On Price Inflation

by

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To Taread and Zaid

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ABSTRACT

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This thesis seeks to analyse price inflation under oligopoly capitalism. Its central argument is that under oligopoly capitalism, price inflation is a structural phenomenon. For a greater understanding of that phenomenon, the adoption of the inter-industrial approach for its analysis seems essential. According to this approach, price inflation can be initiated in a single industry or in an industry group. The initiating factor may be an increase in the mark-up, an increase in the money wage rate or an increase in the foreign currency price of an imported input. It can also be initiated by devaluation. The input-output matrix, the core of the economic system, is the key to the transmission of inflationary impulses (in the form of higher unit cost) from one industry to another. Real wage resistance, rigid mark-up resistance, and rigid foreign resistance do no more than perpetuate or worsen the inflationary experience. The inflationary process itself has a dual role to play. It acts as a mechanism for shifting income distribution in favour of one section of the society against another and as a mechanism for changing the price structure.

The author argues that the abandonment of the macroeconomic approach to the analysis of price inflation and its replacement by the inter-industrial approach is the first step for serious analysis of that structural phenomenon.

Chapter 1: Introduction

1.1 Price inflation, defined as a sustained increase in the general price level, is not a new phenomenon in the capitalist world. From a glance at Phelps-Brown and Hopkins (1956) one can say that in Britain the phenomenon goes back to the fourteenth century, and beyond. One can even say that early capitalism and today's have had a common experience of price inflation given the following facts (Deane, 1979):

(1) money supply has been increasing;

(2) price inflation has been an international phenomenon;

(3) different countries have different rates of price inflation; and

(4) the countries experiencing the same phenomenon have been on the same path of capitalist development.

However, there is one element which differentiates the experience of price inflation in early capitalism from that experience today. That element, which seems to me of central importance for the analysis of price inflation under today's capitalism, is the country's relative location on the path of capitalist development.

During the sixteenth century, the economies witnessing the "price-revolution" were developing towards what may be called competitive capitalism which was the dominant form of market relations in Britain and the capitalist world during the nineteenth century.[1] In the twentieth century, the inflationary experience has taken place in a set of economies characterised by:

1) the presence of trade union organizations

2) the presence of trade federations

3) oligopolistic/monopolistic market structure

4) the presence of multinational corporations, the Eurobanks, and the use of the exchange rate as a policy variable.

None of these features was present when the "price-revolution" of the sixteenth century was under way. In other words, the economies which were experiencing price inflation in the sixteenth/seventeenth centuries are experiencing the same phenomenon now (1986), under completely different institutional arrangements which may be called oligopoly capitalism. The immediate consequence of that, as far as the theory of price inflation is concerned, is that the theory should be based on a set of assumptions, shifting in a unidirectional way, to reflect the realities of each historical stage. As we shall see shortly, some theorists of price inflation, the proponents of what I shall call the A-Conflict theory of price inflation, take competitive market relations as "the" starting point in theory construction, while others, the proponents of the Explicit-Conflict theory of price inflation link the analysis to the main institutional arrangements under today's capitalism. As a result, we find a spectrum of conflicting theories all attempting to explain the same phenomenon, for the same economy, for the same time period.

1.2. This thesis seeks to apply the surplus approach, recently rehabilitated by Sraffa, (1960) to the analysis of price inflation under oligopoly capitalism. It addresses a familiar set of questions, on the initiation, persistence, acceleration, deceleration and termination of price inflation in such economies. They are familiar even to the layman who, however, may be baffled by the competing answers put forward to him by different economists; through magazines, newspapers, radio, television, etc.

In the second chapter of this exploratory work, I present the current explanations of the inflationary phenomenon, in the economies under consideration, with a sketch of the principal policy implication of each. The following chapter, Chapter 3, contains some comments on each of the explanations presented in the second chapter. It also contains a number of questions designed to convince the reader of the necessity of adopting the Kalecki-Leontief-Sraffa method in modelling the inflationary phenomenon. Chapters 4 and 5 are building blocks, the first of which deals with the determination of sectoral money wage rates, while the second deals with the determination of sectoral mark-up. In chapter 6 a simple inter-industrial model of price inflation is constructed with some theoretical analysis and comments, while in chapters 7, 8 and 9 I relax some of the simplifying assumptions upon which the model of chapter 6 is built. Chapter 10 presents some simulations on the initiation, persistence, acceleration, deceleration and control of price inflation discussed in some depth. Chapter 11 closes the thesis by its main conclusions and some proposals for further research.

Note to chapter 1

[1]Baran & Sweezey (1966), pp.19-20.

Chapter 2: The Current Explanations

2.1 Introductory note:

In the present chapter I give an account of the current theories of price inflation under oligopoly capitalism, within a unifying framework, based on the surplus approach to the analysis of value. There will be a brief assessment of each theory in the following chapter.

It should be mentioned, at the outset, that as the published literature on inflation is very large, one is forced to be very selective. I hope that the works which have been selected and classified represent the main currents of thought on inflation.

The classification is designed to be consistent with the surplus approach to the theory of value and to be flexible enough to accommodate the economist who drifts from category to another. The "sample survey" begins with the A-Conflict theory of price inflation, considers the Implicit-Conflict theory and finally tackles the Explicit-Conflict theory of price inflation. The order reflects the relative position of the theories in the educational institutions in North America and Western Europe.

2.2 The A-Conflict Theory of Price-Inflation:

2.2.1 Why "A-Conflict"?

According to this theory, price inflation is not a structural feature of advanced capitalist economies but only occurs in certain circumstances. Price inflation occurs when the money supply or, in another version, aggregate nominal demand increases to such an extent that the economic system is unable to supply an adequate flow of goods and services at existing prices.

Putting aside for the present the hypothesis about the "rationality" of price anticipations[1], the central causal mechanism connecting the money supply, or aggregate demand, to the price level is as follows:

Persistently increasing
money supply
or aggregate nominal demand

↓

Persistent presence of excess demand
for inputs and outputs

↓

Increasing level of individual
input and output prices

↓

Increasing general
level of prices

The hypothesised causal relationship is a-historical[2], i.e. it ignores the particular historical contexts of social values, norms and social institutions[3] in which the terms of the causal relationship are embedded. In consequence, the theory considers that contradictions and conflicts between different groups are irrelevant to the understanding of price inflation. That is why I call this the A-Conflict theory of price inflation.

That label should be applied to any theory of price inflation, applied to today's capitalism, whose core is a causal relationship running from changes in money supply, to changes in demand, to changes in input-output prices and hence to changes in the general price level.

There are two versions of the A-Conflict theory. Since the two have more than one hypothesis in common, I will treat the first in detail and give only a brief resume of the second.

2.2.2 The "Supply-side" version of the A-Conflict theory of price inflation[4]

I start with the assumptions upon which the analysis is based:

First: Workers are disutility minimizers and firms are short-term profit maximizers.

Second: Production takes one unit of time and workers and employers make a binding wage/employment contract at the beginning of each period. Wages are paid at the end of the period.

Third: Whenever excess demand emerges, commodity prices and money wage rate(s) increase to eliminate it.

Fourth: The money supply is exogenous.

To simplify the analysis, we shall assume a closed economy with constant labour force, constant productivity and no taxes of any kind.

(i) Anticipations-free price-Phillips Curve:

To understand the response of the system to a demand shock, consider the following scenario. The labour market is in equilibrium but the government does not perceive this and acts to reduce the level of unemployment by programming a higher level of real government expenditure from the beginning of the current period. The expansion is to be financed by newly created money, obtained by selling bonds to the central bank. However, the nominal rate of interest is controlled at its initial equilibrium level.

The immediate result is the emergence of excess demand in both goods markets and labour market.

The Labour Market, and the Simultaneous Motivation Condition

(1) The demand for labour:

At the beginning of the current period, commodity supplies are the result of previous contractual commitments (assume they were made at the beginning of last period), and therefore must be treated as a datum. Monetary expansion at the beginning of period t creates excess demand in some or all markets. Since commodity supply is given, the market clearing hypothesis dictates that commodity prices must go up to such a level that excess demand is eliminated. The higher price levels of individual commodities lead the general price level index, P_t, to be higher than its last period's equilibrium (= actual) level, P^E.

Gross profits per unit of current sales will increase since $P_t > MC_{t-1}$ (MC = marginal cost), but a further condition is necessary for the higher prices of period t to lead to an above equilibrium level of output and employment. Short-run profit maximization implies that employers will hire labour up to the point at which the marginal physical product of labour is equal to the current period money wage rate, w_t, relative to output price expected to rule at the beginning of the next period (i.e. when the output is to be marketed). Employers must expect prices to rise. If prices are not expected to rise, then because of the advance in money wage rates (see below) the current level of employment cannot exceed its last period equilibrium level. If the price level is expected to rise sufficiently, the demand for labour will increase.

(2) The supply of Labour

On the other hand, and at the beginning of period t, workers see themselves spending their money wages (received at the end of last period) on dearer goods. This means that their "utility expectations" are disappointed , and as a result they are in a state of disequilibrium.

This is so because they are assumed to be disutility minimizers (or utility maximizers), and the utility of last period's money wage rate relative to this period's prices is smaller than the disutility generated by supplying the same amount of labour time this period (period t) as that of last period.

Under these circumstances, they will refuse to supply last period's (equilibrium) labour time unless they get money wage increases proportional to the current period's price increases. The formal implication of that is:

$$\frac{w_t}{P_t} = \left(\frac{w}{P}\right)^E \qquad (2.1)$$

$$\Rightarrow \quad \dot{w}_t = \dot{P}_t \qquad (2.2)$$

where E = (initial) equilibrium, and the dotted variables refer to the proportional rates of change.

To ensure that this period's level of employment can be higher than its last period's, the following condition must be satisfied:

Workers must be granted money wage increases not only enough to restore last period's level of real wage rate, but must also be sufficiently higher to motivate them to supply an amount of labour time, and to induce a number of workers to leave the frictional reserve army and go to the factories, to such a level that the rate of unemployment is reduced from U_0 to U_1 in period t (figure 1 below). Formally, we must have:

$$\frac{w_t}{P_t} > \left(\frac{w}{P}\right)^E \qquad (2.3)$$

$$\Rightarrow \quad \dot{w}_t > \dot{P}_t \qquad (2.4)$$

(3) The Simultaneous Motivation Condition:

The reader will notice the two words "can be" were underlined above. It is "can be" and not "will be" simply because condition 2.3 above is not enough to ensure that the current level of employment is higher than its last period's level such that the (new) rate of unemployment remains at U_1 in figure 1 below. The achievement of that target requires that employers[5] anticipate that commodity prices for period t+1 are higher than their levels in the current period, t . This is so because:

(i) Marginal productivity theory of employment instructs that no more employment is offered unless the real wage rate is made to sink sufficiently below the initial equilibrium level of marginal physical product of labour (MPP_L).

(ii) The output of those employed at the beginning of period t will be offered for sale at the beginning of period t+1 . This implies that the marginal product of labour employed in this period has to be valued at period t+1 prices, which are not known to the employers at the beginning of period t . This means that greater employment in this period can only be achieved when the following condition is satisfied:

$$w_t < (MPP_L)^E \cdot P^a_{t+1} \qquad (2.5)$$

Where P^a_{t+1} is the price level anticipated by the employers to rule in period t+1.

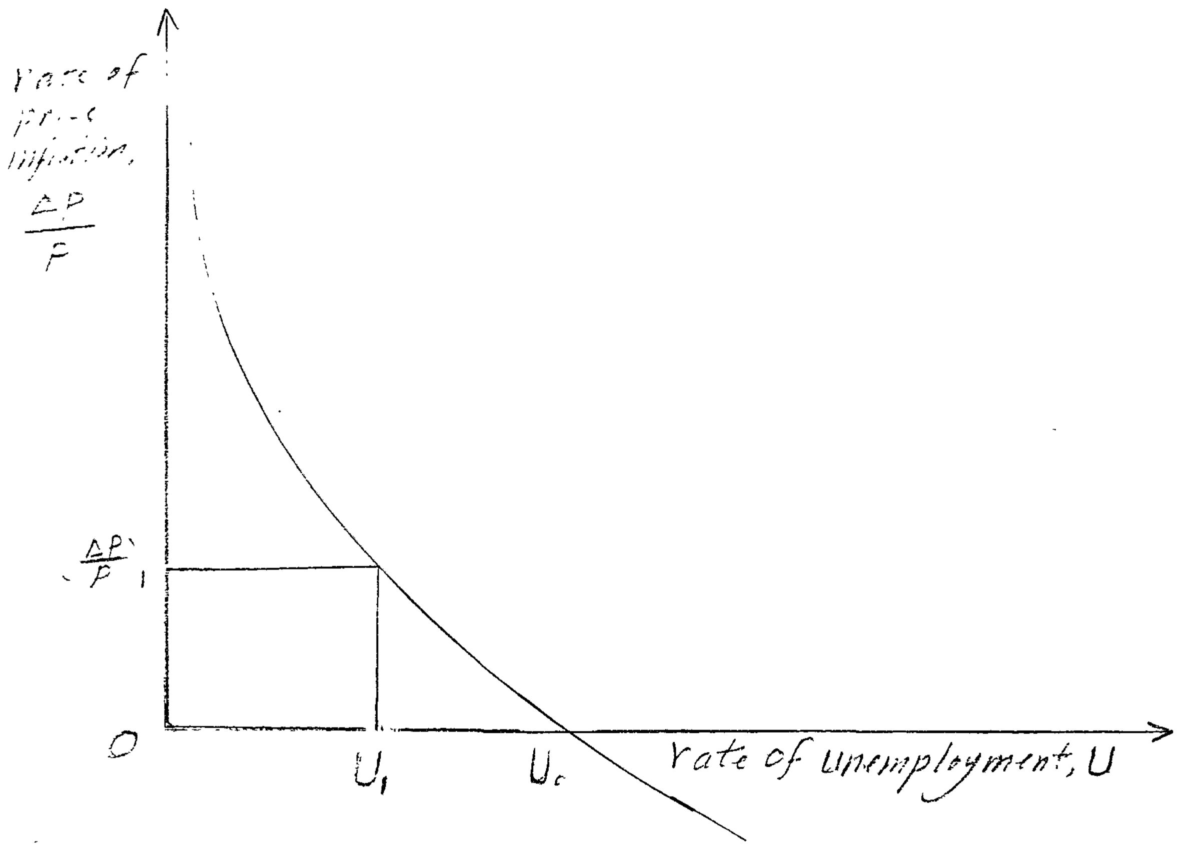
Therefore, the increase in money supply and the resulting presence of excess demand in both goods and labour markets will lead to a higher level of output and employment if, and only if:

$$\frac{w_t}{P^a_{t+1}} < (MPP_L)^E = \left(\frac{w}{P}\right)^E < \frac{w_t}{P_t} \qquad (2.6)$$

Under the above simultaneous motivation condition, which is a missing element in this sort of theory of inflation, excess demand for inputs and outputs lead the economy (according to the present theory) to generate a price inflation-employment-rate combination of

$\left(\frac{\Delta P}{P}\right)_1$, U_1, shown in figure 1 below:

Figure 1



By the end of period t , the economy has experienced the following:

(i) Higher level of money supply

(ii) Higher price level

(iii) Higher money wage rate(s), and

(iv) Higher level of real output

Would it be possible for the same disequilibrium situation to be re-created in period t+1 ? The answer is: yes, if the same inflationary conditions were associated with the same behaviour on the part of workers and the employers, i.e. if the SMC is satisfied. Let us then move to period t+1 .

To maintain last period's rate of unemployment (again U_1, in figure 1 above), money supply must increase by the same percentage as last period's increase. This will lead to the re-creation of excess demand at the beginning of period t+1 .

As we argued earlier (p 10 above), aggregate supply for this period (period t+1) has to be taken as a datum. The market clearing condition necessitates that at the beginning of period t+1 commodity prices must go up to such a level that excess demand is eliminated.

Similar behaviour on the part of the employers and the workers to last period's behaviour (i.e. disutility minimization for the workers and short term profit maximization for employers) leads to the re-creation of the SMC condition which motivated both the employers and the workers respectively to demand more than the initial equilibrium number of employees and to supply the same amount of labour demanded by employers consistent with last period's rate of unemployment, U_1 .

That condition is:

$$\frac{w_{t+1}}{P^a_{t+2}} < (MPP_L)^E = \left(\frac{w}{P}\right)^E < \frac{w_{t+1}}{P_{t+1}} \qquad (2.7)$$

and for period t+2, we have:

$$\frac{w_{t+2}}{P^a_{t+3}} < (MPP_L)^E = \left(\frac{w}{P}\right)^E < \frac{w_{t+2}}{P_{t+2}} \tag{2.8}$$

and for period t+3 we have:

$$\frac{w_{t+3}}{P^a_{t+4}} < (MPP_L)^E = \left(\frac{w}{P}\right)^E > \frac{w_{t+3}}{P_{t+3}} \tag{2.9}$$

etc.

This inflationary situation (in our closed economy) will continue indefinitely, so long as:

(i) Money supply continues to increase at its new rate

(ii) Employers stick to their price expectations and anticipations pattern, and, more importantly,

(iii) Workers do not anticipate price inflation.

The reader is reminded that the object of all rounds of excess demand in the above analysis can be one or a combination of the following:

(a) Final output

(b) Intermediate inputs

(c) Labour input

Excess demand can initially be created (through money supply expansion, of course) in the final output sector, leading to secondary rounds of excess demand, and to corresponding rounds of price and nominal income increases. Alternatively, it can be initiated in the intermediate goods sector, or in the labour market leading to secondary rounds of excess demands for final output and intermediate inputs and to corresponding price-wage increases. Finally, it could be a combination of the above three elements. Needless to say, the above analysis covers the case where the increase in money supply is partly absorbed by price-wage increases and partly by real output increases, as is emphasised by Friedman [6], Lipsey [7], among others, and Keynes[8] before them.

(ii) Anticipations Augmented Price-Phillips Curve:

The reader may wonder how long I can continue to abstract from anticipations of price inflation on the part of the workers. Actually, I have not abstracted from them.

They have been placed in the background by the implicit (and simplifying) assumption that workers take "this period's" prices as the "best" estimates of next period's prices. In other words, we have abstracted from anticipations of price inflation by assuming that the workers have a unit price "elasticity of expectations" for consumption goods[9]. Once we relax that assumption, the economy enters into a new inflationary era. An accelerating rate of price inflation would break out in the system, if the newly created rate of unemployment U_1 were to be maintained.

Here two questions arise:

First: According to the present version of the A-Conflict theory, what is the cause of the acceleration ?

Second: How does that theory envisage the acceleration of price inflation ?

As for the first question, the answer (according to the present version of the A-Conflict theory) is simple: It is caused by an accelerating rate of increase of money supply. But the answer to the second question is less straightforward and more difficult.

Here one has to choose between two alternative explanations. The first alternative maintains the assumption of unit elasticity of price anticipations, on the part of the workers, but relaxes the assumption of a constant target rate of unemployment and replaces it by the assumption that the government has opted for a progressively declining target rate of unemployment. This alternative implies an old-fashioned anticipations-free wage-Phillips curve, originally formulated by Phillips (1958)[10] as a statistical inverse relationship between the U.K. rate of change of money wages and the rate of unemployment together with its rate of change. That discovery was quickly backed by a neoclassical theoretical construction by Lipsey (1960) "only" to prevent "serious misinterpretation".[11] This alternative is irrelevant[12] for the analysis of price inflation under today's conditions and shall be ignored.

In the second and "more promising" alternative, the assumption that the workers have unit elasticity of price anticipations is relaxed. Also, the actual rate of unemployment is allowed to go below its "natural rate", with the latter being dependent on the factors which give rise to frictional unemployment only.[13]

Under these circumstances, the central relationship upon which the present version of the A-Conflict theory of price inflation is based (see page 8 above) becomes embodied in an "expectations" augmented price-Phillips Curve, which may be of the following form.[14]

$$\left(\frac{\Delta P}{P}\right)_t = f(Y_t - Y^*) + \delta\left(\frac{\Delta P}{P}\right)_t^a \qquad (2.10)$$

with: P_t = general price level for period t

Y_t = actual level of aggregate real output, associated with an actual rate of unemployment.

Y^* = the aggregate level of real output which corresponds to the "natural rate" of unemployment.

a = anticipated

δ = constant with a maximum value of unity.

Equation 2.10 above needs to be supplemented by a hypothesis about how decision makers form their price expectations and anticipations with respect to period t . Here, we have two basic hypotheses:[15]

(i) The Extrapolative Anticipations Hypothesis

(ii) The Rational Anticipations Hypothesis

The central difference between the effects of the two hypotheses is that the Extrapolative Anticipation Hypothesis (e.g. price-anticipations based on adaptive expectations hypothesis) allows for the existence of a short-term trade-off between the rate of price inflation and the rate of unemployment[16], with the implication that δ is less than unity. The Rational Anticipations Hypothesis, in its most extreme form[17], rules out that trade-off, with the implications that δ is, in fact, equal to unity, at all times.

I shall first show how the rate of price inflation accelerates when equation 2.10 is combined with extrapolative expctations about the rate of price inflation.

"Irrational" Anticipations-augmented Price-Phillips Curve:

Suppose that the government reflationary expenditure programme has been going for a number of periods so that from the beginning of period t price inflation is anticipated. Assume that the general price level (index) expected by the workers is the following version of the extrapolative hypothesis:

$$P^e_{t,w} = P^e_{t-1,w} + \theta(P_{t-1} - P^e_{t-1,w}) \qquad (2.11)$$

where $P^e_{t,w}$ = worker's expected price index for period t

P_t = actual price index for period t

θ = a constant whose value is between zero and unity

The money wage rate will still be determined, mechanically, by supply and demand forces, but with equation 2.11 is taken into consideration by the workers in <u>deciding</u> whether to take employment offers or not. As for the employers, so long as they act as price takers, they need do no more than to anticipate their selling prices for period t+1 . Suppose that the anticipated price index P^a_{t+1} is <u>based</u> on the following decision rule:

$$P^e_{t+1} = P_t + \lambda(P_t - P_{t-1}) \tag{2.12}$$

with λ between zero and unity. Now, if the actual rate of unemployment for period t were to remain at its target level of U_1 (figure 1 above), the following condition must be satisfied:

$$\frac{w_t}{P^a_{t+1}} < (MPP_L)^E = \left[\frac{w}{P}\right]^E < \frac{w_t}{P_t} \tag{2.13}$$

Condition 2.13 is identical to the SMC condition above. However, it is based on a different hypothesis regarding inflationary anticipations. This is so because in 2.13 both workers and employers anticipate inflation while in condition 2.6 , only employers do that.

Provided that money supply is expanding fast enough to maintain aggregate demand at such a level that the rate of unemployment is kept at its target level of U_1, equation 2.13 above forms a necessary and sufficient condition for the acceleration of the actual rates of price and wage inflation. Let us prove that is so.

Suppose that at the beginning of period t condition 2.6 is satisfied with:

(a) money wage rate for period t increased over last period by x%

(b) expected price index for period $t+1$ is to lead the employers to anticipate an x% increase in their product prices at the beginning of period $t+1$.

(c) a rate of unemployment of exactly U_1.

Now, suppose that, for one reason or another, workers anticipated another x% price increase for the same period, making the total percentage wage increase for period t 2x%.

If employers' price anticipations for period $t+1$ were to remain unchanged, at x%, the 2x% money wage increase at the beginning of period t invalidates the SMC condition 2.6. That is, the condition

$$\frac{w_t}{P^a_{t+1}} < (MPP_L)^E = \left(\frac{w}{P}\right)^E < \frac{w_t}{P_t} \qquad (2.14)$$

will no longer be satisfied. This must be the case because at U_1 the money wage increase of 2x% for period t makes the cost of the marginal physical product of labour (with the MPP_L forthcoming at the beginning of period $t+1$), that is the "marginal cost", greater than the price which is expected to be received by the producers at the beginning of period $t+1$.

If that were the case, then the level of employment for period t must be lower than last period, unless a new situation quickly develops and leads employers to reemploy the dismissed workers and bring the rate of unemployment back to U_1.

But, the story goes on, the government, now keeping an eye on the rate of unemployment, would not let employers choose less than the target level of employment. This means the money wage rate cannot settle at a 2x% money wage increase when there is a budget deficit and when there is excess demand in commodity market and commodity prices are going up. The budget deficit will be instantaneously carried to such a level that the actual price level for this period increases up to a level that it makes P^a_{t+1} [assume it is equal to $P^e_{t+1} = P_t + \lambda\,(P_t - P_{t-1})$] high enough to induce employers to employ more, such that the target rate of unemployment of U_1 is achieved. However, at the higher price level, workers will not supply the necessary amount of labour unless money wage rate increases to such a level that condition

$\frac{w_t}{P_t} > \left(\frac{w}{P}\right)^E$ is satisfied.

On the other hand, employers will not choose the necessary level of employment (consistent with U_1) unless the condition

$$\frac{w_t}{P^a_{t+1}} < (MPP_L)^E = \left(\frac{w}{P}\right)^E \tag{2.15}$$

is satisfied.

This means that for the rate of unemployment to stay at U_1 (figure 1 above), the following condition must be satisfied:

$$\frac{w_t}{P^a_{t+1}} < (MPP_L)^E = \left(\frac{w}{P}\right)^E < \frac{w_t}{P_t} \tag{2.16}$$

which is the SMC 2.6 above. Now, we assumed earlier that workers form this period's expected price index according to the decision rule:

$$P^e_{t,w} = P^e_{t-1,w} + \theta(P_{t-1} - P^e_{t-1,w}) \tag{2.17}$$

For the employers, we assumed they form their anticipated price index for period t+1 according to the following decision rule:

$$P^a_{t+1} = P_t + \lambda(P_t - P_{t-1}) \tag{2.18}$$

$$\Rightarrow \frac{P^a_{t+1}}{P_{t-1}} = \frac{P_t}{P_{t-1}}(1+\lambda) - \lambda \tag{2.19}$$

from 2.19 and 2.16 we get:

$$\frac{w_t}{\frac{P_t}{P_{t-1}}(1+\lambda)-\lambda} < P_{t-1} \cdot (MPP_L)^E = P_{t-1} \cdot \left(\frac{w}{P}\right)^E < \frac{w_t}{\frac{P_t}{P_{t-1}}} \tag{2.20}$$

As far as period t is concerned, the workers' x% anticipated price inflation is a datum and is incorporated in w_t. In other words, w_t is cet. par. a function of P^e_{t+1}, as far as the workers are concerned. The required monetary expansion (i.e. required for achieving U_1) and the corresponding level of excess demand leads to a proportionate increase in both commodity prices and the money wage rate. However, at the same time, it leads to a more-than-proportional increase in the expression $\frac{P_t}{P_{t-1}}(1+\lambda) - \lambda$ which in turn leads the expression $\frac{w_t}{\frac{P_t}{P_{t-1}}(1+\lambda)-\lambda}$ to go further and further below both $P_{t-1}\left(\frac{w}{P}\right)^E$ and $\frac{w_t}{\frac{P_t}{P_{t-1}}}$ in the inequality 2.20 .

There are three implications of this. Firstly, unanticipated price inflation in period t (as far as the workers are concerned) appears. Secondly, it becomes worthwhile for the workers to supply the necessary amount of labour for period t (i.e. a level of potential employment leading to $U = U_1$ figure 2 below). Thirdly, it is worthwhile for the employers to employ a level of employment in period t consistent with U_1, i.e. the target rate of unemployment perceived by the government.

Now, this period's unanticipated rate of price inflation will be incorporated in next period's (period $t+1$) money wage rate. But the necessity of satisfying the Simultaneous Motivation Conditon 2.20 in period $t+1$ leads to the re-emergence of unanticipated price inflation in that period which in turn gets incorporated in the money wage rate for period $t+2$. Again, the satisfaction of condition 2.20 in period $t+2$ regenerates unanticipated price inflation for that period, which again gets incorporated in money wage rate w_{t+3}, etc.

The successive incorporation of unanticipated price inflation in the money wage rate implies that money wage rate is increasing at an increasing percentage rate. At U_1 the marginal physical product of labour is given "by the technology" of the system represented by "the production function" of that system. With MPP_L at U_1 being technologically given, the accelerating rate of wage inflation implies an accelerating rate of price inflation in order to guarantee the employers a continuous equality of prices with marginal costs. This, in turn, implies a continuous re-creation of excess demand in the system by the continuous injection of more money into it at the preplanned accelerating (proportional) rate. The "planner" here, of course, is the government.

One can make the same induction on the accelerating rates of wage inflation and price inflation on purely mathematical grounds, using the inequality 2.20 above, for successive periods as is shown in table 1 below.

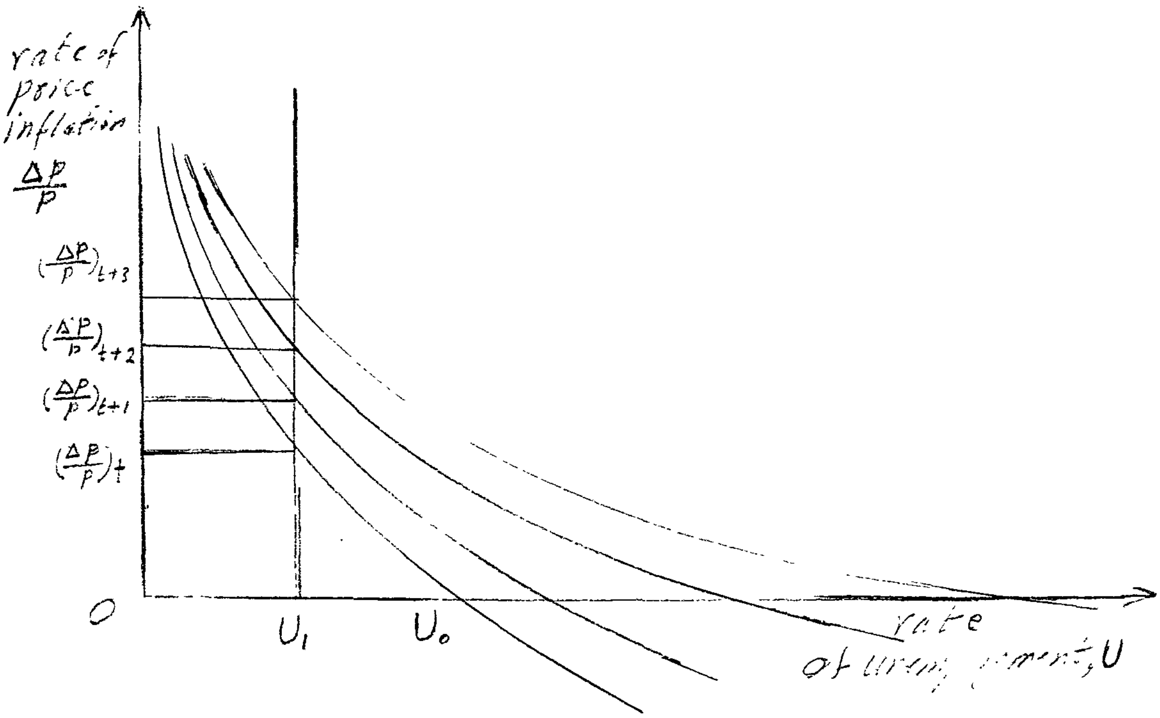
<u>Table 1 showing the simultaneous motivation condition for successive periods</u>

<u>time period</u>	<u>Inequality</u>
t	$\frac{w_t}{P^a_{t+1}} < (MPP_L)^E = \left[\frac{w}{P}\right]^E < \frac{w_t}{P_t}$
$t+1$	$\frac{w_{t+1}}{P^a_{t+2}} < (MPP_L)^E = \left[\frac{w}{P}\right]^E < \frac{w_{t+1}}{P_{t+1}}$
$t+2$	$\frac{w_{t+2}}{P^a_{t+3}} < (MPP_L)^E = \left[\frac{w}{P}\right]^E < \frac{{}_{t+2}}{P_{t+2}}$
$t+3$	$\frac{w_{t+3}}{P^a_{t+4}} < (MPP_L)^E = \left[\frac{w}{P}\right]^E < \frac{w_{t+3}}{P_{t+3}}$
$\vdots$	$\vdots$
$t+k$	$\frac{w_{t+k}}{P^a_{t+k+1}} < (MPP_L)^E = \left[\frac{w}{P}\right]^E < \frac{w_{t+k}}{P_{t+k}}$

Now, since $(MPP_L)^E$ is constant, and since w is increasing at an increasing (proportionate) rate, none of the above inequalities can hold unless P and P^a are increasing at an increasing rate[18]. Now, it is possible to make the following generalization: <u>when workers start anticipating price inflation, the satisfaction of the SMC is a necessary and sufficient condition for accelerating rates of inflation.</u>

From the above analysis, which is one interpretation of equation 2.10 above, we can construct a diagram in which the rate of price inflation and the rate of unemployment are related in an inverse fashion, via equation 2.10 above, according to which the price-Phillips curve is shifting bodily upwards at the beginning of each period (figure 2 below).

Figure 2



It is important, perhaps, to remind the reader that while the above diagram is based on equation 2.10 above, the interpretation of that equation should be that at U_1 it is the workers who persistently under-anticipate the actual rate of price inflation, and the portion of the actual price inflation which is unanticipated by the workers is behind:

(a) The accelerating rate of wage inflation

(b) The accelerating rate of price inflation

(c) The resolution of the increase in money supply into real output-change and price-change.

"Rational" Anticipations-augmented Price-Phillips Curve:

The break-out of the "Rational Expectations Revolution" in the above version of the A-Conflict theory of price inflation destroys the transmission mechanism whereby the successive monetary doses are translated, through whatever channel, into real output change, and price changes.

In the above analysis, causality runs from the budget deficit financed by selling bonds to the central bank, to government expenditures, to excess demand for goods and labour services to prices and wage rates, to money incomes. Should the monetary authority set out to buy various sorts of securities from the bank and non-bank public, perisistently keeping the nominal rate of interest below its equilibrium level, private spending will replace the direct government expenditure as a means of generating the above inflationary process. In other words, by pegging the rate of interest at a predetermined lower level, the government creates a similar inflationary experience, in our hypothetical (closed) economy.

But when decision makers are strictly "rational", that is when:

(1) all have a full knowledge of a model of the economy which accurately represents all its essential realities;

(2) all have the resources and the will to use that model to work out the needed predicted values of the relevant variables;

and (3) all know the government intentions, and all believe these intentions and act accordingly

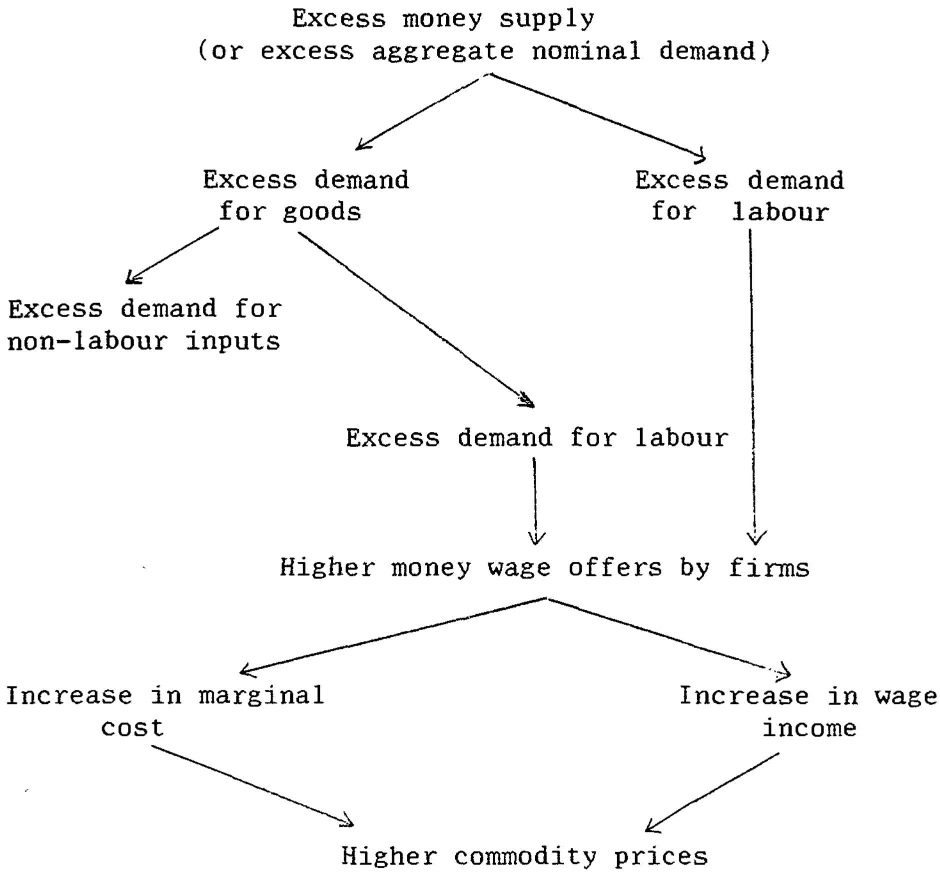
then causality will run directly from money supply to input-output prices, and, as a result, to money income.

No room is left for any real effect of changing the money supply on the part of the government. The government is now powerless to affect the real side of the economy[19].

The word "all" in the above three conditions is very important. If some firms (or unions) know what will be the government policy, while the rest do not, or know but are uncertain of the action of the others and of the consequences of their own, then it is doubtful that they will act according to what the "rational" economists prescribe. Can the latter deny the communication significance of condition (1) in the absence of a direct communication system through which all necessary information flows among all decision making units? If not, why then does one waste one's time shedding more ink on a fruitless venture? If yes, then we must appeal to reality and nothing else. Therefore, in my view, what I have said so far about REH is enough[20]. Now I move to the other version of the A-Conflict theory of price inflation.

