primary products responded to excess demand, whilst there is a strong suggestion that prices of manufactured products were cost determined.⁽²⁾ As for wages, it is well known that over-award rates were paid. Such wages presumably are at least partly responsive to demand conditions.

(1) In several respects the model is anything but general. In particular this is so in regard to the lag structure, see p.44 Appendix A, and the demand function used, see p. 25.

(2) B.M.Cheek, "Economic Theory and Industrial Pricing", Economic Record, August, 1949.

However, many firms and institutions paid no more than the cost adjusted award wage. A full analysis of the inflation that occurred in that period should recognise that both cost and demand influences were present in the general price level and the general wage level.

I.

We shall now proceed to set up a simple model satisfying these requirements. It is assumed that the economy is closed and is at or above full employment with a constant real output limited by the inelasticity of the labour supply. (The analysis is of a short term nature in which investment is assumed to be negligible in relation to total productive capacity and thus does not affect the level of output.) Labour is assumed to be the only factor of production, and units of output are so measured that each worker produces one unit in the period considered. The aggregation problem is ignored so that money national income is defined as the volume of production multiplied by the general price level. Other assumptions emerge later.

SYMBOLS

- P_t - The general price level, period t .
- W_t - The general wage level, period t .
- D_t - The level of aggregate money demand for commodities, period t .
- L_t - The level of aggregate money demand for labour, period t .
- Y_t - The level of money national income, period t .
- Q - The volume of full employment output (= the total employable labour force).

Price Determination

- (a) Demand determined prices: Such prices will rise when there is excess demand and fall when there is excess supply. This function may be written -

$$P_t - P_{t-1} = k_1^1 (D_{t-1} - QP_{t-1}) \quad \dots\dots\dots (1)$$

change in excess demand
price or supply

Where QP_{t-1} is the value of supply and D_{t-1} the value of demand last period (the most recent information available to the producer). k_1^1 is a constant representing the proportion of the reaction completed per time period.⁽³⁾ Naturally the shorter the time interval chosen the smaller is k_1^1 .

- (b) Cost determined prices: If prices are determined by adding a fixed percentage allowance for fixed costs and profit to variable costs of production, either because it is decided that this is the most convenient method of pricing, or because prices are controlled in this fashion, the price function will be, assuming wages are the only variable cost of production -

$$P_t - P_{t-1} = k_2^1 (hW_{t-1} - P_{t-1}) \quad \dots\dots\dots (2)$$

where h is one plus the profit margin and k_2^1 is a coefficient determining the strength of the reaction. Prices rise if $hW_{t-1} > P_{t-1}$.

(3) It is similar to the "speeds of adjustment" used by Samuelson in his examination of the stability of multiple markets. P.A. Samuelson: "Foundations of Economic Analysis", Harvard University Press, Cambridge, 1953, p.271.

- (c) Demand and cost determined prices: It has been suggested in the introductory chapter that some firms may charge prices which vary with both cost and demand changes.⁽⁴⁾ Two types of price determination along these lines were dealt with and it was noted that there were other possible methods. Here we shall restrict ourselves to the case in which the rigid cost formula is varied by adding (or subtracting) an amount proportional to the excess demand (or supply) for the product. This behaviour is described by the following equation:

$$P_t - P_{t-1} = k_1 (D_{t-1} - QP_{t-1}) + k_2 (hW_t - P_{t-1}) \dots (3)$$

k_1 and k_2 represent the weights attached to each element in price determination,⁽⁵⁾ as well as speeds of reaction.

It will simplify the analysis at this stage if we make equation (3) do the work of equations (1) and (2). That is, instead of introducing three price levels explicitly into the analysis we assume that equation (3) is the typical price equation of every seller of final products in the economy.⁽⁶⁾ Demand pricing is

(4) Chapter I, pp.5 and 6.

(5) See Appendix A, p. 39.

(6) It may be objected that it is unwise to base the analysis on the assumption that each seller has a mixed price function, that because we have no evidence that producers add an amount for excess demand to their cost determined price rather than vary their profit margin with excess demand, the system examined should be one in which all prices are either purely demand determined or purely cost determined. It is shown in Appendix B that this two price system produces results very similar to those of the system under examination.

represented by this equation when k_2 is so small that it can be neglected, and cost pricing when k_1 is negligible.

If we aggregate the price functions of all sellers, using fixed weights depending on the share of each producer in the total output we get an expression showing how the aggregate price level is determined. The constants k_1 and k_2 may then be regarded as depending partly on the proportion of each element (k_1 relating to demand elements, and k_2 relating to cost elements) in the general price level. Again they also depend on speeds of reaction.

Wage Determination

- (a) Demand determined wages: A plausible wage function is

$$W_t - W_{t-1} = k_3^1 (L_{t-1} - QW_{t-1}) \quad \dots\dots\dots (4)$$

where k_3^1 is the speed of reaction of wages per unit time period to excess demand for labour, L_{t-1} is last period's demand for labour and QW_{t-1} the value of the supply of labour. $L_{t-1} - QW_{t-1}$ is then last period's excess demand or supply.

- (b) Cost determined wages: Wage variations will be based upon variations in some index of the "cost of living" when either minimum wages are legally fixed in that way and producers wish to pay minimum wages, or when trade union pressure brings some such agreement into force. Under war-time conditions actual wages may sometimes be controlled in this fashion.

$$W_t - W_{t-1} = k_4^1 (j P_{t-1} - W_{t-1}) \quad \dots\dots\dots (5)$$

will be the form of such method of wage deter-

mination, j being the legally fixed or agreed proportion that wages should bear to prices, and k_4^1 being a constant representing the speed with which adjustments are made.

- (c) Demand and cost determined wages: As with prices we have chosen the formula for mixed wage determination in which the cost adjustment is supplemented by a demand adjustment proportional to excess demand for or supply of labour. A producer's wage function would then be:

$$W_t - W_{t-1} = k_3 (L_{t-1} - QW_{t-1}) + k_4 (jP_{t-1} - W_{t-1}) \dots (6)$$

This equation may be used to represent demand determined wages when we can neglect k_4 and cost determined wages when k_3 can be neglected.

The wage function of every producer would then be of the form of equation (6). We can thus aggregate these functions (using weights depending on the proportion of the total labour force employed by each producer) to get a wage function for the whole economy.

We now have two equations - (3) and (6) - explaining price and wage determination. We have yet to specify the demand functions which are necessary to complete the system.

Aggregate demand for commodities:

The subject of aggregate demand functions has been discussed in Chapter II. Here we suppose that part of demand is fixed in real terms, and part in money terms. We thus have:

$$D_t = A + (1-s) Y_t = A + (1-s) QP_t \dots (7)$$

where $(1-s)Y_t$ is the part of demand fixed in real terms and A the part fixed in money terms. The mechanism of inflation can

thus be examined by considering either a single shift or a continuous rise in A. Thus A is treated as an exogenous variable.

This demand function is, however, only one of a number of which could be employed. For instance, the formulation of expenditure plans could be made a lagged function of income. Another variation would be to recognise that wage earners and entrepreneurs have different propensities to spend. Again, demand could have been split into demand for consumption goods, say depending on income and demand for investment goods depending either on the rate of change of income or on monetary factors. The choice of function (7) is mainly justified on the grounds of simplicity. The important complications of our models appear in the price and wage functions, and in order to assess the effects of these it is preferable to avoid complications in other parts of the systems.

Aggregate demand for labour:

The demand for labour will depend on the demand for commodities. It is assumed that it is proportional to the demand for commodities.

Thus

$$\frac{L_t}{D_t} = b$$

$$\text{or } L_t = b D_t \quad \dots\dots\dots (8)$$

In order to appreciate the implications of this function we must consider our previous assumption that one unit of labour equalled one unit of product. This could occur, for example, if one hundred units of labour in combination with fifty units of capital can produce one hundred units of output. To ensure that the assumption is valid for the whole production function and not just one point on it we must make the further assumptions that factors are always used in fixed proportions

and that there are constant returns to scale. This restriction on the generality of the production function makes the marginal physical product of labour constant.

With these assumptions in mind we may rewrite (8) as -

$$QW = b QP \quad \dots\dots\dots (9)$$

$$\therefore \frac{QW}{QP} = b \quad \dots\dots\dots (10)$$

$$\text{and } \frac{W}{P} = b \quad \dots\dots\dots (11)$$

If entrepreneurs are acting so as to maximise profits then they will endeavour to equate the real wage to the marginal physical product of labour (assuming perfect competition). The term "b" then is the marginal physical product of labour, and our assumptions make it necessary to regard it as constant. Moreover, if we treated it as varying with the level of employment we should make the model non-linear. The only justification, other than of expediency, which can be made out for this assumption is that provided we do not contemplate anything more than minor departures from full employment variations in the marginal physical product of labour will be small.

We may now proceed with an analysis of the model.

Equations (3) (6) (7) and (8) constitute model A - I.

Model A - I

$$P_t - P_{t-1} = k_1 (D_{t-1} - QP_{t-1}) + k_2 (hW_{t-1} - P_{t-1}) \quad \dots\dots\dots (12)$$

$$W_t - W_{t-1} = k_3 (L_{t-1} - QW_{t-1}) + k_4 (jP_{t-1} - W_{t-1}) \quad \dots\dots\dots (13)$$

$$D_t = A + (1-s) QP_t \quad \dots\dots\dots (14)$$

$$L_t = b D_t \quad \dots\dots\dots (15)$$

The system resolves into the difference equation

$$P_t + P_{t-1} \{-2 + (k_1 Qs + k_3 Q + k_2 + k_4)\} \\ + P_{t-2} \{1 - (k_1 Qs + k_3 Q + k_2 + k_4) + sQ(k_1 k_3 Q + k_1 k_4 + k_2 k_3 bh) \\ + k_2 k_3 Q(1-bh) + k_2 k_4(1-jh)\} = A(k_1 k_3 Q + k_1 k_4 + k_2 k_3 bh) \dots (16)$$

The stationary value of price (P_e) is

$$P_e = \frac{A(k_1 k_3 Q + k_1 k_4 + k_2 k_3 bh)}{sQ(k_1 k_3 Q + k_1 k_4 + k_2 k_3 bh) + k_2 k_3 Q(1-bh) + k_2 k_4(1-jh)} \dots (17)$$

and that for wages is

$$W_e = \frac{A(k_1 k_3 Qb + k_1 k_4 j + k_2 k_3 b)}{sQ(k_1 k_3 Q + k_1 k_4 + k_2 k_3 bh) + k_2 k_3 Q(1-bh) + k_2 k_4(1-jh)} \dots (18)$$

For the roots of the characteristic equation of (16) to be real (no long period oscillations), at least the larger root positive (no dominant one period oscillations) and less than unity (convergence) it is necessary and sufficient that -

$$0 < sQ(k_1 k_3 Q + k_1 k_4 + k_2 k_3 bh) + k_2 k_3 Q(1-bh) + k_2 k_4(1-jh) \\ < \frac{(k_1 Qs + k_3 Q + k_2 + k_4)^2}{4} < 1 \dots (19)$$

(7) The existence of fixed money elements p and w in the determination of prices and wages would add a term $+p$ and a term $+w$ to the equilibrium for prices and wages respectively.

(8) Conditions (19) involves an amalgamation of the five inequalities:

(a) $sQ(k_1 k_3 Q + k_1 k_4 + k_2 k_3 bh) + k_2 k_3 Q(1-bh) + k_2 k_4(1-jh) > 0$

(b) $sQ(k_1 k_3 Q + k_1 k_4 + k_2 k_3 bh) + k_2 k_3 Q(1-bh) + k_2 k_4(1-jh) < k_1 Qs + k_3 Q + k_2 + k_4$

(c) $sQ(k_1 k_3 Q + k_1 k_4 + k_2 k_3 bh) + k_2 k_3 Q(1-bh) + k_2 k_4(1-jh) > 2(k_1 Qs + k_3 Q + k_2 + k_4) - 4$

(d) $sQ(k_1 k_3 Q + k_1 k_4 + k_2 k_3 bh) + k_2 k_3 Q(1-bh) + k_2 k_4(1-jh) < \frac{(k_1 Qs + k_3 Q + k_2 + k_4)^2}{4}$

(e) $k_1 Qs + k_3 Q + k_2 + k_4 < 2$

(a), (b) and (c) are the conditions for stability whilst (e) ensures that one period oscillations are not dominant, and if (d) is fulfilled longer period oscillations are absent.

A second positive root requires the further condition -
 $sQ(k_1k_3Q + k_1k_4 + k_2k_3bh) + k_2k_3Q(1-bh) + k_2k_4(1-jh) >$

$$k_1Qs + k_3Q + k_2 + k_4 - 1 \quad \dots\dots\dots (20)$$

An idea of the values of the reaction coefficients for which the system is stable may be had from the following numerical example. The values in the table are obtained by assuming $s = 0.5$, $Q = 1$, and $jh = bh = 1$, and that all the k coefficients are equal. This last assumption is of course unreal, but it greatly simplifies the examination and may not materially affect the nature of the conclusions. The table shows the roots of the characteristic equation that may be derived from (16), for different values of the ks .

k	(1) 1.50	(2) 1.00	(3) 0.75	(4) 0.50	(5) 0.10
larger (absolute) root	- 3.50	- 2.00	- 1.25	+ 0.75	+ 0.82675
smaller (absolute) root	+ 0.25	+ 1.00	+ 0.65	- 0.5	+ 0.82375

Cases (1), (2) and (3) are explosive with one period oscillations, whilst case (5) involves a non-oscillatory approach to equilibrium. It is shown in Appendix A that the values of the reaction coefficients will normally be of the order of cases (4) and (5). Thus, in what follows, we may assume that (19) and (20) are fulfilled.

II.

Having shown that there is a reasonable chance that the model will be stable we are now in a position to examine the stationary values which prices and wages will approach.

A stable system will reach the stationary values given by expressions (17) and (18). Let us suppose that $j_h = b_h = 1$. Expression (17) reduces to -

$$P_e = \frac{A}{sQ} \quad \dots\dots\dots(21)$$

and (18) to:

$$W_e = \frac{bA}{sQ} \quad \dots\dots\dots(22)$$

Substituting (21) in the expression for excess demand for commodities we find that the stationary value (21) is also an equilibrium value in the sense that excess demand is zero when it is attained.⁽⁹⁾

Similarly substituting (21) and (22) in the excess demand for labour expression it can be shown that the wage rate (22) equates demand for and supply of labour.⁽¹⁰⁾

As we shall see in Chapter IV, (21) and (22) are the same price and wage levels as are reached by a purely demand determined system. The approach to equilibrium of the two systems will not be the same, as equation (16) of this chapter and the difference equation in footnote (1) of Chapter IV are not identical.

$$\begin{aligned} (9) \quad & D_e - Q_{Pe} \\ & = A + (1-s) Q_{Pe} - Q_{Pe} \\ & = A + (1-s) \frac{QA}{sQ} - \frac{AQ}{sQ} \\ & = 0 \end{aligned}$$

$$\begin{aligned} (10) \quad & L_e - Q_{We} \\ & = bA + b(1-s) Q_{Pe} - Q_{We} \\ & = bA + b(1-s) \frac{QA}{sQ} - \frac{QbA}{sQ} \\ & = 0 \end{aligned}$$

It is only the equilibria that are identical.

Now the condition which ensures that our mixed system will approach stationary values which are also equilibria (that is values of prices and wages which equate demand for and supply of commodities and labour, respectively) is that $j_h = b_h = 1$. What is the significance of this condition? It will be shown that this condition implies complete consistency of income claims.⁽¹¹⁾ We can thus say that complete consistency of income claims ensures that the system approaches a zero excess demand equilibrium.

Let us elaborate this. There are two sets of income recipients in the models, namely profit earners and wage earners. With a constant real national product a real income claim by one group must imply a real income offer to the other group. We may thus discuss the question of income claims in terms of real wage offers (by entrepreneurs) and claims (by wage earners). A state of completely consistent income claims is achieved when real wage claims and real wage offers are equivalent.

Now there are three sets of income claims implicit in the model. First there is the real wage claim of those receiving solely cost based wages. Their desired wage is $W = jP$ which implies a real wage claim $\frac{W}{P} = j$. Profit earners' behaviour in the model implies two real wage offers. Those entrepreneurs charging solely cost determined prices have a price function $P = hW$ or offer a real wage $\frac{W}{P} = \frac{1}{h}$. Profit earners whose prices and wages are determined by market forces offer a real wage "b".

(11) See the definitions of these terms, Chapter I, pp. 9 and 10.

This can be shown as follows. These entrepreneurs desire that two conditions be fulfilled:

$$D = QP \text{ from (12), ensures stable prices} \dots\dots\dots (23)$$

and $L = QW \text{ from (13) ensures stable wages} \dots\dots\dots (24)$

Thus they desire to be in the position where (from (23) and (24))

$$\frac{QW}{QP} = \frac{L}{D} \dots\dots\dots (25)$$

But $\frac{L}{D} = b \text{ from (8)} \dots\dots\dots (26)$

Thus their behaviour implies a real wage offer:

$$\frac{W}{P} = b \dots\dots\dots (27)$$

Clearly then, when $jh = bh = 1$ income claims for shares in the national product are completely consistent in the sense that they are capable of being satisfied.

Are these complete consistency conditions likely to be fulfilled in practice? Internal consistency is ensured if the two real wage offers of entrepreneurs "b" and " $\frac{1}{h}$ " are identical. This will be so only if $\frac{1}{h}$ represents the marginal physical product of labour. Thus only when cost determined prices reflect a real wage rate equal to the marginal physical product of labour will there be internal consistency.

Suppose internal consistency, $bh \approx 1$, is achieved. Complete consistency then requires that wage offers ($b = \frac{1}{h}$) equal wage claims (j). In conditions of sustained full employment it is unlikely that the two opposing groups - entrepreneurs and wage earners - would see eye to eye on the question of the real wage to be paid. In fact under such conditions it will often be the case that $\frac{1}{h}$ (entrepreneurs' offer) is less than j (wage earners' claim).

The reason why consistent income claims result in a demand equilibrium can be understood if we consider the nature of a pure cost system when $jh = 1$. Suppose we have $P_t = hW_{t-1}$, and $W_t = j P_{t-1}$ as our pure cost model. This can be written $P_t = jh P_{t-2}$. It is readily seen that when $jh = 1$ there is no tendency for prices (or wages) to move except in response to some external shock. If there is an external shock which is not repeated prices will rise in response to it, but there will be no multiplier process. Turning now to equations (12) and (13). When excess demand causes the demand element of prices (and wages) to rise it will also induce a rise in the cost element of prices (and wages). But with $jh = 1$ the rise in the cost elements is a once for all response proportional to each excess demand-induced rise, and thus itself proportional to excess demand. When, therefore, excess demand becomes zero the cost elements will not change for there will be no change in the demand element. Thus when $jh = 1$ cost elements play a passive role in price and wage movements rising or falling proportionately with general excess demand.

Let us assume that internal consistency is fulfilled and investigate the effects of inconsistency of claims due to $jh \neq 1$. When $jh > 1$ prices and wages move to stationary values which are above those reached when $jh = 1$, and which necessarily involve excess supply for both commodities and labour.⁽¹²⁾ The larger jh becomes, that is, the more claims for real income exceed the national product, the higher will be the rise in prices

(12) See table V, p.69 , and table VI, p. 70 .

given an initial shock. When j_h becomes very large a previously stable system can become explosive.

A situation involving stationary prices and wages and excess supply for commodities and for labour cannot be a permanent equilibrium and thus at some stage the price and wage functions must break down. There are three ways in which this may occur. Suppose there has been a once for all upwards shift in autonomous demand (A) and the system is adjusting to new stationary values. Before excess supply develops, wage and/or profit earners may realise that the excessive income claims implied by j_h being greater than unity will produce excess supply and will modify these claims so that j_h falls to unity and prices and wages stop rising when excess demand becomes zero. Another possibility is that it may be necessary for some excess supply to develop before income claims are reduced to a level consistent with a demand equilibrium. Thirdly, if income claims are not reduced by the excess supply, entrepreneurs' stocks must pile up, and as this cannot continue indefinitely they must eventually lower prices and/or wages and/or output.

Inflation may be characterised not by a once for all increase in autonomous demand but by a continual rise in A . Our conclusion that excessive income claims will result eventually in excess supply still holds good. This can be seen from figure 1.

Suppose A rises in such a way that D_e (the stationary value of demand) exhibits the trend shown. Then it can be shown that QPe (the stationary value of money income or supply) must lie above it.⁽¹³⁾ Whatever the initial value of excess demand, QP_t must eventually rise above D_t for it approaches asymptotically a level above D_t . However, if for some reason there was an autonomous upward shift in demand (say at point 0) excess supply could be postponed for some time. We shall come back to this point in Chapter VI when discussing the policy implications of the model.

Thus an inflationary process during which income claims become excessive could well conceal the conditions for a downturn. Even if the rise in A is not brought to a halt, the inflation must turn into unemployment. To avoid this it would be necessary to reduce profit margins and/or real wage claims. Often appeals are made by governments to trade unions and to businessmen for voluntary reductions or restraint in income claims, not of course with the object of combatting concealed unemployment, but in order to prevent the excessive price rises which this implies. A fiscal policy designed to reduce excessive income claims is discussed in Chapter VI.

An equilibrium below that for $jh = 1$ is approached if $jh < 1$. It must involve aggregate excess demand, and presumably changes in the constants of our system, e.g. rises in j and h , will eventually bring the system to equilibrium. $jh < 1$ is an unlikely situation when there is full employment.

(13) It is sufficient to show that for any value of A , $QP_e > D_e$ when $jh > 1$. This fact has been ascertained and is presented in table V, p. 69.

Thus inconsistency of income claims will cause prices to under - or over-shoot a demand equilibrium. Excess supply will tend to appear when total claims are excessive, and unless these claims are voluntarily reduced they will be reduced ex post by a recession in employment and insufficiency of demand for commodities. Deficiency of claims implies excess demand in a situation in which prices, according to the model are stationary, and this excess demand (in the absence of autonomous changes) can only be removed by an upward revision of claims.

Only when income claims are completely consistent is there true equilibrium with stable prices and wages and no excess demand or supply for commodities or for labour.

For the last few pages we have been assuming that $bh = 1$, that is, that the cost determined prices reflect the willingness of entrepreneurs for the real wage to be equal to the marginal physical product of labour. When this condition holds inconsistency means that real wage claims are excessive (or deficient) in the sense that they exceed (or are less than) the marginal physical product of labour. However, when there is internal inconsistency, but $j = b$, it is real profit claims which are excessive (or deficient).

Now if we assume that there is not internal consistency, $bh \neq 1$, we find that excessive claims for real profits, $\frac{1}{h} < b$, by sellers can cause prices and wages to overshoot equilibrium levels and thus to bring about a situation of excess supply in both the factor and the goods markets.⁽¹⁴⁾ Similarly, deficient profit claims by cost pricers, $\frac{1}{h} > b$, will lead to excess demand at stationary values of prices and wages, these variables thus under-

(14) This can be seen from inspection of table V, p.69, and table VI, p.70.

shooting equilibrium. We shall not discuss this type of inconsistency at length for the results are very similar to the outcome of inconsistency through wage claims.

Both groups may contribute towards excessive or deficient claims. What then will determine the actual as opposed to the claimed shares of wage and profit earners?

The real wage which is implied by the model can be derived from (14) and (15). It is

$$\frac{W_e}{P_e} = \frac{k_1 k_3 Q(b) + k_1 k_4(j) + k_2 k_3 h b \left(\frac{1}{h} \right)}{k_1 k_3 Q + k_1 k_4 + k_2 k_3 h b} \dots\dots (28)$$

Or with $b = \frac{1}{h}$

$$\frac{W_e}{P_e} = \frac{(k_1 k_3 Q + k_2 k_3) \left(\frac{1}{h} \right) + k_1 k_4(j)}{(k_1 k_3 Q + k_2 k_3) + k_1 k_4} \dots\dots (29)$$

Thus wage earners' and entrepreneurs' ideas of what the real wage rate should be are reconciled by a process which results in wage earners receiving a weighted average of the two claims. The weights are the price and wage coefficients. Only when $bh = 1$, and $jh = 1$ do they simultaneously realize their desired share. When $jh > 1$ the realised real wage will be nearer the wage earners' claim (a) the higher k_4 (and thus the smaller k_3):⁽¹⁵⁾ that is the larger the proportion of cost determined wages in the general wage level; (b) The higher k_1 (and thus the smaller k_2): that is the greater the proportion of demand prices or the smaller the proportion of cost prices in the general price level. This reduces the ability of entrepreneurs to recapture real profits lost by wage rises.

(15) When the system is stationary, the k coefficients represent only the proportion of cost or demand elements in the general wage or price level.

Thus $k_3 Q + k_4 = 1$ and $k_1 Q + k_2 = 1$

So far as the level of real wages which is achieved is concerned, it is in the interest of wage earners, then, for prices to be completely demand determined, and for wages to be completely cost determined.⁽¹⁶⁾ Profit earners, however, are best served by a system in which there are no cost determined wages, and in which prices are cost determined.^{(17)(18).}

III.

Summary

If we examine modern economies we see at least prima facie evidence that there are both cost and demand elements in general prices and general wages. From investigation of a model with these properties it was shown that the claims of workers and of entrepreneurs for real income (expressed through the cost elements in the system) have an important effect on the levels to which prices and wages will tend. Only if these income claims are consistent, in the sense of just exhausting the national product, will an equilibrium with excess demand zero be possible.

During a period of inflation it is likely that income claims in total will become excessive. In this situation prices and wages will be pushed above a demand equilibrium by the

-
- (16) j , of course, may not be a satisfactory real wage claim from the worker's point of view. However, as we are treating the case in which $j_h > 1$ or $j > \frac{1}{h}$ wage earners are better off the nearer to j is h the actual real wage.
- (17) Compare models VIII and VII, Chapter IV.
- (18) Both these statements assume that the cost influenced claim is higher than the marginal physical product of the factor concerned. In these circumstances there will be a tendency for the proportion of cost elements in prices and wages to increase. One limiting factor will be the excess supply which excessive claims will cause.

excessive claims. Excess supply will thus result, and unless this induces a fall in claims a downturn in employment will be the outcome.

The real wage which is actually paid will lie between that offered by the entrepreneur and that claimed by the wage earner, being nearer to the latter the greater the proportion of cost determined wages and the smaller the proportion of cost determined prices in the system.

APPENDIX A

The Stability of the Basic Model

k coefficients	1. ⁽¹⁾ ₅₀	1. ⁽²⁾ ₀₀	0. ⁽³⁾ ₇₅	0. ⁽⁴⁾ ₅₀	0. ⁽⁵⁾ ₁₀
larger (absolute) root	-3.50	-2.00	-1.25	+0.75	+0.82675
smaller (absolute) root	+0.25	+1.00	+0.65	-0.50	+0.82375

The table summarises the values of the roots of the characteristic equation of (16), Chapter III, for different values of the k coefficients of Model A - I. The values assumed in the table are $s = 0.5$, $Q = 1$, $j_h = b_h = 1$. The system is stable roughly in the region where the k coefficients are all 0.5 to 0.10. It remains to be shown that the k's will be normally within this range.

All these reaction coefficients will entail complex mixtures of psychological and technical determinants. We shall be content merely to point to some of the more important factors which would tend to limit their values.

(1) k_1 . What factors will ensure that k_1 is at its maximum value? In the first place this coefficient depends partly upon the proportion of producers using demand pricing. If we suppose that all producers use this method of price determination other things being equal k_1 will be at a maximum. Secondly k_1 has elements which define the speed of reaction to excess demand per unit time period. It will be at a maximum from this point of view provided the time interval chosen is

such that the full reaction to a given amount of excess demand is completed within one time interval.

Suppose both these conditions are present and that producers are selling Q_1 units at the price P_1 . If an increase in aggregate demand now occurs producers may find that they can sell a greater number of units at the price P_1 , say Q_2 . Again k_1 will be greatest, other things being equal, if all producers refrain from attempting to meet any of the increased demand from increased output, but raise prices by the amount necessary to equate supply to the new demand.

Let us also assume that producers realise that the change in demand is an overall change which does not affect their relationship with competitors. Then each must make an estimate of the price elasticity of the aggregate demand function. This elasticity depends upon the behavior of A (see equation (8), p.25). If A increases in proportion with the aggregate price level the elasticity will be unity. It will be greater or less than unity depending on whether A increases in greater or lesser proportion than prices. Now if A increases in the same proportion as or greater proportion than prices demand will be either fixed or increasing in real terms, respectively. With a constant real supply the system would then be unstable, whatever the value of k_1 .

Thus if the system is to have a chance of stability the price elasticity of the aggregate demand function must be less than unity. Nevertheless, in order to find the upper limit to k_1 let us suppose that producers reckon the elasticity of this function as unity. The new price P_2 will then be given by

$$P_2 Q_1 = P_1 Q_2 \quad \dots \quad (1)$$

Subtracting $P_1 Q_1$ from both sides and rearranging we have:

$$P_2 - P_1 = \frac{1}{Q_1} (P_1 Q_2 - P_1 Q_1) \dots (2)$$

In terms of the notation of Chapter III this would be

$$P_t - P_{t-1} = \frac{1}{Q} (D_{t-1} - QP_{t-1}) \dots (3)$$

Thus k_1 has a maximum of $\frac{1}{Q}$ where Q is full employment output.

The lower limit to k_1 will approach zero and will involve all producers reacting extremely slowly to excess demand.

As used in equation (3) Chapter III, k_1 is the sum of individual producers' reaction coefficients. The price level in this equation amounts to a fixed weight index of general prices, and thus k_1 must involve an element representing the proportion of producers, weighted by their output, using demand pricing. Thus the larger the proportion of cost elements in pricing the smaller will be k_1 .

(2) k_3 . If all wages were demand responsive k_3 would lie between $\frac{1}{Q}$ and zero. It would be $\frac{1}{Q}$ where the whole reaction to excess demand for labour was completed in the time period chosen and would approach zero when the reaction of wages to excess demand was very slow, relative to this time period.

Suppose that originally at the wage W_1 the supply of labour is Q_1 and the demand for labour is Q_2 (where $Q_2 > Q_1$). As the supply of labour for the economy as a whole is constant Q_1 cannot rise and thus the new wage level will be given by

$$W_2 Q_1 = W_1 Q_2 \dots (4)$$

This follows from our definition of the demand

function for labour (equation (8), p.25). The sum of money allocated for wage payments does not vary with the wage level so that the demand for labour with respect to wage changes is of unit elasticity.

Rearranging (4)

$$W_2 - W_1 = \frac{1}{Q_1} (W_1 Q_2 - W_1 Q_1) \dots\dots\dots (5)$$

In the symbols of Chapter III this would be

$$W_t - W_{t-1} = \frac{1}{Q} (L_{t-1} - QW_{t-1}) \dots\dots\dots (6)$$

Like k_1 the constant k_3 will be lower the higher the proportion of cost elements in the relevant function.

(3) k_2 . If all prices are cost determined and the reaction of prices to a rise in costs is completed within the time period chosen then k_2 will be unity. To the extent that either of these conditions is unfulfilled k_2 will be less than unity. It will be zero when the reaction to cost changes is so slow that it can be ignored or when there are no cost elements in the general price level.

(4) k_4 . The value of this coefficient is determined by considerations analogous to those determining the value of k_2 . It lies between the limits of zero (e.g. no cost determined wages) and unity (all wages cost determined and the full reaction to cost of living changes completed in a unit time interval).

We thus have shown that the values of the k coefficients will lie between zero and unity, when $Q = 1$. In the numerical example it was assumed that these coefficients were all equal. Suppose that the price and wage lags are equal and that the full reaction of each variable is completed within a unit interval of time. These last assumptions bias the case against stability for they ensure that the k coefficients will be as large as possible, other things being equal. In these circumstances the k coefficients

can only be equal if each is one half. From the table at the beginning of this appendix we see that given $s = 0.5$, $j_h = b_h = 1$ the system will be stable at the value $k = \frac{1}{2}$. All this suggests that for the value $s = 0.5$, $j_h = b_h = 1$ the system will be stable. What if j_h , b_h or s assume different values?

The effect on the stability of the system of varying the values of s , j , h and b can best be seen from an examination of the conditions which ensure stability quoted in footnote (8) Chapter III, page 27. It will simplify the examination if we take all the k coefficients to be equal to one half. The three conditions then become, assuming again that $Q = 1$

$$3s + (1 - b_h) + (1 - j_h) > 0 \quad \dots (7)$$

$$s + (1 - b_h) + (1 - j_h) < 6 \quad \dots (8)$$

$$s - (1 - b_h) - (1 - j_h) < 4 \quad \dots (9)$$

Condition (7) can be upset by a large value of b_h and/or j_h in excess of unity accompanied by a small value of s . This is reasonable because if s is small then $(1-s)$ the marginal propensity to spend is large. This makes for rapid rises in demand determined prices and wages. If at the same time b_h and/or j_h are large and greater than unity this makes for rapid rises in cost determined prices and wages.⁽¹⁾ The two elements reinforce each other and lead to unstable price and wage behaviour.

Condition (8) is not at all restrictive and would be fulfilled in all conceivable cases, for s would rarely be much greater than unity, and $1-b_h$ and $1-j_h$ would only in exceptional circumstances be as high as unity. Clearly, also condition (9) would be fulfilled for most conceivable values of s , b , j and h .

(1) See the pure cost model, Chapter IV, page 57.
When $j_h > 1$ such a system is explosive.

We have thus demonstrated that the system is stable for reasonable values of the coefficients and have indicated some sources of instability. The examination has been limited to the case in which all the k coefficients are equal, but it is felt that the removal of this assumption would not greatly invalidate the conclusions. It must, however, be conceded that the lag structure of the model could, with justification, be altered in a number of ways. For instance, demand price movements could be made a function of stocks on hand (the sum of excess demand or supply from the base date) rather than excess demand at any point of time. Again, demand could reasonably be made a lagged function of income instead of a function of current income.

Because we must choose from a wide range of possible lag structures which would be applicable to our model we have not proved very much when we establish the stability conditions for any particular lag structure.⁽²⁾ Apart from investigating the stability of every conceivable lag structure, which would be beyond the scope of this work the only possible way of avoiding this problem is to choose a lag structure which, other things being equal, would be more unstable than other lag structures. Thus conclusions about the stability of such models would apply a fortiori to other possible models. Thus the demand function in model A - I and other models is unlagged as this makes for greater instability than if it were a lagged function of income.

(2) I am indebted to Professor J.E. Meade for this point.

APPENDIX B

The Two Price System

In Chapter III a single price (and wage) function was employed. The typical price function of sellers was assumed to be:

$$P_t - P_{t-1} = k_1(D_{t-1} - QP_{t-1}) + k_2(h W_{t-1} - P_{t-1}) \dots (1)$$

The price level was thus the result of a mixture of demand and cost components. Pure cost pricing was assumed to exist in a situation in which k_1 was very small and pure demand pricing was represented by the equation when k_2 was negligible. A similar function was used for wage determination.

It may serve to throw some further light on the workings of the system if we examine a model in which two price levels - one for pure cost and the other for pure demand pricing - are treated explicitly. Two separate wage levels showing response to these two influences will also be included in the model.

SYMBOLS

- P_t^1 - The demand determined price level, period t .
- P_t^2 - The cost determined price level, period t .
- P_t - The general price level, period t .
- W_t^1 - The demand determined wage level, period t .
- W_t^2 - The cost determined wage level, period t .
- W_t - The general wage level, period t .
- D_t^1 - The level of money demand for commodities whose prices are demand determined, period t .

- D_t^2 - The level of money demand for commodities whose prices are cost determined, period t .
- D_t - The level of aggregate money demand for commodities, period t .
- L_t^1 - The level of money demand for labour whose wages are demand determined, period t .
- L_t^2 - The level of money demand for labour whose wages are cost determined, period t .
- L_t - The level of aggregate money demand for labour.

The system is:

$$P_t^1 - P_{t-1}^1 = k_1 (D_{t-1}^1 - a_1 P_{t-1}^1) \quad \dots (2)$$

$$P_t^2 - P_{t-1}^2 = k_2 (hW_{t-1} - P_{t-1}^2) \quad \dots (3)$$

$$P_t = a_1 P_t^1 + a_2 P_t^2 \quad \dots (4)$$

$$W_t^1 - W_{t-1}^1 = k_3 (L_{t-1}^1 - a_3 W_{t-1}^1) \quad \dots (5)$$

$$W_t^2 - W_{t-1}^2 = k_4 (j P_{t-1} - W_{t-1}^2) \quad \dots (6)$$

$$W_t = a_3 W_t^1 + a_4 W_t^2 \quad \dots (7)$$

$$D_t^1 = a_1 D_t \quad \dots (8)$$

$$D_t^2 = a_2 D_t \quad \dots (9)$$

$$D_t = A + (1-s) P_t \quad \dots (10)$$

$$L_t^1 = a_3 b D_t \quad \dots (11)$$

$$L_t^2 = a_4 b D_t \quad \dots (12)$$

The constants a_1 , a_2 , a_3 and a_4 require explanation: a_1 is the proportion of total output produced by profit earners using demand pricing; a_2 is the proportion of total output produced by profit earners using cost pricing; a_3 is the proportion of the total labour force receiving demand determined wages; and a_4 is the proportion of the total labour force receiving cost determined wages.

As in previous problems, units of output are defined in terms of the units of labour required to produce them. Consequently total output is identical to the total labour force. For convenience full employment output is assumed to be unity.

The price and wage equations are very similar to equations (1), (2), (4) and (5) of Chapter III. It is assumed that there is no relationship between particular types of price and wage functions. Thus, for instance producers using cost pricing pay both cost and demand determined wages in the proportions that these elements enter into the aggregate wage level. Equations (4) and (7) define the general price and wage levels, respectively, in terms of fixed weight price indexes of the two sets of prices and wages. The function for the aggregate demand for commodities (equation (8)) is the same as for that employed in Chapter III. The other equations ((9) to (12)) describe the various commodity and labour demand functions which are derivable from (8).

Assuming that internal consistency conditions are fulfilled (i.e. $bh = 1$) the stationary value for the general price level is -

$$P_e = \frac{A (a_1 + a_2 a_3)}{s(a_1 + a_2 a_3) + a_2 a_4 (1 - jh)} \quad \dots (13)$$

This solution is very similar to that given for the stationary value of prices in Chapter III (equation (14)). The solutions are seen to be almost identical if we remember that -

$$\begin{aligned} a_1 &= a_1 (a_3 + a_4) \\ &= a_1 a_3 + a_1 a_4, \end{aligned}$$

making the stationary value of P

$$P_e = \frac{A(a_1 a_3 + a_1 a_4 + a_2 a_3)}{s(a_1 a_3 + a_1 a_4 + a_2 a_3) + a_2 a_4 (1-jh)} \quad \dots (14)$$

When there is complete consistency of income claims (i.e. $bh = jh = 1$) the general price level becomes

$$P_e = \frac{A}{s} \quad \dots (15)$$

and equates aggregate demand and supply.

Our present model enables us to examine the stationary values of the demand determined and cost determined price levels. This task was not possible with our previous system. They are - Demand determined prices:

$$P_e^1 = \frac{A(a_1 + a_2 a_3) + a_2 a_4 (1-jh)}{s(a_1 + a_2 a_3) + a_2 a_4 (1-jh)} \quad \dots (16)$$

Cost determined prices:

$$P_e^2 = \frac{A(a_1 + a_2 a_3) - a_1 a_4 (1-jh)}{s(a_1 + a_2 a_3) + a_2 a_4 (1-jh)} \quad \dots (17)$$

Equation (16) is both a stationary value and an equilibrium for it always equates the demand for and supply of the goods concerned.

Equation (17) only equates demand and supply in the relevant market when consistency conditions are satisfied. When these conditions are fulfilled,

$$P_e^1 = P_e^2 = P_e = \frac{A}{s} \quad \dots (18)$$

When $jh > 1$, however, the general price level will approach a level above $\frac{A}{s}$. P_e^1 will approach an equilibrium below the general price level and P_e^2 a stationary value above the general price level. There will be excess supply in the market for those goods sold under cost pricing of -

$$D_e^2 - a_2 P_e^2 = \frac{A a_4 (1-jh)}{s(a_1 + a_2 a_3) + a_2 a_4 (1-jh)} \quad \dots (19)$$

Excessive income claims thus result in a rise in cost determined prices (given an inflationary shock) to a level above a demand equilibrium. This results in excess supply in the markets concerned coupled with a rise in general prices to a level higher than would obtain with consistent income claims.

Analogous conclusions arise from the study of stationary values for wages.

Thus we see that the device of Chapter III of taking each producer to have a mixed price function does not give misleading results for the case in which there are no producers in the economy with mixed price functions.

CHAPTER IV

NINE MODELS OF INFLATIONARY PROCESSES

The basic model described in the previous chapter is but one of nine possible models which can be built up by considering different mixtures of cost and demand components, providing the method of mixture involved is the addition of the various responses. Here we shall discuss and compare the properties of these nine possible cases.

In particular we shall be concerned to compare the properties of model A.I, the basic model of the last chapter and model A.IX, the pure demand case. Much of economic theory has been constructed with a model such as A.IX in which prices and wages are demand responsive. It is thus useful to compare our basic model with such a system in order to discover in what ways the basic model gives results dissimilar to those of conventional theory. At the end of the chapter we shall consider the implications of our system for the often used terms "cost inflation" and "demand inflation".

The tables at the end of this chapter summarise the nine models derived from, and including, model A.I by assuming that various reaction coefficients of model A.I are zero. Thus, for example, model A.IV is found by substituting zero for k_3 in equation (13) Chapter III. This implies that there are no demand elements in wages, and thus model A.IV is based on wages which are solely cost determined, and prices which respond to both demand and cost influences. Stationary values for each model are given in tables II and III, real wages in table IV, and excess demand for commodities table V, and for labour table VI. The stability conditions for the various models (with the exception of model IX) can be

found by substituting zero for the appropriate constants in equations (19) and (20), Chapter III.

The results of these models conform to a pattern which will be discussed later in the chapter. It is, therefore, unnecessary to treat each case in detail, and three cases have been selected to illustrate the methods involved.

I

Model IX⁽¹⁾

This model involves purely demand determined prices and wages. This is the situation envisaged by traditional theory. Provided stability conditions are fulfilled prices and wages always move so as to equate aggregate demand and aggregate supply both in the factor and the goods markets. It is the only model which (if stable) appears to reach equilibrium in the sense in which we have defined the term without any conditions, other than the stability condition, being fulfilled. However, we shall see later that, given a slight change in this system, it too is capable of overshooting equilibrium.

(1) The Model is

$$(1) P_t - P_{t-1} = k_1(D_{t-1} - QP_{t-1})$$

$$(2) W_t - W_{t-1} = k_3(L_{t-1} - QW_{t-1})$$

$$(3) D_t = A + (1-s) QP_t$$

$$(4) L_t = bD_t$$

It resolves into the difference equation for prices -

$$P_t + P_{t-1}(-1 + k_1 sQ) = k_1 A$$

and is stable if $0 < 1 - k_1 sQ < 1$.

The level of real wages, in equilibrium, is traditionally determined by the marginal physical product of labour. If it were less than the marginal physical product it would pay entrepreneurs to engage more labour and produce more, if it were greater entrepreneurs would be better off producing less. The demand for labour is assumed to reflect this situation and in equilibrium real wages are equal to the marginal physical product of labour "b".