2.2.3 The "Demand-side" Version of the A-Conflict Theory of Price Inflation[21]

In the previous subsection, I analysed the initiation, continuity, acceleration and (implicitly) deceleration of price-wage inflation, for a closed "advanced" capitalist economy, from the "supply side". In the present subsection, I shall analyse the inflationary phenomenon by looking at it from the "demand side". According to the "demand side" approach, causality runs as follows:



The dynamics of the above causal relationship will be clarified after setting the assumptions upon which the present theory is based. They are: First: Whenever, and in whatever market excess demand emerges, the labour market is the first to react to presence of excess demand.

Second: In response to the presence of excess demand for output, firms do not increase output prices. Instead, they offer a higher money wage rate in order to make workers work longer hours, and/or to attract more workers who form the pool of frictional unemployment.

Third: At the beginning of period t workers sign a binding wage-employment contract with the employers who expect to sell the forthcoming output at a price equal to the marginal physical product of labour. This assumption implies that production takes time, with inputs entering production at the beginning of period t , and leaving, in the form of finished goods, at the end of that period, to be sold at the beginning of period t+1 .

Fourth: Marginal cost increases with output (of a given production unit) and marginal cost pricing is the rule.

Fifth: Money supply is exogenous.

To simplify, we shall retain the closed economy assumption, constant labour force and labour productivity, and also, we shall assume that no tax is present.

Now, suppose that the government decided on a programme of public expenditure designed to reduce the rate of unemployment from U_0 to U_1 (in figure 3 below). Suppose further that, through a budget deficit financed by selling bonds to the central bank, (hence leaving the nominal rate of interest intact) government expenditure is spent on non-labour inputs only. Given these assumptions, how does the "demand side" theory lead the system to the brink of hyper-inflation? To answer that question, we shall first construct an anticipations-free wage-Phillips Curve, and then introduce the necessary complications which finally lead to the answer.

(i) Anticipations-free wage-Phillips Curve

The immediate response of the system to the excess demand shock is that its units, the firms, find themselves selling more than expected. As a result the production level is revised upwards and from the beginning of period t , firms announce two things:

(a) job vacancies, consistent with $\left(\frac{D-S}{S}\right)_1$ (figure 3a below)

(b) an increase in money wage rate consistent with $\left(\frac{D-S}{S}\right)_1$ and U_1.

With the presence of excess demand in both commodity and labour markets, at the beginning of period t, the first four assumptions above ensure that the SMC is satisfied. That is to say,

$$\frac{w_t}{P^a_{t+1}} < (MPP_L)^E = \left[\frac{w}{P}\right]^E < \frac{w_t}{P_t} \tag{2.21}$$

Therefore, throughout period t, the economy will be characterised by having wage inflation at a rate of $\left(\frac{\Delta w}{w}\right)_1$ associated with an actual rate of unemployment of U_1, as it is shown in figure 3d below. I emphasised the word "associated", to bring the reader's attention to the fact that what caused the money wage rate to increase by $\left(\frac{\Delta w}{w}\right)_1$ is not the direct reduction in the rate of unemployment per se. Rather, it is the derived demand for labour input which led the employers to offer money wage increases of $\left(\frac{\Delta w}{w}\right)_1$. There are two reasons for the offer of a higher money wage rate at U_1:

(1) To induce the already employed workers to work longer hours, and/or to attract more workers to join those who are already in employment.

(2) To prevent inefficiency among those already in employment, resulting from the dissatisfaction of a disturbed wage structure (Schultz, 1959, p.216).

The increased money wage rate leads, on the one hand, to an increase in the marginal cost of the output which will be offered for sale at the beginning of period $t+1$. On the other hand, and since the wage is a cost and an income (to be received at the end of period t), the beginning of period $t+1$ will witness, among other things, an increase in expenditure on the stocks of goods supplied at the beginning of period t+1 . The increased wage bill received at the end of period t and spent at the beginning of period t+1 , creates a new inflationary situation at the beginning of that period.

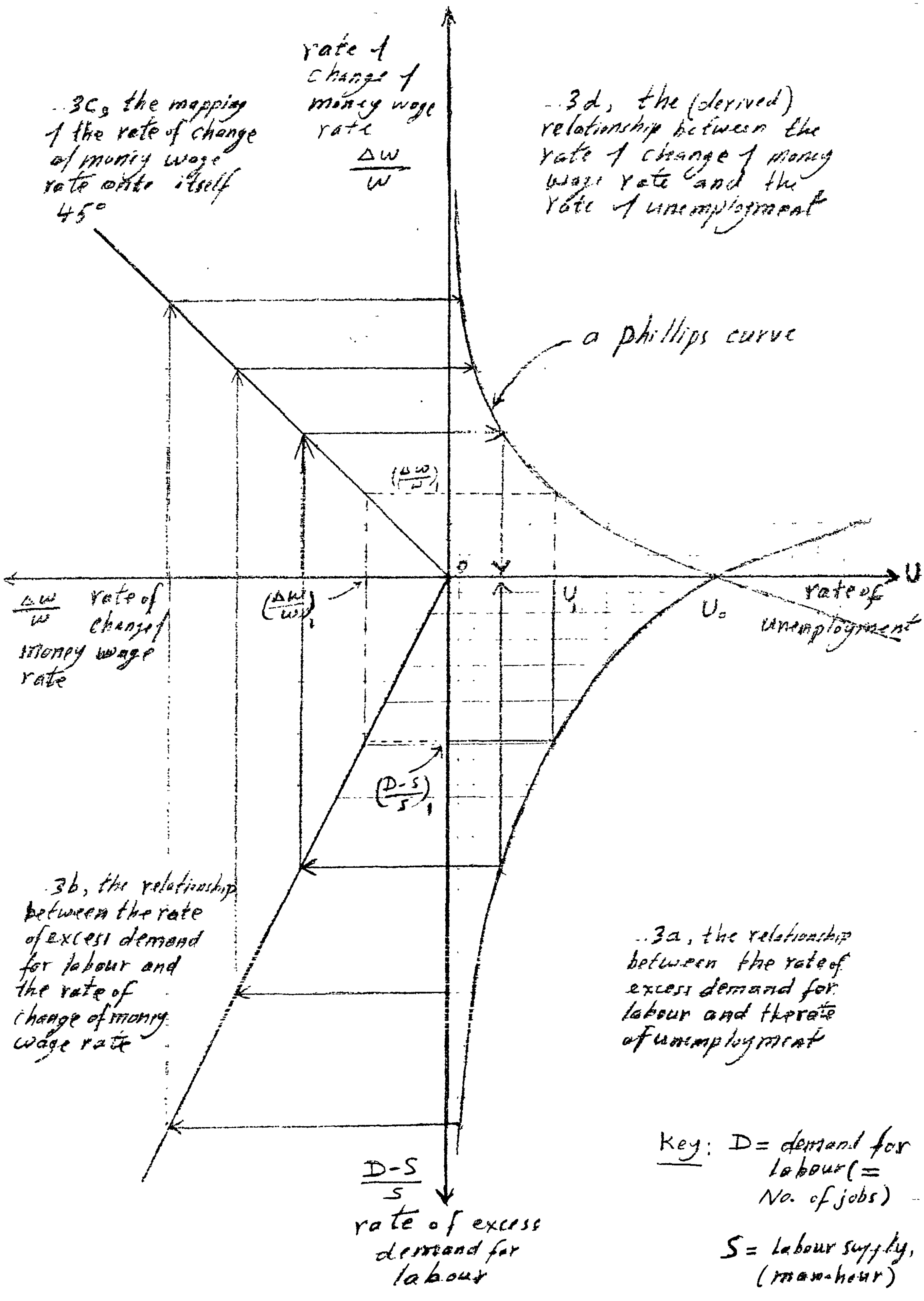
(a) Excess demand for goods is still present, with demand prices being greater than supply prices.

(b) marginal costs are higher than demand prices.

The result (using assumption 4) is an increase in commodity prices to such a level that every marginal cost is equated to price. As a result, the general price level is increased; and when combined with the new rate of unemployment, U_1, it gives us a point on a corresponding price-Phillips Curve (corresponding to figure 3d below).

Now, in the absence of a second round budget deficit to re-create $\left(\frac{D-S}{S}\right)_1$ hence U_1, higher commodity prices at the beginning of period t+1 implies that real wage rate is lower than the initial equilibrium level. A further implication is that the workers <u>choose</u> to disengage from production lines unless they are offered money wage increases which make them think that it is worthwhile to re-offer their labour power for a second production period. Finally, in order to reemploy last period's workers (the level of employment associated with U_1, figure 3 below), the firms must feel that the rate of excess demand for their products is still $\left(\frac{D-S}{S}\right)_1$, in section 3a of the figure. This cannot happen without government's real demand being maintained at the last period's level, which, in turn, implies that a corresponding budget deficit must exist. The latter cannot happen without monetary expansion (remember we assumed the economy is closed, and the nominal rate of interest is held constant). If this were to happen, then the first four assumptions would ensure that the SMC is satisfied, hence leading the system to return, throughout period $t+1$ to the $\left(\frac{\Delta w}{w}\right)_1$, U_1 combination (figure 3d below). This in turn means commodity prices must increase by the same percentage, at the beginning of period $t+2$, an increase associated with U_1.

Figure 3


rate of change of money wage rate
$\frac{\Delta W}{W}$
3c, the mapping of the rate of change of money wage rate onto itself
45°
3d, the (derived) relationship between the rate of change of money wage rate and the rate of unemployment
a phillips curve
$(\frac{\Delta W}{W})_1$
0
U_1
U_0
U
rate of unemployment
$\frac{\Delta W}{W}$ rate of change of money wage rate
$(\frac{D-S}{S})_1$
3b, the relationship between the rate of excess demand for labour and the rate of change of money wage rate
3a, the relationship between the rate of excess demand for labour and the rate of unemployment
$\frac{D-S}{S}$
rate of excess demand for labour
Key: D = demand for labour (= No. of jobs)
S = labour supply, (man-hour)

This wage-price inflation will continue indefinitely, so long as the government budget deficit is maintained, excess demand is maintained at $\left[\frac{D-S}{S}\right]_1$ and, more importantly, decision makers do not anticipate inflation. When inflation gets anticipated, the system enters into a new inflationary phase.

(ii) Anticipations-augmented wage-Phillips Curve

When workers anticipate price inflation, and so long as the SMC is satisfied the money wage rate starts increasing at a faster percentage rate. Since the money wage is an element of the marginal cost, and since marginal cost pricing is the rule, prices will increase to the same extent as the wage rate increases. This in turn means that unanticipated price inflation appears, which leads to acceleration of the actual rate of price inflation. The system begins to move towards the state of hyper-inflation (see pp.16-27 above for analysis). Needless to say, the rate of wage-price inflation will continue to accelerate so long as the rate of unemployment and the nominal rate of interest, remain at their target levels and so long as decision makers are "irrational" in their price anticipations.

Under "rational expectations" the trade-off between the rate of inflation (price inflation or wage inflation) will no longer exist, and all the increase in the money supply will resolve itself in a direct increase in the money wage rate and commodity prices (see pp.26-27 above).

2.2.4 The Loops Test, The Open Economy, and The Difference

The last two subsections covered what I consider the essence of the A-Conflict theory of price inflation in its two versions: the supply-side version, and the demand-side version. Now, three questions remain to be addressed. They are:

First: Do the two theories pass the "loops test" imposed by Lipsey ?(22)

Second: If the assumption of the closed economy were to be relaxed, would the analysis regarding the initiation, continuity, acceleration etc., of price inflation of each of the two theories undergo a substantial change such that their main conclusions need to be qualified? And

Third: What is the basic difference between the two versions?

The remainder of the present section will be devoted to addressing these questions.

As for the "loops test" upon which Lipsey seems to insist, both versions of the A-Conflict theory pass the imposed test, regardless of whether the old Phillips Curve is anticipations-free or not.

A recovery which affects different industries that make up the economy differently, followed by a recession, lead to the creation of an anti-clockwise loop provided that the recession which follows touches each industry, more or less, equally. Here, the reason lies in aggregating the "micro" wage rate-unemployment trade-offs[23]. This applies to the anticipations free price-Phillips curve case, for both theories. The clockwise loops, again for both theories, arise when Phillips curve is augmented by anticipated price inflation on the part of the workers, or wage inflation on the part of the employers. Here, no matter how the recovery affects the different sectors making up the economy, the gradual (or otherwise) control of inflation, via controlling aggregate demand, creates the upper section of the loop first initiated by the recovery. The basic reason for that loop is the (lagged) dependence of wage inflation and price inflation on each other, for the "supply-side" theory, and the (lagged) dependence of price inflation on wage inflation, for the 'demand-side' theory[24].

The answer to the second question is: "it depends". Under a fully flexible exchange rate system, opening the economy brings the analysis of both theories closer to current reality, without invalidating their central argument regarding the initiation, continuity, acceleration and deceleration of price-wage inflation[25]. On the other hand, a "dirty floating" or a fixed exchange rate system renders the domestic rate of price inflation to depend partially or fully on the external rate. Here money supply ceases to be an exogenous variable. Since this is a key factor in the control of inflation (according to the A-Conflict theory), the removal of the condition that money supply is exogenous reduces the government's ability to control price inflation[26].

As for the answer to the third question, that is the basic difference between the two versions of the A-Conflict theory of price inflation, it lies in the following:

(i) In the "supply-side" version of the theory, excess demand <u>in whatever market</u> is eliminated by an increase in input-output prices. In the "demand-side" version, <u>the labour market</u> is the only market which reacts to the presence of excess demand in the system.

(ii) In the "supply-side" version, <u>all prices react</u> in the same period, which implies that commodity prices become higher than marginal cost(s) in the first instance. In the "demand-side" version, price increases at the beginning of period t are a reaction to two things: the increase of last period's marginal cost over last period's commodity prices, and to the demand price in period t being greater than last period's marginal cost.

(iii) In the "supply-side" version, the presence of excess demand is caused by monetary expansion beyond the system's capacity to continuously supply an adequate flow of goods and services, while in the "demand-side" version, that need not be the case.

I now move to the Implicit-Conflict theory of price inflation.

2.3 The Implicit-Conflict Theory of Price Inflation

2.3.1 Why Implicit-Conflict?

In this theory, which offers an alternative interpretation of equation 2.10 above, things are much less foggy than its predecessor with which I had to struggle before I was able to identify its two different versions. Its main features may be summarised as follows:

Under oligopoly capitalism mark-up pricing predominates. Accordingly, most commodity prices are fixed by marking-up unit variable cost (or unit total cost at a standard level of output, or sales). The main physical components of unit variable cost are the following:

a) material inputs (including imports)

b) direct labour

As for the mark-up (see page 100 for definition) it is not expected to sink below a predetermined level[27]. The latter defines a minimum gross income share which must go to profit[28]. This minimum income share is independent of the "law" of "diminishing returns" to labour, given the capital-to-output ratio[29].

The proponents of the Implicit-Conflict theory of price inflation[30] do not mention explicitly the logical association of the minimum mark-up with a minimum income share which goes to profit. As a result, they do not need to state explicitly that a conflict (basically unconscious) over the distribution of net national income is involved in the inflationary process. But that should not deter one from moving from the imposed minimum income share which goes to profit, to the implicit conflict idea, and from that idea to calling the theory of price inflation associated with the minimum mark-up pricing as the Implicit-Conflict theory of price inflation. This should be the case because the process of passing labour (or imports) cost increases fully on to price (as it is implicit in the minimum mark-up pricing hypothesis) implies the occurrence of two events simultaneously:

First: an implicit attempt at changing income distribution in favour of the workers (or the suppliers of imported inputs).

Second: a defeat of that attempt.

Since the minimum income share which goes to profit is implicitly defined (via the minimum mark-up), and since all attempts at changing that share proceed implicitly, it follows that the theory of price inflation which encompasses that implicit conflict process may be more properly classified as the Implicit-Conflict theory of price inflation. But before I move to the central argument of that theory, I first state its basic assumptions[31]:

2.3.2. Assumptions

First: the non-primary commodity market is dominated by a set of oligopolistic firms who fix (commodity) prices according to the mark-up pricing rule.

Second: the labour market is dominated by an organized labour force, with collective bargaining being the dominant form of wage fixing institution.

Third: Workers' bargaining power depends on the state of demand in the labour market and/or on the direction of change in the firms' demand for labour services.

Fourth: Money supply is endogenous.

Fifth: Income distribution is (implicitly) predetermined.

To simplify, I shall assume that the economy is closed, that government expenditures are partly financed by a gross profit tax and partly by "borrowing" high powered money from the central bank, and that labour force and labour productivity are constant.

2.3.3 Anticipations-free price-Phillips curve:

Although a lower rate of unemployment (and/or higher rate of capacity utilization) need not be the indirect initiator of the inflationary process, our account of the generation continuity acceleration, deceleration and termination of the inflationary process (in the present theory) will still be based on that assumption[32]. I shall assume that a government sponsored reflationary expenditure programme is under way, which is designed to reduce the level of unemployment in the economy to a predetermined level.

As aggregate demand for output increases, the levels of employment, output and money stock move in the same direction. The gradual expansion of employment, output and money stock will be associated with an increase in unit variable cost and/or the mark-up. The main resons are the following[33]:

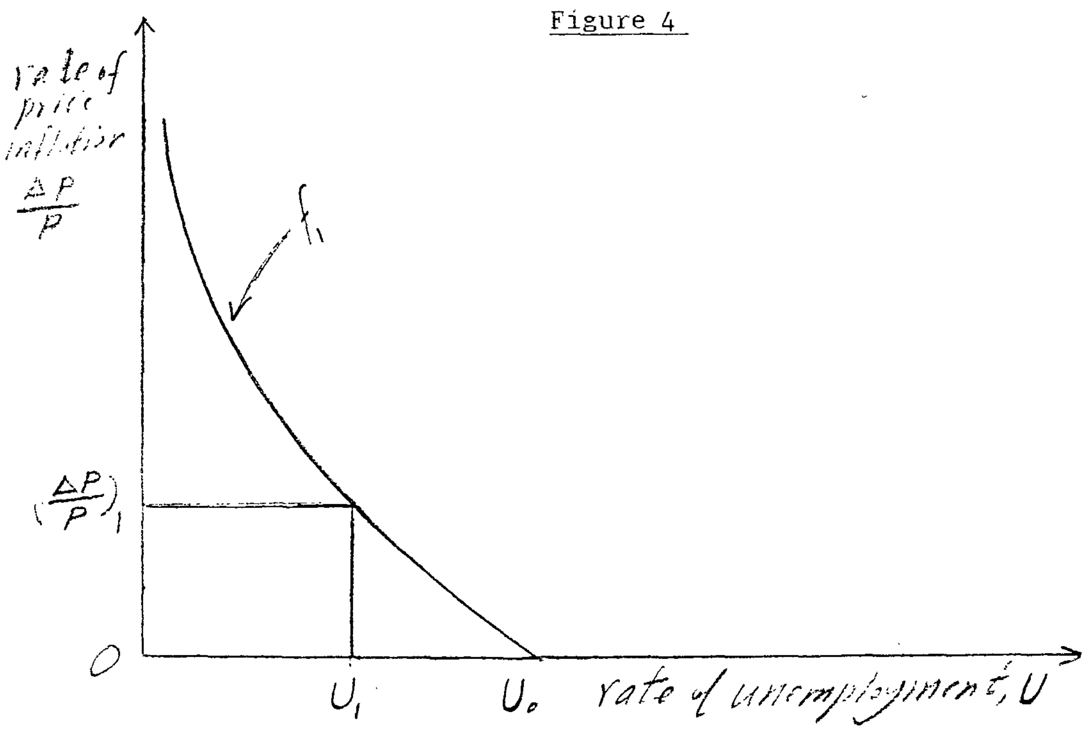
(i) Non-uniform (sectoral) supply elasticities, which result in higher prices of primary inputs and/or higher mark-ups of non-primary inputs.

and

(ii) a higher money wage rate exclusively due to the upwards revision of the money wage element of the wage-time agreement caused by the greater bargaining power of the workers, organized and not organized.

Now, given the minimum mark-up and given the absence of the illiquidity ghost which might otherwise be haunting the firms' decision makers[34] the higher unit cost gets passed on to the price of individual goods (inputs and outputs). The latter leads to an increase in the cost of living index being used by the workers for (among other things) compensatory money wage increases during next period's wage negotiations and agreements. As the process of cost-price increases gets under way, and so long as the workers do not anticipate price inflation, the rate of price-wage inflation stabilises at, more or less, a constant rate. Unemployment is lower, output is higher and money supply is increasing. The lower is the rate of unemployment, the higher is the level of output and profit, the more vigorous become the workers' demands for compensatory wage increases, the faster is the rate of increase of unit variable cost and, in consequence, the faster is the rate of price inflation. In diagrammatical terms, this means that the economy is moving along the price-Phillips curve f_1 in figure 4 below:

Figure 4



In the present theory the increase in the rate of price inflation from zero to $\left(\frac{\Delta P}{P}\right)_1$ need not take place immediately[35]. The system can move from a level of unemployment of U_0 to U_1 without any increase in commodity prices. The latter may start increasing at U_1 to reach $\left(\frac{\Delta P}{P}\right)_1$ after a certain period of time. This can happen: (1) when the rate of unemployment and the rate of excess capacity are very high; (2) when both the unemployed labour force and the unutilized capacity match each other on a sectoral level (at least), and (3) when the workers' mood for higher wage claims gets "switched on" at U_1 rather than before it. However, I shall abstract from this case and assume that the system responds to the gradual increase in aggregate demand by a gradual movement along the Phillips curve f_1 in the diagram above.

2.3.4 Anticipations-Augmented Price-Phillips curve

As I mentioned earlier, the rate of price inflation would stabilize at $\left(\frac{\Delta P}{P}\right)_1$ if the rate of unemployment were to stay at U_1 and if price inflation were not anticipated by both sides of the conflict. However, sooner or later the inflationary experience becomes pervasive. The workers find themselves caught in a situation where compensatory wage increases, agreed upon by the employers at the beginning of each period, become ineffective, because soon[36] it gets passed on to prices by the employers. Once price inflation becomes anticipated by powerful workers (among others), the economy enters into a new inflationary era. The actual rate of price inflation starts accelerating, and our price-Phillips curve starts moving, bodily, upwards. According to the Implicit-Conflict theory of price inflation, the essential reason for the acceleration of the rate of price inflation is not the acceleration of the rate of growth of money supply. It is the inflationary anticipations which lead the workers to attempt to protect their 'excessive' wage claims against next period's price inflation[37]. The important question is: under what condition does price inflation accelerate, and how ?

According to the Implicit-Conflict theory it accelerates when: (i) price inflation gets anticipated by the workers and/or by the capitalists. (ii) money supply acts as a validating variable.
The process by which price inflation accelerates may be characterised as follows:

Suppose that last period's rate of price inflation was 5% and that same rate is being taken by the workers as the anticipated rate for this period. Suppose, further, that workers' bargaining power is strong enough to enable them to get all that they ask for from the employers, who in turn pass all wage increases fully and immediately on to commodity prices via the mark-up mechanism. To simplify further, assume that all elements of unit variable cost other than direct labour are so negligible that they are practically zeros.

Under these circumstances the new wage agreement will include an increase in money wage rate of 10%, made up of two components:

a) 5% compensatory increase

b) 5% anticipatory increase

Since the mark-up is a assumed as predetermined variable (at its minimum level at least), the full wage increase will be passed on to price (at the beginning of this period) making this period's rate of price inflation 10%. The latter increase brings real wage back to its level at the end of last period. This rate of price inflation paves the way for a new wage agreement which again (based on the above assumptions) includes two components:

a) 5% compensatory increase, to compensate the workers for the unanticiated part of price inflation

b) 10% anticipatory increase

The latter 15% money wage increase, when fully passed on to price, leads to a higher rate of price inflation of 15%, which in turn leads to wage increases of 20%, price-increase of 20%, 25%, 30%, etc. At this stage the rigid mark-up mechanism, and workers Real Wage Resistance[38] lead the system to generate three principal rates of inflation, accelerating simultaneously. These are:

i) Money inflation

(ii) Wage inflation

(iii) Price inflation

The only way the above three rates can stabilize is either if the workers accept a progressive reduction in their anticipated rate of price inflation until unanticipated price inflation reaches zero and/or the capitalists accept a progressive erosion of the gross profit margin until all claims on the technologically given level of net output are reconciled.

It is not difficult to show that the above accelerations are the result of a more acute conflict over the planned level of net national product. The minimum mark-up gives the employers a "right" to an *ex ante* income share which will be generated during "this period". On the other hand, workers' attempt at protecting themselves against real wage loss by effectively incorporating anticipated price inflation in "this period's" wage agreement places a direct pressure on that "right". That is to say, workers' anticipations are equivalent to an *ex ante* attempt at squeezing the gross profit margin per unit of sales. The rigid mark-up resistance viciates that attempt. The result is an accelerating rate of price-wage inflation. A similar inflationary process can be generated when the "initiative" comes from an increase in the mark-up in one of the industries in the economy.

Some proponents of the Implicit-Conflict theory like Kaldor[39], argue that the government's attempt at controlling money supply as an indirect means of controlling price-wage inflation is not possible. This is so, Kaldor argues, because of the system's ability after "chaos for a few days", to resupply itself with its needs of "money" through intra-firm credit and the issue of various cards which checks the liquidity crisis from the business sector and enables "the trust-worthy or credit-worthy part of the population" to buy as much as they can afford to buy. The above argument should be based on the following two assumptions, if liquidity crisis and the resulting chaos, bankruptcies and unemployment were to be avoided:

i) There is a full synchronization between the timing of curtailing money supply by the monetary authorities, and the timing of intra-firm credit expansions and the credit card issues.

ii) Correct anticipation by individuals and businesses of the amount of money which the monetary authorities had been contemplating withdrawing from the system.

The above account of the Implicit-Conflict theory of price inflation has been based on a number of simplifying assumptions, the most important of which are: the closed economy assumption; and the absence of material input used by production units. Both assumptions could be relaxed to bring the model closer to reality, but, of course, at the cost of greater complexity[40].

2.4. The Explicit-Conflict Theory of price inflation:

According to this theory, which is once more another rationalization of equation 2.10 above, price inflation is a symptom of the presence of a conscious, or unconscious, conflict among different socio-economic groups (basically, workers vs. capitalists) over the distribution of the technologically (and institutionally) given level of net output. This conflict expresses itself in the form of an ex ante inconsistent claims over the planned level of net output. These inconsistent claims, in turn, create what is called the "aspiration gap", defined as the difference between the "target share" and the "negotiated share" of net private output which goes to profit. The target share depends on the capitalists' pricing policy, while the negotiated share is the share which would be received by the business "leaders" if prices were to go up by the same amount conceived by the workers' representatives at the time of the (periodically revised) wage agreement[41].

The more acute is the conflict, the more inconsistent are the ex ante claims over the planned level of net output, the greater is the aspiration gap and the faster is the rate of price inflation. With a given aspiration gap, and when price inflation becomes anticipated, the rate of price inflation accelerates, and the economy advances towards the state of hyper-inflation at a faster pace, unless the conflict is contained (in one way or another) and made to sink deeply enough below the surface...

2.4.1 Assumptions

Let me unfold the above mass of argument by starting with the basic assumptions upon which it is built. They are:

First: The commodity market is dominated by a set of oligopolistic (maybe multinational) firms who fix commodity prices according to the mark-up pricing rule.

Second: The labour market is dominated by an organized labour force, with collective bargaining being the dominant form of wage fixing institutions.

Third: Market power depends on market conditions.

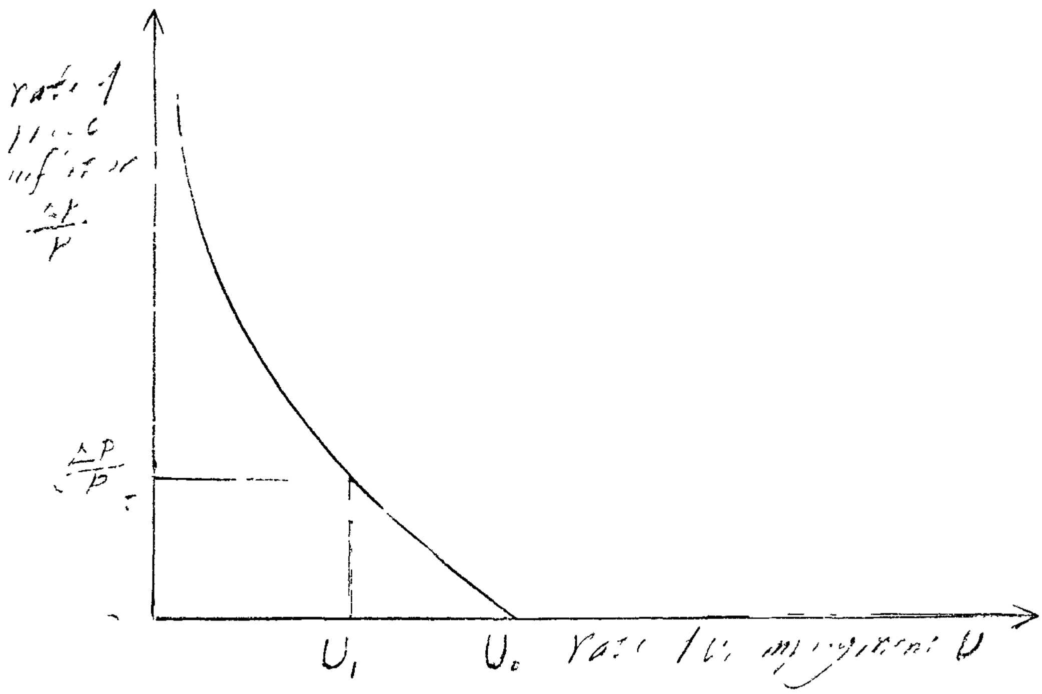
Fourth: Money supply is endogenous and exogenous, depending on the phase of the inflationary experience of the economy.

To simplify further, we shall assume that the economy is closed, constant labour force and labour productivity. Also, we shall abstract from all sorts of taxes.

2.4.2 Anticipation-free Price-Phillips Curve:

Suppose that the government decided to embark upon a large scale reflationary expenditure programme which, after some time, led to a pronounced reduction in both the rate of unemployment and the rate of capacity underutilization. Suppose, further, that the reduction in the rate of unemployment is associated with a movement along the price-Phillips curve f_1 such that a definite rate of price inflation of $\left(\frac{\Delta P}{P}\right)_t$ is generated, as is shown in the diagram below (figure 5).

Figure 5



My task now is to show how $\left(\frac{\Delta P}{P}\right)_t$ is generated according to the Explicit-Conflict theory of price inflation.

The lower rate of unemployment U_1 together with the lower rate of capacity underutilization, strengthens the "market power" of both sides of the conflict, the workers represented by the trade union and the capitalists represented by the management "team". The increase in the capitalists' market power echoes:

(i) their ability to pass "excessive" wage claims on to commodity prices at a faster speed.

and

(ii) their ability to increase the mark-up.

As for workers' market power I cannot avoid mentioning that the way the increase in workers' market power (= union bargaining power) is translated into an increase in unit labour cost is not always clearly spelled out by the model builder. Stretching Goodwin[42], Holzman (1950), Kalecki (1971, ch.12), Robinson[43] and Rowthorn's (1977, p.219) argument; and utilizing Edwards-Scullion's (1982, chs.1 and 10) survey work, the argument should be as follows:

Under capitalism, the core of the conflict lies in the labour process (defined as the expenditure of labour time in the form of actual efforts)[44]. The essence of that conflict lies in the management's attempt at the <u>full</u> control of that process, via controlling the employment-efforts side of the wage-employment contract; and workers' resistance to that attempt. The latter takes the form of periodical attempts at changing the terms of the employment-efforts side of that agreement[45].

Now, the lower rate of unemployment (U_1, figure 5 above) puts the workers' side of the conflict in a stronger bargaining position, at the time of renegotiating the terms of the wage-employment contract. This leads to (among other things) the following:

(i) an upwards revision of <u>money</u> wage rate per unit of labour time.

(ii) an attempt, on the part of the workers, at changing the terms of the employment-efforts side of the wage-employment contract, such that a lower level of effort per unit of labour time may be achieved.

The net result of these two effects is a newly negotiated wage-employment contract leading to a higher labour cost per unit of output. With the newly determined mark-up, acting (now) as a predetermined variable, a given rate of price inflation of $\left(\frac{\Delta P}{P}\right)_t$ is generated (see figure 5 above). This rate will be repeated in period t-1 if:

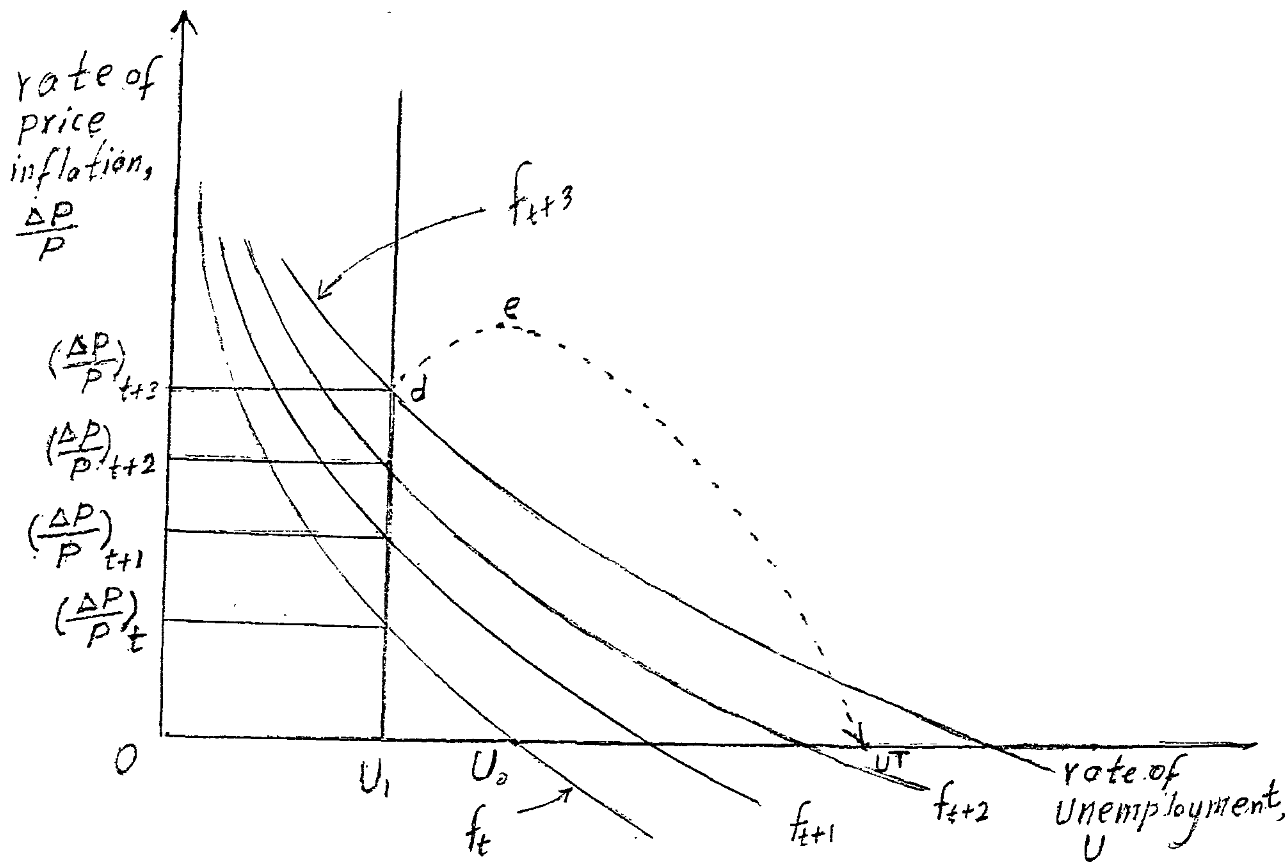
1) the rate of unemployment remains at its new level of U_1.

2) price inflation is not anticipated.

2.4.3 <u>Anticipations-Augmented Price-Phillips Curve</u>

In general, the inflationary experience cannot be separated from inflationary expectations and the related actions on the part of the decision makers. This means that, sooner or later, price inflation will be anticipated by the workers' side of the conflict, at least, which in turn means that the expected rate of price inflation will be incorporated (in one way or another) into the wage-employment contract. Suppose that from the beginning of period t+2 the new agreement is altered so that expected rate of price inflation for period t+2 is taken into consideration. It immediately follows that, according to this theory, the actual rate of price inflation for the following periods must accelerate[46]. This means, looking at figure 6 below, our price-Phillips curve has started shifting in the upwards direction to follow the increasing rate of price inflation with f_{t-2} being associated with $\left(\frac{\Delta P}{P}\right)_{t+2}$, f_{t+3} associated with $\left(\frac{\Delta P}{P}\right)_{t+3}$ etc.

Figure 6



The maintenance of the rate of unemployment at U_1, which implies a maintenance of a higher (short run) rate of capacity utilization, means that all per unit labour cost increases can, via the mark-up mechanism, be passed on to price without fear on the part of the management that these price increases will endanger the volume of sales. In other words, the maintenance of the rate of unemployment at U_1 rules out the emergence of liquidity crisis in the system[47]. Bond financed expansion, through the sale of bonds by the government to the public, shifts to an earlier date both the inflationary experience and its termination.

Suppose that $\left(\frac{\Delta P}{P}\right)_{t-3}$ is the threshold rate at which government intervention, for one reason or another, becomes necessary. Suppose, further, that the government intervention to contain the situation took the form of tightening money supply and at the same time freezing the nominal level of government expenditures.

One immediate result of this policy is the emergence of liquidity crisis[48] associated with what may be a strange phenomenon. Our price-Phillips curve "reverses itself" to produce an accelerating rate of price inflation associated with an increasing rate of unemployment, as is shown by the segment de of the as-if-inverted Phillips curve dU^T in figure 6 above. The tightened money supply, together with the frozen level of government expenditures makes the system plunge into a grand crisis characterised by:

(i) Liquidity crisis

(ii) Excess capacity crisis

(iii) Unemployment crisis

At the U^T rate of unemployment, the unhealthy economy becomes more "healthy", thanks to the zero rate of price inflation.

The above analysis, crude as it is, brings out the essence of the Explicit-Conflict theory of price inflation. Various complications can be introduced into that theory, such as opening the economy, the imposition of sales tax, imposition of wage income tax, etc. These complications, which increase the degree of realism of the theory, do not affect its central argument[49].

2.5 Principal Policy Implications of the Three Theories:

Given the organizational structure, the policy implications of each of the above theories logically follows from the "vision" which guides each of the theoretical constructions presented in the previous sections. This is so because policy follows from theory and not the reverse[50]. Since the fundamental cause, or causes, of price inflation are different for each theory, it follows that the policy recommendations on how the phenomenon is to be brought under control must be different. This is in fact the case[51].

The principal policy implication of the A-Conflict theory of price inflation is to control demand in general and money supply in particular[52]. As for the Implicit-Conflict theory the policy implication is, basically, a social contract and price-policy both packed in the phrase "incomes policy"[53]. Finally, the principal policy implication of the Explicit-Conflict theory is an immediate price control, followed by wage control, as elements of a more comprehensive package[54].

I shall say more, but of a methodological nature, on this in the last two chapters of the thesis.

Notes to chapter 2

[1]The reader will notice I emphasised the word "anticipations". To avoid misunderstanding, I state below the way I will use the term "price anticipations" throughout this thesis. If different input-output prices were expected but not acted upon by the firm's decision makers, then they would not be anticipated. Also, if different wage goods' prices were expected but not incorporated in money wage rate by the workers or the trade union, then they would not be anticipated (Rowthorn, 1977).

[2]When all price expectations of all decision makers are formed "rationally", it is no longer possible to say that the above causal relationship is a-historical, even if the model with which the "rationally" expected prices are estimated is changing over time. This is so simply because that relationship ceases to exist. All prices and money incomes directly relate to changes in money supply. See: Laidler (1982), pp.134-138, 149-150.

[3]In the jargon of sociology, that relationship is independent of the "social structure", see: Coser and Rosenberg (1964), pp.548-558.

[4]The phrase "supply-side" is not my invention. Lipsey wrote "...the new-Classicists tried to reinterpret the [wage-Phillips] curve as a labour supply phenomenon...The supply-side interpretation has been largely discredited...". Lipsey, (1981),p.556.

[5]Here, there is a hidden assumption that no attention to the reduced purchasing power of the money put in the business and no discounting is made, on the part of the employers.

[6]Friedman (1970), pp.221-227.

[7]Lipsey (1978), pp.53-56.

[8]Keynes (1936), pp.280-286, 296.

[9]Hicks (1946), pp.204-206. Quantitatively, Hicks' unit elasticity of expectation formula may be derived as follows:
Let P_t = actual price index for period t, P^e_t = expected price index for period t, estimated at the beginning of that period. Then:

$$P^e_t = P_{t-1}$$

$$P^e_{t-1} = P_{t-2}$$

$$P^e_t - P^e_{t-1} = P_{t-1} - P_{t-2}$$

or

$$\frac{P^e_t - P^e_{t-1}}{P^e_{t-1}} = \frac{P_{t-1} - P_{t-2}}{P_{t-2}}$$

$$E_{p^e} = \frac{\dfrac{P^e_t - P^e_{t-1}}{P^e_{t-1}}}{\dfrac{P_{t-1} - P_{t-2}}{P_{t-2}}} = 1$$

[10]Phillips (1958), pp.283-299. I take this opportunity to say that according to Fisher (1926), causality runs from price inflation to the rate of unemployment, while in Phillips (1958) causality runs from unemployment to wage inflation. Therefore by attributing to Fisher what should be attributed to Phillips, the Editor of the Journal of Political Economy, 1973, Vol.81, p.496 has failed to recognise the two different species of causality, and the implied theoretical anaylsis underneath each. I hope the present subsection and the next, clarify the deep theoretical difference underneath each "curve".

[11]Lipsey (1960), p.12.

[12]But see Lipsey (1978).

[13]Friedman (1968), p.8: Laidler (1982), pp.16-17.

[14]In form, but not in content, equation (2.10) above is similar to that of Laidler (1982), p.126. See also Lipsey (1978), p.53-55, 64-65.

[15]McDonald (1977), pp.490-507.

[16]Lipsey (1978) pp.62-71.

[17]Laidler (1982), pp.134-138, 150-152.

[18]The reader might raise the issue of the anti-clockwise loops. I shall say something on them , common to the two versions of the present theory when I handle the "demand-side" version of the theory (see: pp.35-36 below).

[19]Laidler (1982), pp.134-38, 150-53. See also Heathfield and Hartropp (1983).

[20]More on REH is in Appendix 9.

[21]A short nondynamic version of it is in Lipsey (1981), pp.556-557.

[22]Lipsey (1978), p.62.

[23]Lipsey (1960), pp.19-23.

[24]In the remaining sections of the present chapter, I shall abstract from the "loops test", which is - like Phillips curve - capable of being backed by more than one theory.

[25]See: Laidler (1982), pp.21-24 (in different context).

[26]Laidler (1982), pp.21-24, 147-149.

[27]Kaldor (1961), p.198; Meade (1982), pp.159-160.

[28]Kalecki (1971), Chapter 6. See also the following footnote.

[29]This can be proved, using a circulating capital system, as follows:

$$\underline{p}_t \underline{D}_t = \underline{p}_t \underline{x}_t - \underline{p}_t A \underline{x}_t = w_t N_t + r_{min} \cdot \underline{p}_t A \underline{x}_t \quad \ldots\ldots\ldots\ldots(1)$$

$$\frac{w_t N_t}{\underline{p}_t \underline{D}_t} + \frac{r_{min} \underline{p}_t A \underline{x}_t}{\underline{p}_t \underline{D}_t} = 1 \qquad \ldots\ldots\ldots\ldots\ldots(2)$$

$$r_{min} \cdot \frac{[\underline{p}_t \underline{x}_t - \underline{p}_t \underline{D}_t]}{\underline{p}_t \underline{D}_t} = 1 - \frac{w_t N_t}{\underline{p}_t \underline{D}_t} \qquad \ldots\ldots\ldots\ldots\ldots(3)$$

$$1 - \frac{w_t N_t}{\underline{p}_t \underline{D}_t} = r_{min} \cdot \left[\frac{\underline{p}_t \underline{x}_t}{\underline{p}_t \underline{D}_t} - 1 \right] \qquad \ldots\ldots\ldots\ldots\ldots(4)$$

where: $\underline{p}_t$ = a row vector of commodity prices

w_t = money wage rate

$\underline{D}_t$, $\underline{x}_t$ = column vectors of final demand and gross output respectively

$(1-r_m)$ = minimum mark-up.

N_t = level of employment. A in an nxn coefficient matrix

If $\frac{\underline{p}_t \underline{x}_t}{\underline{p}_t \underline{D}_t}$ were constant, then the R.H.S. of equation (4) must be constant, given r_{min}. Therefore, the minimum mark-up together with the capital-to-output ratio defines the minimum income share which goes to profit and the maximum income share which goes to wages. This does not mean that the real wage rate is not lower, under the "law".

[30]See e.g. Bulmer-Thomas (1977); Davidson (1978), chapters 14 and 16; Dow (1956); Dusenberry (1950); Kahn (1976); Kaldor (1976, 1982); Kregel (1979); Meade (1982, appendix A); Schumpeter (1954, pp.421-424).

[31]See Eichner (1983); Kahn (1977); Kaldor (1970, 1976, 1982).

[32]Theories not based on that assumption are: Phelps Brown (1975); Means (1975); Wiles (1973).

[33]Davidson (1978), p.344) and Kregel (1979, pp.206-207) add "diminishing returns" to the list.

[34]Davidson (1978), p.350.

[35]See Lipsey's argument on "Type II inflations" in Lipsey (1978), pp.68-70.

[36]For a model when money wage increases do not immediately get passed on to price, see: Meade (1982), pp.161-169.

[37]As I shall argue later in the section, inflationary anticipations are the

direct cause for accelerating the rate of price inflation. But the more fundamental indirect cause for that acceleration is the more acute (direct and indirect) conflict over the distribution of the surplus between workers and capitalists.

[38]Hicks (1975), pp.4-6.

[39]Kaldor (1970), especially p.6; see also Moore (1979).

[40]See e.g. Means (1975); Kaldor (1976).

[41]Rowthorn (1977), p.217.

[42]Goodwin (1983a), pp.308-309; Goodwin (1983b), p.53.

[43]Robinson (1971), pp.90-95; Robinson (1980b). See also Robinson and Cripps (1979), pp.141-142.

[44]Edwards and Scullion (1982), pp.4-5.

[45]It seems more accurate to say that the union and the management agree upon the wage-employment contract. And what is at stake is the management's attempt at confiscating the employment-efforts side of that agreement.

[46]To simplify the analysis, Holzman abstracts from the effect of price rises on price expectations and from the effect of these expectations on the actions of the workers. However, in two places he associates (an acted upon inflation) expectations with hyper-inflation. See: Holzman (1950), pp.152, 156-157; See also Dow (1956), p.284 and p.291.

[47]Rowthorn (1980), pp.139, 142-144; Schumpeter (1954), p.422. See also Keynes (1936), p.301.

[48]According to Morris, liquidity crisis appears before the system hits the threshold rate of price inflation. According to Rowthorn, liquidity crisis is an engineered phenomenon. If U_1 were the "peak of the cycle" rate of unemployment, then Keynes' argument that liquidity crisis exacerbates the situation, before the system plunges into the grand crisis, would be very relevant. See: Morris (1973); Rowthorn (1977), pp.233-235; Keynes (1936), pp.315-317.

[49]Rowthorn (1977), pp.215-239.

[50]Henderson (1961), pp.182-184.

[51]"At the present time (1979) a policy based upon those doctrines [doctrines of monetarism] is actually being carried out in the U.K. This will provide a rare chance to show which of [the] two rival hypotheses [Marxian-Kaleckian (short-term) hypothesis vs. monetarists' hypotheses] is going to prove to be the least correct". Robinson (1980a), p.226.

[52]Friedman (1982); Lipsey (1979), pp.294-296; Lipsey (1981), pp.569-572.

[53]Kahn (1976), pp.9-11.

[54]Cowling (1982), pp.173-177.

Chapter 3: Some General Comments, some Desiderata and Some Specific Comments on Two Models

3.1 Some unbalanced surveys and a question

In one survey on price inflation, the authors (Laidler and Parkin, 1975) concluded that the "...analysis of the inflationary process must involve the study of the whole economic system..."[1] In that survey, in which Kalecki's (1941, 1971) work on price inflation was neglected, the size of the bibliography exceeded 400. Since then, the stock has been increasing. To take one case, more than half of Lipsey's bibliography (Lipsey, 1981) of 116 references were published after 1975. Lipsey declared himself "neo-Keynesian" and condemned the "monetarists". However, his condemnation of the "monetarists" did not extend to their neglect of Kalecki, and others of similar persuasion. In fact, he also neglected the man of whom Joan Robinson wrote

> "Kalecki's diagnosis seems unanswerable and later experience has confirmed it, but it was not at all congenial to orthodox opinion either in the wealthy countries or among the intelligentia in the Third World who may admit the argument but would lose by its implementation".[2]

However, the <u>whole</u> stock of literature on price inflation is now (1986) so large that the reader of this thesis may raise the question: <u>is there a real need for another work on the subject ?</u>

To help answer this question, consider two further questions: What should be required of a theory of price inflation ? Can existing theories of price inflation meet these requirements?

3.2 Desiderata partially met

So what should the new work offer <u>in addressing the problem of inflation</u> under today's oligopoly capitalism ? Personally, I propose the following.[3]

(i) The new work must start from the premise that "...inflation concerns the working of the whole economy".[4] I take this to mean:

(1) The set of crucial assumptions upon which the new work is to be based must be realistic. Inflation is a real life problem, and in order to study that problem "...preconceptions based on perfect market theory"[5] must be dismissed at the beginning.

(2) In order "[t]o see how inflation occurs we have first to enquire how [commodity] prices are formed [in reality]".[6]

(3) Since, according to Kaldor (1959) there is "... a fair unanimity among economists on the key role of the rate of increase in money wages in the inflationary process"[7] we need, second, to enquire on how the money wage rate is fixed in reality. And, in addition to that,

(4) the new work must "...indicate how the structure of industry can be incorporated in the analysis of inflation"[8]

(ii) The new work and its associated economic model must:

(1) be able to identify, clearly, the possible initiators of the inflationary process, and be able to identify, clearly, the conditions under which the rate of inflation stabilizes at a certain level, accelerates, decelerates, or terminates at a zero rate.

(2) provide an "...improved vision of the process of inflation, i.e. the gradual transmission of inflationary impulses from market to market"[9] in such a way that "...we can pierce the monolithic general price level and approach the question of the distinctly different degrees of [price] inflation in the various markets".[10]

That was what should be offered by the new work in addressing the problem of price inflation in the economies concerned. The next question to be addressed is the following:

Is there a purely theoretical construction or a quantified theoretical model or both a pure theoretical construction and its quantified economic model, capable of meeting the above desiderata ?

The answer to that question, within the confines of "The Current Explanations" of the previous chapter, is as follows:

Firstly: As far as the elaborated A-Conflict theory of price inflation is concerned, it satisfies none of the above desiderata. As a result, it is to be rejected.

Secondly: Within the remaining theories of price inflation, i.e. the Implicit-Conflict and the Explicit-Conflict theories, one can find pure theoretical constructions capable of meeting (at least implicitly) most of the items of the above desiderata. Kaldor (1976), Kalecki (1941, 1971), Kregel (1979), Means (1975), Robinson (1980b), Rowthorn (1977) and Schultz (1959) are examples. The two points which are least explicit in the works of the above authors (with the exception of Schultz, perhaps) are conditions i.4 and ii.2 above.

Both points imply the necessity of stating explicitly that the core of the economy, whatever is the degree of its inter-industrial disaggregation, may be represented as an input-output matrix which performs three essential functions simultaneously:

First: it acts as a mechanism for the transmission of inflationary impulses from one industry to another.

Second: it acts as a medium of aggregation from a lower level of aggregation (the micro level) to a higher level (the macro level).

Third: it defines (through its inverse) the "backwards linkages"[11] and the "forwards linkages" through which one can link aggregate employment, industrial gross outputs, the level of final demand, nominal national income and commodity prices in a logical way.

That matrix, which many authors keep in the background of their theories, is to others the "black box" which needs to be found and opened for "[t]he understanding ... of inflation ... ", to use Lipsey's words.

Of course the absence of the input-output matrix, from the works of the above authors does not mean that others had not taken it into consideration in building their models. Within the confines of the implicit conflict theory of price inflation, there are models which explicitly incorporate the input-output matrix which forms the core of the economy. However, these models are partial and seem (in one way or another) to lack the necessary coherent theoretical backing for a proper analysis of price inflation under oligopoly capitalism. Also, one can find models which explicitly incorporate the core of the economy in such a way that they appear to their designers to be suitable for (industrial) price-determination only. In the first group, I have in mind the models of Bulmer-Thomas (1977, 1982), Goodwin (1952) and Jorgenson (1960-61) models.[12] In the second group, I have in mind Brown and Licari (1977) and Mathur (1977). Since Bulmer-Thomas and Goodwin's models are the only two of the above six which directly address the problem of price inflation, I shall first identify as sharply as I can the main shortcoming of each. I then point to the relevant part of this work which suggests a possible rectification.

I therefore conclude this section with the following answer to the question posed on page 57 above: We could question the need for more work in the area. We could argue that there is a qualified need for another work which satisfies conditions i.4 and ii.2 above (but they are not necessarily the only ones that could have been proposed).

3.3 Bulmer-Thomas Model (1977, 1982)

The main features of this model are the following:

(i) It is a partial model, because both the physical side and the Money side of the system are absent.

(ii) It is a model of price equilibrium, at all times.

(iii) The money wage rate is <u>cost determined</u>, with the physical components of the wage bundle being <u>exogenously determined</u>.

(iv) Sectoral percentage mark-ups (= percentage rates of profit in a circulating capital model), are <u>exogenously determined</u>.

To simplify, I shall reduce Bulmer-Thomas's 41 industry open economy model using a two-industry constant returns to scale open system, with each industry uses the same (single) complementary imported input, among others. Commodity 1 is assumed exportable. Therefore, the simplified price/wage system is as follows:

$$P_{1t} = (a_{11}P_{1t} + a_{21}P_{2t} + m_1\bar{e}P^M_{3t} + \ell_1 w_t)(1+r_1) \quad (3.1)$$

$$P_{2t} = (a_{12}P_{1t} + a_{22}P_{2t} + m_1\bar{e}P^M_{3t} + \ell_2 w_t)(1+r_2) \quad (3.2)$$

$$w_t = P_{1t}w^*_1 + P_{2t}w^*_2 + \bar{e}P^M_{3t}w^*_3 \quad (3.3)$$

where:

P_{jt} = price of the domestically produced commodity j.

P^M_{3t} = price of the imported input, in foreign currency.

w_t = money wage rate

$\bar{e}$ = exchange rate (= units of local currency needed to obtain one unit of foreign currency).

$(1+r_j)$ = mark-up for commodity j.

a_{1j}, a_{2j}, m_j and ℓ_j are, respectively, domestic, imported and labour inputs which are necessary for the production of one unit of commondity j.

w^*_1, w^*_2, w^*_3 are the exogenously determined quantities of the domestically produced commodities, 1 and 2, and of the imported commodity 3, which make up the real wage bundle.

In matrix form, (assuming $r_1 = r_2 = r$) the above three equation system becomes as follows:

$$\underline{P}_t = \underline{P}_t A(1+r) + \underline{M}\bar{e}P^M_{3t}(1+r) + \underline{\ell}w_t(1+r) \quad (3.4)$$

$$w_t = \underline{P}_t \underline{w}^* + \bar{e}P_3^M w_3^* \tag{3.5}$$

where $\underline{P}_t = [P_{1t} P_{2t}]$, $\underline{M} = [M_1\ M_2]$, $\underline{\ell} = [\ell_1\ \ell_2]$, $\underline{w}^* = [w_1^*\ w_2^*]'$,

and $A = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$

w_1^*, w_2^* and w_3^* can be written as follows:

$$w_1^* = \theta_1 z \tag{3.6}$$

$$w_2^* = \theta_2 z \tag{3.7}$$

$$w_3^* = \theta_3 z \tag{3.8}$$

where θ_1, θ_2, θ_3 are constant with:

$$\theta_1 + \theta_2 + \theta_3 = 1 \tag{3.9}$$

and z is the exogenous real wage rate.

Therefore equation 3.5 can be rewritten as:

$$w_t = \underline{P}_t \underline{\theta} z + \bar{e}P_3^M \theta_3 z \tag{3.10}$$

with $\underline{\theta} = [\theta_1\ \theta_2]'$

As the reader can see by consulting appendix 1, the price-wage system 3.4 and 3.10 has a built-in wage-profit (mark-up) trade-off defined by the following equation[13]:

$$z = \frac{\pi - M_1(r)}{L_1(r)[\theta_3 + \underline{M}(r)\underline{\theta}] + [\pi - M_1(r)]\ \underline{L}(r)\underline{\theta}} \tag{3.11}$$

where:

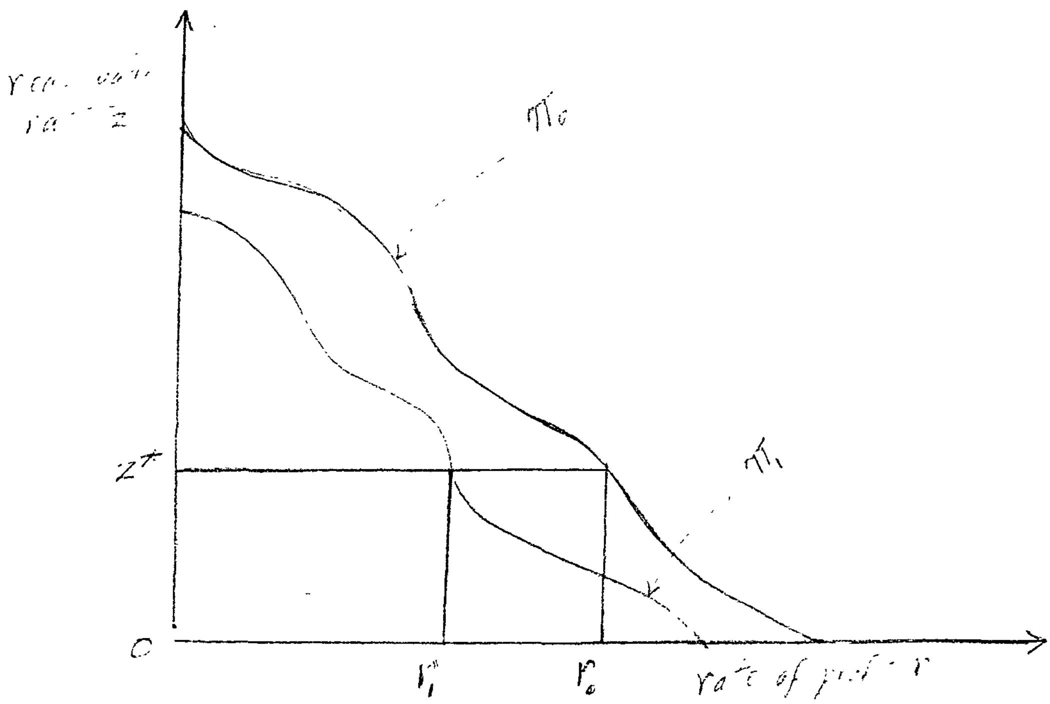
π = Terms of trade which is defined (in the present model) as the number of units of the imported input obtained from the world market per unit of exports of commodity 1.

$\underline{M}(r) = [M_1(r)\ M_2(r)]$ with $M_j(r)$ being the (compounded) number of units of the imported inputs directly and indirectly needed for the production of commodity j .

$\underline{L}(r) = [L_1(r)\ L_2(r)]$ with $L_j(r)$ being the (compounded) direct and indirect labour time needed for the production of commodity j .

Now, viability of Bulmer-Thomas' system implies that $[\pi - M_1(r)] > 0$ and both $M_j(r)$ and $L_j(r)$ are positive and increasing functions of r (j=1, 2). Therefore, for each value of π , there is a unique inverse relationship between z , real wage rate and r the rate of profit (or the percentage mark-up in the present system). In other words, equation 3.11 implies that the economy is capable of generating a positive level of surplus output. Its division between wages and profits is represented by an inverse relationship between z and r , the real wage rate and the rate of profit respectively. This relationship can be expressed in a diagrammatical way as follows (figure 7 below):

Figure 7



Bulmer-Thomas' assumption that real wage rate is exogenously determined (BT, 1982, p.227) implies that z is exogenously determined, say, at z^* in figure 7 above. Now, in the above system, the small open economy assumption (BT, 1982 p.226) necessitates that π, the terms of trade, are exogenous. Hence, contrary to Bulmer-Thomas's assumption, the rate of profit, r, must be endogenously determined. In the above diagram, if both z and π were at z^* and π_1 respectively, then r must be equal to r_1, which is smaller than r_0. In the Bulmer-Thomas model it must stay at r_0. Therefore, his partial model of price inflation is not logically coherent, and it needs to be rectified. I propose a rectification in the Open Economy chapter of this thesis. I must say that, without Metcalfe-Steedman (1979), and therefore Sraffa (1960), it would have been impossible for me to identify that significant shortcoming, and to suggest a possible rectification.

Why then did Bulmer-Thomas get a simulated wholesale price index for Costa Rica, for 1974, which is closer to the actual index than the one which will be predicted by the macro equation of Latin American monetarists ?

I propose the following answer:

Costa Rica (Bulmer-Thomas' case study) is a member of the Central American Common Market (CACM) for which "world" absolute and, hence, relative commodity prices can reasonably be taken as predetermined. However, within CACM all inter-country real wage rates could not possibly be treated as predetermined variables if, again within CACM, all inter-country rates of profit were to be treated as predetermined variables, given the technology. In his seminal work, Steedman (1979a) has shown (though in a different context) that given the techniques of production, if the world's (exemplified by two countries in Steedman 1979a) rates of profits were exogenously determined, then world's relative prices and inter-country real wage rates must be endogenous variables.[14] However, inter-country real wage rates are inversely related. Applying that to Costa Rica, modelled by Bulmer-Thomas, one can easily explain the positive results which were obtained by Bulmer-Thomas in his analysis of price inflation in Cost Rica.

When all z, π and r were taken as predetermined for Costa Rica ($z = z^*$, $r = r_0$, and $\pi = \pi_0$ in figure 7 above) it must imply that the rates of profit and real wage rates outside Costa Rica, but within the CACM had been treated as endogenous variables. If all the CACM rates of profit were taken as exogenous variables (for one reason or another), then the only case that it would be possible for Costa Rica to enjoy an exogenous real wage rate is the case when the remaining cluster of real wage rates, within the CACM, were to move in concert to conform to the laws of the new economics. That, I think, explains why Bulmer-Thomas did get a positive result in his very useful work.

3.4 Goodwin's Model (1952)

The main features of this very useful, but neglected, model are the following:

(i) It is less partial than Bulmer-Thomas' model, because Goodwin incorporates in his model both the price system and the physical system. However, it is still partial because it does not incorporate the monetary side of the system.

(ii) The economy is divided into two sets of industries, one set following the mark-up pricing rule and the remaining set following a non-marginalist competitive pricing rule.

(iii) As a whole, Goodwin's model does not assume that the price system is in a state of equilibrium from period to period.

(iv) The input-output matrix (i.e. the core of the economy) is explicitly incorporated into the model, hence giving the interested reader an insight into the inflationary process.

(v) Full employment is assumed, with sectoral supply elasticity of demand being zero at all times.

Goodwin's own formulation is much richer in its economics and slightly different from the simplified reformulation which I will present, and comment on, below. I did my best to make the reformulation as simple as I can, using a matrix notation consistent with what I have used so far and with what I shall use in the remaining part of this thesis.

Goodwin's basic equation, which combines both his "demand-pull" model and his "cost-push" models is the following:

$$\underline{P}_{t-1}\left[A[I^{\theta}+R^{\theta}] + AI_{\theta}\hat{X}\right] + \underline{\Gamma} = \underline{P}_t \tag{3.12}$$

where:

$$\underline{P}_t = [\underline{P}_t^{I} \quad \underline{P}_t^{II}],$$

$$\underline{P}_t^{I} = [P_{1t} \quad P_{2t}], \quad \underline{P}_t^{II} = [P_{3t} \quad P_{4t}]$$

$$A = \begin{bmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{bmatrix}, \quad A_{11} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}, \quad A_{12} = \begin{bmatrix} a_{13} & a_{14} \\ a_{23} & a_{24} \end{bmatrix},$$

$$A_{21} = \begin{bmatrix} a_{31} & a_{32} \\ a_{41} & a_{42} \end{bmatrix}, \quad A_{22} = \begin{bmatrix} a_{33} & a_{34} \\ a_{43} & a_{44} \end{bmatrix}$$

$$I^{\theta} = \begin{bmatrix} I & \underline{0} \\ \underline{0} & \underline{0} \end{bmatrix}, \quad I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}, \quad \underline{0} = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$$

$$R^{\theta} \begin{bmatrix} \hat{R} & \underline{0} \\ \underline{0} & \underline{0} \end{bmatrix} , \quad \hat{R} = \begin{bmatrix} r_1 & 0 \\ 0 & r_2 \end{bmatrix} ,$$

$$\hat{X} = \begin{bmatrix} \hat{X}_I & 0 \\ 0 & \hat{X}_{II} \end{bmatrix} , \quad \hat{X}_i = \begin{bmatrix} \bar{X}_1 & 0 \\ 0 & \bar{X}_2 \end{bmatrix} , \quad \hat{X}_{II} = \begin{bmatrix} \bar{X}_3 & 0 \\ 0 & \bar{X}_4 \end{bmatrix}$$

$$I_{\theta} = \begin{bmatrix} \underline{0} & \underline{0} \\ \underline{0} & I \end{bmatrix} ,$$

$$\underline{\Gamma} = [\underline{\underline{0}} \quad \underline{\Gamma}_1], \quad \underline{\underline{0}} = [0 \quad 0] ,$$

$$\Gamma_1 = \begin{bmatrix} W_3 + \Pi_3 & W_4 + \Pi_4 \end{bmatrix}$$

All variables and co-efficients have the same definitions as before. The new quantities are the following:

$\bar{X}_j$ = gross output of industry j, which is a fixed quantity due to full-employment assumptions, $j = 1,2,3,4$.

W_j = Total wage bill, in nominal terms for the workers engaged in the production lines of industry j , $j = 3,4$.

π_j = Net total profits, in nominal terms, which is produced by the capitalists of industry j. $j = 3,4$.

After some matrix multiplication, using the above notation equation 3.12 reduces to the following two equations:

$$\left(\underline{P}^{I}_{t-1}A_{11} + P^{II}_{t-1}A_{21}\right)(I + \hat{R}) = \underline{P}^{I}_{t} \tag{3.13}$$

$$\left(\underline{P}^{I}_{t-1}A_{12} + P^{II}_{t-1}A_{22}\right)\hat{X}_{II} + \underline{\Gamma}_1 = \underline{P}^{II}_{t}\,\hat{X}_{II} \tag{3.14}$$

Equation 3.13 means that firms in the mark-up pricing industries follow the historic cost pricing rule. Equation 3.14 represents the set of industries whose prices are demand determined. Its interpretation is very simple, and goes like this:[15]

Production takes time. Inputs purchased at the start of period t-1 emerge at the end of that period in the form of a finished product. After replenishing the reduced stocks, the remainder is supplied to the market at the beginning of period t with its price fixed such that sectoral excess demands are eliminated.

What is missing in Goodwin's system above ?

As far as equation 3.14 is concerned, nothing. Let us then focus our attention on equation 3.13 . Remember, Goodwin's model was published in 1952, some eight years before the publication of Sraffa (1960). Therefore one must not be surprised now (1986) to see the absence of the wage element of the cost vector in equation 3.13 above. That equation can be written, together with equation 3.14 , as follows:

$$\underline{P}_t^{I} = [P_{t-1}^{I} A_{11} + P_{t-1}^{II} A_{21} + 0(w_{t-1}\underline{\ell})] (I + \hat{R}) \qquad (3.15)$$

$$\underline{P}_t^{II} \hat{X}_{II} = [\underline{P}_{t-1}^{I} A_{12} + \underline{P}_{t-1}^{II} A_{22}] \hat{X}_{II} + \underline{\Gamma}_1 \qquad (3.16)$$

Therefore the missing element in Goodwin's fix-price portion of his system is $w_{t-1} \underline{\ell}$. It certainly needs rectification, via Sraffa. To enable the reader to compare Goodwin's system of 1952 with Bulmer-Thomas' system of 1982[16], I return to the latter who wrote "The adaptation of the input-output model to deal with this problem [the simultaneous presence of fixprice and flexprice industries] requires a simple partition of the price vector and the coefficient matrices according to whether prices are set by costs of production (P_1) [$\underline{P}'^{I}$ in my notation] or whether demand considerations are also relevant (P_2) [P'^{II} in my notation]. The latter [P'^{II}] have to be assumed exogenous, so the solution for the former..."[17] is the following

$$\underline{P}^{I} = [\underline{P}^{I}A_{11} + \underline{P}^{II}\ A_{21}] + \underline{V}_{I} \tag{3.17}$$

$$P^{II} = \text{exogenous} \tag{3.18}$$

where $\underline{V}_I$ is the (row) "...vector of value added coefficients for the fix-price commodities"[18].

3.5 Closing note

Now I remind the reader of the first question which I raised at the beginning of this chapter. I am not going to insist that there is a need for analysis of price inflation, at the micro inter-industrial level. That is to be left to the reader to decide for himself. I only say that I had, and have, an uneasy feeling about the macro approach to the analysis of price inflation. I found the rehabilitated surplus approach to economics to be the right point to start with. In the following parts of this thesis, I apply that approach to the analysis of inflation under oligopoly capitalism. It is an exploratory work which, I hope, succeeds in rectifying the two models which I have criticized above.

I close this chapter by accepting Goodwin's view that the economies whose inflationary experience led me to write this thesis are so "...complex as to defy any completely satisfactory analysis..."[19] of that experience. "[R]ather the best that can be hoped for is a number of different approaches, each of which yields valuable but incomplete insight into the various aspects of the [economic] system"[20]. As I mentioned earlier, and following Goodwin's implicit advice, the approach I adopted for analysing price inflation is Leontief-Sraffa's approach which lends itself to matrix algebra.

Notes to Chapter 3

[1]Laidler and Parkin (1975), p.796.

[2]Kalecki (1976), Introduction by Joan Robinson, p.10.

[3]In addressing this question, much can be learned from Sraffa's comments in: Lutz and Hague (1961), p.306.

[4]Lipsey, (1979) p.283.

[5]Robinson and Cripps (1979), p.143.

[6]Robinson (1980b), p.8 (emphasis in original).

[7]Kaldor (1959), p.292.

[8]Goodwin (1952), reprinted in Goodwin (1983b), p.59.

[9]Goodwin, op.cit. (emphasis in original).

[10]Goodwin, op.cit.

[11]Mcgilvary in: Leontief (1977), Ch. 4.

[12]See also: Pasinetti (1977), pp.198-199.

[13]See Appendix (1) for derivation.

[14]Steedman (1979a), pp.116-119.

[15]This interpretation is, essentially, the same as that of Goodwin's two interpretations. See Goodwin (1983b), p.61.

[16]Bulmer-Thomas, V. (1982), p.227.

[17]Bulmer-Thomas, op.cit.

[18]Bulmer-Thomas, Ibid., p.228.

[19]Goodwin (1983b), p.vi.

[20]Goodwin, op.cit.

Chapter 4: The Wage Equation

4.1 <u>The questions to be addressed</u>

In this chapter, which may be considered as one of the building blocks in this thesis, I address the following three related questions.

How is the sectoral, or subsectoral, money wage rate fixed? What variables are to be taken into consideration by the participants in the process of wage negotiation and hence wage agreement ? How are these variables to be related to the newly fixed money wage rate such that a definite wage equation is constructed?

The approach I adopted for the construction of the proposed wage equation is to proceed from a set of assumptions which have some empirical support. No direct maximization act whatsoever is involved on the part of the decision makers, these being workers' representatives or management representatives.

4.2 <u>Justification for a qualified need for another wage equation</u>

In the literature on money wage determination, theoretical or econometric, there is no shortage of wage equations. The fertile imagination of the economist backed by the skills of the econometricians has produced plenty of wage equations from which one may choose. However, there are a number of reasons that led me to construct a new wage equation suitable for the analysis of price inflation in an advanced capitalist economy presented in this essay.

<u>First</u>: the development of the institutions of collective bargaining, associated with the collective wage agreement, is not independent of the process of capitalist development. Therefore the set of variables and the mathematical form which combines them together to make the wage equation must be representative of the institutional characteristics of the period. I say 'must' because the wage equation is a mathematical expression of a theoretical construction, and by definition that

theoretical construction is an abstraction from reality which is supposed to capture the essential characteristics and leaves out the non-essential[1].

Take, for example, the "Philips Curve" (Phillips, 1958) and its re-estimation and interpretation along neo-classical lines by Lipsey (1960). Lipsey's re-estimation shows that the coefficient of price inflation, one of the independent variables in Lipsey's wage equation, increased from 0.21 for the period 1862-1913 to 0.69 for the periods 1923-1939 and 1948-1957[2]. It is difficult to say that that increase is accidental. The period 1862-1957 is long enough for institutional changes to have taken place as a part of the overall process of capitalist development in the U.K. One of the prominent institutional changes during that period was labour organization associated with the development of collective bargaining and collective wage agreements. In the U.K., in 1892, the size of the unionised labour force formed less than 11%. In 1973, more than 50% of the U.K. labour force were unionised, and collective bargaining led to some 80% of wage agreements being of the collective form[3,4].

Again, one finds it difficult to believe that these changes played no role in the determination of the size of the co-efficient of price inflation we referred to above. This means that, in constructing a wage equation for a specific sector or industry under oligopoly capitalism, special attention must be given to the degree of workers' organization and workers' bargaining power in general. We define the latter as the likelihood of workers' representatives being able to influence firms' deçisions and actions regarding money wage rate, working hours, work conditions, shift rate, redundancy, etc.[5] One of the implications of bringing workers' bargaining power to the forefront for modelling the wage determination process is the automatic incorporation of price inflation as one of the important explanatory variables in the wage equation.

Second: It is difficult (for me) to accept the idea that, in today's capitalism, the money wage rate is fixed "by the labour market" such that it is made equal to the marginal net revenue product of labour (Machlup, 1946). According to the Sraffa-Leontief tradition "marginal physical product of labour" is identical to the whole extra net (physical) output created by the employment of an extra "unit" of labour time. The same thing applies to "capital". This means that our old marginal net revenue product (which is replaced by the so called "marginal revenue product" today[6]) is undefined.

Therefore, we shall move away from the marginal productivity theory for the "determination" of money wage rate towards a more intelligible alternative. The alternative is based on the idea that the wage bill is part of the money value of the technologically determined level of net output (or surplus) whose division among different social groups depends on the relative power of each[7].