We are now in a position to compare our basic model A.I with the pure demand model. The difference between these two models is the presence of cost elements in price and wage determination in the basic model. Whereas prices and wages are flexible in model A.IX, approaching equilibria when the system is stable, the addition of cost prices and wages makes for a "cost/price spiral" as well as demand driven inflation. The result is that only those prices and wages which are purely demand determined in the basic model, in general, approach equilibria if the system is stable. In particular, if income claims of wage earners and profit earners are excessive (as will frequently be the case when there is over-full employment), prices and wages will overshoot demand equilibria and excess supply will result. Moreover it is likely that the consequent inflation will involve higher price and wage rises than if prices and wages were purely demand determined. This proposition is evident, so far as prices are concerned, from an examination of figure II.

The relevant stationary values which we need to consider are

(1) P_e (A.IX) and D_e (A.IX), the stationary levels of prices and of demand in the pure demand case. These are identical, assuming

Q to be unity, and they are given by -

$$\frac{A}{s} \quad \dots (1)$$

(2) $P_e (A.I)$, the stationary level of prices in the basic model, which is -

$$\frac{A x_1}{s x_1 + x_2 (1-bh) + x_3 (1-jh)} \quad \dots (2)$$

(3) $D_e (A.I)$, the stationary level of demand in the basic model, given by -

$$\frac{A [x_1 + x_2 (1-bh) + x_3 (1-jh)]}{s x_1 + x_2 (1-bh) + x_3 (1-jh)} \quad \dots (3)$$

In figure II it is assumed that autonomous demand (a) is following a linear trend. The stationary value for demand in the mixed model lies above the stationary value for demand in the flexible model. This can be seen if we subtract (1) from (3) and rearrange. We thus have -

$$\frac{A (s-1) [x_2 (1-bh) + x_3 (1-jh)]}{s x_1 + x_2 (1-bh) + x_3 (1-jh)} \quad \dots (4)$$

Now when the expression $x_2 (1-bh) + x_3 (1-jh)$ is negative, as is likely to be so if income claims are excessive, expression (4) will be greater than zero (and thus $D_e(A.IX) < D_e(A.I)$ if $s < 1$).

(2) The values of the positive constants x_1 , x_2 , and x_3 in terms of the constants of our system can be inferred from equations (17) and (18), Chapter III.

Now the conditions $s < 1$ will be fulfilled in all practical cases for $s = 1$ would mean that demand was unconnected to income, that is, that no part of income was respent.

In figure II the continuous curves represent the course of prices and demand given by Model A.I, and the broken lines the course of prices and demand, Model A. IX, on the assumption that there is initial excess demand and excess income claims. Demand and the price level (supply) asymptotically approach equilibrium in the pure demand model. In the mixed model both demand and the price level rise above the equilibrium levels of model A.IX, with excess supply setting in after the point o.

We may now return to the point mentioned at the outset, namely that the pure demand model is capable of overshooting equilibrium. Suppose we write the system -

$$P_t - P_{t-1} = k_1 (D_{t-1} - QP_{t-1}) \quad \dots (5)$$

$$W_t - W_{t-1} = k_3 (L_{t-1} - QW_{t-1}) + a \quad \dots (6)$$

$$D_t = A + (1-s) QP_t \quad \dots (7)$$

$$L_t = bD_t \quad \dots (8)$$

Wages are still demand responsive but we are supposing that they rise at a rate greater than that dictated by excess demand for labour so that full employment (zero excess demand) will not be associated with a zero wage change. Wages will continue to rise after excess demand for labour becomes zero and unemployment could result. The stationary values of wages is

$$W_e = \frac{bA}{sQ} + \frac{a}{k_3 Q} \quad \dots (9)$$

and is clearly higher than the equilibrium level.

The explanation of this sort of wage reaction lies in the behaviour of organized labour. Unions by maintaining pressure for higher than market wages are shifting the labour supply function to the left. At any given level of employment this means a higher real wage, but at any given real wage it means a lower level of employment.

Let us consider the nature of the unemployment which may arise. Figure III illustrates supply curves (S_1 and S_2) and

Fig III

a demand curve (N) for labour. (The shapes of these curves do not agree with the restrictive assumptions necessary in our algebraic models). The curve S_2 is derived from the real wage demands of unions, and the curve S_1 is the labour supply function (based upon the marginal disutility of work) which would exist if there were no unions. At $\frac{W}{P} = 1$ the number employed is Q_1 , but the number who offer for employment is Q_2 . This unemployment ($Q_2 - Q_1$) is sometimes called voluntary unemployment.

The alternative to unemployment is perpetual inflation through policies designed to raise prices as well as wages (e.g. manipulation of A by fiscal or monetary means), which would have the effect of keeping the real wage lower than $\frac{W}{P} = 1$.

This type of complication could be introduced into all the demand determined wages (and perhaps all the demand determined prices) of the nine systems. We shall not do this as the resulting effects may be inferred from this simple case.

Model VI⁽³⁾

Prices in this model are solely determined by costs (wages) and wages respond to changes in the cost of living (prices). This type of model has sometimes been used to describe war-time price and wage movements. In such cases excess

(3) The Model is

$$(1) P_t - P_{t-1} = k_2 (hW_{t-1} - P_{t-1})$$

$$(2) W_t - W_{t-1} = k_4 (jP_{t-1} - W_{t-1})$$

$$(3) D_t = A + (1-s) QP_t$$

$$(4) L_t = bD_t$$

Equations (3) and (4) are not necessary to predict the course of prices and wages. Thus (1) and (2) form the complete system.

demand is usually repressed by rationing and by price and wage controls which tie these variables to costs. It has also been contended that such a system may serve to explain uncontrolled inflation.⁽⁴⁾ The choice between the numerous price and wage functions which are possible is mainly a matter for empirical investigation. When, however, it is seen that a strict interpretation of the results of this model implies that there is no relationship between aggregate excess demand and prices and wages, the model does not seem very plausible for uncontrolled situations.

The lack of any relationship between excess demand and prices and wages can be demonstrated if we vary this system slightly. As interpreted by the tables at the end of the chapter and by footnote (3), there are no fixed terms in the price and wage functions. This means that the system has an (indeterminate) stationary position only when $j_h = 1$ (and $k_2 + k_4 < 2$), and when j_h is greater than unity (or less than unity) rushes off to infinity (or zero). If we assume k_2 and k_4 to be unity, we can add a constant term p to the price equation, and w to the wage equation. The system then becomes -

$$P_t = hW_{t-1} + p \quad \dots (10)$$

$$W_t = jP_{t-1} + w \quad \dots (11)$$

$$D_t = A + (1-s) QP_t \quad \dots (12)$$

$$L_t = bD_t \quad \dots (13)$$

(4) See F. Holzman, "Income Determination in Open Inflation", Review of Economics and Statistics, May, 1950.

where (10) and (11) are sufficient for the explanation of prices and wages. Stationary values $P_e = \frac{hw + p}{1 - jh}$ and $W_e = \frac{jp + w}{1 - jh}$ will be attained if $0 < jh < 1$. If these stationary values are also equilibria, then:

$$D_e - QP_e = A - \frac{sW(hw + p)}{1 - jh}$$

$$= 0$$

$$\text{and } L_e - QW_e = bA - \frac{Q[b(1-s)(hw+p) - (jh + w)]}{1 - jh}$$

$$= 0$$

Suppose prices rise because of a rise in p . Then, as there is no connection Δp and A , equilibrium will be disturbed and there will be excess supply at the new stationary values. On the other hand a rise in A leaves prices and wages unchanged. The system is thus independent of the level of demand. This does not accord with the facts of recent inflations in which prices and wages have moved somewhat in line with demand.

But those who use these models may argue that there is a connection between ΔA and Δp . That is, that Δp may be caused by a rise in A which sets the system in motion and ensures that there is some increase in aggregate demand which will not leave the system too far out of equilibrium when the process comes to an end. It is still necessary to explain why a rise in A should affect prices at the beginning only of a process and not thereafter. I can see no good reason for this, except perhaps in the case of an individual business where the pricing technique may result in the consideration of demand influences, say every six months. This type of behaviour for the economy as

a whole would be better represented by an equation such as (3) Chapter III or (3) Chapter V.

It thus appears that models such as VI which are completely isolated from demand changes gives results which appear unrealistic.

Model VIII⁽⁵⁾

In this model prices are solely demand determined and wages solely cost determined. It corresponds in this respect to the Keynes, Koopmans, Smithies models of inflation.⁽⁶⁾ Prices tend towards an equilibrium, but wages equate demand for and supply of labour only if j (wage claim) equals b (the marginal product of labour). If $j > b$ there will be excess supply of labour with prices in equilibrium and wages stationary. This can be seen from the expression giving excess demand for (or supply of) labour when the system is at rest.

$$\text{i.e. } L_e - QW_e = \frac{bA(1 - \frac{j}{b})}{sQ} \quad \dots (14)$$

This conclusion supports the well known argument of the classical economists that unemployment can arise because of wage rigidity. That is, if wage claims are in excess of the marginal product of labour there will be unemployment. A fall in the level of employment and output will result unless j is reduced.

(5) The Model is

- (1) $P_t - P_{t-1} = k_1 (D_t - QP_{t-1})$
- (2) $W_t - W_{t-1} = k_4 (jP_{t-1} - W_{t-1})$
- (3) $D_t = A + (1-s) QP_t$
- (4) $L_t = bD_t$

Equation (4) is not necessary to explain the course of prices and wages.

(6) See Chapter II, p.17.

Keynes, in his General Theory, did not deny that if the supply of labour is a function of the real wage rate, unemployment could occur because the real wage was higher than the marginal product of labour.⁽⁷⁾

An interesting parallel is model VII. Prices in this case are solely cost determined, and wages solely demand determined. Wages equate the demand for and supply of labour automatically, whilst equilibrium is approached in the commodity markets only if $\frac{1}{h} = b$. This condition requires the real wage offer of the entrepreneurs to equal the marginal productivity of labour. This is a matter for internal consistency of the firm and is likely to be fulfilled the more rational (in regard to profit making) is the firm's policy. If $\frac{1}{h} < b$ there will be excess supply and if $\frac{1}{h} > b$ excess demand for commodities.

Model VIII, if stable, will reach equilibrium in the commodity market automatically, but will achieve equilibrium in the labour market only if real wage claims of wage earners are consistent with the real wage offered by entrepreneurs. Why should this consistency ensure equilibrium in the labour market? We have assumed that the entrepreneurs' behaviour is such that at a certain real wage (equal to the marginal product of labour) the demand for labour will be satisfied. Consequently, if wage earners will also be satisfied with a real wage equal to the marginal

(7) I do not wish to ask whether unemployment could arise from causes other than inconsistency of income claims. The lack of a monetary sector, and the assumption that full employment output is being produced limit the usefulness of the model for such questions.

product of labour, equilibrium is assured in the labour market. If wage earners have an effective wage claim higher than their marginal product, employers will be forced to pay a higher real wage than they feel it is profitable to pay, and the result will be reduced demand for and thus excess supply of labour.

II

The three cases treated above illustrate the methods of presenting the results of the models and bring out some of the more interesting conclusions which can be derived from them.

These three and the other cases will now be discussed with reference to the pattern into which their results fall.

Equilibrium

In the first place the results of the other models can best be understood when it is seen that the pure demand and the pure cost models are limiting cases. That is, in none of the models other than model IX do both prices and wages approach equilibrium without restrictive conditions being imposed. However, in every model except model VI a condition ensuring consistency of income claims will ensure equilibrium in both the factor and the goods markets.

It can be seen from tables V and VI that -

1. When consistency conditions are unfulfilled or irrelevant to the system considered:

- (a) Those models with solely demand determined prices will reach equilibrium in the goods market. (Models III, VIII, IX).
- (b) Those models with solely demand determined wages will reach equilibrium in the labour market. (Models V, VII, IX).

- (c) Those models with cost elements in prices will not reach equilibrium in the goods market. (Model I, II, IV, V, VI, VII).
- (d) Those models with cost elements in wages will not reach equilibrium in the factor market. (Model I, II, III, IV, VI, VIII).

2. When internal consistency conditions are fulfilled (that is, when the real wage offer of entrepreneurs is unique, and is equal to the marginal physical product of labour, $b = \frac{1}{h}$):

- (a) Those models with solely demand determined wages and cost elements in prices reach equilibrium in the goods market and in the factor market. (Models V and VII).
- (b) Those models with solely demand determined prices will reach equilibrium in the goods market. (Models III, VIII, IX).
- (c) Those models with solely demand determined wages will reach equilibrium in the labour market. (Models V, VII, IX).
- (d) Those models with cost elements in prices and wages will not reach equilibrium in either the factor or the goods market. (Models I, II, IV, VI).

3. When complete consistency conditions are fulfilled, and this as we have defined it implies internal consistency also (wage earners' real wage claim "j" consistent with (i) the real wage offer "b", and (ii) the real wage offer $\frac{1}{h}$ of entrepreneurs):

- (a) All models, except model VI, will reach equilibrium in both the factor and the goods market. (Models I, II, III, IV, V, VII, VIII).
- (b) Model VI, possessing neither prices nor wages related to demand, will not, in general, reach equilibrium in either the factor or the goods market.

Thus equilibrium in the goods market is always reached in the three models (III, VIII, IX) in which prices are purely demand determined, but it is necessary to impose conditions ensuring the consistency of real income claims on the other models for equilibrium to be attained in the goods market. Equilibrium in the factor market is always reached in the three models (V, VII, IX) with purely demand determined wages, but in other models requires consistency of income claims. These statements must be qualified to the extent that consistency of real income claims will not ensure equilibrium in the pure cost model (VI).

Thus the introduction of rigid cost elements into prices and/or wages will in general prevent the system concerned from attaining equilibrium in the commodity and/or the factor market. If the cost elements imply excessive income claims the system will over-shoot equilibrium, and if income claims are deficient the system will under-shoot equilibrium values. In the case of excessive claims excess supply will result and when claims are deficient excess demand will remain after prices and wages come to rest.

Real Wages

In the absence of internal or external consistency of claims the results may be grouped as follows:

1. In the pure demand model (IX) the realized real wage will be the marginal physical product of labour, corresponding to full employment.

2. In models in which prices are solely cost determined but there are demand elements in wages (II and VII), entrepreneurs' real income claim will be satisfied. That is the real wage will be $\frac{1}{h}$. This must be so because the systems imply that whatever the level of wages prices will rise to a level which expresses the desired relationship between wages and prices.

3. In models in which wages are solely cost determined but there are demand elements in prices (IV and VIII), wage earners' claims are met, and the real wage is "j".

4. In models in which neither prices nor wages are solely cost determined, but in which cost elements do appear in the system (I, III, V), the real wage actually realised is a weighted sum of the various claims.

5. In the pure cost model (VI) claims of wage earners and profit earners are simultaneously met only when $jh = 1$. If there are fixed money elements in price and wage determination (see equations (10) and (11)) the stationary value of real wages is $\frac{We}{Pe} = \frac{jp + w}{hw + p}$.

If the condition for internal consistency is met ($bh=1$), profit earners' real wage offer is equal to the marginal physical product of labour, and thus the real wage will approach the marginal physical product of labour in models II and VII. Internal consistency also assures that the real wage will equal the marginal product of labour, instead of a weighted average of b and h , in model V.

Complete consistency ensures that models I and III achieve a real wage equal to the marginal physical product of labour, rather than a weighted average of wage and profit earners' claims.

III.

What meaning can we attach to the terms "cost inflation" and "demand inflation" in the light of our theoretical discussion?⁽⁸⁾ I think it is important to realise that a sensible definition of these concepts cannot imply that demand inflation is the sort of inflation produced only by the pure demand system, and that cost inflation is produced only by the pure cost system. Such definitions would cover only two of the nine possible models.

Another unsatisfactory aspect of this definition of cost inflation is that it divorces cost inflation from demand influences. I have shown earlier that the pure cost model, being unrelated to excess demand, does not produce inflation in any acceptable sense, for from an initial equilibrium every upward movement of prices and wages leads to an increase in excess supply.

A significant classification of inflation types should distinguish between inflation in which income claims are consistent and inflation in which they are not. In particular I define demand inflation as inflation in which there is consistency of claims, and cost inflation as inflation in which income claims are excessive. These definitions apply reasonably well to all cases (except the pure cost model) and have the advantage that, other things being equal, cost inflation will be more severe than demand inflation. We have not given a name to inflation with deficient income claims, but as this is an unlikely situation in a closed economy a short-hand description is unnecessary.

(8) Other versions of these terms are: "Cost-push" and "demand-pull" inflation (e.g. See P.A. Samuelson, "American Talk of New Inflation" in the Finance and Commerce Supplement to the Sydney Morning Herald, October, 1957), and "income inflation" and "profit inflation" (see E. Lindahl, "Full Employment without Inflation", The Three Banks Review, March, 1957).

TABLE II.

Stationary Values, Pe. Model AI - IX

Model	$jh \neq 1, bh \neq 1$	$bh = 1$	$bh = jh = 1$
I Price D/C Wage D/C $k_1, k_2; k_3, k_4 = 0$	$\frac{A(k_1 k_3 Q + k_1 k_4 + k_2 k_3 hb)}{sQ(k_1 k_3 Q + k_1 k_4 + k_2 k_3 hb) + k_2 k_3 Q(1-bh) + k_2 k_4(1-jh)}$	$\frac{A(k_1 k_3 Q + k_1 k_4 + k_2 k_3)}{sQ(k_1 k_3 Q + k_1 k_4 + k_2 k_3) + k_2 k_4(1-jh)}$	$\frac{A}{sQ}$
II Price C Wage D/C $k_1 = 0$	$\frac{Ak_3 hb}{sQk_3 hb + k_3 Q(1-bh) + k_4(1-jh)}$	$\frac{Ak_3}{sQk_3 + k_4(1-jh)}$	$\frac{A}{sQ}$
III Price D Wage D/C $k_2 = 0$	$\frac{A}{sQ}$	-	$\frac{A}{sQ}$
IV Price D/C Wage C $k_3 = 0$	$\frac{Ak_1}{sQk_1 + k_2(1-jh)}$	-	$\frac{A}{sQ}$
V Price D/C Wage D $k_4 = 0$	$\frac{A(k_1 Q + k_2 hb)}{sQ(k_1 Q + k_2 hb) + k_2 Q(1-bh)}$	$\frac{A}{sQ}$	$\frac{A}{sQ}$
VI Price C Wage C $k_1 = k_3 = 0$	$\begin{array}{l} 0 - jh < 1 \\ \infty - jh > 1 \end{array}$	-	The stationary value depends on the initial conditions.
VII Price C Wage D $k_1 = k_4 = 0$	$\frac{Ak_3 hb}{sQk_3 hb + k_3 Q(1-bh)}$	$\frac{A}{sQ}$	$\frac{A}{sQ}$
VIII Price D Wage C $k_2 = k_3 = 0$	$\frac{A}{sQ}$	-	$\frac{A}{sQ}$
IX Price D Wage D $k_2 = k_4 = 0$	$\frac{A}{sQ}$	-	-

TABLE III.

Stationary Values, We. Model A I - IX

Model	$j_h \neq 1, b_h \neq 1$	$b_h = 1$	$b_h = j_h = 1$
I Price D/C Wage D/C	$\frac{A(k_1 k_3 Q b + k_1 k_4 j + k_2 k_3 b)}{sQ(k_1 k_3 Q + k_1 k_4 + k_2 k_3 b_h) + k_2 k_3 Q(1-b_h) + k_2 k_4(1-j_h)}$	$\frac{A(k_1 k_3 Q b + k_1 k_4 j + k_2 k_3 b)}{sQ(k_1 k_3 + k_1 k_4 + k_2 k_3) + k_2 k_4(1-j_h)}$	$\frac{bA}{sQ}$
II Price C Wage D/C	$\frac{A k_3 b}{sQ k_3 b_h + k_3 Q(1-b_h) + k_4(1-j_h)}$	$\frac{A k_3 b}{sQ k_3 + k_4(1-j_h)}$	$\frac{bA}{sQ}$
III Price D Wage D/C	$\frac{A(k_1 k_3 Q b + k_1 k_4 j)}{sQ(k_1 k_3 Q + k_1 k_4)}$	-	$\frac{bA}{sQ}$
IV Price D/C Wage C	$\frac{A k_1 j}{sQ k_1 + k_2(1-j_h)}$	-	$\frac{bA}{sQ}$
V Price D/C Wage D	$\frac{b A(k_1 Q + k_2)}{sQ(k_1 Q + k_2 b_h) + k_2 Q(1-b_h)}$	$\frac{bA}{sQ}$	$\frac{bA}{sQ}$
VI Price C Wage C	$\begin{array}{l} 0 - j_h < 1 \\ \infty - j_h > 1 \end{array}$	-	The stationary value depends on the initial conditions
VII Price C Wage D	$\frac{A k_3 b}{sQ k_3 b_h + k_3 Q(1-b_h)}$	$\frac{bA}{sQ}$	$\frac{bA}{sQ}$
VIII Price D Wage C	$\frac{jA}{sQ}$	-	$\frac{bA}{sQ}$
IX Price D Wage D	$\frac{bA}{sQ}$	-	-

TABLE IV.

Real Wages, $\frac{W_e}{P_e}$. Model AI - IX

Model	$j_h \neq 1, b_h \neq 1$	$b_h = 1, j_h \neq 1$	$j_h = b_h = 1$
I Price D/C Wage D/C	$\frac{k_1 k_3 Q(b) + k_1 k_4(j) + k_2 k_3 h b (\frac{1}{h})}{k_1 k_3 Q + k_1 k_4 + k_2 k_3 h b}$	$\frac{(k_1 k_3 Q + k_2 k_3) (\frac{1}{h}) + k_1 k_4(j)}{(k_1 k_3 Q + k_2 k_3) + k_1 k_4}$	b
II Price C Wage D/C	$\frac{1}{h}$	$\frac{1}{h}(=b)$	b
III Price D Wage D/C	$\frac{k_1 k_3 Q(b) + k_1 k_4(j)}{k_1 k_3 Q + k_1 k_4}$	-	b
IV Price D/C Wage C	j	-	b
V Price D/C Wage D	$\frac{k_1 Q(b) + k_2 h b (\frac{1}{h})}{k_1 Q + k_2 h b}$	$\frac{1}{h}(=b)$	-
VI Price C Wage C	-	-	b
VII Price C Wage D	$\frac{1}{h}$	$\frac{1}{h}(=b)$	b
VIII Price D Wage C	j	-	b
IX Price D Wage D	b	-	-

TABLE V.