Third: in the portion of the literature on wage determination of which I am aware, there exists useful analysis of the determination of the money wage rate which, I think, has not been properly quantified, and needs to be. I have in mind Phelps Brown's (1975) "attitudes and expectations" hypothesis, Hicks (1975) "Real Wage Resistance" hypothesis, and Rowthorn's (1977) "market power of workers" hypothesis, as examples.

In the part of the literature where a definite wage equation is formulated, we can find two types of wage equation. The first type are structural form wage equations. The second are wage equations which are of the reduced form. The first type includes wage equations which capture essentials of wage determination process under collective bargaining in today's capitalist centers, while the second type, the reduced form wage equations, completely ignores that process. One should, of course, include Meade's(1982, Appendix A) and Sawyer's (1982a) wage equations in the first type of equations, while Sargan's (1980) wage equation is to be included in the second. We shall be saying more on the wage equation of these three authors.

4.2.1 Meade's wage equation:

In an appendix to his book, Wage Fixing, Meade (1982) presents an argument leading to various forms of wage equations, the most general of which is the following:

$$w_t = R_t\,[yP_{t-1} + (1-y)P_t^e] \tag{4.1}$$

with

$$R_t = R_o\rho^t \tag{4.2}$$

$$\rho = 1 + \lambda\ , \quad 0 \leqslant \lambda, y < 1 \tag{4.3}$$

w_t = money wage rate, fixed at the beginning of period t

R_t = target real wage rate, designed to grow at a constant fraction of λ.

y = the fraction of period t after the elapse of which the unwarranted wage increase is passed to price via the mark-up resistance mechanism

P_t = a relevant price index

P_t^e = expected price index for period t or a fraction thereof.

From equations 4.1-4.3 we get:

$$w_t = R_o(1+\lambda)^t \; P_{t-1}\left[y+(1-y)\;\frac{P_t^e}{P_{t-1}}\right] \qquad (4.4)$$

from which we get:

$$w_t = w_{t-1}\;\frac{P_{t-1}}{P_{t-2}}\left[\frac{(yP_{t-1} + (1-y)P_t^e)\big/P_{t-1}}{(yP_{t-2} + (1-y)P_{t-1}^e)\big/P_{t-2}}\right](1 + \lambda) \qquad (4.5)$$

If we assume (for simplicity) that $y = 0$ and $P_t^e = P_{t-1} + \delta(P_{t-1}-P_{t-2})$, with $0 < \delta < 1$, we get the following wage equation:

$$w_t = w_{t-1}\left[\frac{P_{t-1}}{P_{t-2}}\right]\left[\frac{P_t^e \big/ P_{t-1}}{P_{t-1}^e \big/ P_{t-2}}\right](1+\lambda) \qquad (4.6)$$

The logic behind equation 4.6 above is simple. Target (= the actual in Meade's case) money wage rate is equal to last period money wage rate adjusted by the following "factors":

(1) a price inflation factor $\left(\frac{P_{t-1}}{P_{t-2}}\right)$ which fully compensates the workers for last period's real wage loss.

(2) an expected inflation factor (the expression in the square brackets) designed to protect the workers against next period price inflation.

(3) productivity, or over-ambitiousness factor, $1 + \lambda$.

The questions one would like to address are the following:

(a) Since expected price inflation is being taken into account in wage fixing, why do we not take last period's <u>unanticipated</u> rate of price inflation[8] $\left[1 + \frac{P_{t-1} - P^e_{t-1}}{P_{t-2}}\right]$ into account instead of $\left[\frac{P_{t-1}}{P_{t-2}}\right]$?

(b) Why should Meade assume that the workers get fully what they ask for? In other words, why should he assume that, in general, workers are so powerful that they can always get what they ask for?

In Meade's analysis, it is difficult for me to find answers to the above two questions. Let us see what Sawyer does.

4.2.2 <u>Sawyer's Wage Equation:</u>

According to Sawyer, actual money wage rate, w_t, is equal to the "money wage objective" w^*, modified by the rate of unemployment, and the firm's ability to pay. Sawyer's wage objective is defined as follows:

$$w^*_t = w_{t-1} \left(P^e_t/P_{t-1}\right)^{\alpha_1} \left[\frac{T_t}{w_{t-1}/P_{t-1}}\right]^{\alpha_2} \left[\frac{w_{c,t-1}}{w_t}\right]^{\alpha_3} \qquad (4.7)$$

Where T_t = "target real wage" rate.

$w_{c,t-1}$ = comparison wages, i.e. the money wage rate which is to be compared with the relevant wage rate in another sector(s).

All the other variables in the above equation retain their earlier definitions.

The derivation of the actual wage takes the form of multiplying w_t^* by the product of two functions: (i) a function of last period rate of unemployment, $f(U_{t-1})$; and (ii) a function of the firm's current level of profit (gross or net), P_t^{profit}, relative to its minimum level, P_{min}^{profit}. Thus Sawyer's actual wage rate is determined as follows:

$$w_t = w_{t-1}\left(\frac{P_t^e}{P_{t-1}}\right)^{\alpha_1}\left(\frac{T_t}{w_{t-1}/P_{t-1}}\right)^{\alpha_2}\left(\frac{w_{c,t-1}}{w_t}\right)^{\alpha_3}\left[f(U_{t-1})\cdot\left(\frac{P_t^{profit}}{P_{min}^{profit}}\right)\right]^{\alpha_4} \qquad (4.8)$$

One would like first to see the above wage equation incorporating an unanticipated inflation factor $\left(1+\frac{P_{t-1}-P_{t-1}^e}{P_{t-2}}\right)$. Secondly, one would like to see T_t explicitly modelled so that the equation is free of the ad hoc functions $f(U_{t-1})$ and $\left(\frac{P_t^{profit}}{P_{min}^{profit}}\right)^{\alpha}$. Finally, one would like to see modelling of the "coefficients" α_j $(j=1,2,\ldots)$ of equation 4.8 above. Perhaps Sargan's wage equation is more realistic. Let us see.

4.2.3 Sargan's wage equation:

Sargan (1980) starts with the following wage equation:

$$\ln w_t - \ln w_{t-1} = \alpha_1(L)(\ln w_t - \ln P_t) + \alpha_2(L)(\ln e_t - \ln w_t)$$
$$+ \alpha_3(L) \ln S_t + \alpha_4(L)\ln U_t + \alpha_5 \ln R_t \qquad (4.9)$$
$$+ \alpha_6 \ln P^o_{et} + \alpha_7 t + \text{seasonals}$$

In the above equation, the following definitions are given to the various variables:

w_t = Index of weeklv wage rate

P_t = index of retail prices

e_t = index of average (weekly?) earning rate

S_t = moving average of working davs lost in strikes

U_t = rate of unemployment

R_t = average income-tax retention ratio

$\dot{P}_{et}$ = expected rate of change of prices

$\alpha_j(L)$ = lag operator polynomial, $j = 1,2,3,4$

Sargan uses sophisticated econometric methods to "test" the above "wage equation". His econometrics implied that the wage equation should be of the following form:

$$w_t = w_{t-1} \left(\frac{w_{t-1}}{w_{t-2}}\right)^{\beta_1} \left(\frac{w_{t-2}}{w_{t-3}}\right)^{\beta_2} \left(\frac{e_{t-1}}{w_{t-1}}\right)^{\beta_3} \left(\frac{w_{t-1}}{P_{t-1}}\right)^{\beta_4} . \; S_{t-1}^{\alpha_5} . \; R_t^{\alpha_6} \; \dot{P}_{et}^{\alpha_8} \qquad (4.10)$$

Clearly, equation 4.10 above is more complicated than either Meade's or Sawyer's. Is it an example of the consequences of letting econometrics "decide" the form of wage equation under today's guidance of sometimes empty formalism ?

None of the above wage equations (structural or reduced form), explicitly incorporate unanticipated price inflation or workers' bargaining power.

4.3 The Determination of Sectoral Money Wage Rate:

In advanced capitalist economies, where product markets are dominated by oligopolistic firms (see chapter 5, p. 100 for the definition of the firm), and the "labour market" is dominated by an organised labour force[9], it seems untrue that supply and demand for labour power (i.e. the worker's capacity to perform specific economic tasks) directly and mechanically determine money wage rate: being sectoral or subsectoral. In such economies, money wage rate for industry j [10] (which is a vehicle for the real wage rate) is one of the results of complex negotiation process between workers' representatives and the management representatives[11]. The negotiating team for the workers put on the negotiating table (in one way or another, depending on the circumstances) the following data:

(i) Money wage rate which prevailed during the period immediately before the new round of wage negotiation, denoted by w_{jt-1}.

(ii) The unanticipated rate of price inflation (in the form of real wage loss) which prevailed during the last period, denoted by $(P_{t-1} - P^{e}_{t-1})/P_{t-2}$ with P_t being the relevant price index and 'e' means expected.

(iii) The expected rate of price inflation factor for period t, denoted by P^e_t / P_{t-1}

(iv) The estimated rate of growth of labour productivity in the industry, denoted by d.

(v) An overall percentage increase over money wage rate of the previous period designed to capture wage differentials and possibly a political factor, all denoted by g.

Under these circumstances the target minimum money wage rate takes the following form:

$$w^*_{jt} = w_{jt-1} \left\{ \left(1 + \frac{P_{t-1} - P^e_{t-1}}{P_{t-2}} \right) \left(\frac{P^e_t}{P_{t-1}} \right) (1+d)(1+g) \right\} \tag{4.11}$$

Clearly w^*_{jt}, is set with reference to a complex set of explanatory variables. The possibility of translating that target into actual money wage rate, w_{jt} depends on the bargaining power of workers' representatives. Let us make the following hypotheses:

Hypothesis 1: Workers' bargaining power depends on the degree of workers' organizations, and on the level of the money value of the trade union's assets. We shall combine these two power variables by T_j.

Hypothesis 2: The effectiveness of workers' organization depends on intra-union and inter-union degree of workers' solidarity, SO_{jt}.

Hypothesis 3: Workers' solidarity depends on the rate of unemployment, U_t and on the firm's recent profit performance, represented by the height of the mark-up and the rate of capacity utilization CU_{jt} .

Given the mark-up, we can (in the short run) represent the rate of capacity utilization CU_{jt} by the rate of unemployment, U_t.[12] Thus $SO_{jt} = f(U_t)$.

Hypothesis 4: Workers bargaining power is indecomposable. It means that workers' bargaining power enables them (under inflationary conditions) to get a package covering, say, last period's real wage loss due to last period's unanticipated price inflation, expected price inflation and productivity growth.

Now hypotheses 1-3 enable us to form the following "power" function:

$$K_{jt} = K(U_t, T_j) \tag{4.12}$$

As we shall see later, this function will play a central importance in the analysis of wage determination under monopoly capitalism. The questions one would like to address are the following:

(i) What restrictions have to be imposed on the function $K(U_t, T_j)$?

(ii) How do we utilise it in our analysis of wage determination?

As regards the answer to the first question, we submit the following argument: a high rate of unemployment associated with poorly organized working class reduces the value of the function $K(U_t, T_j)$ to close zero, and even to a negative value [13].

In the opposite case, i.e.when the rate of unemployment is very low and when the degree of workers' organization is at an advanced stage, the value of $K(U_t,T_j)$ becomes close to unity. Under today's capitalism we should expect the value of $K(U_t,T_j)$ to fluctuate between zero and unity. Hence, the power function must be subject to the following restrictions:

$$0 \leqslant K(U_t,T_j) \leqslant 1 \tag{4.13}$$

As for the answer to the second question, it is supplied by hypothesis (4), i.e. workers' bargaining power is indecomposable.

The above restrictions imposed on the function $K(U_t,T_j)$ together with the power indecomposability hypothesis implies that money wage rate equation should take the following form:

$$w_{jt} = w_{jt-1}\left[\left(1 + \frac{P_{t-1}-P^e_{t-1}}{P_{t-2}}\right)\left(\frac{P^e_t}{P_{t-1}}\right)(1+d)(1+g)\right]^{K(U_t,T_j)} \tag{4.14}$$

with $\quad 0 \leqslant K(U_t,T_j) \leqslant 1$

Simple as it is[14] equation 4.14 above is general enough to incorporate a number of real cases and some important theoretical constructions. For example, the Italian experience[15] of wage indexation can be taken as a special case in equation 4.14 above, i.e. if

$P^e_t = P_{t-1}$, $1 > d \geqslant 0$, and $g = 0$,

then:

$$w_{jt} = w_{jt-1}\left(\frac{P_{t-1}}{P_{t-2}}\right)^{K(U_t,T_j)}\left[1+d\right]^{K(U_t,T_j)} \tag{4.15}$$

Full indexation means that the legislator has replaced the function

$K(U_t,T_j)$ in $\left(\frac{P_{t-1}}{P_{t-2}}\right)^{K(U_t,T_j)}$ by unity. One can incorporate class conflict over the distribution of the surplus (or net real income) by attaching a non-zero value to g, and replacing it by the function $g(U_t)$. One can even incorporate workers' dissatisfaction variable in that equation[16].

Having specified the general form of the wage equation, for sector j, there remain three questions to be addressed:

First: is there any evidence in support of the hypotheses 1-4 ?

Second: to what extent does equation 4.14 encompass other structural wage equations?

Third: How do we deal with the problem of intersectoral wage comparability and skill differentials?

The answers to these questions will occupy the remaining pages of this section.

4.4 Some tentative evidence:

As for the evidence which stands in support or against the four hypotheses which we formulated in pp.82-83 above, I would like to emphasize, from the beginning, that any supportive evidence backing any one of those hypotheses must be regarded as tentative.

As far as hypothesis (1) is concerned, there is ample evidence on the advance of the degree of workers' organization (measured by union density level) in Australia, Western Europe, Canada and the U.S.[17]. But faster than that advance is the advancement of the "coverage rate". In the case of the U.K., the percentage of unionized labour force increased from less than 11% in 1892 to around 50% in 1973-81. But the coverage rate of 1973, in U.K. manufacturing sector, was 80%[18]. Recent anti-union legislation in the U.K. (sections of the Employment Act for 1980) provides another piece of evidence[19].

As for unions' assets, I would prefer (at present) to stick to the hypothesis that the degree of workers' organization and the level of the money value of unions' assets are positively correlated.

The relationship between the effectiveness of workers' organization and workers' solidarity (hypothesis 2) is well established[20].

As for the hypothesised relationship between the degree of (intra or inter-union) workers' solidarity and the rate of unemployment it should be emphasised that this is oversimplification. Workers' solidarity depends on a number of factors: it depends on the number and diversity of the union's purposes, the proportion of workers who are themselves committed to the achievement of these purposes, (inversely related to the proportion of scabs, stooges, stoolies and recalcitrants)[21], the size of the private financial assets of the members, the firm's recent profit level and many others, apart from the current rate of unemployment. In hypothesis (3) we abstracted from many of these factors and limited ourselves to saying: lower rate of unemployment weakens workers' commitment to the trade union organization rendering it less effective. Profit performance of the firm may act in the same way. If we were to take the percentage rate of change of union membership as an index of the degree of workers' commitment to the trade union, then we would find in Bain-Elsheik's[22] study on the determinants of the rate of change of union membership some support for the hypothesis that the degree of workers' solidarity depends on (among others) the change in the rate of unemployment. In the short run, i.e. when productive capacity is given, changes in the rate of unemployment can be taken as an index of the firms' (or industry) gross profit.

As for hypothesis (4) (workers' bargaining power is indecomposable) its confirmation or refutation is, I think, best conducted with reference to case studies. However, there is clear indirect empirical support in the results of Henry et al (1976). One of the interesting things in that study is its sample periods, one of which is the period 1948(I) -1974(IV), which includes the year when "pay explosion" took place. One has to keep in mind that during that period, the U.K. rate of unemployment ranged from 0.89% to 3.08% with an average of 1.62% for the whole period[23]. This period's data base "produced" the following wage equation[24].

$$\log w_t - \log w_{t-1} = \underset{(-0.2220)}{-0.0059} + \underset{(4.33)}{0.589}\,(\log P_{t-1} - \log P_{t-2})$$

$$+ \underset{(1.258)}{0.00083}\,\log U_{t-1} \underset{-(1.995)}{-\,0.1097}\,(\log \bar{w}_{t-1} - \log P_{t-1})$$

$$+ \underset{(2.129)}{0.00066t}$$

$$R^2 = 0.469 \qquad (4.16)$$
$$DW = 1.466$$

where the numbers in parentheses are the t-statistics.

In the above equation, we have three important things:

(1) a statistically significant (at the 5 percent significance level) coefficient of $(\log \bar{w}_{t-1} - \log P_{t-1})$ which carries the implication that workers get compensation for real wage (more correctly, real earning) loss due to last period price inflation.

(2) a statistically significant coefficient of $(\log P_{t-1} - \log P_{t-2})$, which in Henry et al[25] is assumed to represent the expected rate of price inflation for period t .

(3) a statistically significant coefficient of the time variable. From that and from the coefficient of $(\log \bar{w}_{t-1} - \log P_{t-1})$ one gets the rate of growth of labour productivity.

Of course the statistical significance of each of the above coefficients must apply to each of the sample periods. This means for each period workers' representatives simultaneously ask for, and simultaneously get wage increases covering real earning loss due to last period price inflation, protection against next period's price inflation, and an overall increase due to productivity increases.

Therefore it is not unreasonable to say that the hypothesis that workers' bargaining power is indecomposable receives some support from U.K. data, at least.

4.5 Some reconciliations:

Under the assumptions that wage negotiations take place betwen workers' representatives and the management's at the beginning of each period, and wage agreements are in money terms (plus some other simplifying assumptions), we have argued that it is possible to construct a wage equation according to which substantive rationality (conscious utility maximisation) has no place. The "irrational" wage equation which we have constructed, away from maximisation 'principle' is reproduced here for convenience (omitting the subscript j):-

$$w_t = w_{t-1} \left[\left(1 + \frac{P_{t-1} - P^e_{t-1}}{P_{t-2}}\right) \left(\frac{P^e_t}{P_{t-1}}\right)(1+f)\right]^{K(U_t,T)} \qquad (4.17)$$

with 1+f = (1+d)(1+g).

To recap, the logic behind this equation is the following: workers' representatives ask for last period's money wage rate as a base. In addition to that they ask for compensation for the unanticipated price inflation (last period's real wage loss) represented by the expression $(P_{t-1} - P^e_{t-1})/P_{t-2}$, a protection against next period's price inflation represented by the expression P^e_t/P_{t-1} (we mean by next period the time span from the beginning of period t at which wages and prices fixed to its end). Finally, they ask for an overall increase to represent productivity growth and possibly a political factor both represented by f. Workers' ability to realise these claims is represented by the function $K(U_t, T_j)$, whose arguments are the rate of unemployment, U_t, representing the degree of workers' solidarity; and the degree of labour organisation together with the total money value of the organization's assets, both represented by T. The question which is to be addressed in this subsection is this: to what extent can we regard equation 4.17 above as being representative of Sargan-Henry et al's implicit vision of wage determination; Meade's wage equation and Sawyer's wage equation (which is, in part designed to formalize Brown's and Hick's among others analysis)? Let us perform the following manipulations on equation 4.17 above:

$$w_t = w_{t-1} \left[\left[\left(\frac{\bar{w}_{t-1}}{\bar{w}_{t-1}} \right) \right] \left(\frac{P_{t-1}}{P_{t-2}} \right) \left(\frac{P_{t-2}}{P_{t-1}} + \frac{P_{t-1} - P^e_{t-1}}{P_{t-1}} \right) \left(\frac{P^e_t}{P_{t-1}} \right) (1+f) \right]^{K(U_t, T)} \tag{4.18}$$

$$w_t = w_{t-1} \left[\frac{P^e_t}{P_{t-1}} \right]^{K(U_t, T)} \left[\frac{ \frac{\bar{w}_{t-1}}{P_{t-1}} \left(1 + \frac{P_{t-1} - P_{t-2}}{P_{t-2}} \right) (1+f) \left(1 + \frac{P_{t-2} - P^e_{t-1}}{P_{t-1}} \right) }{ \frac{\bar{w}_{t-1}}{P_{t-1}} } \right] \tag{4.19}$$

or $$w_t = w_{t-1}\left(\frac{P_t^e}{P_{t-1}}\right)^{K(U_t,T)}\left[\frac{\left(\frac{\bar{w}}{P}\right)_0.(1+f)^t\left(1+\frac{P_{t-2}-P_{t-1}^e}{P_{t-1}}\right)}{\bar{w}_{t-1}\ /\ P_{t-1}}\right]^{K(U_t,T)} \tag{4.20}$$

with $\bar{w}_t$ being the rate of earning per hour, and $f = d + (1+d)g$. If we set aside the implicit behavioural assumptions,we can write the function

$\left(\frac{\bar{w}}{P}\right)_0 . (1+f)^t$ as

$$\left(\frac{\bar{w}}{P}\right)_0\left[\left(1-\frac{1}{n/f}\right)^{n/f}\right]^{ft} = \left(\frac{\bar{w}}{P}\right)_0 e^{ft} = \left(\frac{\bar{w}}{P}\right)_0 e^{[d+(1+d)g]t} \tag{4.21}$$

$$\therefore\ w_t = w_{t-1}\left(\frac{P_t^e}{P_{t-1}}\right)^{K(U_t,T)}\left[\frac{\left(\frac{\bar{w}}{P}\right)_0 e^{[d+(1+d)g]t}\left(1+\frac{P_{t-2}-P_{t-1}^e}{P_{t-1}}\right)}{\left(\frac{\bar{w}}{P}\right)_{t-1}}\right]^{K(U_t,T)} \tag{4.22}$$

In Henry et al, the following restricted version of equation (4.22) is adopted for statistical measurement[26]

$$w_t = w_{t-1}\frac{P_t^e}{P_{t-1}}\left[\frac{\left(\frac{\bar{w}}{P}\right)_0 e^{dt}}{\left(\frac{\bar{w}}{P}\right)_{t-1}}\right]^{\pi} \tag{4.23}$$

This means,the Henry et al wage equation is the same equation as equation 4.22 if:

(i) $g = 0$

(ii) $P_t^e = P_{t-1}$, applicable to the expression inside the square brackets only.

(iii) $K(U_t,T)$ = the constant, π

In other words, in Henry et al wage equation, there are three built-in (possibly not always valid) hypotheses. The first hypothesis is that conflict over income distribution is absent. Second, this period's price index is the best estimate of next period's. Third, workers' bargaining power is constant. In the mid-1970's, the rate of price inflation accelerated in the capitalist centres. One possible implication of that is that g assumed a positive value. If this were the case then the hypotheses that $P^e_t = P_{t-1}$ and $K(U_t, T)$ is constant are invalid, and a return to a version of equation 4.14 is preferred.

Next, let us see what can be said about Meade's wage equation 4.6 reproduced below for convenience:

$$w_t = w_{t-1}\left(\frac{P_{t-1}}{P_{t-2}}\right)\left[\frac{P^e_t \,/\, P_{t-1}}{P^e_{t-1} / \,P_{t-2}}\right](1+\lambda) \tag{4.24}$$

As Meade shows[27], if $P^e_t = P_{t-1}$, then we will have:

$$w_t = w_{t-1}\left(\frac{P_{t-1}}{P_{t-2}}\right)(1+\lambda) \tag{4.25}$$

The question is: can we get Meade's equation 4.25 from equation 4.14 above? Let us see. (We reproduce equaton 4.14 below for convenience after omitting j from T_j):

$$w_t = w_{t-1}\left[\left(1+\frac{P_{t-1}-P^e_{t-1}}{P_{t-2}}\right)\left(\frac{P^e_t}{P_{t-1}}\right)(1+d)(1+g)\right]^{K(U_t,T)} \tag{4.26}$$

$$0 \leqslant K(U_t, T) \leqslant 1$$

Now, with $P^e_t = P_{t-1}$ substituted in 4.26 we get:

$$w_t = w_{t-1}\left[\left(\frac{P_{t-1}}{P_{t-2}}\right)(1+\lambda)\right]^{K(U_t,T)} \tag{4.27}$$

or

$$w_t = w_{t-1} \left(\frac{P_{t-1}}{P_{t-2}}\right)^{K(U_t,T)} (1+\lambda)^{K(U_t,T)} \tag{4.28}$$

If we set $K(U_t,T) = 1$ (i.e. if we assume that the workers are so powerful that they get what they ask for) we get Meade's equation 4.25 . Thus, equation 4.14 in which unanticipated price inflation and workers' bargaining powers are explicitly incorporated, is more useful than Meade's wage equation.

Finally, we return to Sawyer's wage equation 4.8 (partly designed to incorporate Phelps Brown's "attitudes and expectations" hypothesis, and Hicks "real wage resistance" hypothesis), again, reproduced below for convenience:

$$w_t = w_{t-1} \left(\frac{P^e_t}{P_{t-1}}\right)^{\alpha_1} \left(\frac{T_t}{w_{t-1}/P_{t-1}}\right)^{\alpha_2} \left(\frac{w_{c,t-1}}{w_t}\right)^{\alpha_3} \left[f(U_{t-1}).\left\{\frac{P^{profit}_t}{P^{profit}_{min}}\right\}^{\alpha_4}\right] \tag{4.29}$$

$$w_t = w_{t-1} \left(\frac{P^e_t}{P_{t-1}}\right)^{\alpha_1} \left[\left(\frac{T_t}{(w_{t-1}/P_{t-1}}\right)^{\alpha_2} \left(\frac{wc_{t-1}}{w_t}\right)^{\alpha_3}\right] f(U_{t-1}) \left(\frac{P^{profit}_t}{P^{profit}_{min}}\right)^{\alpha_4} \tag{4.30}$$

In order to make equation 4.30 comparable with equation 4.14 we slightly manipulate the latter to be as follows:

$$w_t = w_{t-1}\left(\frac{P^e_t}{P_{t-1}}\right)^{K(U_t,T)} \left[\left(1 + \frac{P_{t-1}-P^e_{t-1}}{P_{t-2}}\right)(1 - f)\right]^{K(U_t,T)} \tag{4.31}$$

$$w_t = w_{t-1}\left(\frac{P_t^e}{P_{t-1}}\right)^{K(U_t,T)}\left[\frac{\left(\frac{w_{t-1}}{P_{t-1}}\right)\left(1+\frac{P_{t-1}-P_{t-1}^e}{P_{t-2}}\right)(1+d)(1+g)}{\frac{w_{t-1}}{P_{t-1}}}\right]^{K(U_t,T)} \qquad (4.32)$$

$$w_t = w_{t-1}\left(\frac{P_t^e}{P_{t-1}}\right)^{K(U_t,T)}\left[\frac{\left[\left(\frac{w_{t-1}}{P_{t-1}}\right)\left(1+\frac{P_{t-1}-P_{t-1}^e}{P_{t-2}}\right)(1+d)\right](1+g)}{\left(\frac{w_{t-1}}{P_{t-1}}\right)}\right]^{K(U_t,T)} \qquad (4.33)$$

Now, the term $\left(\frac{P_t^e}{P_{t-1}}\right)^{K(U_t,T)}$ in equation 4.33 corresponds to $\left(\frac{P_t^e}{P_{t-1}}\right)^{\alpha_1}$ in Sawyer's equation 4.30 . The expression $\left(\frac{w_{t-1}}{P_{t-1}}\right)\left(1+\frac{P_{t-1}-P_{t-1}^e}{P_{t-2}}\right)(1+d)$ in equation 4.33 above corresponds to T_t in Sawyer's equation; and the term (1 + g) in equation 4.33 corresponds to $\left(\frac{w_{c,t-1}}{w_t}\right)^{\alpha_3}$ in Sawyer's equation (after replacing g by g_t). The basic differences between the two equations are the the following:

(1) In Sawyer's wage equations, the exponents are treated as constant. In our equation they are not, because the bargaining power of the workers is not constant.

(2) In Sawyer's wage equation, unanticipated (price) inflation is not explicitly incorporated. In our equation it is.

(3) In Sawyer's wage equation, the "target real wage" is not analysed, while in our equation an attempt is made to analyse it.

(4) Finally, equation 4.14 is not incapable of incorporating essential elements in Phelps Brown's analysis (wage comparability, workers' dissatisfaction, class conflict, etc.) nor is it incapable of representing Hick's Real Wage Resistance hypothesis. Therefore equation 4.33 (and hence equation 4.14) forms an improvement upon Sawyer's wage equation 4.29 and for that reason, we prefer to use versions of equation 4.14 in our Sraffa based analysis of price inflation which will follow.

4.6 Intersectoral Wage Differentials

In this section we address the following question: How do we deal with the problem of intersectoral wage determination in the presence of the phenomenon of intersectoral wage comparability and skill differentials? Analytically, we can deal with this problem in two ways: the first is to treat g in equation 4.14 above as the variable which captures the part of wage increase necessary to maintain the preperceived wage differentials. The second way is to adopt a relevant version of the 'leading-sector' hypothesis[28]. Let us make the following assumptions:

(i) Workers in sector n are the most militant section of the working population such that they can strike a 'key bargain' at the end of each wage negotiation round whenever possible. The final wage agreement covers all workers of all skills in that sector only.

(ii) Workers in the remaining sectors adjust their wage rates on comparability principle to those of sector n after a one period lag. The adjustment is to be based on the following proportionality vector[29]: $\{\theta_1, \theta_2, \ldots, \theta_{n-1}, 1\}$.

Given these assumptions, we can express sectoral wage equations as follows:

$$w_{nt} = w_{n,t-1} \left[\left(1 + \frac{P_{t-1} - P^e_{t-1}}{P_{t-2}}\right)\left(\frac{P^e_t}{P_{t-1}}\right)(1+f_n)\right]^{K(U_t, T_n)} \qquad (4.34)$$

$$w_{jt} = \theta_j w_{nt-1} \tag{4.35}$$

$$\text{or } w_{jt} = \theta_j w_{nt-2} \left[\left(1 + \frac{P_{t-2} - P^e_{t-2}}{P_{t-3}}\right) \left(\frac{P^e_{t-1}}{P_{t-2}}\right) (1 + f_n) \right]^{K(U_{t-1}, T_n)} \tag{4.36}$$

$j = 1, 2, \ldots, n-1$

Clearly, the workers in industry n are the "key" of the inflationary experience in our hypothetical economy. They must be controlled and "disciplined" if that experience is to be be contained - given the mark-up vector.

4.7 Closing note:

My main task, may I remind the reader, in the present chapter has been to construct a wage equation based, in some sense, on procedural rationality. This sort of construction, it seems to me now, is more useful for the analysis of price inflation under oligopoly capitalism than the "reduced form" constructions (among others).

This is so because causality is clear in the basic wage equation 4.14 , which is the core of the present chapter. It seems to me that under oligopoly capitalism mechanical supply and demand analysis and the underlying marginal productivity theory of wage determination (money or real) is irrelevant. It must be replaced by an analysis whose crucial assumptions reflect, or approximate, the realities of oligopoly capitalism; a recommendation put forward to the students of economics by Baran and Sweezy some twenty years ago...[30]

Notes to Chapter 4

[1]Barran and Sweezy (1966), pp.27-28.

[2]Lipsey (1960), p.26.

[3]Bain (1983), p.5.

[4]Mulvey (1976), p.425.

[5]This definition is based on Max Weber's definition of power quoted by Galbraith (1983), p.20.

[6]Gravelle and Rees (1981), p.368.

[7]See Eatwell (1984), p.215; Mainwaring (1984), Chapters 4 and 6.

[8]I am grateful to Dr. L. Mainwaring, Economics Department, University College, Cardiff, for bringing my attention to the issue of unanticipated price inflation which greatly helped me to sharpen the wage equation constructed in Section 4.3 below.

[9]See Sweezy (1942), pp.254-269, 311-317.

[10]For simplicity, we assume that wage negotiations are conducted at the industry level within a very short interval close to the beginning of each period.

[11]See: Clegg (1979), pp.229-251.

[12]If the prevailing level of unemployment were of Keynes' type, U_t would be inversely related to CU_t. On the other hand, if the prevailing level of unemployment being "enriched" by Marx's type of unemployment (e.g. the new waves of unemployed people are those which were rejected by capacity rationalization) the two variables, U_t and CU_t will not be inversely related. See Morishima (1969), pp.63-64.

[13]We shall rule out the possibility of $K(U_t, T_j)$ being negative ($\Rightarrow w_{jt} < w_{j,t-1}$) because of the post war record of money wage rate in the capitalist centres, at least, does not support that hypothesis.

[14]It is oversimplifiaction. However, different emphasis on the part of the negotiating team for the workers on the elements inside the square brackets can be taken into consideration. This leads equation 4.14 to take the following form:

$$w_{jt} = w_{jt}\left[\left(\frac{P_{t-1} - P^{e}_{t-1}}{P_{t-2}}\right)^{\beta_1}\left(\frac{P^{e}_{t}}{P_{t-1}}\right)^{\beta_2}(1+d)^{\beta_3}(1+g)^{\beta_4}\right]^{K(U_t,T_j)}$$

(I am grateful to Dr.P. Geroski, Economics Department, Southampton University, for bringing my attention to this issue).

[15]The Guardian, March 26, 1984.

[16]In the early seventies, in the US and in Western Europe, the low rate of unemployment brought to the surface the phenomenon of job dissatisfaction among different sectors of the working population expressed in a higher rate of absenteeism, a higher rate of turn-over, poor quality control, etc. The combined effect of these factors is to lower the rate of growth of labour productivity in the manufacturing sector, at least, hence a positive relationship between d and U. This means we have $d_t = f(U_t)$. If on the other hand, the lower rate of unemployment were to be associated with: (i) higher degree of class consciousness, (ii) more effective labour organisation, and (iii) effective group leaders, i.e. capable of the effective mobilisation of class consciousness and labour organisation, then we would have a negative relationship between g and U with $g_t = g(U_t)$. Under these circumstances our wage equation takes the following form:

$$w_{jt} = w_{j,t-1}\left\{\left[1 + \frac{P_{t-1}-P^e_{t-1}}{P_{t-2}}\right]\left[\frac{P^e_t}{P_{t-1}}\right]\right\}^{K(U_t,T_j)} \{1+d(U_t)\}^{K(U_t,T_j)} \{1+g(U_t)\}^{K(U_t,T_j)}$$

This wage equation has far reaching inflationary effects. For example, a lower U can lead to higher prices with no initial change in the whole expression to the right hand side of $w_{j,t-1}$. For more details of a verbal ground argument f this footnote see Braverman (1974) pp.31-39; Kalecki (1971), pp.138-145.

[17]For data on actual and potential union membership in Australia, Sweden, the UK, and the US, see Bain and Elsheik (1976), pp.134-143.

[18]Bain (1983), p.5; Mulvey (1976), p.425.

[19]See Meade (1982), pp.70-77.

[20]Galbraith (1983), pp.67-68.

[21]Galbraith, Ibid., pp.67-68, 76-77.

[22]Bain and Elsheik (1976), pp.81-86.

[23]The rate of unemployment used in the text is the ratio of the registered unemployed to the labour force. These numbers have been worked out by myself using the updated data published in the various editions of the Annual Abstract of Statistics, CSO, U.K.

[24]Henry et al (1976), p.69.

[25]Henry et al, Ibid., p.67.

[26]In Henry et al, Ibid., the letter d is replaced by the letter y.

[27]Meade (1982), p.170, 176.

[28]Kaldor (1976), pp.708-709.

[29]The proportionality vector can be viewed as the vector of multiples which must be applied to skilled labour to reduce it to unskilled labour, using the "indirect labour method" in the reduction. See Rowthorn (1980), pp.234-236.

[30]Baran and Sweezy (1966), pp.17-20.

Chapter 5: The Mark-up Equation

5.1 The questions to be addressed:

The questions to be addressed in this chapter are the following:

What determines the mark-up ? How do we relate these determinants to the mark-up itself such that a definite mark-up equation is constructed ?

As was the case with the wage equation, I base my answer to these questions on a number of assumptions which have some empirical support. My main concern in the present chapter is with a leader firm, or one member of a group of leading firms, in a given industry, who do not set their prices according to the short term profit maximization dogma.

5.2 Definitions and a question

The definition of the firm which will be utilized through this thesis is the one proposed by Penrose (1985). According to Penrose, the firm is a coherent administration unit[1]. It is "...a collection of human and physical resources bound together in an administrative framework, the boundaries of which are determined by the 'area of administrative coordination' and 'authoritative communication'"[2].

Secondly, the phrase "mark-up" is widely used in the literature, with different definitions[3]. To make things clear from the start, we shall define the percentage mark-up (symbolised by r_j , j=1,2,...n) as the fraction which is multiplied by average variable cost (or average total cost at the standard rate of output (defined next page)) to give the gross profit margin per unit of output sold. The phrase "mark-up" is retained for $1 + r_j$. This usage of the term is consistent with Kalecki's definition of the mark-up used in his price fixing hypothesis[4].

The theoretical hypothesis which receives empirical support[5] in capitalist manufacturing at least, is that commodity prices are not directly influenced by the state of excess demand in the product market.

Instead we have the following pricing rule: the price of commodity j is equal to average variable cost (or average total cost at a standard rate of output defined as average actual level of output over a complete cycle period), denoted by m_j, times average mark-up denoted by $1 + r_j$. The latter can be the average mark-up of the leading firm in the industry. Formally, we have:

$$P_j = m_j(1+r_j) \qquad (5.1)$$

$$j = 1,2,\ldots,n$$

Now, plant design and firm's contractual commitments necessitate that m_j is to be known to the cost accounting unit of the firm, at the beginning of period t. The crucial question then is: what determines r_j ?

There are several answers to this question. An answer is implicit in every theory of price determination. One expects these theories to differ from each other due to the sharply different research programmes to which they belong. Therefore, to answer that question, one is led into giving a brief account of the main theories of price determination in the economy under consideration. In the following pages we shall focus our attention on the determination of wholesale prices in the production sector, which embraces the manufacturing sector. The reasons are the following:

(i) It is the most important sector in the economies under consideration[6]

(ii) In distributive trade, pricing takes place according to equation 5.1 with slight modification[7]

(iii) Prices of primary products, i.e. agriculture, fishing, and crude oil, etc. are determined according to the state of excess demand directly.[8]

We now return to the main issue, that is the determination of the mark-up as it is explained by the following prominent four theories: 1) The marginalists' neoclassical theory; 2) Entry preventing theory; 3) The Post Keynesian theory; 4) The new Marginalists' theory;

5.3. The Neoclassical Theory of "mark-up determination":

According to this theory, commodity prices, no matter who produce these commodities (a single plant firm or a multinational corporation) are fixed by the firm's decision makers at the point when marginal cost (MC) equals marginal revenue (MR). When the latter equals the price, we have the so-called perfectly competitive market.[9] When the MC = MR and the latter is less than the price, the market becomes imperfect and can take one of the following forms: i) Monopolistic competition, ii) Oligopoly, iii) Duopoly, and iv) Monopoly. All these theories, according to Latsis[10], have the following two 'hard core' assumptions in common:

First: decision makers are short term profit maximisers

Second: they have a definite knowledge of the shape and position of the demand curve for their own output.

The first assumption is invalid because the second is invalid. While the firm can know the MC 'curve', it does not know the MR curve. Business men are neither familiar with the concept of MR nor can they make a reasonable estimate of the MR curve if they wanted to do so. [11] Secondly, empirical evidence[12] refutes the hypothesis that the mark-up is directly influenced by the state of excess demand which is an indirect refutation of the hypothesis that firms are short term profit maximizers. On these grounds, the marginalists' neoclassical theory of price and mark-up determination has no empirical support. It seems to me that marginalism is irrelevant as a foundation of price fixing method, especially in today's capitalism.

5.4 The entry preventing theory of mark-up determination:

One version of this theory of price/mark-up determination is the 'limit pricing' theory developed by Sylos-Labini, where barriers to entry based on economies of scale are crucial for the determination of the limit price; (the other crucial variables are the position and the shape of the market demand curve).[13] According to this theory, the price is fixed at a level such that a brand new firm is deterred from entering the industry by the prospect of loss making due to its inability to cover average total cost caused by the prospective low rate of capacity utilization. In other words, the potential newcomer is deterred from entering the industry because the limit price set by the leader firm is made equal to the long term average total cost of the least efficient firm existing in the industry. The detailed assumptions upon which the theory is based are of no relevance to us now,[14] except the following:

(i) cost curves of existing firms must be known by the leader firm who sets the product price.

(ii) Market demand must be known by the leader firm. The first assumption may be accepted, but the second is difficult to defend. This is so for two reasons:

First: If the shape and the position of the market demand curve had been known to the leading firm in the relevant market for the 'limit price' to be determined, then any shift of that very curve would necessarily have changed the conditions which led to the determination of the earlier limit price. Thus the prediction which the limit price theory must lead to is that changes in the state of excess demand must lead to changes in the mark-up. That prediction is not vindicated by empirical evidence of capitalist manufacturing, at least.

Second: and in relation to the last point, and since the firm is a dynamic production unit belonging to a dynamic system characterised (among other things) by changing level of real income, it follows that any econometric estimate of the market demand curve by the leading firm loses its validity shortly after its estimation. Hence, a further hypothesis follows from the limit price theory, i.e. the leading firm is continuously engaged in econometric re-estimation of the market demand curve. Do leading firms in today's capitalism engage in such exercise? I doubt that.

Therefore, the 'limit price' is a concept which has no practical validity. As a result, it should be dumped in the same bin where the concept of marginal revenue properly belongs. Therefore, the limit price theory is not a realistic theory of price/mark-up (or, more correctly, mark-up/price) determination in the economies under consideration.[15]

5.5 The Post Keynesian theory of mark-up determination:

According to this theory, the supply price of a typical reproducable commodity is equal to average variable cost times the mark-up. The mark-up is fixed in such a way that a given gross profit margin per unit sold (defined as $r_j.m_j$) is generated. The latter is composed of two parts:

(i) a variable part which depends on the level of internally generated finance capital needed by the firm for capacity expansion.[16]

(ii) a historically given minimum designed to cover overhead cost, depreciation and a 'normal level' of profit on finance capital (invested in the business) whose physical counterpart is running at the 'standard rate of output' or at 'normal capacity'. The level of normal profit (per unit or in total) depends on what the typical entrepreneur regards as attainable in the light of past experience.[17]

The above argument implies that according to the Post Keynesian theory of mark-up determination the mark-up is fixed according to the following:

<u>First</u>: plant design together with the standard rate of output, input prices, overhead and depreciation costs determine total cost at that rate of output.

<u>Second</u>: given the normal rate of profit together with the 'quantity' of finance capital, then total normal (or standard) level of profit is determined.

From the above two categories the minimum profit margin (and therefore the minimum mark-up) logically follows.

<u>Third</u>: given the minimum profit margin (at the minimum mark-up), together with the variable part of the margin which is determined on the base of the internal financial needs of the firm for capacity expansion, then profit margin (i.e. gross profit margin) immediately follows.

Formally, we have[18]

$$r_j = \frac{F_j + \pi_j^* K_j + I_j^m}{m_j Q_j^*} \tag{5.2}$$

where r_j = the percentage mark-up, F_j = overhead cost and depreciation charges at the standard rate of output, Q_j^* , π_j^* = the attainable (or desired) rate of profit, I_j^m = desired level of internally generated finance needed for capacity expansion, and m_j is variable cost per unit. All variables are for commodity j .

It is clear from the above steps and the resulting equation that neither demand, as a direct determinate of the percentage mark-up, is present nor is the level of capital concentration or capital centralisation (both packed in industrial economics by the phrase 'industrial concentration').

5.6 The new marginalists theory of mark-up determination:

The approach to the determination of the mark-up, according to this theory, is essentially neoclassical. The thing which gives it a superficial differentiation from the neoclassical-marginalists' approach is the presence of a concentration index in the mark-up equation. According to Cowling and Waterson (1976), and Cowling (1982), whose starting point is the same neoclassical assumption that firms in monopoly capitalism are short term profit maximizers, the percentage mark-up (and therefore the mark-up) depends on the following variables:

1. The level of industrial concentration measured by Herfindahl concentration index H .
2. Price elasticity of demand η
3. A measure of conjectural variation α , which may be interpreted as an indirect measure of the degree of collusion amongst the established firms.

After some differentiation and manipulation, Cowling[19] was able to relate the above three variables to gross profit margin per unit of sales, calling it the mark-up, according to the following relation:

$$\frac{P_j - MC_j}{P_j} = \frac{H_j}{\eta_j}(1 + \alpha_j) \qquad (5.3)$$

where P_j is the price of commodity j, and MC_j is marginal cost for the same commodity.

The problem with this equation lies with its derivation. As we indicated above, it is based on the hypothesis that firms are profit maximizers, in the neoclassical sense. The logical prediction of that hypothesis is that short-term shifts in demand curve, for the commodity under consideration, lead to corresponding changes in the mark-up and therefore the price. That prediction is supposed to be valid irrespective of the way we choose to interpret the term 'firms are profit maximizers'. That is to say, it doesn't make a difference, as regards that prediction, to say that the firm decides to conduct a single maximization process at one point in time and then, having done that, decide to stick to the final form of that process expressed in terms of equation 5.3 above as the rule of thumb; or to say that the same firm conducts a separate maximization process at the beginning of every period. That prediction is one: short-term shifts in demand curve lead to corresponding changes in the mark-up and therefore the price. That prediction has no empirical support in capitalist production sector, today. Therefore, the new marginalists'approach to the mark-up determination should be abandoned as being unrealistic, though it appears to be less unrealistic than its neoclassical aunt.

5.7 Kaleckian Synthesis

In this sub-section we shall deal with the theory of mark-up determination in two qualitatively different, though not mutually exclusive, cases. A third case, when the price is fixed according to the current state of excess demand, needs no further discussion[20]. One only needs to say that in this sort of industry or market (e.g. crude oil market in Rotterdam, the fish market in Aberdeen) the "mark-up" is volatile, and mirrors the volatility of the current state of excess demand in that industry. The cases discussed here are:

Case I: A highly concentrated industry where one or few firms produce most of the output in that industry. One of the firms is assumed to be acting as the leader from time to time, while the rest of the non-dominant firms act as followers in the literal sense.

Case II: A less concentrated industry, which we may call "competitive", where the "leader" and "followers" change their mark-ups in response to the latest state of inventory holding.

Case I:

In the Kaleckian analysis of price fixing in the capitalist non-primary sectors the following two features are prominent[21]

a) absence of the neo-classical dogma of short-term profit maximisation behaviour;

b) prices are cost determined, given the mark-up. Now, according to Kalecki, the mark-up is a reflection of the 'degree of monopoly' of the (few) firms in the relevant product market[22]. The mark-up, according to Kalecki, depends on the following major factors:

(i) the level of industrial concentration

(ii) trade unions' power.

(iii) level of sales promotion expenditures.

(iv) the level of overhead costs.

According to Stenidl (1952), the first and the third (together with scale and capital requirements barriers to entry) are the major determinants of the mark-up. This is Steindl's case where the industry is dominated by the few and when the 'marginal producer' makes net profit. Steindl's analysis of mark-up determination is made clearer by explicitly assuming that the typical modern capitalist industry is composed of firms of widely different size. Increasing returns to scale is the rule and technical progress is embodied[23]. From the analysis of both writers, Kalecki and Steindl, we get the following relations:

first: the price is equal to average variable cost times the mark-up.

second: the mark-up depends on the degree of monopoly enjoyed by the leading firm or firms in the industry.

third: the degree of monopoly depends on the level of industrial concentration, trade union power, level of sales promotion expenditures, overhead costs, and scale-capital barriers to entry.

On the other hand, as we have seen, the Post Keynesian analysis of mark-up determination broadly shares the Kaleckian approach in two important ways: a) absence of the neoclassical assumption that firms are short term profit maximizers, b) prices are average variable cost times the mark-up. The question which one may address is this: Can we extend equation 5.2 above in such a way that it becomes more representative of the two approaches for mark-up determination and at the same time less unrepresentative of reality? The answer to the first part of the question is 'yes'; but the answer to the second part must be conditional.

Let me propose the following hypotheses which are of primary importance:

Hypothesis 1; the dominant firm in the industry sets a rate of return on finance capital, π^*, which is regarded as target minimum by that firm.

Hypothesis 2; the target rate of return depends on the level of "industrial concentration" CR,and/or the level of internal finance needed for capacity expansion.

Hypothesis 3; the dominant firms operate according to a standard level of output, Q^*, which is smaller that Mrs.Robinson's (1969, pp.183-186) normal capacity output,

Hypothesis 4; average variable cost, m, is constant up to the point of normal capacity.

Granted the above hypotheses, the percentage mark-up equation can be derived as follows:

$$P_jQ_j^* = m_jQ_j^* + F_j + I_j^m + \pi_j^*K_j \tag{5.4}$$

$$I_j^m = a_j\pi_j^*K_j \qquad 0 < a_j < 1 \tag{5.5}$$

Equation 5.4 implies that the value of sales, at the standard level of output, Q_j^* must cover variable cost, $m_jQ_j^*$, fixed cost F_j , internal funds needed for capacity expansion, I_j^m , and net profit on finance capital which is the target rate of profit (or return) π_j^* times the 'amount' of finance capital K_j. Equation 5.4 expresses the post Keynesian argument according to which part or all of expenditures on capacity expansion, I_j^m ; is internally generated, and must come from higher profit through a higher mrk-up. Also, from hypothesis 2 we have the following relation:

$$\pi_j^* = \pi^*(CR_j) \tag{5.6}$$

where CR_j is a measure of industrial concentration in industry j . From equations 5.4- 5.6 the following relation logically follows:

$$r_j = \frac{F_j + (1+a_j)\ \pi^*(CR_j)K_j}{m_jQ_j^*} \tag{5. 7}$$

If we denote Mrs Robinson's normal capacity output for commodity j by Q_j^n and multiply both the numerator and the denominator of equation 5.7 by $(1 / Q_j^n)$ we get the following equation:

$$r_j = \frac{(F_j/Q_j^n) + (1+\alpha_j)\ \pi^*(CR_j)\ K_j/Q_j^n}{m_j^*(Q_j^*/Q_j^n)} \tag{5.8}$$

One of the important features of equation 5.8 above is its denominator. The fraction Q_j^*/Q_j^n has to be treated not as a constant but a choice variable under the control of the firm's top management[24]. We emphasise that in the above equation, which is the equation for the percentage mark-up determination under case I above, demand as a direct determinant of the mark-up is absent.

Case II

The reader has every right to ask the following questions: does the state of excess demand affect the mark-up? If yes, could we take it into consideration in the determination of the mark-up?

The answer to the first question is: yes. The answer to the second question is also yes, but after revising our hypotheses stated on page 109 above. Let us first start with our new set of hypotheses:

Hypothesis (1): The firm's 'target minimum' rate of profit, π_{jt}^*, is a distributed lag of last period's actual rates of profits, the lag being of low order. Formally we have:

$$\pi_{jt}^* = \sum_{i=1}^{\Omega} \gamma_i \pi_{j,t-i} \tag{5.9}$$

Hypothesis (2): firm's planned sales for period t, $Q_{jt}^{P.sales}$, are the sum of the two components: (a) the newly finished output which is ready for sale from the beginning of period t. We designate this finished variable by $Q_{jt}^{finished}$. (b) The undesired positive change in inventories which is realized at the end of period t. We designate this variable by $V_{jt-1}^{end} - V_{jt-1}^*$, where V_{jt-1}^{end} is the actual inventories at the end of period $t-1$, and $V_{j,t-1}^*$ is desired inventories at the end of the same period.

<u>Hypothesis (3)</u>: The firm's production period[25] is t, and the planned level of output (based on production decisions taken at the beginning of period 't') designated by $Q_{jt}^{P.output}$, is related to sales and inventories as follows[26]:

$$Q_{jt}^{P.output} = Q_{j,t-1}^{actual\ sales} - \lambda(V_{j,t-1}^{end} - V_{j,t-1}^{*}) \tag{5.10}$$

with $0 < \lambda < 1$

<u>Hypothesis (4)</u>: production decision taken at the beginning of period t is fully realized in the form of finished output supplied from the beginning of period $t+1$. We have designated the supply of the finished output by $Q_{jt}^{finished}$. Formally we have

$$Q_{jt}^{finished} = Q_{jt-1}^{P.output} \tag{5.11}$$

<u>Hypothesis (5)</u>: Investment expenditures in nominal terms depend on the ratio of last period's actual sales to normal capacity output. Formally, we have:

$$I_{jt}^{m} = f\left(Q_{jt-1}^{actual\ sales}/Q_{j}^{n}\right) \tag{5.12}$$

<u>Hypothesis (6)</u>: average variable cost m_j, is constant up to the level of normal capacity output, Q_j^n.

Granted these hypotheses (or assumptions), our formulation of the mark-up equation goes as follows:

$$Q_{jt}^{P.sales} = Q_{jt}^{finished} + \left(V_{j,t-1}^{end} - V_{j,t-1}^{*}\right) \tag{5.13}$$

$$Q_{jt}^{P.sales} = Q_{jt-1}^{P.output} + \left(V_{j,t-1}^{end} - V_{j,t-1}^{*}\right) \tag{5.14}$$

$$Q_{jt}^{P.output} = Q_{j,t-1}^{actual\ sales} - \lambda \left(V_{j,t-1}^{end} - V_{j,t-1}^{*}\right) \qquad (5.15)$$

From hypotheses 1 and 6, the following relation follows:

$$P_{jt}Q_{jt}^{P.sales} = m_j Q_{jt}^{P.sales} + F_j + \sum_{i=1}^{\Omega} y_i \pi_{j,t-i} K_j \qquad (5.16)$$

As before, F_j = overhead cost; K_j = finance capital.

And from hypothesis (5) we have:

$$I_{jt}^{m} = f\left(Q_{jt-1}^{actual\ sales} / Q_j^n\right) \qquad (5.17)$$

Now from equation 5.16 we get:

$$\frac{P_{jt} - m_j}{m_j} = \frac{F_j + \sum_{i=1}^{\Omega} y_i \pi_{j,t-1} K_j}{m_j Q_{j\ jt}^{P.sales}} = r_{jt} \qquad (5.18)$$

or:

$$r_{jt} = \frac{F_j/Q_j^n + \sum_{i=1}^{\Omega} y_i \pi_{j,t-i} K_j/Q_j^n}{m_j\left(Q_{jt}^{P.sales}/Q_j^n\right)} \qquad (5.19)$$

Equation 5.19 above implies that the percentage mark-up, fixed at the beginning of period t depends positively on fixed cost per unit of normal capacity output, F/Q_j^n, capital to (normal capacity) output ratio K_j/Q_j^n, and the firm's recent profit rates. But it depends negatively on the planned sales to capacity output ratio, $Q_j^{P.sales}/Q_j^n$.

Now, since;

$$Q_{jt}^{P.Sales} = Q_{j,t-1}^{P.output} + \left(V_{j,t-1}^{end} - V_{j,t-1}^{*}\right) \qquad (5.20)$$

It follows that this period's percentage mark-up, r_{jt} depends on two important variables: the quantity of finished output supplied from the beginning of period t, where $Q_{jt}^{finished} = Q_{j,t-1}^{P.output}$ and the <u>state of excess demand during last period signalled by the level of undesired inventories at the end of last period.</u> Thus equation 5.19 above incorporates the following ideas:

(i) Current actual profits are still residual, but the "target minimum", $\sum_{i=1}^{\Omega} \gamma_i \pi_{j,t-i}$, is a moving target, and responds to the state of excess demand in the recent past.

(ii) The percentage mark-up responds to the state of excess demand in a lagged and discontinuous fashion.

The last two points conclude our analysis of the mark-up determination under case II, i.e. the case of the "competitive" market structure. We now return to, and focus our attention on, equation 5.8, which characterizes the theory of mark-up determination under case I, i.e. the case of the highly concentrated product market. Let us rewrite that equation in the following way:

$$r_j = \frac{F_j/Q_j^n + a_j \pi_j^* \left(K_j/Q_j^n\right) + \pi_j^* \left(K_j/Q_j^n\right)}{m_j \left(Q_j^*/Q_j^n\right)} \qquad (5.21)$$

If we set $a_j = 0$, we get a Kaleckian equation for the percentage mark-up. On the other hand, if we were to remove the concentration variable from the determination of the target rate of return, we would get a Post Keynesian expression of the percentage mark-up. The central question is this: Is equation 5.21 realistic? In other words, are hypotheses 1-4 (of page 109 above) valid? To answer that question, we need some evidence.

Some econometric and field-investigation evidence:

As far as hypothesis 1 is concerned, field investigations (though limited, as far as I know) by Lanzillotti (1958) and Blair (1976, Ch.13) suggest that leading firms in US manufacturing, at least, follow the target rate of return pricing objective, and there is a tendency for a wider application of the target return rate of pricing and a tendency of small firms to emulate the big[27]. In the Accumulation of Capital, Mrs Robinson advocates such a hypothesis, not for the US but for all the advanced capitalist centres[28].

As for hypothesis 2 which is in fact two separate hypotheses, we need evidence first on the existence or non-existence of a relationship between the target minimum rate of return and the level of industrial concentration. Second, we need evidence on the existence or non-existence of a relationship between the target rate of return and the planned level of investment expenditures for capacity expansion.

According to Bain (1951) and Mann (1966), average actual rates of profit (over five and eleven years respectively) which I take it as approximating the target rate of profit depends on the level of industrial concentration. For Weiss'(1974) survey article on the concentration-profit relationship, we can construct the following table (table 2):

Table 2 showing the statistical concentration-profit relationship

State of significance of industrial concentration variable at the 5% significance level	Concentration-Rate of profit Relationship		Concentration Percentage Mark-up relationship		All studies	
	Studies	%	Studies	%	Studies	%
Positive & statistically significant	19	47.5	6	85	25	53.1
Positive & predominantly signficant*	15	37.5	0	0	15	32.0
Positive but not significant	2	5.0	1	15	3	6.4
Positive or negative but not significant	3	7.5	0	0	3	6.4
Coefficient have zero value	1	2.5	0	0	1	2.1
Grand total	40	100	7	100	47	100

* Includes the following cases: concentration variable is positive and statistically significant for one period but insignificant for another, positive and significant for one definition of "the" rate of profit and insignificant for another definition; significant for simple regression model but insignificant for a multiple regression model; significant when concentration ratio is 50 percent or more and insignificant otherwise; and some other cases of similar nature. Each case is related to a single study.

As I mentioned above, I take average (actual) rates of profit as a proxy for the target rate of profit and conclude that the level of industrial concentration does affect the target rate of profit which in turn (via equation 5.22 below) affects the mark-up.

As for the second part of hypothesis 2 (page 109), one has to keep in mind a clear distinction between overhead cost exclusive of research and development expenditures, then the latter, and finally planned capital expenditures designed exclusively for capacity expansion. As far as our hypothesis is concerned, we need evidence on the existence or non-existence of a relationship between the target rate of return and expenditures on capacity expansion. The crucial questions are the following: what is the empirical normal rate of capacity utilization? What is the range of actual rate of capacity utilization? When the actual rate of capacity utilization is equal or greater than Mrs Robinson's standard rate of output, and when capacity expansion becomes necessary, do the firms' decision makers increase the target rate of return (and therefore the mark-up) in order to finance that expansion?

Now, empirical evidence suggests that capacity utilization is the most important factor which limits the rate of investment.[29] If the actual rate of capacity utilisation were below the normal rate, then no capacity expansion would be warranted. As a result no finance (for that purpose) would be needed, which in turn means that the mark-up must undergo no increase. On the other hand, if the firm were operating at the normal rate of capacity utilization, it means that the firm is in a state of short and long term equilibrium which in turn means that the actual level of gross profit must be equal to its ex ante level. The equality of the actual level of gross profit with its planned level means that financing the planned capacity expansion has already been taken into consideration. The latter statement necessitates that the mark-up must remain unchanged.

The above argument leaves us with the case when the actual rate of capacity utilization is beyond the normal rate. Here, the acceptance or rejection of the post Keynesian position expressed in the second part of hypothesis 2 (page 109 above) must be based on field investigation. In what follows, I shall assume that the amount of finance needed for capacity expansion, when the plant is operating beyond the normal rate of capacity utilization rate, does not affect the target rate of profit, and comes from:

(i) Amortisation fund

(ii) Retained net profit

(iii) New share issues, or bonds.

The above assumption implies that a_j of equation 5.21 is assumed to be zero. As for hypotheses 3 and 4, (page 109 above) they are reasonable approximation of reality in advanced capitalist economies. As for the power of trade unions evidence, (some of which is indirect) seems to support Baran and Sweezy's(1966) argument that, under oligopoly capitalism, trade unions' power is effective in affecting money wage rate but ineffective in changing the degree of monopoly[30,31].

The preceding argument, evidence, and assumption reduce equation 5.21 into the following:

$$r_j = \frac{(F_j/Q_j^n) + \pi^*(CR_j)K_j/Q_j^n}{m_j(Q_j^*/Q_j^n)} \tag{5.22}$$

Now, if we assume that F_j/ Q_j^n is correlated with the advertisement to shipments ratio, where the latter is a statistically significant variable in Weiss's "Yet Another Study"[32] then we can say that equation 5.22 represents the essence of the price fixing process under oligopoly capitalism. We can incorporate in it a number of things of which the following two are of importance:

(1) The effect of technical progress on the mark-up.

(2) The case when price-wage (or wage-price) inflation is under way.

In the first, to simplify, we assume the firm's capital-output ratio is unchanging. Now, the discontinuous embodiment of technical progress leads to discontinuous reduction of m_j . If CR_j and Q_j^*/Q_j^n were to remain the same, then the percentage mark-up must undergo discontinuous upwards movement. The second case makes equation 5.23 as follows:

$$r_j m_{jt} = \frac{(F_j/Q_j^n) + \pi^*(CR_j)K_j/Q_j^n)}{(Q_j^*/Q_j^n)} \qquad (5.23)$$

The above equation implies that: When variable cost increases by a given percentage, when that increase is fully passed onto price by the firm, and when actual sales remain close to Q_j^* <u>then</u> every member of the management can get salary (or fees) increases per period proportional to the rate of price inflation...

5.8 <u>A Link and a closing note</u>:

In the present chapter we made an attempt at constructing two formulae for the determination of the percentage mark-up (without recourse to any form of short-run maximisation 'principle') which are to be regarded as ways of representing the actual practices under oligopoly capitalism. Equation 5.22 represents the core of mark-up determination under case I while equation 5.19 represents the core of mark-up determination under case II. In the present sub-section I shall reformulate equation 5.22 such that it conforms to our (Kalecki-Sraffa-Leontief based) view of the economic system. In the presence of fixed capital with identical production period in all industries (see chapter 8 below), and abstracting from all other mathematical expressions[33], the percentage mark-up equation (for industry 1) which corresponds to equation 5.22 above, becomes as follows:

$$r_1 = \frac{\left(\dfrac{P_{3,0}\, a^0_{31}\, x^*_1}{\bar{n} x^c_1}\right) + \pi^*_1 \left[\dfrac{K_1}{\bar{n} x^*_1}\right]}{m_1 \left(\dfrac{x^*_1}{x^c_1}\right)} \tag{5.24}$$

$P_{3,0}$ = the price of the new machine produced in industry 3.

a^0_{31} = unit of technical capacity output of the machines per unit of gross output of industry 1.

K_1 = financial capital

$\bar{n}$ = number of production processes

x^c_1 = capacity output of industry 1

The mark-up equations which we synthesised in the present chapter, i.e. equations 5.19 and 5.22, are basic equations in this thesis. Both must be regarded as approximations to mark-up determination in an industry in an advanced capitalist economy. If they lead the reader to raise questions regarding their degree of realism, I would refer him (or her) to the field investigations.

Notes to Chapter 5

[1]Penrose, E. (1985), p.8.

[2]Penrose, E. (1985), p.7.

[3]See Coutts et al. (1978), p.44; Sylos-Labini (1979a), p.6; Cowling (1982), pp.6-7; and Morisihima (1984), p.26.

[4]Kalecki (1979), pp.44-47.

[5]Means (1935); Means (1972); Hall and Hitch (1939); Godley and Nordhaus (1972); Coutts et.al. (1978), ch.4.

[6]According to UK employment statistics, 1983, 23% of total employment is concentrated in production sector. In the US, 1983, 20% of total employment is concentrated in manufacturing only. See: UK, CSO, Annual Abstract of Statistics, 1985, p.108; US Department of Commerce, Bureau of Census, Statistical Abstract of the United States, 1985, p.387, 395.

[7]See: Sylos-Labini (1974), pp.17-20, 30, 48, 71-73.

[8]Kaldor (1976), pp.704-708; Robinson (1980b), p.9.

[9]When the MC curve is flat, neoclassical profit maximization implies bankruptcy for all firms. See Robinson (1947), pp.73-74.

[10]Latsis (1976) pp.23-33.

[11]See: Lester (1946); Steindl (1952), p.1; Davidson (1978),pp. 37-39.

[12]See references in footnote 5 above.

[13]See Sylos-Labini (1974) pp. 2-4, 67-70; Koutsoyiannis (1979), Ch. 14.

[14]See: Koutsoyiannis (1979) pp.305-306, 312-322.

[15]For methodological evaluation, see: Latsis, ibid.

[16]Eichner (1973); Eichner (1983); Harcourt and Kenyon (1976).

[17]Robinson (1969) pp.183-186.

[18]See section 5.7 for a more general formulation.

[19]See appendix (2) for a step by step derivation of Cowling's mark-up equation, 5.3.

[20]See Robinson (1980b) p.9.

[21]Kalecki (1971), pp.43-44.

[22]Ibid., pp.47, 49-52.

[23]Steindl, Ibid., pp.52-106, 133. The term "increasing returns to scale" is generally used to connote the case of more than proportionate increase in gross output in response to a proportionate

increase in all "factors". It seems to me that (taking into consideration the fact that excess capacity is endemic under oligopoly capitalism) the terms should be used to connote the case of less than proportionate increase in total cost, at capacity level, in response to a given proportionate increase in capacity output. This use of the term covers the highly theoretical case of the proportional expansion of all factors associated with more than proportional increase in capacity output, as a special case. It is also consistent with the case when long term total cost curve shifts bodily downwards, over time.

[24]The treatment of (Q_j^*/Q_j^n) as a choice variable appears in Harcourt and Kenynon (1976), pp.452-453.

[25]See page below for the definition of the production period.

[26]In formulating this hypothesis, I benefited from Heathfield (1979), pp.157-188; see also Ackley (1961), pp.355-358.

[27]Lanzillotti, (1958) pp. 929-930

[28]Robinson (1969), pp.185-186.

[29]Cowling (1982), pp.46-48

[30]See Baran and Sweezy (1966), pp. 84-86; Weiss (1966) and Mulvey (1976).

[31]Cowling (1982), pp.104-111

[32]Weiss (1974) pp. 227-231.

[33]See Appendix (3).

Chapter 6: A Simple Inter-Industrial Model of Price Inflation

6.1 A Reminder

In the first chapter, if I may remind the reader, I stated that the aim of this thesis is to apply the surplus approach to economic analysis to the analysis of price inflation, under oligopoly capitalism. With that approach in mind, I found it necessary to reclassify the current theoretical explanations of the phenomenon into three theories:

(i) the A-Conflict theory of price inflation

(ii) the Implicit-Conflict theory of price inflation, and

(iii) the Explicit-Conflict theory of price inflation.

Almost all theorists handle the analysis of the phenomenon exclusively with macroeconomic tools; price inflation is a macroeconomic topic, and works like those of Leontief and Sraffa (among others) fall outside macroeconomics and are considered irrelevant to the analysis of that monetary phenomenon. Economists of the "macro" persuasion either hold the view that price inflation is the direct result of faster growth rate of "money supply" than the growth rate of labour productivity or the view that it is a symptom of conflict between different socio-economic groups over income distribution.

By putting together some quotations which identify the divergent methodological positions of a number of prominent thinkers, it was possible for me to say (in chapter 3) that the macroeconomic approach is, to put it mildly, unhelpful to the serious analyst in addressing the following five questions:

(i) what initiates the inflationary process ?

(ii) how does price inflation creep over the various industries which make up the economic system ?

(iii) how do sectoral, i.e. industrial, rates of price inflation accelerate or decelerate ?

(iv) who are the beneficiaries and who are the losers, in the income sense, from the outbreak of price inflation in the economic system ? and

(v) how could it be controlled, without inflicting further injustice on those adversely affected by the inflationary experience ?

I maintain that greater understanding of that difficult phenomenon cannot be achieved without abandoning the macroeconomic approach to its analysis. If you were to ask me for the alternative, I would say: It is Sraffa's approach to economic analysis culminating in his book Production of Commodities by Means of Commodities. One should not be surprised at seeing no one referring to that book when looking at any reasonably selected sample of works on price inflation under oligopoly capitalism published during the 1970's. However, it is surprising that after two decades of drawing downwards sloping wage-profit frontiers, the mechanism by which relative prices change under oligopoly capitalism is still missing.

I put this question to the Sraffians: Is it illegitimate to argue that, under oligopoly capitalism, price inflation is the mechanism by which the system of relative prices tends to adjust ? If it were legitimate, and if a logically coherent answer to that question were to be submitted, then it would be possible to achieve two objectives. First: Clear answers to each of the above five questions would be attained. As a result, a clear understanding of the phenomenon (which is a precondition for policy) is achieved. Second: and this is also important, the analysis of price inflation would, of necessity, be bodily lifted from macroeconomics in order to be fitted as a chapter in an introductory text on Sraffa's Economics, whose title could be: The Transmission Mechanism for Relative Prices; a task for another thesis.

In order to achieve the first objective, it was necessary to start by laying down a number of building blocks. The first building block was the subject of chapter 4, where I constructed a wage equation suitable for the task at hand. The second building block was the subject of chapter 5, where I constructed a (sectoral) mark-up equation. As for "money supply", it is given a low key in the present chapter. My task now is to put these building blocks together in such a way that a simple coherent structure emerges. Having done that, I will then proceed to answer each of the five questions above. My ultimate task is to defend the following hypothesis:

In advanced capitalist economies, conflict over income distribution is the cause of price inflation.

6.2 A Simplified Inter-industrial Model of Price Inflation:

The hypothetical economy represented by the model below is composed of three sub-systems. After setting out the assumptions upon which each sub-system rests and after setting out the specification of each; the three sub-systems are put together to make a coherent whole. I then put the full model in the short term equilibrium state as a prerequisite for identifying what initiates the inflationary process in the first place. Having done that, I then disturb (or shock, if you like) the system by an inflationary disturbance and by studying the disturbed system answer the remaining four questions raised above.

6.2.1 Assumptions:

The main set of assumptions upon which the model is based are the following:

i. We consider a closed capitalist economy composed of three basic industries. Each industry is characterised by single process - single product fixed technology. Physical capital stock is circulating. Each industry is dominated by a group of oligopolistic firms on the product side and by highly organised labour force in the labour market.

ii. In each industry the dominant firm(s) fix output prices by marking up average variable cost . The mark-up is not directly sensitive to the state of excess demand and depends on the degree of monopoly prevailing in the industry.

iii. Money wage rates are sectorally and periodically negotiated between workers' representatives and the management. At the end of the wage negotiation the negotiating parties agree upon a given money wage rate, which is assumed to prevail during the whole period of the binding wage contract .

iv. The wage bill contracted at the beginning of period t is paid at the end of that period, and spent wholly on consumption goods during period $t+1$. Sales of wage goods during period $t+1$ determines the level of output and employment in wage goods sector for period $t+2$. The same argument applies to the part of non wage income designed to be spent on consumption goods.

v. Labour input is homogeneous.

6.2.2 Model Specification

(i) The price/wage system and the mark-up equation:

For simplicity it is assumed that in all industries firms follow the same version of historic cost pricing method. Given that assumption, we can formulate the price/wage system and the mark-up equation as follows:

$$P_{jt} = (a_{1j}P_{1,t-1}+a_{2j}P_{2,t-1}+a_{3j}P_{3,t-1}+\ell_j w_{t-1})(1+r_j) \tag{6.1}$$

$$w_t = w_{t-1} \left\{ \left[1 + \frac{P_{t-1} - P^e_{t-1}}{P_{t-2}} \right] (P^e_t / P_{t-1}) (1 + g) \right\}^{K(U_{t-1},T)} \tag{6.2}$$

$$r_j = \bar{r}_j \qquad j = 1,2,3 \tag{6.3}$$

where P_{jt} = the price of commodity j, fixed at the beginning of period t.

w_t = money wage rate fixed at the beginning of period t

P_t = a relevant price index

P^e_t = expected price index

g = the percentage increase in money wage reflecting worker's "militant" behaviour

a_{ij}, ℓ_j = material input and direct labour input per unit of output of commodity j, respectively.

$\bar{r}_j$ = is the percentage mark-up for commodity j, assumed given.

Equation 6.1 is based on assumption (ii), i.e. all dominant firms in each industry follow the mark-up pricing rule.

The rationale for using $P_{j,t-1}$ and w_{t-1} with a_{ij} and ℓ_j, respectively, is that production takes time. It is assumed that production period, defined as the length of time between buying the input and selling it in the form of finished product, is of one standard period. If input prices were to go up at the beginning of period t, after one time period, the new product price would appear at the beginning of period $t+1$.

Equation 6.2 is a slightly restricted version of equation 4.36 of chapter 4. Equation 6.3 is a very restricted version of equation 5.23, of chapter 5.

(ii) The Physical System

The specification of the physical system is much less realistic in its assumption than the specification of the price/wage system, and the mark-up "equation". However, it seems to me that a more realistic, and therefore more complicated, formulation of the physical system would not invalidate the main conclusions of the less realistic specification.

Following Kalecki (1971), it is assumed that the wage bill is wholly spent on consumption goods while capitalists' profits, partly, finance their consumption spending. As for investment expenditures, I have drawn heavily on Kalecki's work and on the results of the empirical work presented by Cowling (1982, pp.44-48). As for the response of output to changes in demand, it is assumed that causality runs from the volume of sales to changes in actual level of inventory (or orders), to output decisions to the actual level of output. This assumption is not an unrealistic assumption as far as non-primary sectors are concerned.

Workers' and Capitalists' Consumption Demand:

Following Morishima et al (1972, p.79) and Steedman (1979a, p.16), we assume that consumption expenditure for period t is divided between different commodities in fixed proportions. Applying this argument to the wage bill, we get the following relation:

$$\begin{bmatrix} C_{w1t} \\ C_{w2t} \\ C_{w3t} \end{bmatrix} = \begin{bmatrix} \theta_1 \\ \theta_2 \\ \theta_3 \end{bmatrix} w_{t-1} N_{t-1} \tag{6.4}$$

using assumption iv . $\theta_1 + \theta_2 + \theta_3 = 1$, C_{wjt} = workers consumption expenditures on commodity j , and $w_{t-1}\ N_{t-1}$ is the wage bill paid at the end of period t-1 . To translate the money flows, C_{wjt} into physical flows we must divide C_{wjt} by P_{jt}, assumed to be fixed at the beginning of period t . By dividing each money flow by the relevant price, we get the following relation:[1]

$$\begin{bmatrix} w^*_{1t} \\ w^*_{2t} \\ w^*_{3t} \end{bmatrix} = \begin{bmatrix} 1/P_{1t} & 0 & 0 \\ 0 & 1/P_{2t} & 0 \\ 0 & & 1/P_{3t} \end{bmatrix} \begin{bmatrix} \theta_1 \\ \theta_2 \\ \theta_3 \end{bmatrix} w_{t-1} N_{t-1} \tag{6.5}$$

where w^*_{jt} is the quantities of commodity 'j' purchased by the workers during period t .