Excess Demand for Commodities at Stationary Values Model AI - X

Model	$j_h \neq 1, b_h \neq 1$	$b_h = 1$	$j_h = b_h = 1$
I Price D/C Wage D/C	$\frac{A[k_2 k_3 Q(1-b_h) + k_2 k_4 (1-j_h)]}{sQ(k_1 k_3 Q + k_1 k_4 + k_2 k_3 b_h) + k_2 k_3 Q(1-b_h) + k_2 k_4 (1-j_h)}$	$\frac{A k_2 k_4 (1-j_h)}{sQ(k_1 k_3 Q + k_1 k_4 + k_2 k_3) + k_2 k_3 Q(1-b_h) + k_2 k_4 (1-j_h)}$	Zero
II Price C Wage D/C	$\frac{A[k_3 Q(1-b_h) + k_4 (1-j_h)]}{sQ k_3 b_h + k_3 Q(1-b_h) + k_4 (1-j_h)}$	$\frac{A k_4 (1-j_h)}{sQ k_3 + k_4 (1-j_h)}$	Zero
III Price D Wage D/C	Zero	-	Zero
IV Price D/C Wage C	$\frac{A k_2 (1-j_h)}{sQ k_1 + k_2 (1-j_h)}$	-	Zero
V Price D/C Wage D	$\frac{A k_2 (1-b_h)}{s(k_1 Q + k_2 b_h) + k_2 (1-b_h)}$	Zero	Zero
VI Price C Wage C	-	-	Indeterminate
VII Price C Wage D	$\frac{A k_3 (1-b_h)}{s k_3 b_h + k_3 (1-b_h)}$	Zero	Zero
VIII Price D Wage C	Zero	-	Zero
IX Price D Wage D	Zero	-	-

TABLE VI.

Excess Demand for Labour at Stationary Values Model A I - IX

Model	$j_h \neq 1, b_h \neq 1$	$b_h = 1$	$j_h = b_h = 1$
I Price D/C Wage D/C	$\frac{bA \sqrt{k_1 k_4} Q (1 - \frac{j}{b}) + k_2 k_4 (1-j_h)}{sQ(k_1 k_3 Q + k_1 k_4 + k_2 k_3 h b) + k_2 k_3 Q (1-b_h) + k_2 k_4 (1-j_h)}$	$\frac{bA k_4 (k_1 Q + k_2) (1-j_h)}{sQ(k_1 k_3 Q + k_1 k_4 + k_2 k_3) + k_2 k_4 (1-j_h)}$	Zero
II Price C Wage D/C	$\frac{bA k_4 (1-j_h)}{sQ k_3 h b + k_3 Q (1-b_h) + k_4 (1-j_h)}$	$\frac{bA k_4 (1-j_h)}{sQ k_3 h b + k_4 (1-j_h)}$	Zero
III Price D Wage D/C	$\frac{bA k_4 (1 - \frac{j}{b})}{sQ (k_3 Q + k_4)}$	-	Zero
IV Price D/C Wage C	$\frac{bA \sqrt{k_1 Q} (1 - \frac{j}{b}) + k_2 (1-j_h)}{sQ k_1 + k_2 (1-j_h)}$	$\frac{bA \sqrt{k_1 Q} (1 - \frac{j}{b}) + k_2 (1-j_h)}{sQ k_1 + k_2 (1-j_h)}$	Zero
V Price D/C Wage D	Zero	Zero	Zero
VI Price C Wage C	-	-	Indeterminate
VII Price C Wage D	Zero	Zero	Zero
VIII Price D Wage C	$\frac{bA (1 - \frac{j}{b})}{s}$	-	Zero
IX Price D Wage D	Zero	-	-

Notes to Tables II, III, IV, V and VI

These tables summarise the results of nine models which may be derived from the basic model of Chapter III, page 26. Model A. I contains the four constants k_1 , k_2 , k_3 and k_4 . If one of these constants becomes zero either a cost element or a demand element in price or wage determination drops out. Thus when $k_1 = k_3 = 0$ the demand elements drop out and the model becomes completely cost determined. This situation is represented by model VI.

Price D denotes solely demand determined prices.

Price C denotes solely cost determined prices.

Price D/C denotes both cost and demand elements in price determination.

Wage D, Wage C, Wage D/C represent the same possibilities for wages.

Each table gives three views of the results. First the results when no conditions as to external and internal consistency are applied ($j_h \neq 1$, $b_h \neq 1$).

This part of the table should be interpreted as the results of the models before consistency conditions are applied. In some cases consistency conditions are irrelevant. The results in these cases are also entered in this column.

The second column in the tables gives the results when there is internal consistency ($b_h = 1$). Only if this condition is relevant are entries made in this column. If b and h are not included in the model concerned then no entry is made in the second column. This means that for all models

which do not possess both the constants k_2 and k_3 internal consistency is irrelevant.

The third column gives the results when complete consistency is achieved ($j_h = b_h = 1$). No entry is made in this column only in the case of model IX in which consistency is irrelevant.

CHAPTER V.

FLEXIBLE PROFIT MARGINS AND REAL WAGE CLAIMS.

Profit and wage margins are assumed to be rigid in the basic model. Thus if they start out at levels implying inconsistency of claims they remain at those levels. It would be more realistic to assume that these factors possess some degree of flexibility so that they vary with excess supply and demand, and we shall here construct a model which allows for this.

It may at first appear that if we permit profit margins and real wage claims to vary with excess demand the conclusions of the previous chapters will not hold. The argument involved is basically the same as that sometimes used to suggest that full cost and marginal cost pricing amount to the same thing. It is contended that if profit margins of cost determined pricers vary every time there is excess demand or supply the only stable price possible is one which involves zero excess demand, that is, the equilibrium price.⁽¹⁾ This argument is correct in a static context, but is misleading if the dynamic aspects of the mechanism are neglected. The time path of such a model is quite likely to over-shoot equilibrium, although eventually it will return to it. Suppose the system is at equilibrium and an upward shift in autonomous demand occurs. Demand based prices and wages rise, with cost determined prices and wages following. At the start of this process income claims are consistent, for we have assumed an initial equilibrium. However, when excess demand appears

(1) Precisely the same argument may be used to show that wages approach equilibrium if real wage claims vary with excess demand for labour.

real profit and real wage claims rise so that taken together they become excessive. This situation will force prices and wages above equilibria, for income claims will rise whilst excess demand remains. Once equilibrium values are exceeded general excess supply sets in and profit and wage margins will be reduced towards consistent levels. The process continues until stable equilibrium is reached.

This behaviour is very closely related to that described in Chapters III and IV. There we started off assuming that claims were excessive and then examined the effect of a jump in demand. The result was that prices over-shot, and because of the rigidity of claims did not return to equilibrium. It was then stated that either it may be necessary for some excess supply to develop before claims are reduced to levels consistent with equilibrium, or that if income claims are not reduced by the excess supply entrepreneurs' stocks must pile up. As this cannot continue indefinitely profit earners must eventually lower prices and/or wages and/or output.

We shall now set out a model involving flexible profit and wage margins and shall examine its properties in more detail.

SYMBOLS.

- D - Money demand for all commodities.
- D_1 - Money demand for commodities whose prices are demand determined.
- D_2 - Money demand for commodities whose prices are cost determined.
- L - Money demand for all labour.
- L_1 - Money demand for labour whose wages are demand determined.

- L_2 - Money demand for labour whose wages are cost determined.
- P - The average price level.
- P_1 - Demand determined prices.
- P_2 - Cost determined prices.
- W - The average wage level.
- W_1 - Demand determined wages.
- W_2 - Cost determined wages.
- H - Unity plus the average profit margin on commodities whose prices are cost determined.
- J - The real wage claim (wage margin) of labour whose wages are demand determined.

The Model.

$$\frac{dP_1}{dt} = a_1 (D_1 - x_1 Q P_1) \quad \dots (1)$$

$$\frac{dW_1}{dt} = a_2 (L_1 - y_1 Q W_1) \quad \dots (2)$$

$$\frac{dP_2}{dt} = a_3 (H W - P_2) \quad \dots (3)$$

$$\frac{dW_2}{dt} = a_4 (J P - W_2) \quad \dots (4)$$

$$\frac{dH}{dt} = q (D_2 - x_2 Q P_2) \quad \dots (5)$$

$$\frac{dJ}{dt} = r (L_2 - y_2 Q W_2) \quad \dots (6)$$

$$P = x_1 P_1 + x_2 P_2 \quad (x_1 + x_2 = 1) \quad \dots (7)$$

$$W = y_1 W_1 + y_2 W_2 \quad (y_1 + y_2 = 1) \quad \dots (8)$$

$$D = A + (1-s) Q P \quad \dots (9)$$

$$L = b D \quad \dots (10)$$

$$D_1 = x_1 D \quad \dots (11)$$

$$D_2 = x_2^D \quad \text{.....(12)}$$

$$L_1 = y_1^L \quad \text{.....(13)}$$

$$L_2 = y_2^L \quad \text{.....(14)}$$

For simplicity we shall refer to this system as the "flexible model".

Equation (1) : The rate of change of demand determined prices depends upon the amount of excess demand or supply for the commodities concerned. a_1 is a constant representing the speed of response. The constant x_1 is the proportion of total output sold at demand prices. We assume (equation (11)) that the proportion of total demand for these commodities is also x_1 . If it were not, changes in price levels and in the components of total output would bring this about. The assumption then is entirely justified if we start our analysis from an initial equilibrium, and we shall always do this.

Equation (2) : The rate of change of demand determined wages depends upon the amount of excess demand or supply for the labour involved. a_2 represents the speed of reaction of wages and y_1 is the proportion of workers receiving such wages (assumed equal to the proportion of total demand for this labour y_1 (equation (13)).

Equation (3) : This equation, with H taken to be constant, would describe the reaction of cost determined prices to a change in wages, a_3 being the speed of response. But H is now a variable (equation (5)), so that (3) and (5) taken together represent a combination of cost and demand pricing in which profit margins vary with excess demand and supply.

Equation (4) : Similarly, with J constant, this equation described the reaction of cost determined wages to a change in prices, a_4 being the speed of response. As J varies in equation (6) these wages are determined partly by cost and partly by demand considerations.

Equations (5) and (6) : Profit margins (5) and real wage claims (6) vary with excess demand and supply for commodities and labour, respectively. The speed of response of profit margins is q and of real wage claims is r .

Equations (7) and (8) : These equations describe the composition of the average price level (7) and the average wage level (8).

Equations (9) and (10) : These are the same functions that have previously been used to describe the behaviour of demand for commodities (9) (see Chapter III, equation (7)) and for labour (10) (see Chapter III, equation (8)).

Equations (11) and (12) : Demand for commodities is divided into demand for demand priced goods (11) and demand for cost/demand priced goods (12).

Equations (13) and (14) : Demand for labour is divided into demand for demand priced labour (13) and demand for cost/demand priced labour (14).

The products HW and JP make the system non-linear and thus not amenable to the usual methods of solution. For this reason it was decided to examine the form of the solution on an

analogue computer.⁽²⁾ A number of time paths of the system were recorded with certain parameters held constant at the following values. Q was assumed to be unity. As it is an index of real output this assumption could not change the problem in any way. The marginal propensity not to spend " s " was taken to be 0.4. Larger values of s would probably have meant a more stable system, whereas smaller values would have increased the likelihood of instability. The reaction coefficients " a_1, a_2, a_3, a_4 " were all taken as 0.5. This means that approximately $2/3$ of the reaction to any change would be completed in $\frac{1}{0.5} = 2$ units of time.⁽³⁾ No direct information is available on the value of the continuously distributed lags of equations (1) to (6), although responses are clearly not instantaneous (so that $a_1, a_2, a_3, a_4 \neq \infty$). Let us assume that the average period during which firms leave prices and wages unchanged is three months. With the speeds of response at 0.5 two thirds of an aggregate reaction which takes individual units three months will be performed in two periods. With these assumptions then our period will be of the order of

(2) The computer used was the University of Technology Analogue Computer. Mr. C.P. Gilbert of the Electrical Engineering Department of the N.S.W. University of Technology prepared the problem for the machine and ran off the solutions.

(3) See R.G.D. Allen, Mathematical Economics, Macmillan, 1938, pp. 26, 27, and 28.

If $\frac{dy}{dt} = a(Z - Y)$ and if Z_0 is the initial value of Z ,

$\frac{Y}{Z_0} = (1 - \frac{1}{e}) = 0.632$ after $\frac{1}{a}$ units of time.

one month's duration. (4) The share of wages "b" was given a value of 0.5.

The constants q and r were valued together, as were the constants x_1 and y_1 (and thus x_2 and y_2). The values taken are illustrated in the following table:

$x_2=y_2$ =	$q=r$ $x_1=y_1$ =	0.0	0.2	0.4	0.6	0.8	1.0
0.0	1.0	A1	B1	C1	D1	E1	F1
0.2	0.8	A2	B2	C2	D2	E2	F2
0.4	0.6	A3	B3	C3	D3	E3	F3
0.6	0.4	A4	B4	C4	D4	E4	F4
0.8	0.2	A5	B5	C5	D5	E5	F5
0.85	0.15	A6	B6	C6	D6	E6	F6
1.0	0.0	A7	B7	C7	D7	E7	F7

The cases in row 1 resolve into the single case representing the pure demand model when we take into account that q and r do not appear in the system if $x_2 = y_2 = 0$. Cases A2, A3, A4, A5 and A6 are differential equation representations of the mixed cost/demand model of Chapter III, for with $q = r = 0$

(4) No precision is claimed with respect to the time involved in the processes.

profit margins and real wage claims are rigid. The proportion of cost elements in these models increases as we move down the columns. The pure cost model ($q = r = 0$, $x_1 = y_1 = 0$) is given by A7. The remaining cases are non-linear models, but they are not all representative of our flexible model. Row 7 does not possess any purely demand determined prices or wages (for $x_1 = y_1 = 0$) and is a mixed model only in the sense that cost determined prices and wages involve margins which change with excess demand.

The twentyfive cases in the square marked out by the heavier lines constitute examples of the flexible model.

The system was set up with a value of $A = 0.3$ and was permitted to settle down to its stationary value. It was then disturbed by raising A to 0.4 , and the path followed by the system was recorded.

The pure demand model ($x_1 = y_1 = 1.0$) and the flexible model ($x_1, y_1 > 0$; $x_2, y_2 > 0$; $q, r > 0$) were stable for the values given and settled down to an initial value of $P = 0.75$, when $A = 0.3$. When A was raised to 0.4 they eventually settled down to a value $P = 1.0$. This result suggests that aggregate prices have a stationary value equal to the equilibrium,

$$P_e = \frac{A}{sQ} \left(= \frac{0.3}{0.4}, = \frac{0.4}{0.4} \right) \dots\dots (15)$$

and this is the value which in our earlier discussion was suggested as the stationary value. (5)

(5) Wages also settled down to equilibrium values.

$$\begin{aligned} W_e = \frac{bA}{sQ} &= \left(\frac{0.5 \times 0.3}{0.4} = 0.375 \right) \\ &= \left(\frac{0.5 \times 0.4}{0.4} = 0.5 \right) \end{aligned}$$

In every case studied⁽⁶⁾ the average price P in the flexible model reacted to the upward shift in A by over-shooting and then returning after a number of oscillations to equilibrium (see Figs. IV and V). This certainly suggests that the mechanisms previously described in this chapter were operative. Apparently the inflationary shock operated to raise real wage claims and profit margins above consistent levels and so forced prices and wages above equilibria.

Several features could be added to the flexible model which would make it more realistic. At some stage after the overshoot a reaction from output could be expected. If output were reduced real income (Q in equation (9)) would fall so that demand falls, but producers' potential supply (Q in equations (1) and (5)) would be unchanged so that excess supply for commodities increases and the fall in prices would be accelerated (or the rise decelerated). There would be a similar effect on wages.

The effect of permitting output to vary downwards would be to reduce perhaps both the degree and the length of time of the overshoot. If we introduced the further assumption that prices and wages fall less readily than they rise this would lengthen the time of the overshoot and thus of the duration of excess supply.

To return to the model in hand let us study the variations in the results of the flexible system when we change

(6) B~~6~~, C~~6~~, D~~6~~, E~~6~~ were the only cases not examined.

the proportion of cost and demand elements and the flexibility of income claims.

Varying q and r (Flexibility of Income Claims)

Reducing the speed of reaction of profit and wage margins in all cases slowed up the process reducing the rate of rise of aggregate prices and lengthening the period of time of the initial overshoots. Figure V shows a change in $q = r$ from 0.2 to 1.0. With $q = r = 1.0$ two overshoots are completed in the time it takes for one overshoot if $q = r = 0.2$. The degree of damping increases as q and r fall.

Thus with highly flexible claims rapid oscillations which take some time to die out are experienced, whilst if claims are inflexible oscillations are slow but damp more quickly.

Varying $x_1 = y_1$ and $x_2 = y_2$ (Cost and Demand Elements)

Figure IV shows the results of varying the proportion of pure demand and quasi-cost elements in the model. Case 1, the pure demand model, describes a non-oscillatory path to equilibrium.

The introduction of cost elements causes aggregate prices to rise above 1.00, and the higher the proportion of these elements the higher the level reached (compare 1, F4 and F6).

In fact, it appears that for the values assumed, when cost elements are a very large proportion the system becomes unstable. With demand elements absent ($x_1 = y_1 = 0$) attempts to establish a steady state with $A = 0.3$ were unsuccessful, whilst $x_2 = y_2 = 0.85$ (F4, Figure IV) appears to be near the limit of stability.

We have shown that the underlying tendency of our earlier models for prices and wages to over-shoot equilibria is not altered in a number of feasible cases in which profit margins and real wage claims are flexible. However, the flexible model is more realistic than the previous system for a number of reasons. First we do not have to introduce excessive claims as part of the initial data or the initial shock, for they are induced by the rise in autonomous demand. Secondly we may deduce from the flexible model that a high degree of inflexibility means that the over-shoot would persist longer than with a high degree of flexibility. Thirdly the eventual stationary values of the flexible model are equilibria.

For both the flexible system and the basic model of Chapter III a high degree of cost elements means that prices rise on the initial over-shoot to higher levels than they would if cost elements were minor.

CHAPTER VI.

ANTI-INFLATION POLICY IN A CLOSED ECONOMY.

Conventional anti-inflation policy has been thought out in the context of a model in which prices are purely demand responsive after full employment has been reached. The assumptions made about wage behaviour are not always clear, but there is usually a presumption that it can be adequately described by assuming that excess demand for commodities also indicates excess demand for labour.

Recently concern has been felt in the United States⁽¹⁾ and the United Kingdom⁽²⁾ about the possibility of inflationary situations in which prices and wages may not be wholly demand determined. This has resulted in several reviews of the old policy prescriptions. I shall discuss some of these contributions to anti-inflation policy and also present my own views on how inflation with excessive income claims may be controlled.

First let us examine the policy implications of the pure demand model, for this is the system which often seems to underlie policy proposals.

SYMBOLS.

- R_t - Personal disposable income, period t .
- S_t - Sales tax collections, period t .
- T_t - Direct or income tax collections, period t .
- m - Unity plus the average rate of sales tax.

(1) See the article by P.A. Samuelson referred to in footnote (8) on p.64.

(2) The Economist, July 20, 1957, p.189.

The other symbols which we shall use have been defined in the previous chapters.

The model is:-

$$P_t - P_{t-1} = k_1 (D_{t-1} - QP_{t-1}) \quad \text{.....(1)}$$

$$W_t - W_{t-1} = k_3 (L_{t-1} - QW_{t-1}) \quad \text{.....(2)}$$

$$D_t = A + (1-s) R_t \quad \text{.....(3)}$$

$$T_t = v + rY_t \quad \text{.....(4)}$$

$$Y_t = Q P_t \quad \text{.....(5)}$$

$$S_t = QP_t (m-1) \quad \text{.....(6)}$$

$$R_t = Y_t - (T_t + S_t) \quad \text{.....(7)}$$

$$L_t = b D_t \quad \text{.....(8)}$$

Equations (1) and (2) are identical to the price and wage functions of model A.IX. Demand pricers are unable to pass on sales taxes so m does not appear in price equations.

Equations (3) to (8) describe the various modifications to the demand functions which are necessary when direct and sales taxes are introduced. Demand is then a function of personal disposable income (equation (3)), which is national income at market prices minus direct and indirect tax collections (equation (7)). Direct taxes are assumed to be a linear function of national income (equation (4)), and in order that the tax rate should increase with income the constant " v " is regarded as negative and the constant " r " as positive. Sales taxes vary with total receipts from the sale of commodities (equation (6)). The function describing the demand for labour (equation (8)) has been discussed in Chapter III.

We shall present only the stationary values of prices and wages. The stability conditions would be closely allied to those for model A.IX.

$$P_e = \frac{A - (1-s) v}{Q[1 - (1-s) \{1 - r - (m-1)\}]} \quad \dots\dots(9)$$

$$W_e = \frac{b [A - (1-s) v]}{Q[1 - (1-s) \{1 - r - (m-1)\}]} \quad \dots\dots(10)$$

Suppose an inflation develops with autonomous demand "A" rising. The consequent price and wage rises could be counteracted by monetary and/or fiscal policy. Monetary policy would be directed towards checking the rise in autonomous demand and reducing the marginal propensity to spend out of income, "1-s". Fiscal policy would require an increase in the direct tax schedule (decrease in t_v and/or increase in "r"), and perhaps an increase in the rate of sales tax "m - 1", to offset the rise in A.

Thus when the values of the various constants are fixed prices and wages will asymptotically approach new equilibria. Unemployment would be encountered only if the measures taken to correct the inflation are too harsh and precipitate a recession through a deficiency of aggregate demand.⁽³⁾ It is not immediately apparent from the model that this can happen, but it must be remembered that Q is constant for upward movements and for no change in demand, but may vary downwards with decreases in aggregate demand.

The basic model of Chapter III gives different results to the pure demand system. This model, modified to include sales and income taxes is -

(3) With flexible prices and wages such a recession may only be temporary.

$$P_t - P_{t-1} = k_1 (D_{t-1} - QP_{t-1}) + k_2 (hm W_{t-1} - P_{t-1}) \dots\dots(11)$$

$$W_t - W_{t-1} = k_3 (L_{t-1} - QW_{t-1}) + k_4 (j P_{t-1} - W_{t-1}) \dots\dots(12)$$

together with the demand functions described by equations (3) to (8).

In equations (11) and (12) the only difference from the price and wage functions of Chapter III is that sales taxes are assumed to be passed on by those entrepreneurs using cost pricing. Thus entrepreneurs' price without sales tax would be hW , and with sales tax is hmW .

The stationary value for prices is -

$$P_e = \frac{(k_1 k_4 + k_1 k_3 Q + k_2 k_3 b hm) [A - (1-s) v]}{Q(k_1 k_4 + k_1 k_3 Q + k_2 k_3 b hm) [1 - (1-s) \{1 - r - (m-1)\}] + k_2 k_3 Q(1 - bhm) + k_2 k_4 (1 - jhm)} \dots\dots(13)$$

and for wages is

$$W_e = \frac{(k_1 k_4 j + k_1 k_3 b Q + k_2 k_3 b) [A - (1-s) v]}{Q(k_1 k_4 + k_1 k_3 Q + k_2 k_3 bhm) [1 - (1-s) \{1 - r - (m-1)\}] + k_2 k_3 Q(1 - bhm) + k_2 k_4 (1 - jhm)} \dots\dots(14)$$

Now if $jhm = bhm = 1$ it can be seen that the system will approach the same values as those approached by the pure demand model (equations (9) and (10)). These equilibrium values are such as to equate demand and supply in the markets concerned.

As before $\frac{1}{hm}$ and b may be thought of as the real wage offers of entrepreneurs (and thus $1 - \frac{1}{hm}$ and $1 - b$ as their real profit claims). The real wage claim is " j ". Thus the condition

$jhm = bhm = 1$ ensures consistency of real income claims, and again this consistency guarantees that stationary values of the system are also equilibrium values.

Suppose that inflation starts from an initial point of equilibrium in both markets. Autonomous demand rises and the wage and profit margins j and h also rise so that the consistency conditions are violated. Let us consider the effect of using monetary policy and direct tax manipulations to bring price and wage rises to a halt. With inflexible income claims the result will sooner or later be excess supply in both markets. When excess supply threatens the deflationary policy should be reversed, but this may well start the inflation again. The authorities would thus be faced with the dilemma that no reasonable pattern of policy changes will achieve stable equilibrium. Of course, it would be possible to postpone excess supply by action which stimulated demand each time excess supply threatened, but this is hardly feasible if we wish to retain our original aim of preventing inflation.⁽⁴⁾ We are thus forced to conclude that conventional

(4) It is interesting to speculate on the causes of the slight recession in America which became noticeable in October, 1957. The Commerce Department recently revealed that in both September and October personal income declined, and that the October decline was made up of declines in payrolls in manufacturing industries. (The Australian Financial Review, November 21st, 1957). Prior to this there had been considerable discussion of the fact that America seemed to be experiencing an inflation in which cost elements played an important part. (P.A. Samuelson, Ibid). Of course, the decline in defense spending, and the deflationary policy of the Federal Reserve Board would have been behind the fall-off in demand. However, after a bout of cost inflation is the time when we should expect some excess supply, and it is likely that excessive claims have had some effect on the level of employment.

remedy measures are not by themselves an adequate means of combatting inflation with fairly rigid and excessive income claims.⁽⁵⁾

The usual problem associated with cost inflation is that the resultant price and wage rises are more severe than they would be if claims were consistent. Various policies have been tried and suggested as a means of reducing income claims to a consistent level.

First there is the view of those who believe that conventional policy will be effective in bringing the economic system to equilibrium. A leading exponent of this view is the Chairman of the Federal Reserve Board, Mr. William McChesney Martin. In a statement before a Senate Committee on Finance he admitted that cost elements could make prices rise more sharply than would be expected if the system were only demand responsive.

"There is much to be said for the view that contractual or other arrangements designed as shelters or hedges from inflation have the effect of quickening its tempo. The 5 per cent rise in the cost of living which we have experienced over the last two years has probably been reflected in more rapidly rising wage costs because of the prevalence of cost-of-living clauses in many modern wage contracts. Cost-plus contracts tend to have the same quickening effect on the inflationary spiral.

The spiral is also, however, a demand spiral. At each point of time in the development of the inflationary spiral, there must be suffic-

(5) If claims have a high degree of flexibility stabilization policy along the lines suggested by Phillips ("Stabilization Policy in a Closed Economy", Economic Journal, 1954) might be successful in controlling price and wage fluctuations.

ient demand to take the higher priced goods off the market and thus keep the process moving". (6)

However, he does not recommend any specific action to deal with excessive income claims, but states that -

"....the present situation calls both for a larger budgetary surplus than we have had or have in prospect, and a continuance of restraint upon creation of new supplies of money.

Let us not follow the defeatist path of believing that widespread unemployment is the alternative to inflation."(6)

Mr. Martin may be tacitly assuming that income claims can never be excessive, in which case conventional policies will bring the system to equilibrium. On the other hand he states that cost influences can speed up inflation, and I think it is fair to say that this implies excessive claims. Another possibility is that he inclines to the view that conventional policy measures will be adequate because he believes that claims are flexible. However, our analysis of the effect of highly flexible claims suggests that in this case if cost elements are an important part of the system prices and wages may well oscillate with a fairly high frequency. In this event conventional policies would have to be considerably modified, although some form of operation on the level of demand may be adequate. (7)

(6) Statement by the Chairman of the Federal Reserve Board before the Senate Committee on Finance, August 13, 1957; reprinted in The Banker, October, 1957, p.663.

(7) Phillips, Op.Cit.

If claims, as may often be the case, are fairly rigid, conventional policies will not be sufficient to restore equilibrium except with a long delay.

The ideas of Professor Harrod and Professor Lindahl represent opposite points of view of this subject.⁽⁸⁾ They both recognise that if excess demand is removed in conditions of excess claims an economy can stagnate, but they differ in their judgments as to how best to cope with the problem.

Professor Harrod believes that the excessive income claims which have been a feature of the recent British inflationary experience would best be dealt with by permitting the economy to develop as fast as possible. The consequent gains in real income, he claims will mean an automatic reduction of income claims. He thus believes that it is worth risking the stability of the price level in order to achieve growth.

It is feasible that income claims may be moderated as the total product increases, but it is by no means certain that they will be. Desired living standards seem to have shown a marked ability to keep pace with the increases in real income in recent years. Moreover, are trade unions likely to be satisfied with any increase in production foreseeable in the near future?

If claims do not fall with increased production the problem of cost inflation will be a long-run and not a temporary phenomenon. Lindahl suggests that if workers wage demands are excessive it is preferable to bring inflation under control even

(8) R.F.Harrod, The Financial Times, July 17,18, 1957;
E.Lindahl, "Full Employment without Inflation", The Three Banks Review, March, 1957.

though this may involve some unemployment.

"Suppose that the outcome of the wage negotiations is a relatively high wage level, at which the demand for labour falls short of the supply, but that workers are nevertheless not prepared to sacrifice any part of their wage increase in order to make a higher level of employment possible. What now is the policy implication of the demand for full employment?

If capital equipment is under-employed, then there need be no hesitation in undertaking expansionary measures in order to increase employment. But in other cases an increase in employment is conditional upon lowering workers' real wages by raising the price level. It can hardly be considered a sensible policy, however, to force workers, in the interests of full employment, to accept lower real wages than they are willing to accept, for they will simply make even greater demands for increases in money wages, and this will force the authorities to take collective measures in order to bring the inflation under control, and this, in turn, will tend to reduce employment further. It seems therefore that in such a case stabilization of the price level is to be preferred even from the employment aspect, in spite of the fact that the level of employment will not be as high as the workers might wish."(9)

Thus Lindahl suggests that growth should be sacrificed for the sake of stability when forced to choose between the two. An alternative policy would involve sacrificing stability in order to achieve growth.

The British government's policy of combatting the excess

(9) E. Lindahl, Ibid, p.35.

demand and excess income claims which have recently been experienced in the United Kingdom is to attack the former by holding down government expenditure and by a credit squeeze, and the latter by a policy of opposition to demands for increased wages.⁽¹⁰⁾ If a sufficiently strong line on wage policy can be pursued this can result in a reconciliation of full employment and stability, but there is a likelihood that the problem may be transferred to the industrial relations field.

It is not possible to choose between the various undersirable feature of each of these policies on economic grounds, but we may well ask whether policies are possible which avoid the undesirable consequences which we have mentioned?

Mr. Burchardt makes the point that something could be achieved in the long run by redesigning bargaining practices so that the various groups compete for consistent shares in the real national income.⁽¹¹⁾ Differences of opinion about shares in the real income would thus be removed from the sphere in which they can and do affect the price level. To bring this about would be a formidable task, and any treatment here of the

(10) The Economist, November 9, 1957, p.467.

"...the Government has made plain its view that the nation would be better served this winter by standing up to strikes, rather than by giving way to inflationary wage settlements".

(11) F.A.Burchardt: "Cost Inflation", Bulletin of the Oxford Institute of Statistics, November, 1957.

problems involved would necessarily be superficial. However, if such a state of affairs could be achieved inflation with excessive income claims would be held in check.

It is feasible that some control over income claims may be achieved through variations of those indirect taxes which are passed on through prices. An example will show how this policy might work. In the second model set out in this chapter it was assumed that sales taxes were passed on by cost pricers. The condition for consistency of income claims was $b = \frac{1}{hm} = j$. Suppose that the real wage share offered to wage earners is $b = \frac{1}{hm} = 60\%$, and that wage earners claim a share of $j = 64\%$. Suppose also that $h = 1.25$ so that the profit margin is 25% , and $m = 1.33$ so that the average rate of sales tax is $33.1/3\%$. Income claims are clearly excessive. If, however, the average rate of sales tax is reduced to 25% we should have $j = \frac{1}{hm}$, and $b < \frac{1}{hm}$ where $j = \frac{1}{hm} = 64\%$ and $b = 60\%$.

Excess income claims have thus been eliminated and some deficiency of claims introduced. The excess demand which must also be a feature of the inflation will have to be eliminated by direct tax changes or by monetary policy. Such policy will also be required to offset the expansionary effects of the reduction in sales tax. If this is done a stable price level will be achieved without excess supply, but perhaps with some excess demand (due to deficiency of claims), and this price level will be lower than it would have been had claims not been reduced.

Thus inflation with excess claims may be overcome by -

- (i) a reduction in indirect taxes such as sales or payroll taxes, and
- (ii) direct tax increases or a tighter monetary policy

- (a) to eliminate the excess demand which existed before the change in indirect taxes, and
- (b) to counteract the increase in demand due to reduced indirect taxes.

Two qualifications must immediately be made. In the first place reducing indirect taxes reduces the ex ante and probably also the ex post share of entrepreneurs using cost pricing. They may try to regain their former share by increasing their profit margins (i.e. absorbing, instead of passing on the reduction in indirect taxes). It is to be hoped that the accompanying deflationary policy would deter them from completely absorbing the indirect tax reduction.

The second qualification has to do with the probability that excess claims will be a continuing problem in many economies. In those countries in which a high rate of development is desired not only will there be a tendency for demand to keep ahead of production but also the devotion of a relatively large proportion of output to investment will encourage wage earners to try to increase their share of real income. Reductions in indirect taxes (and increases in subsidies) would hardly be adequate to meet the problem in its long term aspects. The need is thus apparent for work along the lines suggested by Burchardt so that bargaining for real income shares will not affect the price level.

Indirect tax policies may then provide some temporary relief, but a permanent solution must be sought in a change in the methods of determining the real income of various groups in the economy. It is realised that a practical solution along these lines would be extremely difficult to devise and implement.

PART B.

THE OPEN ECONOMY

CHAPTER VII

INFLATION IN AN OPEN ECONOMY - I

Our simple model of mixed inflation was designed to answer questions about an economy which does not engage in international trade (or at the most, whose trade in relation to its national income is negligible). In this and the next two chapters we shall discuss the effects of mixed cost and demand price and wage responses in the context of an open economy. To simplify the exposition it is assumed here that export and import prices move proportionately, but in Chapter VIII this assumption is relaxed and separate changes in export and import prices are allowed.

In the previous chapters it was concluded that inflation with excessive income claims would be more severe (in the sense of involving higher price and wage rises) than inflation in which claims were consistent, and could result in some excess supply before equilibrium is reached. Our task now is to discover whether, and if so under what conditions, such results are applicable to the open case. In the first section we shall set up the model with which we shall work, and in Section II its solution will be examined for compatibility with equilibrium. Again we shall find that consistency of income claims ensures equilibrium, but for the open economy these claims vary with export/import prices and with autonomous domestic demand. Thus the size of the profit margin " $h - l$ " relative to the size of the wage adjustment coefficient " j " is not the sole factor, as was the case in the closed economy, upon which inconsistency of claims will depend. Even without

domestically generated changes in these two important elements (j and h) of our problem it will be shown that disproportionate rises in autonomous domestic demand and in external prices can radically alter the nature of the inflation experienced.

I

For an open economy we may distinguish three classes of goods and services whose price levels are subject to different types of influence. These classes we shall call exportables, importables and domestic products. Exportables (exports plus potential exports consumed at home) and importables (imports plus domestically produced import substitutes) shall be referred to collectively as trade products.

The determinants of the exportables price level will vary with the type of economy considered. The analysis is confined to a system possessing attributes of the Australian economy. The price of Australian exportables is taken to be determined largely by world rather than domestic demand and cost considerations, and for this reason is assumed to be ~~exogenous~~ exogenous. This may be justified on the following grounds. First Australia's consumption of exportables is a small proportion of her output of these products. This means that domestic demand does not exert much influence on their price. Secondly in many cases her total supply is a small proportion of the amount of the products concerned entering into world trade so that their prices are largely unaffected by domestic costs.

This assumption would not be justified in the case of the United Kingdom, for her export prices are very dependent on domestic conditions. A large proportion of total output is consumed at home, and in many instances she supplies a large proportion of the total quantity entering into world trade. Domestic demand and costs then would have considerable influence in the formulation of the price level of exportables. For similar reasons we could not treat American export prices as given exogenously.

Domestic products are goods and services whose prices are largely independent of external conditions. Such industries as building, many types of personal service, transport, and industries sheltered by quantitative import restrictions would fall in this class.

We shall assume that the price level of importables is exogenously determined. This assumption is valid if Australia does not absorb such a large share of world trade in the commodities concerned that, in the short run, changes in Australian demand are reflected by changes in import prices.

We now proceed to formulate a model based on these assumptions.

SYMBOLS

P_t^1 - The general price level of domestic goods, period t .

P^2 - The general price level of tradeable goods.

P_t - $(= a_1 P_t^1 + a_2 P^2)$. The "cost of living" index upon which wage claims are based, period t . a_1 and a_2 are fixed weights showing the proportions of domestic goods and tradeable goods, respectively, in the regimen representing the consumption of wage earners.

- Z_t - $(= c_1 W_t + c_2 P_t^2)$. The variable cost per unit of production of domestic goods, period t . $c_1 W_t$ is the wage cost per unit of output and $c_2 P_t^2$ the tradeable materials cost per unit of output of domestic goods. Holding to our assumption of Chapter III that a unit of labour equals a unit of output, then $c = 1$.
- W_t - The general wage level of labour employed in the production of domestic goods, period t .
- Y_t - Money national income, period t .
- D_t^1 - The level of money demand for domestic goods, period t .
- D_t^2 - The level of money demand for tradeable goods (excluding tradeable goods used in the production of domestic goods) period t .
- L_t - The level of money demand for labour used in domestic goods industries, period t .
- X - The volume of full employment output of exportables and importables produced at home less the volume of importables and exportables used in the production of domestic goods, $c_2 Q$. We are assuming that the production of trade goods requires negligible quantities of domestic goods and importable inputs.
- Q - The volume of full employment output of domestic goods.

Both Q and X are assumed to be constant, as are the weights c_1 , c_2 , a_1 and a_2 . These assumptions are necessary in order that the model should be linear, but they are justified only if the structure of production and consumption is relatively insensitive in the short run to discrepancies between trade

goods and domestic goods prices and wages.

The Model

$$P_t^1 - P_{t-1}^1 = k_1(D_{t-1}^1 - QP_{t-1}^1) + k_2(hZ_{t-1} - P_{t-1}^1) \quad \dots (1)$$

$$W_t - W_{t-1} = k_3(L_{t-1} - QW_{t-1}) + k_4(jP_{t-1} - W_{t-1}) \quad \dots (2)$$

$$Z_t = W_t + c_2 P_t^2 \quad \dots (3)$$

$$P_t = a_1 P_t^1 + a_2 P_t^2 \quad \dots (4)$$

$$Y_t = QP_t^1 + XP_t^2 \quad \dots (5)$$

$$D_t^1 = A(1-i_1) + (1-s-i_2)Y_t - xQ(P_t^1 - P_t^2) \quad \dots (6)$$

$$D_t^2 = Ai_1 + i_2Y_t + xQ(P_t^1 - P_t^2) \quad \dots (7)$$

$$L_t = bD_t^1 \quad \dots (8)$$

Equation (1). This equation is similar to that used for price determination in Chapter III (equation (12)). Domestic product prices are assumed to react to changes in costs of production as well as to excess demand or supply.

Equation (2). The analogous function in Chapter III is equation (13). Wages vary with excess demand for and supply of labour and with changes in the cost of living.

Equations (3) and (4). Explanations of these equations have already been given in the description and discussion of symbols.

Equation (5). Total money income consists of the value of domestic goods produced (QP_t^1) plus the value of exportables and home produced importables less the importable and exportable content of home production (XP_t^2).

Equation (6). The demand for domestic goods (both for consumption and investment) is divided into an autonomous part $A(1-i_1)$ (in money terms), a part which varies with money national income $(1-s-i_2)Y_t$, and a term $-xQ(nP_t^1 - P^2)$ which allows for the influence of relative price changes on demand.

To take each part in turn: A is autonomous money demand for both trade and non-trade goods, i_1 being the proportion of autonomous demand devoted to trade goods. Thus $A(1-i_1)$ is autonomous demand for domestic goods. $(1-s)Y_t$ is the amount of total demand which varies with income, and i_2 being the marginal propensity to buy trade goods $(1-s-i_2)Y_t$ is the value of demand for domestic goods which varies with income. The level of demand for domestic goods will be partly determined by the relationship between domestic and trade goods prices. The demand for domestic goods should thus include a term which increases when the ratio $\frac{P_t^1}{P_2}$ falls and decreases when this ratio rises. Suppose $n = \frac{P_o^1}{P_2}$ is the initial ratio of domestic to trade goods prices, then $-(nP_t^1 - P^2)$ decreases with falls in P^2 and rises with falls in P^1 , but is constant for equi-proportional changes in P^1 and P^2 . There is no reason why we cannot so define our units of commodities that initially $n = \frac{P_o^1}{P_2} = 1$. Now, if for every unit of price by which P^1 and P^2 diverge an amount xQ is added or subtracted from domestic demand and subtracted or added to demand for tradeable goods we shall have a term $-xQ(P_t^1 - P^2)$ in our demand function.

Equation (7). This function describes the behaviour of the demand for tradeable goods. It is not necessary to have it in our model in order to determine prices, and it is included mainly for illustrative purposes. Its explanation should be clear by contrast with equation (6).

Equation (8). The demand for labour equation was explained in Chapter III. As before we assume that the marginal product of labour is constant.

II

The model explains the behaviour of the domestic goods price level. Its time path is given by the difference equation -

$$P_t + P_{t-1}(-s+d_o) + P_{t-2}^1[1-d_o+Qs^1d_1+d_2(1-bh)+d_3(1-jha_1)] \\ = A(1-i_1) + P^2 \{ [1-s-i_2)X+xQ]d_1+(d_2+d_3)hc_2+d_3jha_2 \} \dots (9)$$

Where:

$$\begin{aligned} s' &= s + i_2 + x \\ d_o &= k_1 Qs' + k_2 + k_3 Q + k_4 \\ d_1 &= k_1 k_3 Q + k_1 k_4 + k_2 k_3 h b \\ d_2 &= k_2 k_3 Q \\ d_3 &= k_2 k_4 \end{aligned}$$

The stationary value of domestic product prices is -

$$P_e^1 = \frac{A(1-i_1)+P^2 \left\{ \left[(1-s-i_2) \bar{x} + xQ \right] \bar{d}_1 + (d_2+d_3)hc_2 + d_3jha_2 \right\}}{d_1 Qs' + d_2 (1-bh) + d_3 (1-jha_1)} \quad \text{.....(10)} \quad (1)$$

and of wages paid in domestic goods industries is -

$$W_e = \frac{A(1-i_1)d_4 + P^2 \left\{ \left[(1-s-i_2) \bar{x} + xQ \right] \bar{d}_4 + Qs' (k_1 k_4 ja_1 - k_2 k_3 bhc_2) + \right.}{d_1 Qs' + d_2 (1-bh) + d_3 (1-jha_1)} \quad \text{.....(11)}$$

For the pure demand model ($k_2 = k_4 = 0$)

$$P_e^1 = \frac{A(1-i_1) + P^2 \left[(1-s-i_2) \bar{x} + xQ \right]}{Qs'} \quad \text{.....(12)}$$

$$W_e = \frac{b \left\{ A(1-i_1) + P^2 \left[(1-s-i_2) \bar{x} + xQ \right] \right\}}{Qs'} \quad \text{.....(13)}$$

The level of excess demand for commodities at the stationary value of prices is

$$\begin{aligned} D_e^1 - QP_e^1 &= \left[\bar{d}_2(1-bh) + d_3(1-jha_1) \right] - P^2 Qs' \left[\bar{d}_2 + d_3 \right] hc_2 + d_3 jha_2 \\ &= \frac{A(1-i_1) \left[\bar{d}_2(1-bh) + d_3(1-jha_1) \right] + P^2 \left[(1-s-i_2) \bar{x} + xQ \right] \left[\bar{d}_2 + d_3 \right]}{Qs' d_1 + d_2 (1-bh) + d_3 (1-jha_1)} \quad \text{.....(14)} \end{aligned}$$

-
- (1) The stability conditions for this model may be derived in a form comparable to that in Chapter III, footnote (8). I assume in what follows that price and wage behaviour is stable and (with rigid j and h) not oscillating.