Applying the same argument to consumption expenditures of non-wage earners for period t , we get the following quantities of commodity j purchased by them:

$$\begin{bmatrix} C^*_{1t} \\ C^*_{2t} \\ C^*_{3t} \end{bmatrix} = \begin{bmatrix} 1/P_{1t} & 0 & 0 \\ 0 & 1/P_{2t} & 0 \\ 0 & 0 & 1/P_{3t} \end{bmatrix} \begin{bmatrix} \lambda_1 \\ \lambda_2 \\ \lambda_3 \end{bmatrix} C^c_t \tag{6.6}$$

where $\lambda_1+\lambda_2+\lambda_3 = 1$. $C_{ct} = \beta_0+\beta_c\Pi_{t-1}$ is the non-wage earners' consumption function. It implies that non-wage earner's consumption is composed of two components one of which is constant in the short-run β_0. The other is a linear function of last period's gross profits Π_{t-1}, with β_c as the marginal propensity to consume by non-wage earners. This specification of capitalists' consumption function is close to Kalecki's own (1935) specification[2]. The definition of Π_t, which is based on the assumption that all firms follow historic cost pricing, is as follows:

$$\Pi_t = [\underline{P}_t\underline{x}_{t-1} - (\underline{P}_{t-1}A + w_{t-1}\underline{\ell})\underline{x}_{t-1}] + [\underline{P}_{t-1}A + w_t\underline{\ell})\Delta\underline{V}_t \qquad (6.7)$$

with $\underline{P}_t = [P_{1t}\ P_{2t}\ P_{3t}]$, vector of nominal prices.

w_t = the money wage rate

$\underline{x}_t = [x_{1t}\ x_{2t}\ x_{3t}]'$ vector of gross output, produced during period t and supplied for sales in period t+1.

$\Delta\underline{V} = [\Delta V_{1t}\ \Delta V_{2t}\Delta V_{3t}]'$ vector of actual change in inventories measured as the difference between stocks at the end of period t and the stock at the end of period t-1.

Government Demand

Government expenditures are assumed to be on goods and services produced in the private sector. These goods are 'material' and labour inputs. If we make the fixed proportions assumption for government spending, G^m_{1t}, we can translate G^m_{1t} into a vector of physical demand as follows:

$$\begin{bmatrix} G^*_{1t} \\ G^*_{2t} \\ G^*_{3t} \\ L_{gt} \end{bmatrix} = \begin{bmatrix} 1/P_{1t} & 0 & 0 & 0 \\ 0 & 1/P_{2t} & 0 & 0 \\ 0 & 0 & 1/P_{3t} & 0 \\ 0 & 0 & 0 & 1/w_t \end{bmatrix} \begin{bmatrix} \phi_1 \\ \phi_2 \\ \phi_3 \\ \phi_4 \end{bmatrix} G^m_{1t} \qquad (6.8)$$

where L_{gt} is government demand for labour input, w_t is the money wage rate fixed at the beginning of period t and $\phi_1+\phi_2+\phi_3+\phi_4 = 1$.

$$G^m_{1t} = G^m_{1,t-1}(P^e_t/P_{t-1})^{\eta}(1+f) \qquad (6.9)$$

where P^e_t is the expected price index; η and f are fiscal policy parameters (see ch.7, section 7.7 below).

Inventories and their relation to planned and actual level of gross output:

As for the relationship between planned and actual output on the one hand, and the level of inventories on the other, we shall use our earlier formulation (see chapter 5, section 5.7 above). However, for consistency with what will follow, we shall use different notation.

(1) The change in actual level of inventories, $\Delta\underline{V}_t$, during period t is defined as the difference between the volume of sales during period t, $\underline{x}^{sa}_t$ and the level of output supplied in period t, $\underline{x}_{t-1}$. Formally, we have:

$$\Delta\underline{V}_t = \underline{x}^{sa}_t - \underline{x}_{t-1} \qquad (6.10)$$

with the obvious implications that:

$$\underline{V}_t = \underline{V}_{t-1} + \underline{x}^{sa}_t - \underline{x}_{t-1} \qquad (6.11)$$

where $\underline{V}_t$ is the actual level of inventories at the end of period t. The interpretation of equation 6.10 is as follows: the actual level of output, decided upon at the beginning of period t-1 becomes ready for sale at the beginning of period t. The amount actually sold during period t is $\underline{x}^{sa}_t$. The difference between $\underline{x}^{sa}_t$ and $\underline{x}_{t-1}$ is met by inventory variation.

(2) The relationship between the gross output vector, $\underline{x}_t$, and the level

of inventory is assumed to be as follows:

$$\underline{x}_t = \underline{x}^{sa}_{t-1} + \lambda(\underline{V}_{t-1} - \underline{V}^*_{t-1}) \qquad 0 < \lambda < 1 \tag{6.12}$$

(3) As for the vector of desired inventories at the end of period t , $\underline{V}^*_t$, it is assumed to be a lagged function of actual volume of sales. Formally, we may define

$$\underline{V}^*_t = \sum_{i=1}^{k} \alpha_i \underline{x}^{sa}_{t-i} \tag{6.13}$$

Since $\underline{x}^{sa}_t = A\underline{x}^{sa}_t + \underline{D}_t$ (6.14)

it follows that:

$$\underline{x}^{sa}_t = (I-A)^{-1}\,\underline{D}_t \tag{6.15}$$

Therefore,

$$\underline{x}_t = (I-A)^{-1}\underline{D}_{t-1} - \lambda(\underline{V}_{t-1} - \underline{V}^*_{1-t}) \tag{6.16}$$

where:

I is a 3x3 identity matrix; A is the 3x3 technical coefficients matrix. From equations 6.8 and 6.16 we get:

$$N_t = \underline{\ell}\,\underline{x}_t + Lg_t \tag{6.17}$$

Equation 6.17 shows total employment (in man-hour) in the economy as made up of two parts: total employment in the capitalist sector, $\underline{\ell}\,\underline{x}_t$; and total employment in the government sector, Lg_t.

Note on Investment Demand:

The present model implies the decomposition of investment demand into two components. The first is the addition to the physical stock of circulting capital needed to sustain a given level of final demand. This component is taken care of under the specification of $\underline{x}_t$ (equation 6.16 above). The second component, which may be zero, is exogenous. We shall assume that there is an exogenous level of investment demand, denoted by $\underline{\bar{I}}^*$, which is independent of the level of current economic ctivity and prices. This assumption enables us to write the current value of the exogenous part of investment demand as follows:

$$\bar{I}^m_t = \begin{bmatrix} P_{1t} & 0 & 0 \\ 0 & P_{2t} & 0 \\ 0 & 0 & P_{3t} \end{bmatrix} \begin{bmatrix} \bar{I}^*_1 \\ \bar{I}^*_2 \\ \bar{I}^*_3 \end{bmatrix} \tag{6.18}$$

In the relevant parts of this thesis, we shall use the notation $\bar{I}^* = [\bar{I}^*_1\ \bar{I}^*_2\ \bar{I}^*_3]'$ to represent the aforesaid exogenous part of investment demand.

(iii) The financial system:

We shall assume that the financial system is made up of the banking system plus the treasury. Its structure is as follows:[3]

$$M_{dt} = m_0 + m_1 Y^m_t - m_2 i_t \tag{6.19}$$

$$M^P_t = \left[\frac{1+\varepsilon}{\sigma+\varepsilon}\right] H_t \tag{6.20}$$

$$H_t = H_{t-1} + \Delta H_t \tag{6.21}$$

$$\Delta H_t = \Delta H^G_t + \Delta H^{bank}_t \tag{6.22}$$

$$\Delta H_t^G = \left\{ G^m_{1,t-1} \left[\frac{P_t^e}{P_{t-1}} \right]^{\eta} (1-f) + G^m_{2t} \right\} - R_t \qquad (6.23)$$

M_{dt} = demand for money

M_t^P = potential money supply

Y_t^m = nominal national income

$i_t = \bar{i}$, the nominal (basic) rate of interest (6.24)

H_t = stock of high powered money

ΔH_t^G = new "borrowing", of the other governmental units from the central bank.

ΔH_t^{bank} = new borrowings of the commercial banks from the central bank.

G^m_{1t} = Government expenditures on commodities and labour services.

G^m_{2t} = debt-service by the government

R_t = total (profit tax) revenues received by the government at the end of period t-1.

m_0, m_1 and m_2 are constants; ε is the fraction of their total bank deposits the non-bank public hold in cash; and σ is the legal minimum reserves ratio.

Equation 6.24 suggests that the current nominal rate of interest is predetermined, with the implication that money supply is assumed endogenous. In what follows, I shall abstract from the non-bank public holdings of bonds.

6.3 Short term accidental equilibrium; the starting point:

The question "where to start?" is a basic one. It needs to be addressed before one starts the analysis of price inflation, which is normally a disequilibrium phenomenon. It is a disequilibrium phenomenon because it expresses a state of disequilibrium in the economy, in the sense that all expectations with respect to period t are not realised. Now, starting with an economic model designed to reflect a snap-shot of an economy in a state of disequilibrium would, in my view, be useless for the analysis of price inflation. It is useless simply because it does not enable the serious analyst to show what initiated the inflationary process in the first place. And if one did not know what initiated the price-wage spiral, could he utter a word on its control?

Therefore, the response to the question "where to start?" should be: by putting the economic system on the state of equilibrium path.

The next question which logically follows is this: In what state of equilibrium should the economy be "placed"?

A quick look at table (3) below should lead to an immediate answer. The table is based on Joan Robinson's (1969) "The Meaning of Equilibrium" and Robinson (1971) "The Short Period"[4].

Table 3 showing the states of the economic system

The equilibrium/disequilibrium state of the economy			
Long-term equilibrium		Long-term disequilibrium	
I Stationary	II Moving	III Short-term equilibrium	IV Short-term disequilibrium

As is clear from block III above, the economy can hypothetically be in a state of short-term equilibrium within a state of long-term disequilibrium. One implication of that equilibrium/disequilibrium state is that the actual rate of profit is not the same for each firm and industry. I am going to start the analysis of price inflation with the assumption that the system as a whole is in a state of short-term equilibrium. I prefer to state explicitly that this short-term equilibrium state can only be "reached" by accident; hence the use of the term short-term accidental equilibrium.

Now, an inflationary disturbance (external or internal) which perturbs that fragile state of equilibrium leads the whole system to plunge into a state of short-term disequilibrium (block IV). The sort of economic analysis which deals with such a state is, of course, short-term disequilibrium dynamics. It is that branch of economics which deals with the discovery of the economic laws according to which the units of an actual economy, at a specific stage of capitalist development, behave. It is difficult for me to call such a sort of analysis a "transition to equilibrium" analysis, because that name is based on the belief that under oligopoly capitalism the economic system is stable[5].

6.4 Some Theoretical Analysis

I start first with the assumptions. The more realistic they are, the more realistic is what we build on them, and the more meaningful is the analysis resulting from that building, or model. The crucial assumptions upon which I constructed the price system, the physical system, and the financial system are the following:

1) The core of the economy, however large the number of the industries composing it, is an input-output matrix. That matrix is a technical coefficients matrix which dictates the necessary amounts of material inputs, and of direct labour input, per unit of gross output. These inputs, together with their respective prices (fixed at the beginning of the period), determine average variable cost per unit of gross output.

2) The leading firm in each industry fixes its price by marking-up average variable cost. The mark-up is not directly sensitive to changes in demand and it depends on the degree of monopoly prevailing in the relevant industry.

3) The sectoral money wage rate is fixed after a complex negotiation process, in which the concept of 'marginal product of labour' is irrelevant.

4) Output is a function of effective demand.

5) "Money supply" is demand determined.

6) There exist legally enforceable contractual arrangements.

The above set of assumptions, together with another set of simplifying assumptions, led to the formulation of three important subsystems representing an economy assumed to be emerging from last period's short term equlibrium:-

(1) The price/wage system and the mark-up equation:

$$
\begin{aligned}
P_{1t} &= (a_{11}P_{1,t-1} + a_{21}P_{2,t-1} + a_{31}P_{3,t-1} + \ell_1 w_{t-1})(1+r_1) \\
P_{1t} &= (a_{12}P_{1,t-1} + a_{22}P_{2,t-1} + a_{32}P_{3,t-1} + \ell_2 w_{t-1})(1+r_2) \qquad (6.25) \\
P_{1t} &= (a_{13}P_{1,t-1} + a_{23}P_{2,t-1} + a_{33}P_{3,t-1} + \ell_3 w_{t-1})(1+r_3)
\end{aligned}
$$

$$w_t = w_{t-1} \left\{ \left[1 + \frac{P_{t-1} - P^e_{t-1}}{P_{t-2}} \right] \left[\frac{P^e_t}{P_{t-1}} \right] (1+g) \right\}^{K(U_{t-1},T)} \qquad (6.26)$$

$$r_j = \bar{r}_j \qquad j = 1,2,3 \qquad (6.27)$$

(2) The physical system and the employment equation:

$$\underline{x}_t = \underline{x}^{sales}_{t-1} - \lambda(\underline{V}_{t-1} - \underline{V}^*_{t-1}) \quad (6.28)$$

$$\Rightarrow \underline{x}_t = (I-A)^{-1}\underline{D}_{t-1} - \lambda(\underline{V}_{t-1} - \underline{V}^*_{t-1}) \quad (6.29)$$

$$\underline{D}_t = F(\underline{P}_t, \underline{P}_{t-1}; W_{t-1}, N_{t-1}; \Pi_{t-1}; \underline{\bar{I}}^*; G^m_{1,t-1}) \quad (6.30)$$

(see 6.32 below)

$$\underline{V}^*_t = \sum_{i=1}^{k} \alpha_i \underline{x}^{sales}_{t-i} \quad (6.31)$$

By backwards substitution (see equations 6.5 - 6.17), we get the following complicated equation for the determination of the level of employment for period t :

$$N_t = \underline{\ell}\,(I-A)^{-1}\left\{\begin{bmatrix} 1/P_{1,1-t} & 0 & 0 \\ 0 & 1/P_{2,t-1} & 0 \\ 0 & 0 & 1/P_{3,t-1} \end{bmatrix}\left(\begin{bmatrix}\theta_1\\ \theta_2\\ \theta_3\end{bmatrix} w_{t-2}N_{t-2} + \begin{bmatrix}\lambda_1\\ \lambda_2\\ \lambda_3\end{bmatrix} C^c_{t-1} + \begin{bmatrix}\phi_1\\ \phi_2\\ \phi_3\end{bmatrix} G^m_{1,t-1}\right)\right.$$

$$\left. + \begin{bmatrix}\underline{\bar{I}}^*_1\\ \underline{\bar{I}}^*_2\\ \underline{\bar{I}}^*_3\end{bmatrix}\right\} - \lambda(\underline{V}_{t-1} - \underline{V}^*_{t-1}) + \frac{1}{w_t}\phi_4 G^m_{1t} \quad (6.32)$$

with $\ell = [\ell_1 \ell_2 \ell_3]$, the vector of the direct labour input per unit of output.

(3) The Financial System and the government sector:

$$M_{dt} = m_0 + m_1 Y^m_t - m_2 i_t \quad (6.33)$$

$$M^P_t = \left(\frac{1+\varepsilon}{\sigma+\varepsilon}\right)\left\{H_{t-1} + \left[G^m_{1t}\left(\frac{P^e_t}{P_{t-1}}\right)^{\eta}(1+f) + G^m_{2t} - R_t\right] + \Delta H^{Bank}_t\right\} \quad (6.34)$$

$$R_t = \tau\Pi_{t-1} \quad (\tau = \text{profit tax rate}) \quad (6.35)$$

$$i_t = \bar{i} \quad (6.36)$$

The above three subsystems, together, make up a "simplified" miniature of a closed "advanced" capitalist economy. It is really a complicated system. We now use the whole system to give an answer to each of the questions raised on pages 124 & 125. It is the first step in the long series of steps which should finally lead to the empirical testing of the central hypothesis of this thesis.

6.4.1 A once and for all increase in the mark-up in a single industry:

Let us assume that, after a hectic period of capital centralization through a wave of merger activity, the level of "concentration" in industry 1 increased to such a level that the dominant firm (or firms) in that industry decided to increase the target rate of return on finance capital invested by them in the industry. This means the target rate of profit π_1^* in that industry goes up and, as a result, the percentage mark-up in industry 1, i.e. r_1 goes up (see ch.5, equation 5.23). The higher mark-up leads immediately to two things. The first thing is a successful attempt to change income distribution in favour of the capitalists in industry 1. Now, by assumption, capital centralization in the remaining industries is unchanged. In the presence of a sufficiently high rate of unemployment (assume the labour force is constant), the change in income distribution has been in favour of the capitalist class as a whole. This in turn means that income distribution is changed against the workers in all industries. This, ceteris paribus, will have negative employment effects[6].

Since, by assumption, the rate of unemployment is very high, and workers' organization is fragile, the value of $K(U_{t-1},T)$ in equation 6.26 would be close to zero. This in turn means that $w_t = w_{t-1}$. Therefore, as a result of the once and for all increase in r_1, a mild price inflation is generated. The way this mild price inflation is generated is simple to explain. Due to the higher mark-up in sector 1, output price for that industry goes up at the beginning of period t. This means there will be a higher cost per unit in all industries which use the output of industry 1 as input. Using the assumption of a universal historic pricing rule, the higher cost gets passed on to price at the beginning of period t+1 in these industries. In response to that, in period t+2, industry 1 increases its price which in turn leads to higher prices in the other industries which use the output of that industry as input. The process goes on until the price-system converges to its equilibrium counterpart, $\underline{P}^E$, where[7]

$$P^E = w\underline{\ell}(I+\hat{R})[I-A(I+\hat{R})]^{-1} \tag{6.37}$$

Convergence is assumed because $w > 0$ and $0 \leqslant a_{ij}P_i \,/\, \sum_{i=1}^{3} a_{ij}P_i < 1$ for all i,j. This analysis tells nothing about 'the' relationship between price inflation and the rate of unemployment unless we make specific assumptions about the actions the government takes in response to the initial price rise and afterwards. This requires that specific values to the policy parameters η and f of equation 6.9 must be assigned before we make any statement on the relationship between the rate of price inflation and the rate of unemployment. If the government were to <u>increase its real purchases</u> such that the level of employment is maintained at its initial level(implying that $\eta=1$ and $f > 0$), there would be <u>no relationship</u> between price inflation and the rate of unemployment. On the other hand, if the government were <u>to maintain</u> its real purchases at their initial level, we would be having a <u>positive relationship</u> between price inflation and the rate of unemployment. This relationship is worked out via the physical system with which price inflation and unemployment are connected (see equation 6.32 above).

What would happen to the rate of price inflation if Hicks' (1975) Real Wage Resistance were to be introduced into the analysis after a number of periods following the increase in r_1 ?

Let me first reproduce the basic wage equation 6.26 for convenience:

$$w_t = w_{t-1}\left\{ \left(1 + \frac{P_{t-1}-P^e_{t-1}}{P_{t-2}}\right)\left[\frac{P^e_t}{P_{t-1}}\right](1+g)\right\}^{K(U_{t-1},T)} \tag{6.38}$$

In the above equation, the quantity g represents workers' wage claims due to both their "militancy" and to the higher productivity. However, since they did not initiate the inflationary process and since we are dealing with a "fixed co-efficients system", it follows that the value of g must be zero. Accordingly, equation (6.38) becomes:

$$w_t = w_{t-1}\left\{\left(1 + \frac{P_{t-1}-P^e_{t-1}}{P_{t-2}}\right)\left[\frac{P^e_t}{P_{t-1}}\right]\right\}^{K(U_{t-1},T)} \tag{6.39}$$

Following Henry et al (1976, p.67), we shall, for simplicity, assume that $P^e_t = P_{t-1}$. If we further assume , again for simplicity, that $K(U_{t-1},T) = 1$, then we get:

$$w_t = w_{t-1}\left[\frac{P_{t-1}}{P_{t-2}}\right] \tag{6.40}$$

Equation 6.40 is a very simple mathematical expression of Hicks' Real Wage Resistance hypothesis, coined more than a decade ago.

The incorporation of that equation in the price system 6.25 above, leads immediately to a faster rate of price inflation. More importantly, and from the moment equation 6.40 is incorporated in to the price system, the analyst can talk of wage inflation for the first time. Also, he can safely say that wage inflation has not been initiated by the workers. That can be said now because we did not start the analysis with the system being in a state of short term disequilibrium.

After a sufficient number of periods and so long as the workers abstain from anticipating price inflation, the latter would stabilize at a constant rate of ϕ, say. Under these circumstances, the price vector takes the following moving equilibrium form[8]:

$$\underline{P}_t^E = w_t \, \underline{\ell}(I+\hat{R})[I-A(I-\hat{R})]^{-1} \tag{6.41}$$

$$w_t = (1+\phi)^t \, w_o \qquad 0 < \phi < 1 \tag{6.42}$$

Needless to say, should the government decide to follow a fiscal policy which more or less maintains the rate of unemployment at its initial level, the policy parameter values of the function

$G^m_{1t} = G^m_{1t-1}\left[\frac{P^e_t}{P_{t+1}}\right]^{\eta}(1+f)$ must both be positive, with $\eta = 1$ and $f > 0$. If the budget deficit were to be financed by "borrowing" from the central bank, then money supply must be growing at a rate of ϕ. The reader will remember that price inflation in the present case was initiated by a once and for all increase in the mark-up in industry 1, and nothing else.

6.4.2 An increase in money wage rate:

The case presented above is one of the cases in which the workers play no causal role in the inflationary process. The case in which they do play a causal role is the one when the workers attempt to secure (mostly unconsciously) a greater relative share in net national income and face a rigid resistance by the capitalists through rigid mark-up resistance mechanism. Here we have two cases: a once and for all increase in money wage rate, which leads to a period of price inflation during which its rate converges to zero. The second case is when the workers persist in their attempt to increase their relative share in national income, the result of which is a stable rate of price inflation so long as the workers do not anticipate price inflation . In this case, the moving equilibrium price vector, would be the following:

$$\underline{P}_t = (1+\phi)^t w_o . \underline{\ell}(I+\hat{R})[I-A(I+\hat{R})]^{-1} \tag{6.43}$$

The economy is undergoing a state of price inflation at a constant rate of ϕ.

Here, contrary to the case where price inflation was initiated by a once and for all increase in the mark-up in industry 1, price inflation is not associated with any change in relative prices. Again, we cannot say anything on the relationship between the rate of price inflation and the rate of unemployment without knowing what action the government takes (i.e. what values are assigned to η and f) in response to the initial inflationary experience. Suppose the government assigns values for both η and f such that a more or less constant rate of unemployment at its initial level is maintained. Suppose further that all of the budget deficit is financed by selling bonds to the central bank. Granted that, the money supply would be increasing at more or less the same rate as the rate of wage/price inflation. For all cases (except the case when w is assumed constant) one can find a positive relationship between money inflation and price/wage or wage/price inflation (see ch.10 below). That relationship, which may be econometrically "successful", tells nothing on causality in the inflationary process, contrary to the Friedmanites claim.

The analysis in case 6.4.1 and case 6.4.2 , supplies the answers to the first two questions raised on page 124 above. The increase in the mark-up or the increase in money wage rate each could be the cause of the break out of price inflation in the system. The input-output matrix is the vehicle through which inflationary impulses get transmitted from one industry to another. Workers' Real Wage Resistance does lead to a faster rate of price inflation. In the present model the "degree of monopoly" determines who is the loser from the inflationary experience in relative terms. In absolute terms, the loss inflicted on any social group depends on its relative income share as well as on the absolute level of real national income.

6.5 Summary and a closing note:

6.5.1 Summary

My main tasks in this chapter were twofold. The first task was to put together the seemingly separate material located in chapters 3,4,and 5. The result of that effort was a simple inter-industrial model of price inflation. Having achieved that task, I then used part of the model to trace the initiator of the inflationary process. In the first case, I dealt with the mark-up as the single initiator of that process. In a way, the analysis was no more than an elaboration on Means' (1975). He wrote "[s]ubsequent information has made it clear that the steel price rise involved a very considerable widening of steel profit margins, so that this particular administrative inflation was initiated as a profit push"[9].

I then dealt with the case which is familiar in today's classroom macroeconomics in which the workers are the "trouble makers". Needless to say, the two cases were based on much simplifying assumptions, and as a result, on a very simplified inter-industrial model of price inflation. However, the reader may consult chapter 10 for a more general case together with some simulations and some comments of deeper economic and distributional content.

6.5.2 Closing note:

The conclusions I arrived at in the last two sections are based on a model which abstracts from many essential elements of reality. It is assumed that the economy is closed, and uses a fixed technique and circulating (physical) capital to produce three basic goods. The production period is assumed to be the same for all industries and the mark-up pricing is the rule. The mark-up is generally assumed to be independent of the state of excess demand for the relevant product. Labour input is assumed homogenous, and the money wage rate is centrally negotiated and determined. The increase in demand for money during the inflationary period is fully met in a Kaleckian-Kaldorian fashion. In addition to the above set of assumptions, there is an extra set of assumptions added to further simplify the analysis.

No real world economy has any of these features. Every real economy is linked, in one way or another, with the rest of the world. Within each economy, fixed capital is produced and used with fixed capital being the means by which the new technical knowledge is transformed into productive capacity (or forces of production). The production period is not uniform[10]. Labour input is not homogeneous and wage negotiations and wage agreements are not synchronical and not centralised. And, finally, retail trade is an indispensable complementary part to the manufacturing sector. My task in most of the remaining parts of this thesis is to incorporate a number of these features into the model.

Notes to Chapter 6

[1]See Goodwin (1952) reprinted in Goodwin (1983b), pp.57-74.

[2]According to Kalecki (1935, p.327) "[t]he personal consumption of capitalists, C, is not very elastic". Kalecki specified capitllists' consumption function as follows:

$$C = C_1 + \lambda B$$

where C_1 is "a constant part"
λ "is a small constant fraction".
(see Kalecki, Ibid.)

[3]Greater attention to the financial system and credit money is given in chapter 7.

[4]Robinson (1969), pp.57-60, and Robinson (1971), pp.16-24, respectively.

[5]Accoring to Harrod (1939), the system is unstable.

[6]The reader may wish to consult appendix (4) for an analysis on the relationship between changes in real wage rate and the level of employment in the economy.

[7]See appendix (5) for a more general proof according to which equation (6.37) is a special case.

[8]See appendix (5).

[9]Means (1975), p.12.

[10]See: Coutts, e.al. (1978), p.40.

Chapter 7: Government Debt and Credit Money

7.1 The Supply price of money, the banking system "factor" income, and the nonbanking surplus:

The various roles "money" plays in modern capitalist economies -as a unit of account, as a means of exchange, and as a store of value -pivot on its possession of three important properties[1]: (1) The elasticity of employment with respect to its production is negligible, and for all practical purposes that elasticity can be safely assumed to be zero. The same thing may be said about other inputs alongside labour[2]. (2) There is a zero or negligible elasticity of substitution between "money" and all other non-financial assets. (3) There is a zero or negligible storage costs, transportation costs, interest charges, insurance charges, etc.

Of the above three properties, the first is of primary importance for the analysis of price inflation which occupies most of the parts of this thesis. This is so because that property rules out the existence of a positive supply price of money, and as a result it rules out the need for a separate process specific for the production of money to be present in the input-output matrix which forms the core of the economic system. The only modification that needs to be introduced to the physical system, at whose heart lies the input-output matrix, is to make the aggregate level of employment inclusive of the labour force engaged in the banking system. The latter, which is assumed to be identical to the financial system[3], acts as a supplier of no inputs to the remaining industries which make up the rest of the economic system.

Now, if the core of the economic system is separated from the money generating system, what is the link between the two? The answer to that question comes from the surplus approach to economic analysis. It goes like this:

Salaries and gross profits "earned" by the banking system are (roughly) equal to the payments made to it by the nonbank business sector to the former. These payments, which are made out of gross profits of the nonbank business sector, take one or a combination of the following forms:

(1) interest charges on bank credit and all other forms of loans extended by the banking system to the nonbank business sector.

(2) gross profit "earned" by the banking system exclusively due to its holding of shares of various types in the nonbank business sector.

Having sketched how the physical and financial systems are separated and how they are relinked via the financial route, I now move to the questions which I want to address in this chapter.

7.2 Some comments and the main question to be addressed:

It is widely accepted to one extent or another, especially among macroeconomists (who also teach or are ready to teach microeconomics) that changes in monetary policy lead, directly or indirectly, to changes in lending behaviour on the part of the banking system. Changes in lending behaviour in turn lead to changes in output-input (and possibly, pricing) decisions on the part of the nonbank business sector which makes up the remaining part of the economic system. The nonbank business sector is so wide a sector that it includes the shopkeeper round the corner, the mini-Co-op, the supermarket, etc. etc., until you reach the multinational corporation.

Also, it is widely accepted to one extent or another that changes in monetary policy lead to changes in wealth holding/expenditure behaviour on the part of the households sector. That nicely named sector is composed of the homeless individuals, the homeless families, the unemployed, the individuals and families with mortgaged homes, etc., etc., until you reach that section of the "household sector" whose wealth is so large that monetary policy has nothing to do with their life style.

It is the reaction of those involved in the above two "sectors" that forms the substance of the "transmission mechanism" with which changes in monetary policy are supposedly translated into higher or lower levels of real output, employment and prices, in the short term at least[4]. All "transmissions" are "transmitted" to the students of economics (who may become advisors, Ministers or even Prime Ministers), in the classrooms, though a macroeconomics course of one sort or another. On the micro level, especially when the teacher teaches "the theory of the firm", the transmission mechanism is forgotten. In fact, Hicks implicitly imposed a ban on those who would like to arrive, through the micro level, at macro conclusions. Look at what he wrote:

> Though some excellent papers were given, reviewers have rightly perceived that the conference [on micro foundations of macro economics, S'Agaro, Spain, 1975] as a whole was a failure. We did not get to grips with the question we were supposed to be discussing...One of the reasons...was that the question had been wrongly posed. It took for granted that "micro[economics]"...was a solid foundation, on which the more dubious "macro[economics]"...was to be built...We might have discussed, without attention to "micro[economics]", the foundations of macro-economics[5].

I do not here raise objections to the "transmission mechanism" which relates to wealth holding/spending behaviour in the "households sector". However, it is difficult for me to proceed futher in the analysis of price inflation, under oligopoly capitalism, without being absolutely clear on how the macro transmission mechanism works in the nonbank business sector, on the firm level. The way to achieve that, I think, is to address the following question:

Apart from its possible effect on investment in fixed capital, how do changes in monetary policy affect the level of output and hence employment, on the firm level ?

To the extent that this question is not answere realistically, an important part of the transmission mechanism would be unclear and the analysis of price inflation would , in my judgement, be unsatisfactory.

I must admit that, had I not been able to consult Sraffa's[6] article of 1926 and Kalecki's[7] works of 1937, 1939 and 1971 it would have been impossible for me to get to the above question; and to put in perspective what I learned from the (few) works to which I shall refer below. The essential points of the above two thinkers are the following:

According to Sraffa, an increase in demand for the firm's output leads to (1) an increase in its finance needs to meet the extra working capital required for enlarging the current output from existing productive capacity, and (2) extra finance required to expand the latter. If the banker, with which the firm deals, "stands in a privileged position in respect to it" he can make the firm pay a marginal interest rate which is higher than the firm's average. According to Kalecki[8,9],demand could not act as an alternative to collateral security against the bank loan if (from the banker's viewpoint) the entrepreneur's own "capital" and personal wealth were not in the right proportion to the loan he applies for. What is of importance for me here is not the powerful argument which Kalecki submitted to explain "the various sizes of enterprises started in the same industry at a given moment...". My main concern, now[10] is with its byproduct, upon which I am going to build. that "byproduct" is this relationship: given the firm's own (finance) capital, acting a collateral, the supply of external working capital is an increasing function of the short term rate of interest. For simplicity, that relation will be assumed continuous, though it is more realistic to assume that it is discontinuous.

7.3 Monetary policy, firm's finance and the firm's level of output; some more questions:

It has to be obvious to those concerned that, to have any short-term effect on the firm's level of output (which can be a retail service) and hence employment, changes in monetary policy must lead to changes in the firms' production cost. changes in the firm's production cost (or, more precisely, the cost of repeating last period's level of output), exclusively attributed to changes in monetary policy, should then come from changes in the cost of obtaining the external portion of the total funds needed by the firm in order to carry out its production decisions. The reader will notice that there are two crucial assumptions involved in the above argument:

(1) the typical firm depends, to some degree, on external finance to carry out its production decisions.

(2) the cost of obtaining that finance is incorporated, in one way or another, in the firm's production cost.

Therefore, to have a sound analysis of the way changes in monetary policy may lead to changes in the level of output and employment, the analyst needs to answer the following questions:

First: To what extent does the typical firm depend on external finance in carrying out its production decisions ?

Second: What is the nature of that external finance ?

Third: How does its cost enter into the firm's production cost ?

Fourth: How do changes in such costs make it less profitable for the firm to maintain its current level of output ?

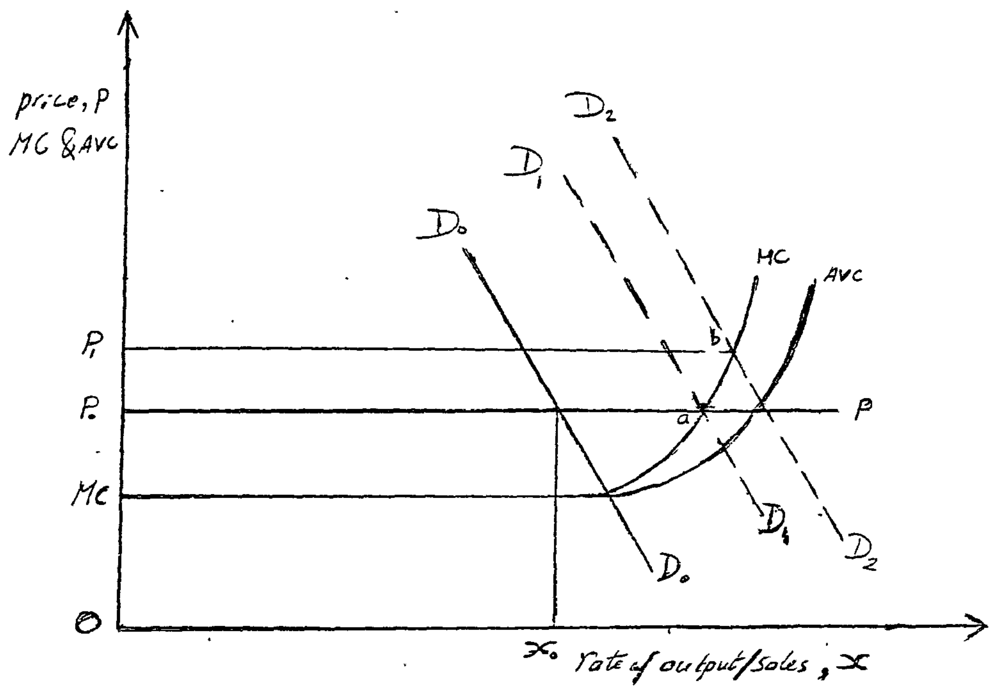
In what follows, I propose an analysis of how a more restrictive monetary policy may affect the output level of different firms in a hypothetical industry characterised by oligopolistic market structure. The case of the possible effects of an expansionary monetary policy will be dealt with in the following section.

The industry is assumed to be dominated by a single leader firm while the remaining smaller[11] firms act as followers in the strict sense.

7.4 Monetary policy, firm's finance, interest charges, production cost, and the firm's level of output; geometric analysis:

Before I begin the analysis, I must submit an answer to each of the four questions which I raised earlier. In the present case, we shall assume that 25% of the leader firm's working capital needs is obtained through a bank loan[12] extended at an increasing cost (i.e. interest rate). Interest charges paid on external finance will be part of marginal cost. These assumptions supply the answer to the first three questions above. Finally, and as a contribution to answering the fourth question, we shall assume that the leader firm's pricing policy is that of mark-up pricing, so long as marginal cost is not increasing. When the latter starts increasing due to (among other things) the increasing cost of external finance, the firm's output may be carried out up to the point at which the firm's mark-up price is equal to marginal cost. This pricing hypothesis is based on pricing hypotheses proposed by Robinson[13] and Rowthorn[14] to represent the behaviour of the firms' decision makers under specific market conditions. Both writers argue that in a sellers' market, the reaction of the typical firm is one of allowing the actual rate of output to follow the rate of demand, up to the point where the firm's marginal cost (MC) hits the "ceiling" of its administered price (P_0). In figure 8 below it is the intersection point a . Beyond this point, the two writers differ on the determination of commodity prices.

Figure 8



Key: MC = marginal cost
AVC = average variable cost
DD = Demand line

According to Joan Robinson the firm's actual rate of output may be allowed to follow the rate of demand. The increasing marginal cost will be taken care of by the upwards revision of commodity prices so that the full marginal cost is covered by the price. In the diagram above, the shift in the demand line from D_1D_1 to D_2D_2 will be accompanied by an increase in the level of output, the marginal cost, and the selling price. These are represented by the new intersection point b .

According to Rowthorn, P_1 is demand determined.

For both writers, marginal cost does not include interest changes on finance capital whatever its nature[15,16]. This implies one of the following hypotheses:

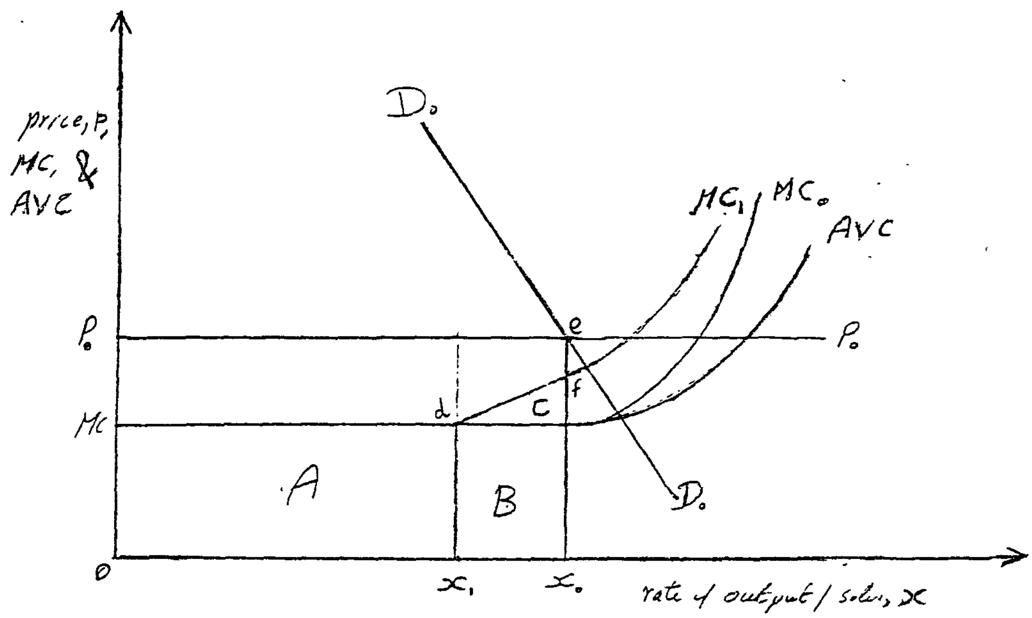
(i) firm's working capital needs are internally financed at zero opportunity cost.

(ii) Firm's working capital needs are, to some extent, externally financed at a positive interest rate, with interest charges being treated as a part of overhead production cost.

Hypothesis (i) must be ruled out because, according to Robinson "[w]hen employment and output are expanding, businesses finance the growth of working capital by bank loans"[17]. While according to Rowthorn "...monetary policy does influence expenditures..." ,[18] and when money is made tight "[i]t drives up the rate of interest, and thereby alters the savings and investment propensities of the non-governmental sector..."[19].

Therefore, following hypothesis (ii), a tighter monetary policy does affect firm's (overhead) production cost, depending on the extent to which the firm relies on costly external funds to finance its working capital needs. As a result, firms' output and employment will shrink through the close down of "unviable" production lines for the "large" firms, and through bankruptcy for the smaller firms[20]. I would accept this line of argument should the evidence refute the central hypothesis upon which the remaining part of the present section is based. That hypothesis is: <u>interest charges on the external portion of working capital are treated by both firms (the leader and the follower) as a part of marginal cost.</u> Diagrammatically, we have the following representation of the leader firm (Figure 9):

Figure 9



Key: MC_o = The familiar marginal cost

MC_1 = Marginal cost inclusive of interest charges on bank loan

AVC = average variable cost exclusive of interest charges on the bank loan

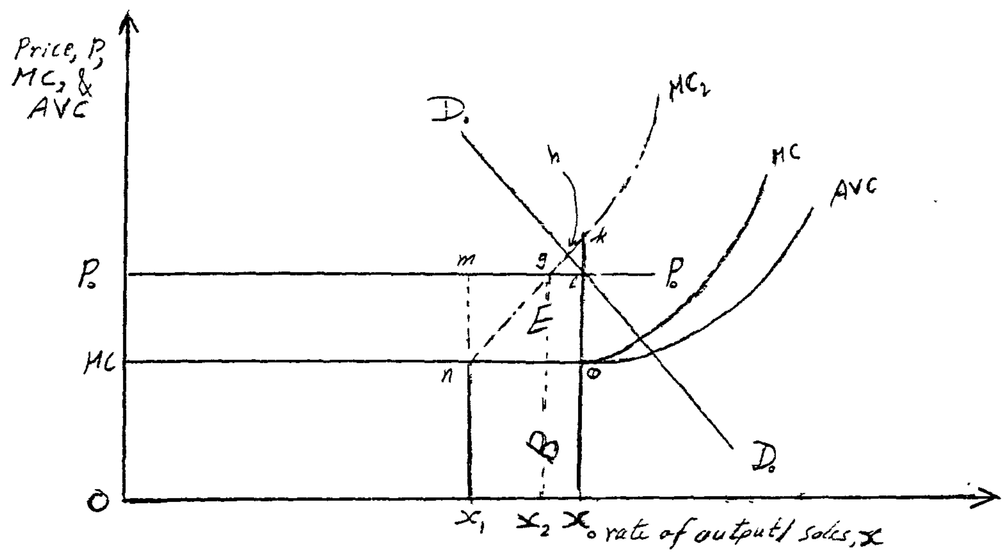
In the above diagram, the firm's current rate of output is x_0 of which x_0x_1 is financed by a bank loan. The area A is the internally financed working capital needs. The bank loan is the area B. Interest charges on that loan is the area C. When the latter gets incorporated in the firm's production cost, a new species of marginal cost is generated. The new marginal cost curve MC-MC_1 differs from the familiar marginal cost curve $MC\text{-}MC_0$ by (the former) being inclusive of interest charges on working capital needs externally obtained by a bank loan.

7.4.1 More restrictive monetary policy and the leader firm's level of output:

Having submitted an answer to each of the four questions (page 154 above), I now proceed further in the analysis. But before we do that, we have to make sure that the analysis is not upset by the possible shift of the firms' own demand curve through "...the possibility of obtaining credit..."[21] on the part of its customers. To remove that possibility, we shall assume the firm sells no part of its output on credit. With that assumption at the back of your mind, you may now consider the following question: how does a more restrictive monetary policy lead to a lower level of output and employment of the leader firm in the industry? In the first place, the tighter monetary policy means that the market price of bonds are lower than they were before. This in turn means that the basic rate of interest on the colaterally determined bank loans is made higher. Now, since interest charges on the bank loan obtained by our leader firm are incorporated in its marginal cost ($MC\text{-}MC_1$ of figure 9 above) the part $d\text{-}MC_1$ of that curve will swing upwards to the left. However, so long as the new marginal cost curve cuts the vertical line ex somewhere between e and f in the above diagram, the more restrictive monetary policy will have no effect on this (leader) firm's level of output. As a result, it will have no effect on the level of employment for the same firm.

Let us further tighten monetary policy such that the following new marginal cost curve is generated ($MC\text{-}MC_2$, figure 10 below):

Figure 10



Having allowed the monetary policy to be tight enough to lead to a new marginal cost curve of MC-MC_2, in the diagram above, we now address the following question: should that tighter monetary policy make it unprofitable for the firm to carry on producing an output level of x_0 ? A strict answer (that is an answer based on the absence of other alternatives which may be made available to the firm) is yes. At P_0, the cash flow for selling the "marginal output" x_0x_1 is the rectangle $x_1m\ell x_0$. The marginal cost of that volume of output is the area B plus interest charges on the bank loan B. These charges are the area of the triangle nko. But

$$\text{triangle } B + \text{triangle } nko > \text{rectangle } x_1 m \ell x_0 \qquad (7.1)$$

Therefore, it is unprofitable for the firm to carry on producing x_0 and selling the output at P_0. Now, what can our leader firm do in order to reduce its marginal losses ? The answer depends on the options available to the bosses of that firm. Let us consider the following options:

(1) The leader firm can keep its price/output combination at their initial levels (P_0, x_0) until it can find a cheaper alternative source of finance. If its attempts were successful, say, through new trade-credit arrangements with its suppliers, then that would be equivalent to a parallel shift of the curve n-MC_2 to the right until it cuts the D_0D_0 line at point ℓ. If that were to happen, then the potential negative output/employment effect of the tighter monetary policy would be neutralized.

(2) The leader firm can stick to its initial equilibrium price, P_0, and reduce its output to x_2, and then let its order book lengthen but serve its customers on the basis of first ordered, first supplied, in order for the firm to keep its customers to itself, instead of raising the possibility of losing them by increasing the price.

(3) It can increase its price to a level around P_1, hence reducing its output to a level somewhere between x_2 and x_0, depending on how accurate the firm is in its estimate of the D_0D_0 line on one hand and on how confident the firm's decision maker is in his "confidence intervals".

(4) There is another tricky alternative which would be available to the firm by relaxing our earlier assumption (p.159) that our leader firm did not give any trade credit to its customers. Suppose that, at the initial (accidental) equilibrium position, the firm were selling the quantity x_2x_0 on credit. If the firm's credit-given policy were

inversely related to the rate of interest on the bank loans extended to it then it would be possible for the firm to act as follows:

- keep the price at P_o
- cut its credit-based sales to zero, hence shifting the D_oD_o curve to the left until the latter cuts the P_oP_o line at point g.
- cut the level of output by x_2x_o, with a corresponding cut in the level of employment.

(5) A fifth, and more complex, alternative available to this leader firm is to choose a policy package composed of a combination of a number of the above four alternatives.

Crude as it is, the above analysis provides one rationalisation on the way a more restrictive monetary policy may affect the level of output and employment for the leader firm . It would not have been possible had I not been able to specify the answers to the four questions which I formulated on page 154 above. The conclusion which follows from the above analysis is the following: as far as the leader firm is concerned, a more restrictive monetary policy can have no effect on the level of output/employment, i.e. its effect can be "neutral", to use Chiplin and Wright's[22] word. It can also be negative. <u>In the latter case, and when the firm's output is a means of production for another commodity, an inflationary process may be initiated</u>. This means, under oligopoly capitalism, a more restrictive monetary policy <u>can be</u> inflationary.

7.4.2. <u>More restrictive monetary policy and the follower firm level of output:</u>

First, the answers to the four questions. We shall adopt the following hypotheses:

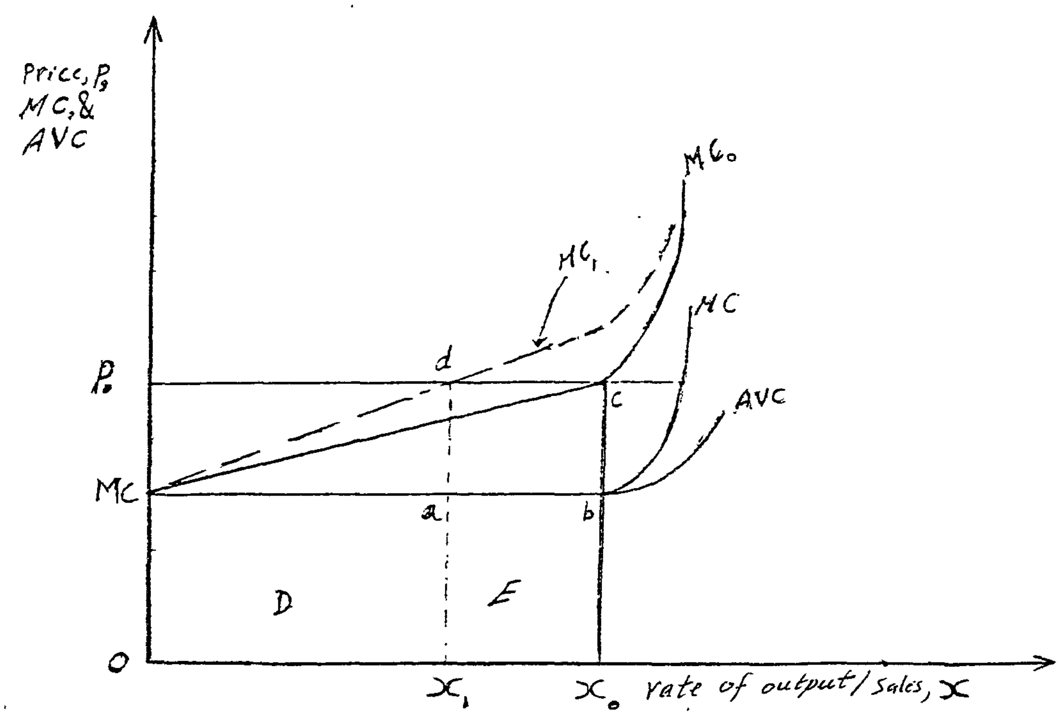
Hypothesis (1)[23] : 100% of the firm's working capital requirements are obtained through bank loan.

Hypothesis (2): the interest rate is an increasing function of the size of the bank loan.

Hypothesis (3): interest charges on the bank loan are treated as a part of the firm's marginal cost.

Given the above hypotheses, the diagrammatical representation of the firm's operations may be as follows (figure 11).

Figure 11



In the above diagram, $MC - MC_0$ is the firm's initial marginal cost curve, including interest charges on the bank loan (area D+E being the bank loan). We shall maintain the assumption that the whole working capital needs of the follower firm is a bank loan which is colaterally determinant. Since the present firm is a follower, its initial equilibrium level of output must be x_0, where the price P_0 equals "marginal cost". If monetary authorities were to tighten "money supply", hence increasing the bank rate, the firm's initial marginal cost curve would swing upwards to the left. Assume the new marginal cost curve is $MC-MC_1$. At the new marginal cost curve, the highest profitable level of output/sales is x_1. A tighter and tighter monetary policy, in the absence of cheaper alternative finance, leads the firm to further and further output/employment cuts until it goes bankrupt. The likely result is a greater degree of capital centralization.

7.4.3. Assumptions may be relaxed:

May I remind the reader that the analysis and the conclusions which followed in the present section are conditional upon the assumptions upon which they are based? Exogenous shifts in demand for the leader firm's output are absent; all firms, the leader and the followers, need short term loans to finance their working capital needs; the followers' whole working capital needs were bank loans; commercial banks are the only financial institutions present; interest charges are part of marginal cost; and the collateral security was given a very low key. Relaxing these assumptions makes things more complicated. However, their relaxation does not lead to significant change in the analytical approach, and the conclusions followed.

7.5 Expansionary monetary policy and the firm's level of output:

The question to be addressed in this subsection is the following: Under what conditions may an "expansionary monetary policy" be regarded as expansionary, on the household and on the firm level ?

7.5.1 Introductory note on the meaning of "money supply" in the presence of the collateral constraint to borrowing from banks:

To start with, we shall assume that potential money supply (defined below) is exogenous. Now, when the size of the bank loan (= a bank deposit), advanced to the household or to the firm, is collaterally determined, whatever is the form of the collateral[24], will the term "money supply" still remain immune to any criticism for being vague ? The answer to that question must be in the affirmative, as I shall argue below.

Potential Money Supply

In order to "purify" it, the term "money supply" must be preceded by the adjective "potential" or "actual", depending on the context within which the new term is being used. The question, now, is: what do we mean by "potential money supply" ? It is the maximum amount of credit obligations plus currency in circulation that the financial system (assumed to be composed of central bank and the commercial banking system) can sustain, per unit reserve of high powered money, under a given set of institutional constraints[25]. Formally it can be shown that potential money supply can be expressed as follows[26]:

$$M^P = \left[\frac{1 + \varepsilon}{\sigma + \varepsilon}\right] H \qquad (7.2)$$

where:

M^P = potential money supply

H = stock of high powered money, which is total reserves of commercial banks plus currency in circulation.

ε = the fraction of their total bank deposits the non-bank public hold in cash.

σ = Legal (minimum) reserves ratio.

M^P can be equal to actual money supply (which is demand determined), M^d, only when the conditions for the full absorption of M^P are ripe in the economic system. The question which immediately follows is: what are these conditions ?

<u>Actual money supply</u>

The absorption condition, or conditions, which are necessary for the full absorption of M^P by the economic system are the following:

Both the nonbank business sector and the households' sector <u>must simultaneously be able and willing</u> to hold the full credit potentials and currency (i.e. M^P) in the form of deposits with the banking system, and cash outside that system.

The key elements in the above condition are two:

(i) ability, which is based on the availability of a collateral security, in whatever form (personal wealth, own capital, etc.)

(ii) willingness; a condition basically related to the state of "confidence" in the nonbank business sectors.

As far as the households sector is concerned, the rule is common sense. If you had nothing to offer as a collateral security against whatever loan you ask the banker to extend, you would get nothing from that bank even if you were to promise its manager a very much higher interest rate than the current basic rate, which the bank charges the others. Here, willingness to "hold" any portion of potential money supply, by the households' sector is checked by the absence of an acceptable collateral to the bank. A rich household, by definition, is in no need to borrow.

As far as the nonbank business sector is concerned, the issue would be clear once neoclassical theology is discarded.

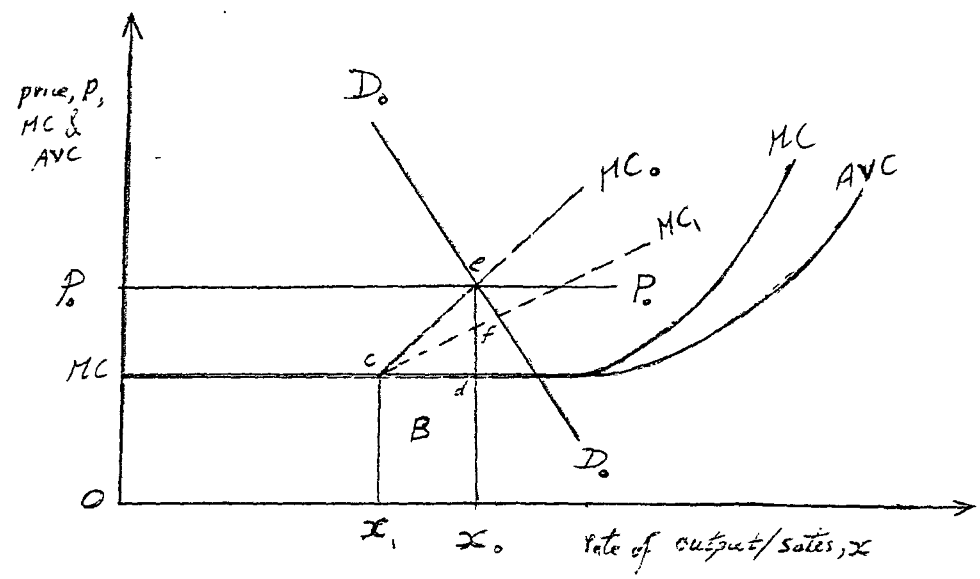
7.5.2 Expansionary monetary policy and the leader firm's level of output:

Assumptions: Assume that the economy is stuck in a state of unemployment/excess capacity equilibrium, "business confidence" being so low that no planned net addition to the stock of physical (fixed) capital is taking place. Assume that all commodity prices - assumed to be mark-up determined - are unchanging. Assume also that government's bonds (issued by the treasury) are the only alternative financial asset available to holding money; and the banking system observes the legal minimum reserves ratio. Finally, assume the economy is closed.

Granted that, we may now address the following question: Given the binding collateral constraint for the households sector, how can an expansionary monetary policy induce the leader firm to increase its current level of output, hence employment ?

Consider first figure 12 below:

Figure 12



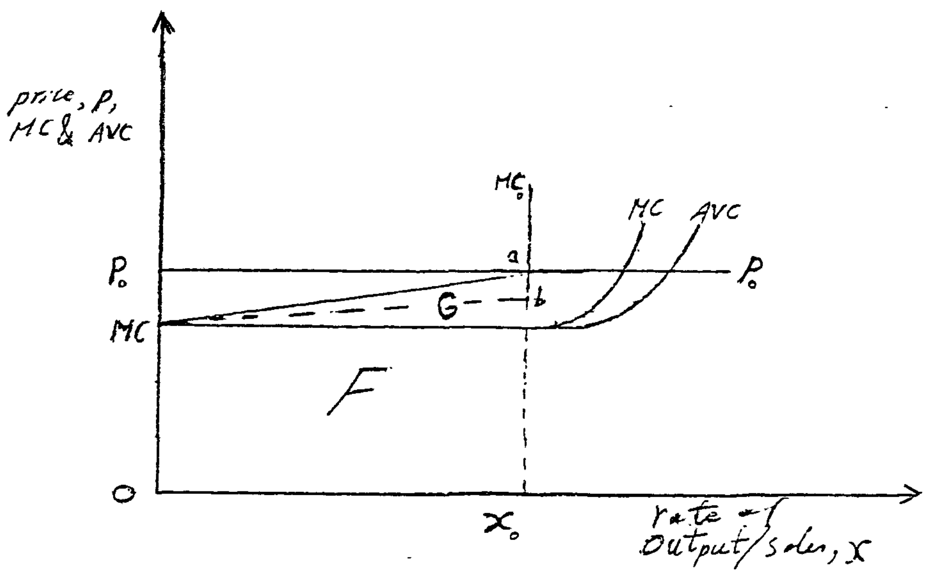
The (leader) firm's initial short term equilibrium position is represented by point e . The price is P_0, output level is x_0 , marginal cost (including interest charges on the bank loan of B) curve is MC_0 - MC, while the demand curve is D_0D_0. The triangle ced is interest charges at the initial rate of interest on the borrowed working capital B. The "expansionary" monetary policy leads, via the lowering of the rate of interest, to the new marginal cost curve MC - MC_1. The new, and lower, interest charges on the same working capital needs is the triangle cfd .

Should the lower rate of interest lead the firm to expand its actual level of output ? The answer simply is: It should not. One might be tempted to say that the lower rate of interest would <u>indirectly</u> lead the firm to expand its actual level of output through the shifting of its demand curve, D_0D_0, to the right. This could not happen because we have already assumed that <u>the whole economy is in a state of unemployment/ excess capacity equilibrium</u> with all (mark-up) prices unchanging, <u>and household borrowing is collaterally determined</u>. So long as these constraints are not lifted the lowering of the rate of interest, by itself, could not lead to an upwards shift in the firm's demand curve, D_0D_0. If this were the case, then the firm's actual level of output would not increase. This in turn means that no more working capital needs would arise and as a result no more bank loans would be needed by the firm.

7.5.3 Expansionary monetary policy and the follower firm's level of output:

Let us turn now to the follower firm represented by figure 13 below:

Figure 13



In the above diagram, MC-a-MC_0 is the firm's initial (kinked) marginal cost curve, which includes interest charges on the wholly borrowed working capital of F. It is vertical at x_0 because of the collateral constraint facing the firm. Its own finance capital and/or the personal wealth of its owners impose a maximum working capital ration of no more than F. The new "expansionary" monetary policy, again via lowering the current rate (or the structure of rates) of interest, leads to a new kinked marginal cost curve. That curve is MC-b-MC_0 in the diagram above. Will that lead the firm to produce and employ more ? Not necessarily. This is so because the lower rate of interest did not improve the firm's "collateral position", so to speak. However, if the surplus funds made available by the lower rate of interest, represented by the triangle G, were suitably large and if the firm were confident that it will not be faced by a price war by the leader, then it could increase its output level and sales. This is equivalent to parallel shift of the MC-b-MC_0 curve to the right, with the implication that the firm now is using its <u>own funds</u> to finance a tiny part of its working capital needs.

7.5.4 A Conclusion

Now things are more clear. For the leader firm, operating in an economic atmosphere leading to low business confidence, the lower rate of interest did nothing to improve the demand for its output. The follower firm's "improved capacity" to invade the leader's territories is limited by the terrorising financial power of the leader. For the relevant section of the "households" sector, the binding collateral constraint on its capacity to borrow from the banking system is not affected by the lower rate of interest resulting from the "expansionary" monetary policy. The result is: demand will not increase; output will not increase, working capital needs will not increase; borrowing from the banking system will not increase; demand deposits to back that borrowing will not increase. Since demand deposits (or time deposits) form a major component of "money supply" it follows that actual money supply will not increase. The "expansionary" monetary policy was expansionary in the potential sense only. The gap between actual money supply, (= money demand) and potential money supply is as large as ever.

The analysis in this and the previous subsection is based on a number of simplifying assumptions, all of which can be relaxed step by step without violating the central conclusions we arrived at earlier on. The crucial assumptions upon which the whole argument is based are the following:

(i) Bank lending is collaterally determined

(ii) Given (i), output is demand determined.

7.6 The demand for money function

The demand for money function upon which this thesis is based is Keynes'[27]. Demand for money balances (= actual supply), M_{dt}, is a function of the nominal national income, Y_t^m, and the nominal rate of interest, i_t. Following Ackley (1978), the definite form of the system's demand for money function is assumed to be the following:

$$M_{dt} = m_0 + m_1 Y_t^m - m_2 i_t \qquad (7.3)$$

with m_0, m_1 and m_2 being a set of structural constants. Equation 7.3 acts as a link between our earlier micro analysis conducted in sections 7.4-7.5 and present macro analysis. The nominal rate of interest i_t, thanks to the Speculative Liquidity Preference theory for the determination of nominal rate of interest[28], can be written as a function of excess demand for speculative (nominal) money balances (or bonds of various maturity and risks) given the distribution of "normal" rates of interest amongst those involved. With the latter clumsily represented by $\bar{i}^*$, the equation for the current rate of interest becomes as follows:

$$i_t = L(M_t^{d,s} - M_t^{s,s} \; ; \; \bar{i}^*) \tag{7.4}$$

Where:

$M_t^{d,s}$ = demand (stock level) of speculative nominal money balances.

$M_t^{s,s}$ = supply (stock level) of speculative nominal money balances.

If potential money supply were exogenous, we must have

$$\frac{di_t}{dM_t^{d,s}} > 0 \tag{7.5}$$

On the other hand, if potential money supply were endogenous, as is the case with Kaldor[29] (among others), we must have:

$$\frac{di_t}{dM_t^{d,s}} = 0 \quad \text{for} \quad M_t^{d,s} \geqslant M_t^{s,s} \tag{7.6}$$

Now, the dynamic version of equation 7.2, i.e. the equation of potential money supply, is the following:

$$M_t^p = \left(\frac{1+\varepsilon}{\sigma+\varepsilon}\right) H_t \tag{7.7}$$

The split of the actual portion of M_t^p (i.e. M_{dt} in equation 7.3) between transactions and precautionary money balances on the one hand, and speculative balances, on the other, depends on two effects:

First: the levels, and the distribution among speculators, of the expected rates of interest.

Second: the level of effective demand.

7.7 The budget deficit, potential money supply, and its relation to actual money supply.

The budget deficit, naturally, is the difference between the total revenues the government expects to procure out of the nominal value of the economic surplus generated during period t-1 , and its expected expenditures for period t . Assume for simplicity that the economy is closed, and that the tax base is only composed of the wage bill, W_{t-1} and gross profit, Π_{t-1}, generated during last period. Assume, also for simplicity, that there is one uniform income tax rate, t_y, falling on both of these components. Granted that the government's maximum revenue function will take the following form:

$$R_t^{max} = t_y \, (W_{t-1} + \Pi_{t-1}) \tag{7.8}$$

We shall further assume that tax collection personnel are working at their maximum efficiency and that all "agents" are honest. Granted that, we can remove the maximum superscript from equation 7.8 above, and write our revenue function as:

$$R_t = t_y(W_{t-1} + \Pi_{t-1}) \tag{7.9}$$

Now, we turn to expected government expenditures for period t , assumed, again for simplicity, to be made of two components:

First: expenditures on goods and services, of both military and civilian nature.

Second: debt service.

Since government expenditures on goods and services G_{1t} are policy determined, the quantitative form of those expenditures will have to include the essential parameters which reflect that policy. I propose the following function for those expenditures:

$$G_{1t} = G_{1,t-1} \left[\frac{P_t^e}{P_{t-1}}\right]^{\eta} (1+f) \tag{7.10}$$

$$0 \leqslant \eta, \ f \leqslant 1 \qquad (7.11)$$

with η and f being the only policy parameters.

The interpretation of equation (7.10) is very simple. If the government decided to allow no increase in last period's level of nominal expenditures (on goods and services, of course), then both η and f must be assigned zero values. On the other hand, if the government prefers to keep this period's expenditures as those of last period in real terms, then we must have:

$$\eta = 1, \quad f = 0 \qquad (7.12)$$

Finally, the government (for whatever reason) may assign positive value to f. In fact, f may be a fraction of last period's rate of unemployment. Here, logic dictates that the positivity of f is a necessary condition for η being unity.

As for the second component of government expenditures, i.e. debt service, it may quantitatively be expressed as follows:

$$G_{2t} = \left(\sum_{j=1}^{J} i_j P_j^B \ B_j\right)_t + \left(\sum_{j=1}^{Z} P_{jk}^B B_{jk}\right)_t , \quad J > Z \qquad (7.13)$$

where: i_j = coupon rate of interest on (government) bond j.

P_j^B = nominal price of bond j.

B_j = number of bonds of type j.

k = a number which identifies those bonds whose maturity date is the beginning of period t.

The first term in the right had side of equation 7.13 above is interest payment which must be made by the government on all debt outstanding at the beginning of period t. The second term is the portion of all public debt outstanding at the beginning of period t, whose maturity date coincides with the beginning of period t.

Therefore, the budget deficit, which must be covered in one way or another, is defined as follows:

$$(Def)_t = R_t - (G_{1t} + G_{2t}) \qquad (7.14)$$

$$= ty(W_{t-1} + \Pi_{t-1}) - \left\{G_{1,t-1}\left[\frac{P_t^e}{P_t}\right]^{\eta}(1+f) + \right.$$

$$\left.\left[\left(\sum_{j=1}^{J} i_j P_j^B B_j\right) + \left(\sum_{j=1}^{Z} P_{jk}^B B_{jk}\right)_t\right]\right\} \quad , J > Z \qquad (7.15)$$

It is really a complicated expression. $(Def)_t$ can be financed by further public borrowing from the non (central) bank public and/or by borrowing from the central bank. Let us give the first type of public borrowing the symbol $(\Delta Bro)_t$ and give the second type of public borrowing (i.e. government "borrowing" from the monetary authority represented by the central bank) the symbol ΔH_t^G.

Therefore, $(Def)_t = (\Delta Bro)_t + \Delta H_t^G$ (7.16)

If we let the banking system borrowing from the central bank be ΔH_t^{Bank}, and had a quick look at our earlier formulation we would end up with the following system of equations:

$$\Delta H_t = \Delta H_t^G + \Delta H_t^{Bank} \qquad (7.17)$$

$$H_t = H_{t-1} + \Delta H_t \qquad (7.18)$$

$$M_t^P = \left(\frac{1+\varepsilon}{\sigma+\varepsilon}\right) H_t \qquad (7.19)$$

$$M_{dt} = m_0 + m_1 Y_t^m - m_2 i_t \qquad (7.20)$$

$$\frac{M_{dt}}{M_t^P} = \frac{m_0 + m_1 Y_t^m - m_2 i_t}{\left(\frac{1+\varepsilon}{\sigma+\varepsilon}\right) H_t} \qquad (7.21)$$

Equations 7.17-7.21 defines a dynamic (skeleton?) financial system of an economy which is in a state of short term disequilibrium. The last equation of that system defines the rate of capacity utilization of money. Hopefully, equation 7.21 above makes a translation of Bhadari's argument which culminates in his phrase "...the commodity character of credit money..." under oligopolv capitalism into a definite quantitative form[30].

7.5 Closing note:

Before closing this chapter, may I remind the reader of the main question addressed at the beginning of the present chapter. It was this: apart from its possible effect on investment in fixed capital, how do changes in monetary policy affect the level of output and hence employment on the firm level ?

The answer I gave to that question is a conditional one. This is so because it is based on a number of simplifying assumptions, some of them being more important than the others. The typical firm is assumed to emplov a single technique. The follower firm is assumed to have no finance capital of its own. All firms are assumed to incorporate interest charges into the marginal cost in a continuous fashion. Moreover, the economy was closed. However, it is not difficult for me to relax these assumptions for a greater degree of realism.

Notes to Chapter 7

[1]Keynes (1936), ch.17; See also, Davidson (1978), Ch.6.

[2]But see Benston (1982).

[3]I shall maintain the simplifying assumption that the financial system is identical to the banking system, with the latter being composed of clearing banks and the central bank. The latter is assumed to stand for the monetary authority. This means we have to abstract from insurance companies, building societies, investment trusts, etc. The Treasury is here treated as separate from the financial system.

[4]See Laidler (1982), Ch.4; Tobin (1978); and McKenzie (1979).

[5]Hicks (1979), pp.vii-viii (emphasis added).

[6]Sraffa (1926), especially pp.549-550.

[7]Kalecki (1937); Kalecki (1971), Chs. 5 and 9.

[8]May I say that this reconstruction of Kalecki's argument is based on a reference to Sraffa (1926) Kalecki made in his article of 1939. "Money And Real Wages", published in english in his book, Studies In The Theory Of Business Cycles, 1933-1939 (Basil Blackwell) in 1966. His reference to Sraffa, on page 52 (footnote), in that book, implies that Kalecki had not been fully satisfied with Sraffa's implicit argument (Sraffa, 1926, p.550) that positive demand prospects lead to automatic availability of bank loans.

[9]One wonders whether Rowan's diagrammatical analysis on the determination of the volume of investment could have been improved upon by Kalecki's 1937, "The principle of Increasing Risk, Economica, Vol.IV, No.13-16; see Rowan, D.C., 1983, Output, Inflation, and Growth, 3rd Ed., Macmillan, London, p.155.

[10]Compare Binks (1979) with Kalecki (1937, especially pp.442-442). See also Sardoni (1984).

[11]Firm's size is measured by the replacement (i.e. the current) cost of its productive capacity under the current economic climate.

[12]Data for British corporations operating in manufacturing, distribution and service industries for the period 1969-1977 are the following:

Savings and sources of funds for UK corporations

	1969	1970	1971	1972	1973	1974	1975	1976	1977
Savings ratio (1)	64.9	62.9	68.8	81.6	83.1	81.0	83.5	86.3	n.a.
Source of funds (2)									
Issue of shares	4.1	1.4	3.5	3.0	0.4	0.9	8.8	6.3	4.5
Issue of loan capital	4.6	5.7	13.2	4.7	5.5	1.0	4.1	3.0	5.1
Increase in amount owing to bank	12.5	12.9	-3.7	5.3	13.9	19.1	-1.1	9.0	6.1
Increase in short-term loans	-	7.3	1.4	2.9	2.5	3.9	2.8	0.6	0.6
Increase in trade and other creditors	27.0	23.4	4.5	17.9	30.7	27.8	23.7	25.7	17.6
Retained earnings	44.8	41.5	73.1	62.0	44.4	45.6	59.3	52.5	63.8
Other	7.0	7.9	8.0	4.0	2.7	1.6	2.4	3.0	2.2

Source: Sawyer (1982b), p.167

Notes: (1) Retained earnings as a percentage of gross post-tax profits minus interest payments.

(2) Percentages of total use of funds minus dividends, interest payments and taxation and minus expenditure on acquiring subsidiaries financed by share issue. This equals expenditure on fixed assets, current assets and on acquiring subsidiaries financed by cash.

[13]Robinson (1969), pp.187-188.

[14]Rowthorn (1981), pp.31-32. See also Kalecki (1966), pp.41-42 and Kalecki (1971), pp.105-109.

[15]Robinson (1969), p.183.

[16]Rowthorn (1981) p.3 (this point is implicit in the author's argument).

[17]Robinson(1980b),p.11.

[18]Rowthorn (1977),P.237.

[19]Rowthorn, Ibid., p.234.

[20]The argument under hypothesis ii is not inconsistent with the analysis of

the determination of the mark-up presented in chapter 5.

[21]Sraffa (1926), p.544.

[22]Chiplin and Wright (1985).

[23]This hypothesis provides the answers to the first two questions above.

[24]Kalecki (1971), pp.105-109; Bhaduri (1986), pages 111, 125-129; Binks (1979).

[25]Bhaduri (1986), pp.111-114.

[26]Bhaduri (1986), pp.107-111. See also Morishima (1984), pp.263-269.

[27]Keynes (1936), Ch.15; see also Bhaduri (1986), pp.92-102.

[28]Keynes (1936), Ch.13, especially pp.170-171, 176-199; see also Shackle (1967), Ch.15, especially pp.203-209.

[29]Kaldor (1970).

[30]Bhaduri (1986), pp.102-129

Chapter 8: Fixed Capital and Nonuniform Production Period

8.1. Fixed capital and multiperiod production processes introduced into the circulating capital price system

Two of the assumptions upon which the model of price inflation of chapter (6) is based are: firms use no fixed capital, and the production period (defined as the length of time necessary to pass between the date of purchasing the variable input and the date when it becomes ready for sale in the form of finished product) is the same for all industries. Clearly, the two assumptions are unrealistic. Any model of price inflation for which these assumptions are crucial is no more than a fruitless intellectual exercise. To be useful, in the sense of giving insight into the the inflationary process and pointing to some policy proposals with realistic goals, our model must be able to survive the relaxation of the assumptions that 'capital' is circulating and the production period is uniform.

The questions that will be addressed in this chapter , then, are the following:

(1) How do we introduce fixed capital and multiperiod production processes into the circulating capital model of chapter 6 ?

(2) Will the extended model be significantly different, in any way, from the earlier one ?

(3) If the extended model were different from the earlier one in which fixed capital has no place and the production period is uniform, how should we adapt the former so that it becomes suitable for the analysis of price inflation under today's capitalism? and finally,

(4) Does that analysis differ from the analysis of price inflation which is based on a model with circulating capital and uniform production period?

8.1.1. The theoretical price system with uniform production period and single machine:

The introduction of fixed capital into each of the three industries which make up the private sector of our miniature economy leads to a very complicated formulation indeed. To simplify things[1] I shall introduce fixed capital into the circulating capital model of chapter (6) on the basis of the following assumptions:

(i) industry 3 uses circulating capital and labour to produce machines of homogenous type, the technical life of each of which is n standard periods (weeks, months, etc.)