Excess demand at stationary prices may be either positive or negative, and will not, in general, be zero. Nevertheless the conditions which are satisfied when excess demand is zero are meaningful and are related to the analogous conditions for the closed case. In fact when real income claims are consistent in the sense that they are just capable of being satisfied it will be shown that excess demand in the commodity market (and later as we shall see in the labour market also) is zero.

What income claims are present in our system? The problem may be handled in terms of the money (or real) wage offers implied by entrepreneurs' behaviour, and the money (or real) wage claims of the wage earners.

Entrepreneurs using cost pricing charge a price -

$$P^1 = h(W + c_2 P^2) \quad \text{..... (15)}$$

which (on rearrangement) implies a wage offer -

$$W = \frac{P^1 - c_2 P^2}{h} \quad \text{..... (16)}$$

Wage earners whose wages are cost determined claim a money wage -

$$W = P^2 j a_2 + P^1 j a_1 \quad \text{..... (17)}$$

Taking account of demand determined wages we know that at stationary (which will be the same as the equilibrium) values the wage offer equals the wage claim will be -

$$W = P^1 b \quad \text{..... (18)}$$

The proportion of total wages which are cost determined

is $\frac{k_4}{k_3Q+k_4}$ and the proportion demand determined $\frac{k_3Q}{k_3Q+k_4}$
(see equation (2)). (2)

Thus the average wage claim for all workers in domestic product industries is -

$$W = \frac{k_4(P^2ja_2 + P^1ja_1) + k_3Q(P^1b)}{k_3Q + k_4} \dots\dots (19)$$

The claims and offers are consistent when (16) = (19), that is -

$$(k_3Q+k_4) \frac{(P^1-c_2P^2)}{h} = k_4(P^2ja_2 + P^1ja_1) + k_3Q(P^1b) \dots\dots (20)$$

If we substitute P_e^1 (from (10) into (20) and rearrange we reach the conclusion that the satisfaction of (20) requires excess demand in the commodity market (14) to be zero.

It can also be demonstrated that if the consistency condition (15) is fulfilled wages will be such as to equate the demand for and supply of labour.

Now, if there is no excess demand or supply in the labour market at stationary values it must follow that $bP_e^1 = W_e$. The expression for excess demand for labour at stationary wages

$$\begin{aligned} & Le - QW_e \\ &= bD_e' - QW_e, \text{ then becomes} \\ & bD_e' - bQP_e^1 \\ &= b(D_e' - QP_e^1). \dots\dots (21) \end{aligned}$$

(2) At stationary values $k_2Q + k_4 = 1$.

As (21) is proportional to the level of excess demand for commodities, then the fulfilment of the consistency condition which makes excess demand for commodities zero, must also ensure zero excess demand for labour.

We have thus discovered that for the open as well as for the closed economy the consistency of income claims will ensure that there is equilibrium in both the commodity and the labour market. It must be remembered that for the open just as for the closed case there is no necessary reason why, with rigid profit margins and wage margins, this condition should be fulfilled. Thus, in general, prices and wages will tend to stationary values other than equilibria.

III

There are two autonomous variables, P^2 and A , in the model, and we are now in a position to describe the price adjustments which will occur if these exogenous elements change in any particular way. Wage adjustment will not be considered, but in most instances will follow a similar pattern to price adjustments. In each case we shall start from a position in which the consistency condition is fulfilled, but prices are below equilibrium so that in the absence of autonomous changes a "normal" inflation would occur. We then change A or P^2 or j or h ⁽³⁾ and see what

(3) Changes in j and h , with A and P^2 constant, give us roughly the same type of cost inflation conditions as were described in the chapter on the closed economy.

type of process emerges.

1. Increase in Autonomous Demand (A).

(This change may also be interpreted as covering the case of an increase in A greater than in proportion to any increase in P^2 which may simultaneously occur).

A domestically generated increase in demand will raise prices and wages in the domestic goods industries. What will be the nature of the consequent inflation?

Suppose the rise in A is such that the asymptotic value of domestic goods demand (D^1_{eI}) rises in the way shown in figure VI.

- (4) The subscript I, as before refers to the mixed model and the subscript IX to the pure demand model. In order to simplify the diagram we assume that Q is unity.

Where will the other asymptotes (P_{eI}^1 , D_{eIX}^1 , and P_{eIX}^1) lie in relation to D_{eI}^1 ? If we examine the consistency condition (that is (14) equated to zero) it can be seen that a rise in A results in excess demand at asymptotic values. The price asymptote P_{eI}^1 must then be below the demand asymptote D_{eI}^1 . The pure demand asymptotes $P_{eIX}^1 \equiv D_{eIX}^1$ will be above D_{eI}^1 . (5)

If there is an initial amount of excess demand both demand and price will rise towards equilibria. However, the rising level of autonomous domestic demand will generate an increasing amount of excess demand at asymptotic values and the mixed system will therefore not approach equilibrium. The paths of prices and demand for the mixed system are shown by the continuous curves in figure VI. The dotted lines show how a purely demand determined system would behave, prices rising to higher levels than in the mixed system, and equilibrium being achieved at asymptotic values.

Why should deficiency of claims be generated by a rise in A, so that our mixed model, even though it started out with the possibility that prices could reach equilibrium, will generate excess demand at asymptotic values?

(5) This can be seen as follows:

$$\begin{aligned} D_{eIX}^1 - D_{eI}^1 &= A(1-i_1) + (1-s-i_2) Y_{eIX} - xQ(P_{eIX}^1 - P^2) \\ &\quad - A(1-i_1) - (1-s-i_2) Y_{eI} + xQ(P_{eI}^1 - P^2) \\ &= (1-s-i_2-x) Q [P_{eIX}^1 - P_{eI}^1] \end{aligned}$$

So that $D_{eIX}^1 > D_{eI}^1$ if $P_{eIX}^1 > P_{eI}^1$. But P_{eIX}^1 must be greater than P_{eI}^1 as there is excess demand at P_{eI}^1 . Thus $D_{eIX}^1 > D_{eI}^1$.

If we examine entrepreneurs' wage offers (16) we see that a rise in A , through its upward effect on domestic prices, raises money wage offers more than in proportion to the rise in domestic prices. Money wage offers are the residual after paying for the cost of trade goods used in production. If domestic prices rise, but the prices of trade goods remain constant or rise by a smaller percentage (as they must if A rises by a greater percentage than P^2) then the money wage offer must rise more than in proportion to the rise in domestic prices.

The money wage claim, from (19), rises less than in proportion to the rise in domestic prices, for that element of the claim which depends upon the prices of trade goods is constant, or rises less than in proportion to domestic prices.

The combined result is that real claims considered together are deficient after the rise in autonomous domestic demand.

If profit and wage margins are responsive to excess demand we can see from (14) that the consequent rises in these elements will reduce the amount of excess demand at asymptotic values. In terms of figure VI our asymptotes P_{eI}^1 and D_{eI}^1 will tend to

swing upwards and together, with complete consistency being achieved if they become as high as $P_{eIX}^1 = D_{eIX}^1$. With flexible claims

equilibrium would perhaps eventually be reached. Without an analogue solution of the system it is not possible to be more precise about the effect of flexibility.

2. Increase in Trade Goods Prices (P^2).

(Again we may interpret such a change to mean a greater proportionate increase in prices of trade goods than in autonomous demand A.)

Suppose that in figure VII D_{eI}^1 is the asymptotic value of demand for the mixed system induced by this change.

From the consistency condition ((14) equated to zero) a rise in P^2 creates excess supply at the asymptotic value for prices. Clearly then $P_{eI}^1 > D_{eI}^1$. If there is excess supply prices in the mixed system must be above prices in the pure demand system, and from footnote (5) it follows that the pure demand price asymptote will be below D_{eI}^1 .

This fixes the positions of the asymptotes on figure VII. If there is initially a price level below equilibrium, and thus excess demand, the dotted lines show the behaviour of the pure demand model. Prices in the mixed model are forced above equilibrium, and excess supply results when these prices rise beyond equilibrium levels. In the mixed system then the inflation involves higher price rises than if there were no cost elements in the system, and excess supply results from the excessive claims. Falls in profit and wage margins induced by excess supply in the commodity and labour markets may reduce the height of price rises and the severity of excess supply. The exact effects of flexible claims could only be derived by an analogue examination of the system.

It remains to show how rises in trade goods prices cause excessive income claims. If tradeable goods prices increase this increases the price level of domestic goods, but not in proportion to the rise in trade prices. From (16) then the money wage offer does not rise in proportion to the rise in the domestic price level because a larger share of revenue must be devoted to buying trade goods materials. Similarly money wage claims rise more than in proportion to the rise in domestic prices (from (19)). The result is thus inconsistent and excessive claims after trade goods prices have risen.

3. Proportional increases in Autonomous Demand (A) and in Trade Goods Prices (P₂).

If we start from a situation of zero excess demand at stationary values, prices in the mixed system will rise to the same level as if they were demand determined and the asymptotic values

will be equilibria.

If we begin with excessive claims the price line ($P_{e_I}^1$) will be above the demand line ($D_{e_I}^1$) with consequent excess supply at asymptotic values. The pure demand equilibria ($P_{e_{IX}}^1 \equiv D_{e_{IX}}^1$) will be below both the mixed system lines so that price rises in the mixed system are more severe than in the pure demand system.

With deficient claims the opposite happens and $P_{e_I}^1 < D_{e_I}^1$. There is then excess demand at asymptotic values and the pure demand case implies higher price rises than in the mixed case.

4. Increases in Profit and Wage Margins (h and j).

This situation corresponds closely to the type of cost inflation possible in the closed economy. If we assume that initially there is consistency of claims all our asymptotes coincide. Suppose that prices are below this equilibria, but that the accompanying excess demand induces a once for all rise in j and h. The price and demand asymptotes $P_{e_I}^1$ and $D_{e_I}^1$ rise above $P_{e_{IX}}^1 \equiv D_{e_{IX}}^1$.

Profit and wage margins may be sensitive to excess demand and supply. Perhaps results similar to those of Chapter V would be produced by this flexibility.

CHAPTER VIII

INFLATION IN AN OPEN ECONOMY - II

Here we introduce separate importables and exportables prices into our model. As in the last chapter we shall compare the types of inflation which our basic model produces with the type of inflation possible in the conventional pure demand model.

SYMBOLS

- P_t^1 - The general price level of domestic goods, period t .
- P^3 - The general price level of exportables.
- P^4 - The general price level of importables.
- P_t - $(= a_1 P_t^1 + a_2 P^3 + a_3 P^4)$. The "cost of living" index, period t .
- Z_t - $(= W_t + c_2 P^3 + c_3 P^4)$. The unit variable cost of producing domestic goods, period t .
- W_t - The general wage level of labour employed in the production of domestic goods, period t .
- Y_t - Money national income, period t .
- D_t^1 - The level of money demand for domestic goods, period t .
- L_t - The level of money demand for labour used in domestic goods industries, period t .
- X - The volume of full employment output of exportables less the volume of exportables used in the production of domestic goods ($c_2 Q$). We are assuming that the production of trade goods requires negligible quantities of domestic and imported goods.
- Q - The volume of full employment output of domestic goods. The value added by domestic goods industries is $Q P_t^1$ less exportables costs $c_2 Q P^3$, less importables cost of production $c_3 Q P^4$.

Again Q and X , and the weights c_2 , c_3 , a_1 , a_2 , and a_3 are assumed constant. It is also assumed that import and export prices are exogenously determined.

The Model

$$P_t^1 - P_{t-1}^1 = k_1(D_{t-1}^1 - QP_{t-1}^1) + k_2(hZ_{t-1} - P_{t-1}^1) \quad \dots\dots (1)$$

$$W_t - W_{t-1} = k_3(L_{t-1} - QW_{t-1}) + k_4(jP_{t-1} - W_{t-1}) \quad \dots\dots (2)$$

$$Z_t = W_t + c_2 P^3 + c_3 P^4 \quad \dots\dots (3)$$

$$P_t = a_1 P_t^1 + a_2 P^3 + a_3 P^4 \quad \dots\dots (4)$$

$$Y_t = QP_t^1 + XP^3 + M P^4 \quad \dots\dots (5)$$

$$D_t^1 = A(1-i_1) + (1-s-i_2)Y_t - x_1 Q(P_t^1 - P^3) - x_2 Q(P_t^1 - P^4) \quad \dots\dots (6)$$

$$L_t = b D_t^1 \quad \dots\dots (7)$$

Equation (5). This is the only equation in the model whose nature may not be apparent by comparison with the equations of the previous chapter. This is because X was there defined as net of the volume of exportables and imports used in the production of domestic goods, whereas in this chapter it is net of the volume of exportables used in domestic goods production only. Thus $Y_t = (XP^3 + c_2 QP^3) + (MP^4 + c_3 QP^4) + (QP_t^1 - c_2 QP^3 - c_3 QP^4)$ and is the sum of the value added in export and importables industries, and the value added in domestic goods industries.

II

We shall not present the stationary values for wages in this

chapter as the behaviour of the wage level can be inferred from the behaviour of domestic goods prices. The stationary value of domestic goods prices is -

$$P_e^1 = \frac{A(1-i_1)d_1 + P^3 \left\{ \left[(1-s-i_2)X+x_1Q \right] d_1 + (d_2+d_3)hc_2 + d_3jha_2 \right\} + P^4 \left\{ \left[(1-s-i_2)M+x_2Q \right] d_1 + (d_2+d_3)hc_3 + d_3jha_3 \right\}}{Qs^1 d_1 + d_2 (1-bh) + d_3 (1-jha_1)} \dots\dots(8)$$

for the mixed model, and

$$P_e^1 = \frac{A(1-i_1) + P^3 \left[(1-s-i_2)X+x_1Q \right] + P^4 \left[(1-s-i_2)M + x_2Q \right]}{Qs^1} \dots\dots(9)$$

for the pure demand model.

Where d_1 , d_2 and d_3 have the same values as for the previous chapter, and

$$s^1 = s + i_2 + x_1 + x_2$$

Excess demand for commodities at the stationary value of prices is:

$$\begin{aligned} D_e^1 &= QP_e^1 \\ &= A(1-i_1) \left\{ d_2(1-bh) + d_3 (1-jha_1) \right\} \\ &\quad + P^3 \left\{ \left[(1-s-i_2) x + x_1Q \right] \left[d_2(1-bh) + d_3(1-jha_2) \right] \right. \\ &\quad \quad \left. - s^1Q \left[(d_2+d_3)hc_2 + d_3 jha_2 \right] \right\} \\ &\quad + P^4 \left\{ \left[(1-s-i_2) M+x_2Q \right] \left[d_2(1-bh)+d_3(1-jha_1) \right] \right. \\ &\quad \quad \left. - s^1Q \left[(d_2+d_3) hc_3 + d_3 jha_3 \right] \right\}^{(1)} \dots\dots(10) \end{aligned}$$

(1) For the sake of simplicity of presentation I have neglected the denominator of this expression. Thus the right hand side of (10) should be divided by $Qs^1 d_1 + d_2(1-bh) + d_3(1-jha_1)$.

Again we can show that if income claims are consistent expression (10) will be zero.

Entrepreneurs whose prices are cost determined, charge a price -

$$P^1 = h(W + c_2 P^3 + c_3 P^4) \quad \text{.....(11)}$$

and this implies a wage offer -

$$W = \frac{P^1 - c_2 P^3 - c_3 P^4}{h} \quad \text{.....(12)}$$

Wage earners, receiving cost determined wages claim a money wage -

$$W = P^1 j_{a_1} + P^3 j_{a_2} + P^4 j_{a_3} \quad \text{.....(13)}$$

The wage offer (equals the wage claim) arising from demand determined wages is -

$$W = P^1 b \quad \text{.....(14)}$$

As before, taking account of the fact that $\frac{k_4}{k_3 Q + k_4}$ of all wages paid in domestic goods industries are cost determined and $\frac{k_3 Q}{k_3 Q + k_4}$ are demand determined the total wage claim is -

$$W = \frac{k_4 (P^1 j_{a_1} + P^3 j_{a_2} + P^4 j_{a_3}) + k_3 Q (P^1 b)}{k_3 Q + k_4} \quad \text{.....(15)}$$

Claims are consistent when (12) = (15), that is when -

$$(k_3 Q + k_4) \frac{(P^1 - c_2 P^3 - c_3 P^4)}{h} = k_4 (P^1 j_{a_1} + P^3 j_{a_2} + P^4 j_{a_3}) + k_3 Q (P^1 b) \quad \text{..... (16)}$$

If we substitute for P_e^1 in (16) and rearrange, it is seen that the satisfaction of this consistency condition requires excess demand (from (10)) to be zero.

III

We have three exogenous variables in this model, and there are thus a number of possible combinations of movements of these elements. Each may rise, fall or stay constant, so that twentyseven types of autonomous change are conceivable. Several of these cases were considered in the previous chapter, and of the remaining two will be selected to illustrate the forces at work. They are the cases involving a rise in import prices, and a rise in export prices.

1. Increase in Export Prices(P^3).

From (8) it is seen that an increase in export prices will raise domestic prices both from the demand side and through costs. The rise in export prices results directly in an increase in costs through the rise in the prices of exportable materials used in domestic goods production ($\Delta P^3_{c_2}$) and indirectly raises costs because it raises wages ($\Delta P^3_{k_4ja_2}$).

If we begin with consistency of claims how will the rise in export prices affect consistency? Expression (10) if equated to zero is a form of the consistency condition. It can be seen that a rise in export prices has conflicting effects on the level of excess demand or supply at stationary values. Thus, to the extent that demand is increased by the rise excess demand at stationary values will be created, but the higher the proportion of exportables used in domestic goods production and in the consumption of wage earners the greater will be the tendency for costs to rise, and for excess supply to be created. The outcome depends

on the relative size of these cost effects and demand effects. The change is more likely to result in excess demand at the new stationary value the higher are exports, other things being equal. It will be more likely to produce excess supply the higher, other things being equal, is the volume of potential exports consumed at home by wage earners and used up in domestic goods production.

If the forces making for excessive claims and excess demand dominate, the type of inflation experienced is similar to that described in the last chapter under the effects of a rise in trade goods prices.⁽²⁾ Domestic goods price levels will be forced above equilibria, thus rising more than they would if there were no cost elements in the system, and the final stages of the process being accompanied by excess supply.

If the demand effects dominate, the inflationary process which follows the rise in export prices is similar to the price rise which accompanies a rise in domestic autonomous demand.⁽³⁾ Deficient claims lead to a failure of the system entirely to eliminate excess demand with domestic prices rising to lower levels than would be approached if all prices and wages were demand determined.

2. Increase in Importables - Prices (P^4).

For reasonable values of the coefficients of the system a rise in importables prices will result in an increase in the

(2) See p. III.

(3) See p. 108..

domestic goods price level (see (8)), partly because of the rises in the cost of production and in wages which will be induced partly because of the increased money incomes of producers selling import substitutes, and also for the reason that domestic goods demand will increase because domestic goods are substituted for imports.

Starting from initial consistency of claims the rise in importables prices are likely to generate excess supply if importables costs form a large proportion of domestic goods costs, if importables are a large proportion of wage earners' consumption, and if the output of import competing industries is small (from (10)). Here then we would have cost inflation closely allied to the case discussed under the heading " a rise in trade goods prices" in the preceding chapter.

A situation could be envisaged in which a rise in import prices causes excess demand rather than excess supply at the new stationary values. However, during or after a prolonged period of inflation j and h would be high, and this alone would make such a situation improbable (see (10)).

Changes in profit and wage margins and in the structure of production on consumption will operate gradually to reduce any inconsistency which is engendered by these changes. In the short run, however, the inconsistent claims may prolong excess demand (if deficient) or produce excess supply (if excessive).

CHAPTER IX

PROBLEMS OF POLICY IN AN OPEN ECONOMY.

In a closed system excessive income claims accompanied by rises in demand cause two related problems. Prices and wages may be pushed above equilibrium levels, and if nothing is done to prevent or offset this excess supply will result. Conventional remedy measures operating on the level of demand may be applied during the inflation to moderate price rises, or during the recession to overcome excess supply. If they are applied during the inflation excess supply will result from the excessive claims. If they are used in the recession it will be found that there is no possible increase in demand which will just wipe out the excess supply without causing price and wage rises.

Conventional remedies then are not adequate to cope with cost inflation. In fact if there is a tendency to prefer inflation to recession conventional policies become part of a mechanism producing continued inflation.

Flexibility of claims may be thought to be the answer to cost inflation. However, our analysis of Chapter V suggests that this may increase the tendency for prices to oscillate. (Nevertheless a full investigation of the effect of various policies in such a model has not been made.)

Manipulation of sales taxes in an attempt to moderate the effects of excessive claims, combined with conventional policies to combat excess demand (or supply) may be successful in

eliminating cost inflation. Ideally it would be preferable to institute some form of bargaining for shares in real income which would prevent excessive claims from influencing the price level.

Has this closed economy analysis relevance to any existing economy? The policies discussed are applicable to the problems of inflation with excessive claims arising from domestic rather than external causes.

Suppose there is excess demand and excessive claims in an open economy. Any reduction in the level of demand for domestic goods would lead to a further increase in the already excessive claims,⁽¹⁾ so that policies designed to reduce claims must be combined with policies designed to reduce demand in order completely to offset cost inflation. There is this difference in the open economy, however, that there is a possible rise in domestic autonomous demand which will bring claims to consistency.

On the other hand if excessive claims have caused a recession there is some justification for the view that the problem may be more amenable to solution by conventional policy in the open than in the closed case. A rise in autonomous domestic demand in so far as it raises domestic goods prices (relative

(1) See Chapter VII equation (14). A fall in the domestic goods price level will induce a more than proportionate fall in the wage offer and a less than proportionate fall in the wage claim if trade goods prices are constant. The lower the level at which the domestic price level is stabilised the more excessive, other things being equal, will be the level of claims.

to trade goods prices) will reduce claims so that claim reducing policies may not be so urgently needed as in the closed economy. Wage claims do not rise proportionately with domestic prices, but wage offers rise more than proportionately with domestic prices if trade goods prices remain unchanged when domestic autonomous demand increases. If, however, the increase in demand is mainly effective in raising output to the full employment level, and does not have much effect on prices, excessive claims will not be greatly moderated by the measure.

This is about the extent of the problem of cost inflation in a large country such as the United States. Her foreign trade is a small proportion of her national income, yet a large proportion of world trade. External influences are thus likely to have only a minor effect on the United States economy, and domestic inflations are more likely than imported inflations. Even if an imported inflation became a problem domestic measures to combat it would be likely to result in changes in trade goods prices almost proportional to changes in domestic prices so that the problems to be discussed will not apply.

Economies such as Australia and New Zealand, and to a lesser extent the United Kingdom, whose export and import prices are not so closely related to domestic demand are likely to experience imported inflation more frequently. Moreover, when they do they will find greater difficulty than the United States in offsetting its effects.

Suppose trade goods prices are rising and it is desired to prevent a rise in domestic goods prices. In theory it is possible to reduce autonomous demand for domestic goods in such a way

that domestic goods prices and wages remain unaffected.⁽²⁾ In practice this will be very difficult to do. If domestic goods prices and wages remain constant, that is if our policy is successful, wage and profit earners in these industries will suffer a fall in real income. Whilst the prices of the exportables and importables which they consume increase their money incomes do not rise. This fall in real income in the face of rising real income in other sectors⁽³⁾ will engender a good deal of opposition to the policy of reducing autonomous demand. Moreover, the reduction in autonomous demand would almost certainly mean a reduction in government expenditure or an increase in taxation. The former is always difficult and the latter is politically dangerous.

All that has been said about imported inflation applies equally well to a pure demand or a mixed demand/cost system, except that in the latter system some of the obstacles to reducing autonomous demand are explicit in the pricing mechanism.

In a mixed system money income claims are related to the trade goods price levels. A rise in these prices with domestic goods prices constant therefore will cause money income claims to rise, and to become excessive in real terms.⁽⁴⁾ If the reduction

(2) See Chapter VII, equations (10), (11), (12), (13).

(3) While exporters' money incomes rise the prices of the domestic goods which they purchase stay constant.

(4) The wage offer rises less than in proportion, whereas the wage claims rises more than in proportion to the rise in trade goods prices.

in autonomous demand is sufficient to counteract all the expansive effects of the increase in trade goods prices excess supply will result from the excessive claims.⁽⁵⁾

To avoid this excess supply claims would have to be reduced - a difficult policy in the circumstances - or the deflationary policy would have to be reversed. Even if autonomous demand is not reduced, but held constant, a process of cost inflation will result from rises in trade goods prices, leading ultimately to excess supply.

The type of policy which could avoid this would require autonomous domestic demand to rise proportionately with trade goods prices so that domestic goods prices rise proportionately with trade goods prices and consistency of claims is maintained. Inflation, of course, proceeds unabated.

All this goes to show that it is difficult for a small country to avoid the effects of a world inflation. But it is not impossible, for something may be achieved by export and import subsidies designed to reduce trade goods prices, or by, what amounts to the same thing, appreciation of the exchange rate.⁽⁶⁾ The effect would be to lower trade goods prices relative to domestic goods prices, thereby reducing excessive claims and making it possible

(5) If it is not cost inflation will appear with eventual excess supply.

(6) If our assumption that export and import prices are mainly determined by external factors is correct appreciation will lower import and export prices in terms of domestic currency. .

for manipulation of the level of demand to check price rises without causing excess supply.⁽⁷⁾

Such measures could not be contemplated unless the balance of payments was strongly favourable and external reserves were high.⁽⁸⁾ Moreover, if a continuing rise in trade goods prices occurs a succession of appreciations would be required, and this must eventually lead to balance of payments difficulties.

The simplest and most effective way of preventing imported inflation (from the point of view of the small countries) would be for the large countries to impose sufficiently severe anti-inflation measures so that price rises do not spread internationally. Our discussion of policy in a closed economy was essentially concerned with the difficulties of doing this.

(7) Export and import subsidies would create additional demand which would need to be offset. Appreciation, because it reduces incomes in trade goods industries would thereby reduce excess demand.

(8) The case for appreciation of the Australian pound to offset the postwar import and export price rises was argued by Professor T.W.Swan in the unpublished papers: The Anatomy of Inflation, Canberra, 3rd April, 1950, and The Australian Post-War Inflation, 26th July, 1951, s.s.5. (see bibliography).

SELECT BIBLIOGRAPHY.

A. Books.

- P.W.S. Andrews : Manufacturing Business,
Macmillan, 1949.
- C.Brescioni-Turroni : The Economics of Inflation,
Allen and Unwin, 1953.
- A.J.Brown : The Great Inflation, 1939-51,
Oxford University Press, 1955.
- H.K.Charlesworth : The Economics of Repressed
Inflation, Allen and Unwin, 1956.
- B.Hansen : A Study in the Theory of
Inflation, Allen and Unwin, 1951.
- S.E.Harris : Inflation and the American
Economy, McGraw-Hill, 1945.
- J.M.Keynes : How to Pay for the War,
Macmillan, 1940.
- P.A.Samuelson : Foundations of Economic
Analysis, Harvard University
Press, 1947.
- R.Turvey (ed.) : Wages Policy Under Full
Employment.

B. Articles.

- F.A.Burchardt : "Cost Inflation", Bulletin of
the Oxford Institute of Statistics,
November 1957.
- H.Brems : See R.Turvey and H. Brems.
- A.D.Campbell : "Reflections on Inflation",
Scottish Journal of Political
Economy, October 1956.

- B.M.Cheek : "Economic Theory and Industrial Pricing", Economic Record, 1949.
- J.C.R.Dow : "Analysis of the Generation of Price Inflation: a Study of Cost and Price Changes in the United Kingdom 1946-54", Oxford Economic Papers, October 1956.
- J.Duesenberry : "The Mechanis of Inflation", Review of Economics and Statistics, 1950.
- M.Friedman : "Discussion of the Inflationary Gap", American Economic Review, 1942.
- R.M.Goodwin : "A Note on the Theory of the Inflationary Process", Economia Internazionale, 1952.
- R.L.Hall and J.H.Hitch : "Price Theory and Business Behaviour", Oxford Economic Papers, No.2.
- R.F.Harrod : "Two Types of Inflation", Financial Times, July 17th and 18th, 1957.
- A.G.Hart : "What it Takes to Block Inflation", Review of Economics Statistics, 1942.
- J.H.Hitch : See R.L.Hall and J.Hitch.
- F.Holzman : "Income Determination in Open Inflation", Review of Economics and Statistics, 1950.
- T.Koopmans : "The Dynamics of Inflation", Review of Economics and Statistics, 1942.

- C. Sinkin : "Notes on the Theory of Inflation",
Review of Economic Studies, 1952-3.
- A. Smithies : "The Behaviour of Money National
Income Under Inflationary Conditions",
Quarterly Journal of Economics, 1942.
- R. Turvey : "A Further Note on the Inflationary
Gap", Economisk Tidskrift, 1949.
- _____ : "Period Analysis and Inflation",
Economica, 1949.
- _____ and
H. Brems : "The Factor and Goods Market",
Economica, 1951.
- _____ : "Some Aspects of the Theory of
Inflation in a Closed Economy",
Economic Journal, 1951.

C. Unpublished Material.

- H. P. Brown : Statement in connection with the
Basic Wage Case 1952-3, Common-
wealth Court of Conciliation and
Arbitration. [Australian National
University Library].
- T. W. Swan : "The Anatomy of Inflation", Can-
berra, 3rd April 1950. [This docu-
ment has become scarce. The Prime
Minister's Department, Canberra has
a copy].
- _____ : "The Australian Post War Inflation",
26th July 1951, Social Science
School Monograph No. 5.

COST AND DEMAND ELEMENTS IN THE INFLATIONARY PROCESS

**By
J. D. PITCHFORD**

**Reprinted from THE REVIEW OF ECONOMIC STUDIES
Vol. XXIV No. 2**

Cost and Demand Elements in the Inflationary Process*

Much of the discussion about the process of inflation has been carried out in terms of either purely demand or purely cost determined prices and wages.¹ Apart from the fact that the two approaches give conflicting results, it is often apparent that these elements appear in the real world not in their pure forms, but in various combinations with each other. Thus there have been a number of attempts to make the theory more realistic by combining cost and demand elements in different ways.² Whilst these are useful examples of inflationary processes, they do not have a wide application because of an element of arbitrariness in their choice of functions.

In this article an attempt is made to present a general model for the closed economy possessing a maximum of both cost and demand elements, and thus capable of being broken down into subsidiary models for alternative mixtures of these components. In the third section we shall consider the implications of this general model for the often used terms "demand" and "cost" inflation.

I

It is assumed that the economy is closed and is at or above full employment with a constant real output limited by the inelasticity of the labour supply. Labour is assumed to be the only factor of production. The aggregation problem is ignored so that money national income is defined as the volume of production multiplied by the general price level.

In order to facilitate comparison of the results with the Keynesian multiplier no distinction is made between the factor and the goods markets. Other assumptions emerge later.

SYMBOLS

- P_t — The general price level, period t .
- W_t — The general wage level, period t .
- D_t — The level of aggregate money demand, period t .
- Y_t — The level of money national income, period t .
- Q — The volume of real, full employment output.

PRICE DETERMINATION

(a) Demand determined prices : From a consideration of price theory it is possible to postulate that changes in prices will be determined by the amount of excess demand or excess supply for the good or goods in question. This gives us a function—

$$P_t - P_{t-1} = k_1 (D_{t-1} - QP_{t-1}) \quad (1)$$

change in excess demand
price or supply

* I am indebted to Professor T. W. Swan for advice and criticism in preparing this paper.

¹ Examples of demand determined systems may be found in B. Hansen : *The Theory of Inflation*, George Allen and Unwin, London 1951 ; and of cost determined systems in F. Holzman : "Income Determination in Open Inflation," *Review of Economics and Statistics*, May 1950.

² For example see J. Duesenberry : "The Mechanics of Inflation", *Review of Economics and Statistics*, May 1950 ; C. Simkin : "Notes on the Theory of Inflation", *Review of Economic Studies*, 1952-3 ; R. M. Goodwin "A Note on the Theory of the Inflationary Process", *Economia Internazionale*, Vol. V, 1952.

QP_{t-1} is the value of supply and D_{t-1} the value of demand last period (the most recent information available). k_1 is a constant representing the proportion of the reaction completed per time period.¹ Naturally the shorter the time interval chosen the smaller is k_1 . A discussion of its value both to the individual producer and in the determination of the general price level is included in the Appendix.

(b) Cost determined prices : If prices are determined by adding a percentage to variable costs of production, either because it is decided that this is the most convenient method of pricing, or because prices are controlled in this fashion, the price function will be, assuming wages are the only variable cost of production :

$$P_t - P_{t-1} = k_2 (hW_{t-1} - P_{t-1}) \quad (2)$$

where h is unity plus the profit margin and k_2 is a coefficient determining the strength of the reaction. Prices rise if $hW_{t-1} > P_{t-1}$.

(c) Demand and cost determined prices : A firm which determines its price on the basis of costs may be maximising long-run at the expense of short-run profits, whilst a firm which prices according to demand changes will maximise short-run profits, but may well spoil its own market for the future. Perhaps a middle course combining both cost and demand elements in price determination may sometimes be advisable. Thus although pricing with reference to a long-run normal profit margin a producer may shade his price somewhat to take account of the state of the market. For example his cost adjustment may seem a necessary step to take to keep in line with other firms in his industry whilst a further demand adjustment will provide an opportunity to exploit the market. The two adjustments will be additive and the price function will have the form :

$$P_t - P_{t-1} = k_1 (D_{t-1} - QP_{t-1}) + k_2 (hW_{t-1} - P_{t-1}) \quad (3)$$

k_1 and k_2 representing the weights attached to each element in price determination.

Equation (3) represents demand pricing when k_2 becomes so small that it can be neglected, and cost pricing when k_1 becomes negligible. Thus every producer has a function such as (3), and by adding them together for all producers in the economy an aggregate price relationship of the same form as equation (3) is obtained. This aggregate price amounts to a fixed weight index of the three sets of prices corresponding to the three methods of price determination.² The constants k_1 and k_2 may be regarded as depending on the proportion of producers using each type of pricing as well as on their speeds of reaction.

WAGE DETERMINATION

(a) Demand determined wages : A plausible wage function is :

$$W_t - W_{t-1} = k_3 (D_{t-1} - QP_{t-1}) \quad (4)$$

where k_3 is the speed of reaction of wages per unit time period to excess demand for commodities.

(b) Cost determined wages : Wages will be determined according to some index of the "cost of living" when either they are legally fixed (as a minimum) in that way and

¹ It is similar to the "speeds of adjustment" used by Samuelson in his examination of the stability of multiple markets. P. A. Samuelson : *Foundations of Economic Analysis*, Harvard University Press Cambridge, 1953, page 271.

² It would be possible to introduce three separate price levels explicitly into the analysis. If this were done and the distribution of production and demand amongst the three price categories were fixed the prices could be combined in a fixed weight index and the resulting equilibrium values would be the same as in the text.

producers wish to pay no more than minimum wages, or when trade union pressure brings some such agreement into force. The function :

$$W_t - W_{t-1} = k_4 (jP_{t-1} - W_{t-1}) \quad (5)$$

will be the form of such methods of wage determination, j being the legally fixed or agreed proportion that wages should bear to prices, and k_4 being a constant representing the speed with which the adjustments are made.

(c) Demand and cost determined wages : If a producer feels that $k_4 (jP_{t-1} - W_{t-1})$ is a wage adjustment which he must make in order not to lose labour to his competitors he will not regard this adjustment as affecting his demand for additional labour. Thus if he is interested in increasing his output (knowing perhaps that he must do so at the expense of his competitors) he will also make a further adjustment in accordance with his excess demand. His wage function will thus be :

$$W_t - W_{t-1} = k_3 (D_{t-1} - QP_{t-1}) + k_4 (jP_{t-1} - W_{t-1}). \quad (6)$$

Equation (6) can also be regarded as the aggregate wage function for the economy, i.e., the result of the summation of equations (4), (5) and (6) for every producer. The total values of k_3 and k_4 will thus depend on the proportions of each type of reaction in the aggregate wage function, as well as on the strength of individual reactions.

MODEL I

$$P_t - P_{t-1} = k_1 (D_{t-1} - QP_{t-1}) + k_2 (hW_{t-1} - P_{t-1}) \quad (7)$$

$$W_t - W_{t-1} = k_3 (D_{t-1} - QP_{t-1}) + k_4 (jP_{t-1} - W_{t-1}) \quad (8)$$

$$D_t = A + (1-s) Y_t = A + (1-s) Q P_t \quad (9)$$

Equation (9) gives us an expression for aggregate demand. A is the money demand for consumption and investment goods which is not directly related to the level of national income, but is determined by some exogenous factors such as government policy, the level of liquid assets or the state of the new issue market, interacting with the general state of expectations. It is treated as an exogenous variable because making it endogenous would require a much more elaborate and profound discussion than is attempted here, and because the mechanism of inflation can readily be understood by considering a single shift in A . (If A were to vary proportionately with the price level there would be an indefinite cumulative process such as results, in the Wicksellian system, from the assumption of a perfectly elastic monetary system.) Thus $1-s$ is the proportion of income devoted directly to consumption and to investment demand. sY_t then is Keynesian savings (equalling investment *ex post*) only when the investment content of $1-s$ is zero.

The system resolves into the difference equation :

$$\begin{aligned} P_t - \left\{ 2 - (k_1 Qs + k_2 + k_4) \right\} P_{t-1} \\ + \left\{ 1 - (k_1 Qs + k_2 + k_4) + sQ(k_1 k_4 + k_2 k_3 h) + k_2 k_4 (1-jh) \right\} P_{t-2} \\ = A (k_1 k_4 + k_2 k_3 h) \end{aligned} \quad (10)$$

The equilibrium value of price (P_e) is :

$$P_e = \frac{A (k_1 k_4 + k_2 k_3 h)}{Qs (k_1 k_4 + k_2 k_3 h) + k_2 k_4 (1-jh)} \quad (11)$$

and that for wages is :

$$W_e = \frac{A (k_1 k_4 j + k_2 k_3)}{Qs (k_1 k_4 + k_2 k_3 h) + k_2 k_4 (1-jh)} \quad (12)$$

¹ The existence of fixed elements p and w in the determination of prices and wages would add a term $+p$ and a term $+w$ to the equilibrium for prices and wages, respectively.

For the roots of the characteristic equation of (10) to be real (no long period oscillations), at least the larger root positive (no dominant one period oscillations) and less than unity (convergence), it is necessary and sufficient that :

$$0 < sQ(k_1k_4 + k_2k_3h) + k_2k_4(1 - jh) < \frac{(k_1Qs + k_2 + k_4)^2}{4} < 1^1 \quad (13)$$

A second positive root requires the further condition :

$$sQ(k_1k_4 + k_2k_3h) + k_2k_4(1 - jh) > k_1Qs + k_2 + k_4 - 1 \quad (14)$$

An idea of the values of the reaction coefficients for which the system is stable may be obtained from the following numerical example. The values in the table are obtained by assuming $s = 0.45$, $h = 2$, $Q = 1$, and $jh = 1$, and that all the k coefficients are equal. This last assumption is of course unreal, but it greatly simplifies the examination and may not materially affect the nature of the conclusions. The table shows the roots of the characteristic equation that may be derived from (10), for different values of the k 's.

k	(1) 1.50	(2) 1.00	(3) 0.75	(4) 0.50	(5) 0.10
larger (absolute) root	-1.420	-0.613	+0.372	+0.582	+0.910
smaller (absolute) root	-0.255	+0.163	-0.210	+0.193	+0.846

Case (1) is explosive with one period oscillations ; case (2) converges, but with one period oscillations ; case (3) converges with minor initial one period oscillations ; whilst cases (4) and (5) involve a non-oscillatory approach to equilibrium. That the values of the reaction coefficients will normally be of the order of cases (4) and (5) is shown in the Appendix. Thus in what follows we shall assume that (13) and (14) are fulfilled.

¹ Condition (13) involves an amalgamation of the five inequalities :

- (a) $sQ(k_1k_4 + k_2k_3h) + k_2k_4(1 - jh) > 0$
- (b) $sQ(k_1k_4 + k_2k_3h) + k_2k_4(1 - jh) < k_1Qs + k_2 + k_4$
- (c) $sQ(k_1k_4 + k_2k_3h) + k_2k_4(1 - jh) > 2(k_1Qs + k_2 + k_4) - 4$
- (d) $sQ(k_1k_4 + k_2k_3h) + k_2k_4(1 - jh) < \frac{(k_1Qs + k_2 + k_4)^2}{4}$
- (e) $k_1Qs + k_2 + k_4 < 2$

(a), (b) and (c) are the conditions for stability, whilst (e) ensures that one period oscillations are not dominant, and if (d) is fulfilled longer period oscillations are absent.

With jh equal to unity expression (11) reduces to :

$$P_e = \frac{A}{Q_s} \quad (15)$$

$$\therefore QP_e = Y_e = \frac{A}{s} \quad (16)$$

which is analogous to the Keynesian multiplier expression. As we shall see later, (15) is the same as the equilibrium price which may be derived from a purely demand determined system. Moreover it can be shown that substituting (15) in the expression for excess demand :

$$D_t - QP_t \quad (17)$$

makes it zero. The reason why making $jh = 1$ ensures equilibrium with aggregate excess demand zero can be seen from equation (7) and (8). Suppose excess demand is zero ; prices will be stable provided $h W_{t-1} = P_{t-1}$ from (7) and $j P_{t-1} = W_{t-1}$ from (8), that is if $jh = 1$.¹

When jh is greater than unity prices move to a stationary value which is above that reached when $jh = 1$ (see expression (11)), and which necessarily involves excess supply.² A situation involving stationary prices and excess supply cannot be a permanent equilibrium and thus at some stage the price and wage functions must break down. There are three ways in which this may occur. Before excess supply develops wage and/or profit earners may realise that the excessive income claims implied by jh being greater than unity will produce excess supply and will modify these claims so that jh falls to unity and prices and wages stop rising when excess demand becomes zero. Another possibility is that it may be necessary for some excess supply to develop before income claims are reduced to a level consistent with a demand equilibrium. If income claims are not reduced by the excess supply entrepreneurs' stocks must pile up, and as this cannot continue indefinitely they must eventually lower prices and/or wages and/or output. If there is no increase in autonomous demand A at this stage a downturn could well be precipitated. If it rises everyone's behaviour is justified and prices and wages begin to rise again.

If income claims are excessive and rigid, monetary policy and fiscal policy used to reduce A , or to hold A constant, would turn inflation into unemployment. To avoid this it would be necessary to reduce profit margins and/or real wage claims. (In a model which included ad valorem indirect taxation as an element of price, a reduction in the tax rates might be used to achieve the same effect.)

An equilibrium below that for $jh = 1$ is approached if $jh < 1$. It must involve aggregate excess demand and presumably changes in the constants of our system, e.g., rises in j and h , which will gradually bring the system to equilibrium.

¹ This condition in fact ensures that the income claims of those using cost determined prices and wages are consistent. In a purely cost determined system it ensures that prices, once determined, have no tendency to move.

² When jh is very large a previously stable system can become explosive. A stable system non-oscillatory system will approach equilibrium faster when $jh > 1$ than when jh is unity.

Thus inconsistency of income claims will cause prices to under or over shoot a demand equilibrium. Excess supply will tend to appear when total claims are excessive, and unless these claims are voluntarily reduced they will be reduced *ex post* by a recession in employment. Deficiency of claims implies excess demand in a situation in which prices according to the model are stationary, and this excess demand (in the absence of autonomous changes) can only be removed by an upward revision of claims.

Only when income claims are consistent ($jh = 1$) is there a true equilibrium with stable prices and neither excess supply nor excess demand.

II

By assuming the absence of some elements of cost or demand in price and/or wage determination, nine possible combinations of demand and cost elements for the economy as a whole may be distinguished.¹ The models based on these combinations and their stationary values are contained in the table below. Thus, for example, model IV is found by substituting zero for k_3 in equation (7) model I. Stability conditions may be found by substituting zero for the k or k 's concerned into expressions (13) and (14).

When jh is unity model II has values $P_e = \frac{A}{Qs}$, $W_e = \frac{A}{Qsh}$, whilst those for model IV are $P_e = \frac{A}{Qs}$, $W_e = \frac{Aj}{Qs}$. As with model I consistent income claims lead to an equilibrium in which aggregate excess demand is zero.

The detail and plausibility of the situations envisaged in models II-IX is left to the reader, but there are several general points which are worth making here.

1. In every model except VI aggregate demand equilibrium will be approached provided that in models, I, II and IV jh is unity. These three models contain demand determined prices and/or wages as well as cost determined prices and wages. They are thus subject to a cost/price spiral in addition to demand influences. The values approached by prices and wages in model VI have, of course, no relation to demand, as this model describes the pure cost/price spiral.

2. In those models, again with the exception of model VI, in which cost elements appear in both prices and wages inconsistency of income claims leads to a tendency towards excess demand or supply at the end of the inflationary process.

Stationary Values : Models I-IX

¹ Compare R. Turvey's presentation of combinations of demand and cost elements, "Some Aspects of the Theory of Inflation in a Closed Economy", *Economic Journal*, Vol. 61, 1951. Turvey's analysis does not admit a general price or wage level containing both demand and cost elements. His general price and wage levels are thus either purely cost or purely demand determined with the result that only four types of inflation are possible. These are similar to models VI to IX.

Model (a)	P_e	W_e
I Price D/C $k_1, k_2, k_3, k_4 \neq 0$ Wage D/C	$\frac{A(k_1k_4 + k_2k_3h)}{Qs(k_1k_4 + k_2k_3h) + k_2k_4(1-jh)}$	$\frac{A(k_1k_4j + k_2k_3)}{Qs(k_1k_4 + k_2k_3h) + k_2k_4(1-jh)}$
II Price C $k_1 = 0$ Wage D/C	$\frac{Ak_3h}{Qs k_3h + k_4 (1 - jh)}$	$\frac{A k_3}{Qs k_3h + k_4 (1 - jh)}$
III Price D $k_2 = 0$ Wage D/C	$\frac{A}{Qs}$	$\frac{Aj}{Qs}$
IV Price D/C $k_3 = 0$ Wage C	$\frac{A k_1}{Qs k_1 + k_2 (1 - jh)}$	$\frac{A k_1j}{Qs k_1 + k_2 (1 - jh)}$
V Price D/C $k_4 = 0$ Wage D	$\frac{A}{Qs}$	$\frac{A}{Qsh}$
VI Price C $k_1 = k_3 = 0$ Wage C	$\begin{array}{l} \infty - jh > 1 \\ 0 - jh < 1 \end{array}$	$\begin{array}{l} \infty - jh > 1 \\ 0 - jh < 1 \end{array}$
VII Price C $k_1 = k_4 = 0$ Wage D	$\frac{A}{Qs}$	$\frac{A}{Qsh}$
VIII Price D $k_2 = k_3 = 0$ Wage C	$\frac{A}{Qs}$	$\frac{Aj}{Qs}$
IX Price D $k_2 = k_4 = 0$ Wage D	$\frac{A}{Qs}$	The equilibrium depends on the initial relation of prices to wages.

(a) C—cost elements; D—demand elements; D/C—both demand and cost elements enter into price or wage determination.

3. The distribution of income varies from one model to another. The ratio $\frac{W_e}{P_e}$ gives the share of wages in national income. For models II, V and VII it is $\frac{1}{h}$ and for III, IV, and VIII it is j . Thus, where the only cost element is in prices, the entrepreneurs'

desired share is certain to be satisfied, and where the only cost element is in wages, the wage earners' desired share is certainly satisfied. In the full model :

$$\frac{W_e}{P_e} = \frac{k_1 k_4(j) + k_2 k_3 h \left(\frac{1}{h}\right)}{k_1 k_4 + k_2 k_3 h} \quad (18)$$

That is, wage earners claims for a particular share in income and entrepreneurs' offers of a share to wage earners are reconciled by a process which results in wage earners receiving a weighted average of the two views of what wages should be. The weights are the price and wage coefficients. Profit earners' share of national income is similarly decided. Only when $jh = 1$ do they simultaneously realize their desired shares.

In the pure cost case the value approached by prices and wages is either zero or infinity unless $jh = 1$ when both shares claimed will be met. In the pure demand case the distribution of income is independent of income claims and reflects demands for goods and for labour.

III

We may define demand inflation as the price rise and/or wage rise brought about by D_{t-1} being greater than QP_{t-1} , and cost inflation as the price rise brought about by hW_{t-1} being greater than P_{t-1} and/or the wage rise resulting from an excess of jP_{t-1} over W_{t-1} . As these terms are often used in discussions about inflation it is as well to spell out their precise meaning in the models. Because the relationships of the model are derived from accepted economic hypothesis, conclusions about the nature of these terms should hold widely.

Cost inflation and demand inflation in their pure forms exist only in models VI and IX respectively. In the other models the inflation is a complex mixture of the two factors. Basically there are two types of plans which may be in excess of real opportunities to meet them ; expenditure plans for real consumption and real investment which if in excess of real output lead to excess demand, and real income claims by wage and salary earners and by entrepreneurs which may lead to cost inflation exerting an effect additional to the demand inflation if they are in excess of real income, ($jh > 1$). In an actual process it would be extremely difficult to isolate the two elements, but the terms do have use as indicating the causes behind the process.

It may be noted in passing that pure cost inflation can only take place without the accompaniment of excess demand to the extent that entrepreneurs are prepared to allow stocks to pile up. When stocks are too high further cost inflation will produce unemployment.

Excessive income claims and excess demand imply cost inflation and demand inflation. Deficient income claims and excess demand must therefore imply cost *deflation* and demand inflation, for costs are exerting a downward pressure on prices and wages. Admittedly deficiency of income claims is an unlikely case when inflation becomes advanced, but it could well exist for mild doses.

Canberra.

J. D. PITCHFORD.

APPENDIX

THE VALUES OF THE REACTION COEFFICIENTS

The range of values in which these coefficients may lie will be at a maximum if the time period chosen is sufficiently long to allow the full reaction to the excess demand or the changing cost conditions to be made. Thus the values are investigated for the most part in the context of such a time interval.

All these coefficients will be complex mixtures of technical and psychological determinants. We shall be content to point out some of the more important factors which tend to limit their values.

(1) k_1 . Suppose an entrepreneur is initially selling Q_1 units at a price P_1 . There is then a general increase in demand which is of the same proportion for all products. He now finds that at the price P_1 he could sell Q_2 units. If he is unable to expand his output above Q_1 , and realises that this is so, he can raise his price without any fear of retaliation provided he does not try to increase the value of his sales above P_1Q_2 .

$$\therefore P_2Q_1 = P_1Q_2$$

Subtracting P_1Q_1 from both sides of the expression :

$$P_2 - P_1 = \frac{1}{Q_1} (P_1Q_2 - P_1Q_1) \quad (i)$$

Comparing this with equation (1) of the text it can be seen that k_1 has a maximum of $\frac{1}{Q}$; a greater rise in price would result in the entrepreneur losing some of his share of the market. The lower limit will be zero, and will involve the entrepreneur in trying to meet all the excess demand by increasing output.

As used in equation (7) k_1 is the sum of individual producers' reaction coefficients. The price level in this equation amounts to a general price index, and thus k_1 must involve an element representing the proportion of producers, weighted by their output, using demand pricing. As the reaction coefficients are held constant throughout the inflationary process we must be using fixed weights in the summation of the three types of prices. When we consider k_1 for the whole economy its value will thus be less than for an individual producer if demand pricing is not the only type of pricing in use.

k_1 may reflect an allowance for cautiousness. For instance, the more frequently a producer reviews his price, or the more uncertain he is about the future course of demand, the larger (other things being equal) will this allowance be, and the smaller will be k_1 .

Many other influences would be at work to determine the value of k_1 , but it should in general be within the limits set.

(2) k_3 . As with k_1 it is impossible to be precise about its magnitude, but limits can be set and some important determinants indicated. Suppose a producer faced with excess demand decides to meet it purely by expanding output. Suppose also that his

estimate of the elasticity of supply of labour is incorrect, and it is, in fact, zero. If h is unity plus his normal profit margin he will allocate $\frac{1}{h} (D_{t-1} - QP_{t-1})$ towards hiring more labour. His extra demand for labour will succeed in adding an amount :

$$QW_t - QW_{t-1} = \frac{1}{h} (D_{t-1} - QP_{t-1}) \quad (\text{ii})$$

to his wage bill without securing additional labour. Comparing this with equation (4), it can be seen that k_3 has a maximum of $\frac{1}{hQ}$.

Another viewpoint which incidentally justifies an assumption of realized zero elasticity of supply to the firm, is to suppose the trade unions are aware of and take advantage of the excess demand for labour. By collective bargaining or some such means they raise wages to an equilibrium level without waiting for the market process to do it. This equilibrium level will be something like that shown in (ii).

If the entrepreneur realises that the elasticity of the supply of labour to him is zero k_3 should be zero. If the elasticity of the labour supply to him is, in fact, infinite and he realises this k_3 would again be zero for there would be no necessity to increase wages

in order to hire additional labour. Thus k_3 is less than $\frac{1}{hQ}$ to the extent that his elasticity of supply of labour is greater than zero, and to the extent that he is aware that this elasticity is not infinite.

k_3 in equation (8) is the result of the summation of individual reaction coefficients. It is thus smaller than it would be to the individual producer to the extent that not all wages are demand determined. It will also involve a margin for cautiousness, and will vary with the length of the time interval used in the analysis.

(3) k_2 . As well as being the proportion of producers using cost pricing this element represents the ability of the cost pricer to maintain his normal profit. It will be at a maximum of unity for the individual producer when the full reaction is completed in one unit time period, unless he is also adjusting price to demand changes, in which case it will have a maximum less than unity. For the economy as a whole it becomes a fraction of unity if some prices are demand determined.

(4) k_4 . This constant, like k_2 , is smaller than unity to the extent that the full reaction is not completed within a unit time period and to the extent that there are demand as well as cost based wages being paid.

Central Banking after Bagehot

By R. S. SAYERS

18s. net

The twentieth century has seen a great increase in the number of central banks, and their developing techniques have been increasingly interesting to economists. In this volume of papers Professor Sayers discusses some aspects of the subject, especially in the light of English experience since Bagehot's classic *Lombard Street*. Among the papers included is a detailed review, not hitherto available in English, of Bank Rate policy in the twentieth century. Other items primarily relating to the Bank of England are concerned with its constitutional position, its open-market operations, and its control over the volume of bank deposits. The possibilities of central banking in under-developed countries form the subject of three lectures, not previously published. Two essays, on the theoretical basis of central banking and on reserve ratios, have been written specially for this volume.

United States Imports and World Trade

By HENRY G. AUBREY

21s. net

This book makes a new approach to the solution of "the dollar problem", by examining in detail the prospects of greater American imports over the next twenty years. The author, himself an American, shows convincingly that the rise is likely to be much greater than has been commonly assumed. His book is divided into two parts. In the first he outlines the general economic conclusions and the conditions for a redistribution of the additional dollar supply to Britain and other traditional deficit areas. In the second he presents the evidence on which his estimates are based; it consists of studies of the major American import commodities, in a form suitable for consultation by economists and business men alike.

Reflections on International Administration

By A. LOVEDAY

42s. net

How to maintain efficiency and a good morale in a staff recruited from the four quarters of the globe, how to promote agreement and stimulate constructive imagination among the states members of an international organization—these are the questions with which this book deals. The author considers these questions from the point of view of a responsible international official and advocates a policy of administrative liberalism and the creation of a real international civil service rather than of rigid controls and the recruitment of narrow specialists. He urges governments to establish machinery to view problems objectively before entering upon negotiations, insists on the need for co-ordinating the activities of the numerous institutions that have been set up and of establishing a financial system which will afford a real incentive to economy. In marshalling his evidence he draws mainly on the record of the UN and the larger specialized agencies and in part on his own twenty-five years' experience as an international official.

OXFORD UNIVERSITY PRESS

The Canadian Journal of Economics and Political Science

*The Quarterly Journal of the Canadian Political Science
Association*

CONTENTS

Vol. XXII No. 4 NOVEMBER, 1956

The Changing Influence of the United States on the
Canadian Economy *J. Douglas Gibson*

Likely Trends in Canadian-American Political Relations
G. V. Ferguson

Non-Resident Ownership of Canadian Industry
C. D. Blyth and E. B. Carty

The International Allocation of Resources *Sidney Pollock*

The Role of the Canadian Life Insurance Companies in
the Post-War Capital Market *Wm. C. Hood and
O. W. Main*

Religious Affiliation and Electoral Behaviour *John Meisel*

The Customs Administration in Canadian Historical
Development *Gordon Blake*

Staff Relations in the Canadian Federal Public Service
S. J. Frankel

Government Conciliation in Labour Disputes
William G. Phillips

Interest in News and the Selection of Sources *Kurt Lang*

Notes and Memoranda

Are Interpersonal Comparisons of Productivity Valid?
Arnold Brekke

Review Article

Sir John A. Macdonald *J. H. Aitchison*

Review of Books. Current Topics

Annual Subscription ... \$6.00

Single Copies ... \$1.50

Subscriptions may be sent to :

THE UNIVERSITY OF TORONTO PRESS
TORONTO 5, CANADA

The Journal of Political Economy

Edited by Albert E. Rees in Co-operation with other
members of the *Department of Economics of the University
of Chicago*

The August, 1956 Issue contains :

Some Foundations of Economic Development in the
Upper East Tennessee Valley, 1850-1900
William H. Nicholls

Prices of Basic Industrial Products in the U.S.S.R.,
1928-1950 *Abram Bergson, Roman Bernault, and
Lynn Turgeon*

The Limitations of Local Price-Cutting as a Barrier to
Entry *Wayne V. Leeman*

Saving in the United States *F. W. Paish*

Recent Developments in Brazilian Agriculture
Clarence A. Moore

Book Reviews and Books Received

FOUNDED in 1892. Published bi-monthly: February,
April, June, August, October, December. Single copy
11s. 9d. plus 9d. postage. Subscription rate, 45s. per
volume, plus 4s. postage.

Published by

**THE UNIVERSITY OF CHICAGO
PRESS**

British Agent:

CAMBRIDGE UNIVERSITY PRESS
Bently House, 20 Euston Road, London, N.W.1

ECONOMICA

PUBLISHED QUARTERLY

New Series, VOL. XXIII No. 92 NOVEMBER, 1956

CONTENTS

Seven Centuries of the Prices of Consumables, compared
with Builders' Wage-rates *E. H. Phelps Brown and
Sheila V. Hopkins*

Post-war Wage Bargaining in the United States
H. M. Douy

Seamen's Sixpences : An Index of Commercial Activity,
1697-1828 *Ralph Davis*

Iron and Steel Prices *Lucien Foldes*

Factor Endowment and Relative Commodity Prices :
A Comment *E. J. Mishan*

Official Economic Statistics *R. G. D. Allen*

The Royal Commission on the Taxation of Profits and
Income *A. R. Prest*

BOOK REVIEWS

BOOKS RECEIVED

Annual Subscription £1 10s. 0d. per annum, post free.
Copies can be obtained from any bookseller or from the
Publication Department of the London School of Economics,
Houghton Street, London, W.C.2.

International Labour Review

(Issued monthly since 1921)

VOL. LXXII DECEMBER, 1955 No. 6

CONTENTS

Automation—Some Social Aspects *H. de Bivort*

Productivity in Underdeveloped Countries *S. Tilles*

The Aims of Mexico's Indian Policy *Alfonso Caso*

Reports and Inquiries

Wage Differentials affecting Young Workers

An Actuarial Analysis of the Pension Schemes in the
Federal Republic of Germany and the Land Berlin

Bibliography

Problems and Prospects of the Cotton Textile Industry
Publications of the I.L.O.

Publications of the United Nations and other inter-
governmental organisations

Other Publications

A specimen copy of the *REVIEW* and a catalogue
of International Labour Office publications will be
forwarded on application to the International Labour
Office, Geneva, Switzerland, or to the London Branch
Office of the I.L.O., 38 Parliament Street, London, S.W.1.

The *INTERNATIONAL LABOUR REVIEW* may
also be obtained from the publishers in the United
Kingdom, Messrs. George Allen & Unwin, Ltd., Ruskin
House, 40 Museum Street, London, W.C.1.

Annual subscription : £1 16s. ; \$6.00

Single copies : 3s. 6d. ; 60 cents

(Published in English, French and Spanish editions)

ECONOMIE APPLIQUÉE

Archives de l'Institut de Science Economique Appliquée
(The French Journal of Economic Science)

Directeur : François Perroux
I.S.E.A., 35 Boulevard des Capucines, Paris 26

Vol. IX Juillet-Septembre, 1956 No. 3

SOMMAIRE

Sur la quantité "suffisante" d'innovations et la distribution correcte de leurs effets quant à l'économie des facteurs de production. *W. J. Fellner*

La théorie des trois secteurs et le développement économique. *O. Okyar*

La concurrence socialiste en Yougoslavie *R. Bicanic*
Commentaires *S. Wickham*

La théorie de la croissance et l'expansion régionale *J. Milchau*

Notes sur l'indétermination du concept de productivité dans une économie dynamique *Y. Mainguy*

Stocks et stratégie des entrepreneurs dans le cycle. *M. Moret*

Joseph A. Schumpeter : History of Economic Analysis *E. James*

THE ECONOMIC RECORD

The Journal of the Economic Society of Australia and New Zealand

Vol. XXXII MAY, 1956 No. 62

Articles :

The Australian Economy, March, 1956 *R. I. Downing*
Australia's Long-Term Balance of Payments Problems *Erik Lundberg and Malcolm Hill*

Uniform Taxation with States Taxing Incomes *K. J. Binns and L. V. Bellis*

Towards a Theory of Industrial Concentration *Edith T. Penrose*

The Effect of Inflation on Company Profits and Financial Structures *J. McB. Grant and R. L. Mathews*

The Ottawa Agreement Now *W. R. Carney*

A Pilot Survey of Personal Savings *G. C. Harcourt and Duncan Ironmonger*

Current Agricultural Development and the Utilisation of Resources *K. O. Campbell*

Notes :

Forced Saving and the Multiplier *C. S. Soper*
Unemployment in New Zealand During the Great Depression *C. Weststrate*

Full Cost Pricing in the Multi-Product Firm *A. C. Cook, N. F. Duffy and E. H. Jones*

Productivity and Size of Establishment in New Zealand Distributive Trades, 1953 *J. W. Rowe*

The Definition of Economics *L. J. Hume*
Rejoinder *Kenneth Rivett*

Single Copies 12s. 6d. (Australian).
Annual Subscription 25s. (Australian)

MELBOURNE UNIVERSITY PRESS
The University, Melbourne, N.3,
Victoria, Australia.

THE Quarterly Journal of Economics

FOUNDED 1886

Vol. LXX NOVEMBER, 1956 No. 4

Accounting for Depreciation in the Soviet Economy. *Robert W. Campbell*

A Probabilistic Theory of Consumer Behavior *Richard E. Quandt*

A Complete Capital Model Involving Heterogeneous Capital Goods *Paul A. Samuelson and Robert M. Solow*

The Shifting of the Corporation Income Tax in a Growing Economy *Diran Bodenhorn*

After Twenty Years : The General Theory *James R. Schlesinger*

Shift Working : An Application of the Theory of the Firm *K. J. W. Alexander and John Spraos*

A Second Supplementary Bibliography on Monopolistic Competition *Edward H. Chamberlin*

Notes and Discussions :

Investment Criteria, Productivity and Economic Development :

Comment *Hans Neisser*

Reply *Walter Galenson and Harvey Leibenstein*

Recent Publications

Edited by E. H. Chamberlin for the Department of Economics, Harvard University

\$1.50 per copy, \$5.00 a year ; 3 years \$14.00.
Special Student Rate \$3.00 a year

Order from :

THE HARVARD UNIVERSITY PRESS
CAMBRIDGE 38, MASS.

Social and Economic Studies

Quarterly Journal of
INSTITUTE OF SOCIAL AND ECONOMIC
RESEARCH

UNIVERSITY COLLEGE OF THE WEST INDIES
JAMAICA, B.W.I.

Vol. 5 June, 1956

Journal devoted to research especially in the problems of economic development, social change, political action in underdeveloped territories

Amongst papers published are:

The Transformation of Land Rights by Transmission in Carriacou *M. G. Smith*

Social Security Problems with Special Reference to the British West Indies *J. Henry Richardson*

Depreciation Policy and the Investment Stream *H. D. Huggins and E. R. Chang*

Immigration as a Social Process : The Case of Coloured Colonials in the U.K. *Anthony H. Richmond*

Savings in an African Economy *Okwaru O. Amogu*

Subscription per volume (4 numbers) :
£1 10 0 ; U.S. \$4.25 B.W.I. \$7.20