(ii) industry 2 uses circulating capital and labour to produce a single good of circulating capital nature only.

(iii) industry 1 uses the machine, circulating capital, and labour to produce two goods: a marketable good of circulating capital nature, and a second good jointly produced with it which is the machine of one 'year' older. By the end of period $n+1$ the machine becomes a piece of scrap with zero market price, and can be disposed of free of charge.

Granted the above assumptions, we can reformulate the price system as follows:

$$(a_{11}P_1 + a_{21}P_2 + a^0_{31}P_{3,0} + \ell_1 w)(1+r) = P_1 + a^1_{31}P_{3,1} \qquad (8.1.1)$$

$$(a_{11}P_1 + a_{21}P_2 + a_{31}^1 P_{3,1} + \ell_1 w)(1+r) = P_1 + a_{31}^2 P_{3,2} \qquad (8.1.2)$$

....

....

$$(a_{11}P_1 + a_{21}P_2 + a_{31}^{n-1} P_{3,n-1} + \ell_1 w)(1+r) = P_1 + a_{31}^n P_{3,n} \qquad (8.1.n)$$

$$(a_{11}P_1 + a_{21}P_2 + a_{31}P_{3,n}^n + \ell_1 w)(1+r) = P_1 + 0 \qquad (8.1.n+1)$$

$$(a_{12}P_1 + a_{22}P_2 + \ell_2 w)(1+r) = P_2 \qquad (8.2)$$

$$(a_{13}P_1 + a_{23}P_2 + \ell_3 w)(1+r) = P_{3,0} \qquad (8.3)$$

In the above system, a_{31}^k, $P_{3,k}$ are a machine of age k per unit of capacity output of process 1 and its associated price, respectively. Here, r is the target minimum rate of profit. All other symbols carry their earlier meanings. Let us, for the moment, concentrate on the first $n+1$ equations and leave the remaining two equations for later analysis. If we follow Sraffa's (1960, Ch.10) procedure, we multiply the first equation by $(1+r)^{n-1}$, the second by $(1+r)^{n-2}$, etc. until we reach the $n+1$ th equation which we multiply by 1 . Then by summing the left hand side of the new system and setting it equal to the sum of its right hand side, and doing some algebraic manipulations, we get the following equation:

$$(a_{11}P_1 + a_{22}P_2 + \ell_1 w)(1+r)\frac{(1+r)^n-1}{r} + a_{31}^0 P_{3,0}(1+r)^n = \frac{(1+r)^n-1}{r} P_1 \qquad (8.4)$$

from which we an obtain the following:

$$(a_{11}P_1 + a_{21}P_2 + \ell_1 w)(1+r) + a_{31}^0 P_{3,0} \frac{r(1+r)^n}{(1+r)^n-1} = P_1 \qquad (8.5)$$

By combining equation 8.5 with equations 8.2 and 8.3, the transformed price system takes the following form:

$$(a_{11}P_1 + a_{21}P_2 + \ell_1 w)(1+r) + a^0_{31}P_{3,0}\frac{r(1+r)^n}{(1+r)^n - 1} = P_1 \qquad (8.6)$$

$$(a_{12}P_1 + a_{22}P_2 + \ell_2 w)(1+r) = P_2 \qquad (8.7)$$

$$(a_{13}P_1 + a_{23}P_2 + \ell_3 w)(1+r) = P_3 \qquad (8.8)$$

The above price system is different from system 8.1 - 8.3 in two ways. Firstly, all old machines and their corresponding prices have disappeared from the original system. Secondly, we have a new peculiar term which appears in equation 8.6. However, I shall argue below that these differences (relative to system 8.1 - 8.3 above or relative to system 6.1 of chapter 6) have no effect on the analysis of price inflation and the conclusions which we arrived at in chapter 6 of this thesis.

8.1.2. The theoretical price system with multiperiod production process and a single machine.[2]

Let us now reconsider the assumption that the production period is the same for each industry. A movement towards a greater degree of realism in modelling the economy necessitates the removal of this awkward assumption. In this subsection we reformulate the price system such that multiperiod production processes and fixed capital are taken into consideration, albeit in a simple manner. To start with, let us make the following simplifying assumptions:

(i) industry 1, the one which uses the machine produced by industry 3, is characterised by having a production period whose length is equivalent to the number of standard periods the machine technically lasts (which is n standard periods).

(ii) industries 2 and 3 still use circulating capital and labour to produce two goods. The output of industry 2 is of circulating capital nature, while industry 3's output is, of course, machines. Both industries are characterised by having identical production periods whose length is one standard period.

(iii) The system is in a state of equilibrium, with truncation $n+1$.

(iv) The economy is closed.

Granted these assumptions, our (von Neuman – Sraffa) price system becomes as follows[3]:

$$(a_{11}P_1 + a_{21}P_2 + a_{31}^{0}P_{3,0} + \ell_1^{0}w)(1+r) = b_{11}P_1^{1} + a_{31}^{1}P_{3,1} \qquad (8.9.1)$$

$$(b_{11}P_1^{1} + 0 + a_{31}^{1}P_{3,1} + \ell_1^{1}w)(1+r) = b_{22}P_1^{2} + a_{31}^{2}P_{3,2} \qquad (8.9.2)$$

....

....

$$(b^{n-1}_{n-1,n-1}P_1^{n-1} + 0 + a_{31}\ P^{n-1}_{3,n-1} + \ell_1\ \ w)(1+r)^n = b^{n}_{nn}P_1 + a_{31}P_{3,n} \qquad (8.9.n)$$

$$(b_{nn}P_1^{n} + 0 + a_{31}^{n}P_{3,n} + \ell_1^{n}\ w)(1+r) = P_1 \qquad (8.9.n+1)$$

$$(a_{12}P_1 + a_{22}P_2 + 0 + \ell_2 w)(1+r) = P_2 \qquad (8.10)$$

$$(a_{13}P_1 + a_{23}P_2 + 0 + \ell_3 w)(1+r) = P_{3,0} \qquad (8.11)$$

The above system is composed of two sets of equations. The first $n+1$ equations are the price equations for the final commodity 1 in its decomposed form. The decomposition runs as follows:

By assumption (i), production period of the final commodity 1 is composed of n+1 standard periods which is equal to the length of the technical life of the machine being used in the production of that commodity. Following the von Neuman approach, we can decompose the single process of n+1 standard periods into an n+1 process, the first n processes of which are ficticious.

The first process uses a_{11} unit of the final commodity 1, a_{21} units of the final commodity 2, a^0_{31} machine-units of the final commodity 3 and ℓ^0_1 amounts of labour time to produce two goods:

1) b_{11}, which is going to be used as an input in the next period (and process); its price is P^1_1.

2) a one period old machine-unit, a^1_{31}, whose price is $P_{3,1}$

This process, because it has no commercial existence, is called a 'ficticious' process.[4]. The outputs of this ficticious process are the two 'ficticious' outputs b_{11} and a^1_{31}. The two prices associated with these two ficticious outputs are the two ficticious prices P^1_1 and $P_{3,1}$ respectively.

The same argument applies to the fictitious processes from process 2 until process n inclusive. The last process of this set, process n+1, uses the ficticious output of process n to produce the final commodity 1, which has the same commercial existence as that of the remaining two[5].

The second set of equations is the one formed by processes 2 and 3, each of which is characterised by having identical production periods whose length is equal to a single standard period. As a result, they undergo no change at all. We can present the above system in a more elegant way as follows:[6]

$$(\underline{P}A + w\underline{\ell})(1+r) = \underline{P}B \tag{8.12}$$

8.12 where $\underline{P}$ is a 1Xq row vector, A is a qXm matrix, and B is a qXm output matrix, $\underline{\ell}$ is a 1Xm row vector of direct labour input, w is the real wage rate and r is the rate of profit. Clearly, relaxing the assumptions that fixed capital is absent and the production period is uniform complicates things very much. It led to the emergence of three new concepts: we have now fictitious processes, fictitous products, and fictitious prices. The three correspond to the first n equations of system 8.9 - 8.11. The adjective 'fictitious' implies that none of the processes, products and prices associated with the first n equations of the above system has any commercial existence. Let us, for the moment, bring system 8.9 - 8.11 a little closer to a real world price system by imposing the relevant mark-ups and then dynamise it, and conduct a limited theoretical experiment. First, the price system:

$$(a_{11}P_{1,t-1} + a_{22}P_{2,t-1} + a_{31}^{0}P_{3,0,t-1} + \ell_{1}^{0}w_{t-1})(1+r_{1})$$

$$= b_{11}P_{1,t}^{1} + a_{31}^{1}P_{3,1,t} \tag{8.13.1}$$

$$(b_{11}P^{1}_{1,t} + a^{1}_{31}P_{3,1,t} + \ell^{1}_{1}w_{t})(1+r) = b_{22}P^{2}_{1,t+1}$$

$$+ a^{2}_{31}P_{3,2,t+1} \tag{8.13.2}$$

$$\cdots\cdots\cdots\cdots \qquad .$$

$$\cdots\cdots\cdots\cdots \qquad .$$

$$(b_{n-1,n-1}P^{n-1}_{1,t+n-2} + a^{n-1}_{31}P_{3,n-1,t+n-2} + \ell^{n-1}_{1}w_{t+n-2})(1+r)$$

$$= b_{nn}P^{n}_{1,t+n-1} + a^{n}_{31}P_{3,n,t+n-1} \tag{8.13.n}$$

$$(b_{nn}P^{n}_{1,t+n-1} + a^{n}_{31}P_{3,n,t+n-1} + \ell^{n}_{1}w_{t+n-1})(1+r_{1}) = P_{1,t+n} \tag{8.13.n+1}$$

$$(a_{12}P_{1,t-1} + a_{22}P_{2,t-1} + \ell_{2}w_{t-1})(1+r_{2}) = P_{2,t} \tag{8.14}$$

$$(a_{13}P_{1,t-1} + a_{23}P_{2,t-1} + \ell_{3}w_{t-1})(1+r_{3}) = P_{3,t} \tag{8.15}$$

Now, suppose that we have solved the problem of dividing cost increases, in the above system, between the 'joint products' of industry 1 which is now decomposed into $n+1$ subindustries. To simplify further, we shall pay no attention to the money supply and to the physical system. Given these assumptions, we can now analyse the inflationary process in response, say, to a <u>once and for all</u> increase in money wage rate w which happened at the beginning of period t in simple terms.

We shall limit ourselves to a single case, i.e. all firms follow the historic cost pricing (HCP) rule (see below). If this were the case, then the increase in money wage rate Δw at the beginning of period t, would be fully passed on to price in each of the processes of the above system, at the beginning of period $t-1$. The difference between industry 1 and the other two industries, as far as the inflationary effect of Δw is concerned, is that when $a_{ij} = 0$ all Δw would be passed to price in industries 2 and 3 in a single standard period while in industry 1 it must take $n+1$ standard periods. In the case when $a_{ij} \geqslant 0$, the inflationary effect of a once and for all increase in w would be fully performed over a longer period of time as we shall see below. In the case when all firms follow the replacement cost pricing (RCP) rule, <u>the full inflationary effect of a once and for all increase in w will be worked out in a single standard period.</u> The proof is lengthy, but not difficult, and may be described as follows:

Let us take the above system and lag every term on the right hand side of each process by the relevant number of standard periods in such a way that for each price equation of each process, whether it is of fictitious good or not, it is brought up to period t . If this operation were conducted, then the new price system would be as follows:

$$(a_{11}P_{1,t-1} + a_{21}P_{2,t-1} + a_{31}^{0}P_{3,0,t-1} + \ell_{1}w_{t-1})(1+r_{1})$$

$$= b_{11}P_{1,t}^{1} + a_{31}^{1}P_{3,1,t} \tag{8.16.1}$$

$$(b_{11}^{1}P_{1,t-1}^{1} + a_{31}^{1}P_{3,1,t-1}^{1} + \ell_{1}^{1}w_{t-1})(1+r)$$

$$= b_{22}P_{1,t}^{2} + a_{31}^{2}P_{3,2,t} \tag{8.16.2}$$

. . . .

. . . .

$$(b_{n-1,n-1}P_{1,t-1}^{n-1} + a_{31}^{n-1}P_{3,n-1,t-1} + \ell_{1}^{n-1}w_{t-1})(1+r_{1}) \tag{8.16.n}$$

$$= b_{nn}P_{1,t}^{n} + a_{31}^{n}P_{3,n,t}$$

$$(b_{nn}P^{n}_{1,t-1} + a^{n}_{31}P_{3,n,t-1} + \ell^{n}_{1}w_{t-1})(1+r_{1}) = P_{1,t} \tag{8.16.n+1}$$

$$(a_{12}P_{1,t-1} + a_{22}P_{2,t-1} + \ell_{2}w_{t-1})(1+r_{2}) = P_{2,t} \tag{8.17}$$

$$(a_{13}P_{1,t-1} + a_{23}P_{2,t-1} + \ell_{3}w_{t-1})(1+r_{3}) = P_{3,t} \tag{8.18}$$

Suppose that the rate of price inflation has been zero for a number of standard periods larger than n+1, and that all firms have alreadv decided that in the face of anv 'cost' increases, the HCP rule is to be applied. Suppose further that the working class is so weak that they are powerless to influence the money wage rate whatever the value of $\frac{\Delta P}{P}$, where P is a relevant price index. Under these circumstances an increase in r_2 (for whatever reason) at the beginning of period t will lead to the following inflationary process:

From the beginning of period t, P_2 increases by a certain percentage. Since it is used as an input in the ficticious process 1, it would led to an increase in the price of the fictitious outputs b_{11} and $a^{1}_{3,1}$. That increase will materialize at the beginning of period t+1. This in turn leads to an increase in the price of the ficticious outputs b_{22}, $a^{2}_{3,1}$ at the beginning of period t+2. After n+1 standard periods, the price of the final commodity 1 will go up in response to the increase in the prices of the ficticious outputs b_{nn}, a^{n}_{31} which took place at the beginning of period t+n-1.

Superimposed on this layer of inflationary process is the secondary increase in P_2 and P_3 which took place at the beginning of periods t+1, t+2 ... t+N with N > n. The important point which has to be emphasized here is this:

The increase in P_2 at the beginning of period t will lead to an increase in 'unit cost' in the early stages of the production process of the final commodity 1 . Abstracting from the various layers of increase in P_2 between the initial increase and the equilibrium point, that increase will sink for n standard periods and show up again at the beginning of period t+n in the form of an increase in the price of the final commodity 1 at the beginning of that period. The same process is repeated so long as the price system is not in equilibrium.

What is the difference between the above inflationary process, where all firms apply HCP rule, and the inflationary process which will be generated in response to the same increase in P_2 at the beginning of period t when the HCP rule is replaced by the RCP rule? What is the effect on the rate of price inflation of a conscious decision taken by the "business leaders" to switch, in the middle of the way from HCP rule to RCP rule?

Let us first answer the first question. In order to deal with the problem at hand in a clear way, we shall lag each of the first n+1 equations of system 8.13 - 8.15 by n standard periods. The resulting system is as follows:

$$\left(a_{11}P_{1,t-(n+1)} + a_{21}P_{2,t-(n+1)} + a^0_{31}P_{3,0,t-(n+1)} + \ell^0_1 w_{t-(n+1)}\right)(1+r_1)$$

$$= b_{11}P^1_{1,t-n} + a^1_{31}P_{3,1,t-n} \qquad (8.19.1)$$

$$(b_{11}P^1_{1,t-n} + a^1_{31}\ P_{3,1,t-n} + \ell^1_1 w_{t-n})(1+r_1) = b_{22}P^2_{1,t-n+1} + a_{31}P^2_{3,2,t-n+1} \qquad (8.19.2)$$

....
....

$$(b_{n-1,n-1}P^{n-1}_{1,t-2} + a^{n-1}_{31}P_{3,n-1,t-2} + \ell^{n-1}_1 w_{t-2})(1+r_1) = b_{nn}P^n_{1,t-1} + a^n_{31}\ P_{3,n,t-1} \qquad (8.19.n)$$

$$(b_{nn}P^n_{,t-1} + a^n_{31}\ P_{2,n,t-1} + \ell^n_1\ w_{t-1})(1+r_1) = P_{1,t} \qquad (8.19.n+1)$$

$$(a_{12}P_{1,t-1} + a_{22}P_{2,t-1} + \ell_1 w_{t-1})(1+r_2) = P_{2,t} \qquad (8.20)$$

$$(a_{13}P_{1,t-1} + a_{23}P_{2,t-1} + \ell_3 w_{t-1})(1+r_3) = P_{3,t} \qquad (8.21)$$

Suppose, as before, that the initial rate of price inflation has been zero for a number of standard periods longer than n+1, the working class is powerless to achieve any money wage increase <u>but</u> all firms in the economy have already decided to apply the RCP rule in response to any cost increase. What happens to the above system when the price of commodity 2 is to go up by a certain percentage, at the beginning of period t? By definition the RCP rule implies that all produced inputs, wherever their time-position in the production process, must be priced at their replacement price which is fixed at the beginning of period t. There are two impliations of this. <u>First</u>: a_{11} in the first equation must be multiplied <u>not</u> by $P_{1,t-(n+1)}$, but by $P_{1,t}$; a_{21} is not multiplied by $P_{2,t-(n+1)}$, but by $P_{2,t}$; and a^0_{31} is not multiplied by $P_{3,0,t-(n+1)}$, but by $P_{3,0,t}$. Finally, ℓ^0_1 is not multiplied by $w_{t-(n+1)}$, but by w_t.

<u>Second</u>: Since all other fictitious products appearing in the various stages in the production of commodity 1 (following the change in the pricing policies) have to be costed according to RCP rule, and since we are at the beginning of period t which witnessed an increase in the price of the commodity 2 , it follows that all other ficticious inputs and outputs must be priced at their replacement costs, implying that $P^{i}_{1,t-m}$ and $P_{3,i,t-m}$ must be replaced by $P^{i}_{1,t}$ and $P_{3,i,t}$ respectively. <u>This in turn means that the increase in P_2 at the beginning of period t led to a complex inflationary process which took place within period t , as if it were conducted in a vacuum.</u>

The end result of that process is that all commodity prices increase at the beginning of period t , reach their equilibrium level and settle there. It should be clear by now that when RCP rule is to be substituted for HCP rule we are doing no more than <u>replacing a case</u> where a given percentage increase in the measure of price inflation (being CPI or WSPI, or whatever) is worked itself out during a large number of standard periods <u>by a case</u> where the very same percentage increase in the same measure of price inflation is worked itself out within a single standard period. Now, if we are concerned with the rate of price inflation for a specific standard period, then we should say that HCP rule leads to lower rate of price inflation (for period t) than the case when RCP rule is applied. If we were to allow for the response of the working class to the erosion of their standard of living by, say, fighting successfully for the maintenance of a given real wage rate, and then compare the rate of price inflation when HCP is the rule with its rate when RCP is the rule we should conclude that RCP rule is associated with higher rate of price inflation per standard period than the case when HCP rule is being applied. I think the issue is clear enough to need no further elaboration.[7]

The answer to the second question (page 191 above) is more interesting.

Here the effect of the switch from HCP to RCP rule on the rate of price inflation (per standard period, of course) depends on a number of factors. They are the following:

(a) The number and the size of the firm(s) that switch from HCP to RCP rule.

(b) The speed of the switch from HCP rate to RCP rule

A gradual switch from HCP rule to RCP rule introduces a gradual increase in the rate of price inflation. This very fact can initiate the state of hyper-inflation. As I mentioned earlier, the above formulation is used to analyse the inflationary process in a system when HCP is the rule compared with another system where RCP is the rule.

Whatever is the degree of realism or unrealism of the above formulation, its more realistic version conveys the same message. The main differences are two. First the mark-up formulation of the "more realistic" price system is less clear cut. Second the mark-up mechanism (see below) embodies an indirect treatment of the same issues raised here, but in a less clear cut fashion. For this reason, the switch hypothesis is discussed in this section. The implication of the above argument is that, at the early stages of the inflationary phenomenon at least, the rate of price inflation measured with reference to each standard period is lowest when the predominant rule of pricing is the historic pricing rule. On the other hand, a shift from historic cost pricing rule to replacement cost pricing rule increases the rate of price inflation. When that happens, then one can say that the economy is entering, or has entered, the stage of hyper-inflation.

The reader should not forget that so far our analysis of the inflationary process is based on the assumption that the above price system is representative of the actual price system, and the problem of dividing cost increases between the two 'joint products' is resolved. Neither of the two assumptions is true. They have been made in order to focus the attention on the more important, and more interesting, issue which is the effect on the rate of price inflation of a switch from one pricing rule to another.

After this digression, we now return to the problem of getting a price system which is somewhat closer to an actual price system, for an economy with fixed capital and multiperiod production processes. The problem appears difficult. But it isn't. It can be solved by conducting certain algebraic manipulations on system 8.9 - 8.11, making one assumption, and utilising the fact that mark-up pricing is the rule in advanced capitalist economies. Let us carry out the same operation as we did on system 8.1 - 8.3 above, i.e. we multiply the first equation of system 8.9 - 8.11 by $(1+r)^{n-1}$, the second equation by $(1+r)^{n-2}$, etc. until equation $n-1$ which we multiply by 1. Of course the sum of the left hand side set of the new equations is equal to the right hand side. This leads, after some algebraic manipulations, to the following equations:

$$(a_{11}P_1 + a_{21}P_2 + a_{31}^0 P_{3,0} + \ell_1^0 w)(1+r)^n + \left[\ell_1^1 w(1+r)^{n-1} + \ell_1^2 w(1+r)^{n-2} + \ldots \right.$$

$$\left. \ldots + \ell_1^{n-1} w(1+r)^2 + \ell_1^n w(1+r)\right] = P_1 \qquad (8.22)$$

from which we get[8]

$$\left[a_{11}P_1 + a_{21}P_2 + w\sum_{k=0}^{n}\ell_1^k\right](1+r) + a_{31}^0 P_{3,0}(1+r)^n + F = P_1 \quad (8.23)$$

with $F = (a_{11}P_1 + {}_{21}P_2)[(1+r)^n - (1+r)] + \{[\ell_1^0(1+r)^n + \ell_1^1(1+r)^{n-1} + \ldots$

$$+ \ell_1^n(1+r)] - (1+r)\sum_{k=0}^{n}\ell_1^k\}w \quad (8.24)$$

When the target rate of profit r is given, and when the rates of price inflation and wage inflation are stable, the following relation holds:

$$\frac{a_{31}^0 P_3(1+r)^n + F}{(a_{11}P_1 + a_{21}P_2 + w\sum_{k=0}^{n}\ell_1^k)} = \Omega \quad (8.25)$$

The last equation, when combined with the two price equations of industries 2 and 3 respectively, leads to the following price system:

$$\left[a_{11}P_1 + a_{21}P_2 + w\sum_{k=0}^{n}\ell_1^k\right](1+r^*) = P_1 \;,\; r^* = r+\Omega \quad (8.26)$$

$$(a_{12}P_1 + a_{22}P_2 + w\ell_2)(1+r) = P_2 \quad (8.27)$$

$$(a_{13}P_1 + a_{23}P_2 + w\ell_3)(1+r) = P_{3,0} \quad (8.28)$$

Clearly, system 8.26 — 8.28 is highly theoretical. It represents an economy in a state of moving price equilibrium one aspect of which is the absence of conflict over the distribution of the technologically given level of net output. In reality, of course, the equilibrium state has no existence and as a result, system 8.26 - 8.28 represents a very limited aspect of reality. In fact, it is a very distorted version of a price system of an advanced capitalist economy. In what way does it differ from the price system characteristic of an advanced capitalist economy ?

Basically, it differs in two ways. (i) In system 8.26 - 8.28 we have a cost-price rule based on the application of the equilibrium rate of profit r . In reality (in most part) we have a mark-up pricing rule in which the mark-up, as a means for the achievement of a target rate of profit, takes the place of r . (ii) In system 8.26 - 8.28 we have a uniform pricing rule. P_j, $(j=1,2,3)$, is expressed as $1+r$ (or $1+r^*$) times a linear combination of a_{1j}, a_{2j}, and ℓ_j (or $\sum_{k=0}^{n} \ell_j^k$) with the weights attached to the latter coefficients being the equilibrium (money) prices and (money) wage rate, respectively. In reality firms predominantly apply one of the following pricing rules: (a) Historic Cost Pricing rule (b) Replacement Cost Pricing rule (c) Average Cost Pricing rule. A switch from one rule to another, in conditions of price inflation, is a hypothesis worth testing via sample survey and direct questioning of the decision makers. Let us have a closer look at each of these pricing rules and their corresponding price systems.

8.1.3. Pricing rules and price systems incorporating multiperiod production processes and fixed capital.[9]

We mentioned above that firms' pricing rules range from HCP to RCP. The 'in between' ACP rule as the one which received the strongest econometric support in Coutts et al (1978, Ch.4). Moreover, Dixon (1983) has shown that the speed of price adjustment to changes in prime cost depends on the length of the production period and, to a lesser extent, on the degree of industrial concentration. In the light of Dixon's results and Coutts et al. results, and some other works not directly concerned with the specific pricing rule being applied or the speed-of-adjustment relation to production period, it seems necessary that the price system 8.26 - 8.28 be brought closer to reality and then exposed to the variations of pricing rules and to the variations in the length of production period. The purpose of the exercise is to reformulate that system so that fixed capital, multiperiod production processes, and different pricing rules are incorporated in a single price system. In what follows, we shall maintain the assumption that for each industry the production period is composed of a number of standard periods.

Historic Cost Pricing Rule:

According to this rule, the price of commodity j fixed at the beginning of period t is equal to the mark-up times Historic Cost Per Unit (HCU). HCU is defined as the latest portion of inputs per unit priced at their latest contractual price plus the sum of all other portions of inputs per unit each priced at the contractual price relevant to its stage in production. When direct labour is the only input which is uniformly applied, and production period is an integer, as we shall assume all the way in this chapter, the price of commodity j becomes as follows:

$$P_{jt} = (1+r_j) \sum_{i=1}^{\theta} \frac{1}{\theta} w_{t-i} \qquad \theta > 1 \tag{8.29}$$

This is for the case when labour is a progressively added input. For the case when labour is an initial entry input, we have

$$P_{jt} = (1+r_j)w_{t-\theta} \tag{8.30}$$

with w_t being the money where wage rate per unit of output; r_j is the percentage mark-up for commodity j ; and θ is the production period.

<u>Replacement Cost Pricing Rule</u>:

According to this rule, the price of commodity j again fixed at the beginning of period t is equal to the mark-up times Replacement Cost Per Unit (RCU). RCU is defined as the successive portions of labour input per unit, <u>all</u> priced at the latest price of the latest input portion. Formally:

$$P_{jt} = (1+r_j)w_t \tag{8.31}$$

Equation 8.31 applies to both initial entry and progressively added labour input.

<u>Average Cost Pricing Rule</u>:

According to this rule, P_{jt} is equal to the mark-up times Average Cost Per Unit (ACU). ACU is defined as the weighted average of current and lagged input prices that go back to the beginning of the production period. The weights are the successive portions of inputs for each production stage divided by the sum of all portions over the whole production period. Formally:

$$P_{jt} = (1+r_j)2 \sum_{i=0}^{\theta} \frac{(\theta-i)}{\theta(\theta+1)} \quad w_{t-i} \tag{8.32}$$

for the case when labour is a progressively added input.

and

$$P_{jt} = (1+r_j) \sum_{i=0}^{\theta} \frac{1}{\theta} w_{t-i} \tag{8.33}$$

for the case when labour is an initial entry input.

Having specified the lag structure that corresponds to each rule and each type of input entry, two problems remain to be solved. The first problem is to reexpress equations 8.29 - 8.33 so that the assumption that production period is an integer is relaxed. The second problem concerns the reformulation of the price system so that the mark-ups, multiperiod production processes, fixed capital, and costing rules are all incorporated in that system in a meaningful way.

The solution of the first problem is a simple task, and is relegated to an appendix.[10] The solution of the second problem is, for the sake of brevity, limited to the case when all inputs (direct labour and material) are of progressively added nature.

The price system:

For the sake of simplicity, we shall further reduce our economy to a two-industry economy with industry 2 producing machines used in industry 1. As a result, the price system is reduced to a two-equation system. Under these circumstances, the price system which corresponds to the case when all variable inputs are of progressively added nature is as follows:

(i) HCP rule:

$$P_{1t} = (a_{11}\sum_{i=1}^{\theta_1} \frac{1}{\theta_1} P_{1,t-1} + \left[\sum_{k=0}^{n} \ell_1^k\right] \sum_{i=1}^{n} \frac{1}{\theta_1} w_{t-i})(1+r_1) \tag{8.34}$$

$$P_{2t} = (a_{12}\sum_{i=1}^{\theta_2} \frac{1}{\theta_2} P_{1,t-i} + \ell_2 \sum_{i=1}^{\theta_2} \frac{1}{\theta_2} w_{t-i})(1+r_2) \tag{8.35}$$

With the aid of the lag operator, L, system 8.34 - 8.35 can be rewritten as follows:

$$P_{1t} = \Big[a_{11}(\frac{1}{\theta_1} LP_{1t} + \frac{1}{\theta_1} L^2P_{1t} + \dots + \frac{1}{\theta_1} L^{\theta_1}P_{1t}) +$$

$$\sum_{l=0}^{n} \ell_1^k (\frac{1}{\theta_1} Lw_t + \frac{1}{\theta_1} L^2w_t + \dots + \frac{1}{\theta_1} L^{\theta_1}w_t)\Big] (1+r_1) \tag{8.36}$$

$$P_{2t} = \Big[a_{12}(\frac{1}{\theta_2} LP_{1t} + \frac{1}{\theta_2} L^2P_{1t} + \dots + \frac{1}{\theta_2} L^{\theta_2}P_{1t}) + \ell_2(\frac{1}{\theta_2} Lw_t + \frac{1}{\theta_1} L^2 w_t$$

$$+ \dots + \frac{1}{\theta_2} L^{\theta_2} w_t)\Big](1+r_2) \tag{8.37}$$

In matrix notation, using the lag polynomial function C(L) for the first equation and the function D(L) for the second equation, we can write system 8.36 - 8.37 as follows:

$$\begin{bmatrix} P_{1t} \\ P_{2t} \end{bmatrix} = \begin{bmatrix} 1+r_1 & 0 \\ 0 & 1+r_2 \end{bmatrix} \left\{ \begin{bmatrix} a_{11}C(L) & 0 \\ a_{12}D(L) & 0 \end{bmatrix} \begin{bmatrix} P_{1t} \\ P_{2t} \end{bmatrix} + \begin{bmatrix} \sum_{k=0}^{n} \ell_1^k C(L) \\ \ell_2 D(L) \end{bmatrix} w_t \right\} \tag{8.38}$$

and more compactly:

$$\underline{P}'_t = \hat{R}\ [A'(L)\underline{P}'_t + \underline{\ell}'(L)w_t] \tag{8.39}$$

where $\underline{P}'_t$ is a column vector of commodity prices, $\hat{R}$ is a diagonal matrix of sectoral mark-ups, $A'(L)$ is the technical coefficients matrix each of its coefficients being attached to the relevant lag polynomial function, $\underline{\ell}'(L)$ is a column vector whose elements are labour coefficients each attached to the relevant lag polynomial function, and w_t is the money wage rate agreed upon at the beginning of period t .

Equation 8.39 preserves the sequential nature of price determination. The degree of monopoly determines the mark-ups . Given those and given w_t, then P_{jt} depends on θ_j. Moreover, the analysis of price determination we conducted so far is based on the assumption that demand plays no <u>direct</u> role in the determination of commodity prices.

(ii) <u>RCP rule</u>:

This pricing rule has two versions. According to the first version, all layers of variable inputs are valued at their last (standard) period prices. Accordingly, the price system takes the following form:

$$P_{1t} = (a_{11}P_{1,t-1} + \sum_{k=0}^{n} \ell_1^k w_{t-1})(1+r_1) \tag{8.40}$$

$$P_{2t} = (a_{12}P_{1,t-1} + \ell_2 w_{t-1})(1+r_2) \tag{8.41}$$

more compactly

$$\underline{P}'_t = \hat{R}\ (A'\underline{P}'_{t-1} + \underline{\ell}'\ w_{t-1}) \tag{8.42}$$

According to the second version all layers of variable inputs are priced at their prices expected to prevail during period t. In this case, the price system takes the following form:

$$P_{1t} = \left[a_{11}P^{e}_{1,t} + \sum_{k=0}^{n} \ell_1^k w_t\right](1+r_1) \qquad (8.43)$$

$$P_{2t} = (a_{12}P^{e}_{1,t} + \ell_2 w_t)(1+r_2) \qquad (8.44)$$

more compactly

$$\underline{P}'_t = \hat{R}(A'\underline{P}'^{e}_t + \underline{\ell}' w_t) \qquad (8.45)$$

It should be noted that the money wage rate need not be anticipated because the wage contract is concluded at the beginning of period t, or earlier via the multiperiod wage contract. When price expectations are formed 'rationally', equation 8.45 becomes:

$$\underline{P}'^{e}_t = \hat{R}(A'\underline{P}'^{e}_t + \underline{\ell}' w_t) \qquad (8.46)$$

It should be emphasised that if commodity prices were formed by decision makers 'rationally', an important part of the inflationary process is removed from the analysis. That process is the input-output transmission of price-wage (or wage-price) increases from one industry to another.[11]

(iii) ACP rule:

Under this pricing rule, our simple price system becomes as follows:

$$P_{It} = \left[2a_{11}\left(\frac{\theta_1}{s_1} P_{1t} + \frac{\theta_1 - 1}{s_1} P_{1,t-1} + \dots + \frac{1}{s_1} P_{1,t-\theta_1}\right) + \right.$$

$$\left. 2\sum_{k=0}^{n} \ell_1^k \left(\frac{\theta_1}{s_1} w_t + \frac{\theta_1 - 1}{s_1} w_{t-1} + \dots + \frac{1}{s_1} w_{t-\theta_1}\right)\right](1+r_1) \qquad (8.47)$$

$$P_{2t} = \left[2a_{12}\left(\frac{\theta_2}{s_2} P_{1t} + \frac{\theta_2 - 1}{s_2} P_{1,t-1} + \dots + \frac{1}{s_2} P_{1,t-\theta_2}\right) + \right.$$

$$\left. 2\ell_2\left(\frac{\theta_2}{s_2} w_t + \frac{\theta_2 - 1}{s_2} w_{t-1} + \dots + \frac{1}{s_2} w_{t-\theta_2}\right)\right](1+r_2) \qquad (8.48)$$

where $s_j = (\theta_j + 1)\theta_j \qquad j = 1,2$

In matrix notation, in polynomial form, we have:

$$\underline{P}'_t = \hat{R}(A'_1(L)\underline{P}'_t + \underline{\ell}'(L)w_t) \qquad (8.49)$$

Again, the ground of the above formulations is sequentiality in price determination and its immediate independence of changes in the demand for the relevant product. The implication of the first two pricing rules for the rate of price inflation has already been stated in section 8.1.2 above, in some detail. Here, we need not say more than two sentences. When all firms follow the HCP rule, the rate of price inflation for each standard period is lowest in comparison with the other pricing rules. A switch from HCP rule to RCP rule, whether that switch is gradual (i.e. firms adopt RCP rule in sequence) or sudden, leads to a higher rate of price inflation.

8.1.4. The inflationary process in the presence of fixed capital and multiperiod production processes:

In this section we shall look a little more closely at the way system 8.23 - 8.28 is brought closer to a real price system in an advanced capitalist economy, then we deal with the main issue. As far as P_2 and P_3 are concerned, there is no problem. All that is needed is to specify the pricing rule for commodity 2 and 3 and multiply per unit cost by the relevant mark-up to arrive at P_{2t} , and P_{3t}. The problem lies with the first equation of that system. However, it is not difficult to handle.

The mark-up mechanism embodies a special treatment to the following expression which appears in the left hand side of equation 8.23 , reproduced below for convenience.

$$(1+r)^n a_{31}^0 P_{3,0} + F \tag{8.50}$$

By marking up average variable cost, this expression is automatically replaced by a fraction of average variable cost denoted by Ω in equation 8.25 above. It means that interest charges on finance capital, depreciation, and other elements of fixed costs, are assumed to vary in proportion to the variation in average variable cost.[12] If this argument were accepted, then we could proceed to bring the above system closer to a real price system as follows:

First: specify the pricing rule for commodities 1,2, and 3.

Second: multiply per unit cost by the corresponding mark-up, the latter being the means for attaining the target rate of profits r . If the first version of replacement cost pricing were the rule, then the price system would be as follows:

$$P_{1t} = (a_{11}P_{1,t-1} + a_{21}P_{2,t-1} + \sum_{k=0}^{n} \ell_1^k w_{t-1})(1+r_1) \tag{8.51}$$

$$P_{2t} = (a_{12}P_{1,t-1} + a_{22}P_{2,t-1} + \ell_2 w_{t-1})(1+r_2) \tag{8.52}$$

$$P_{3t} = (a_{13}P_{1,t-2} + a_{23}P_{2,t-1} + \ell_3 w_{t-1}(1+r_3) \tag{8.53}$$

System 8.51 - 8.53 is the same as system 6.1 of chapter (6) except for the absence of the coefficients a_{31}, a_{32} and a_{33} from system 8.51 - 8.53 due to the way we handled the presence of fixed capital and multiperiod production processes, albeit in a very simplified way. The questions one would like to address are these:

(1) What hypothesis should follow from the introduction of fixed capital and the lengthening of the production period (more work in progress in value terms) for industry 1 ?

(2) Do we have any evidence on that hypothesis?

(3) What difference does the introduction of fixed capital and mutliperiod production processes into the circulating capital single period system <u>make</u> to the analysis of price inflation which is based on the latter ?

The answer to the first question is this: the introduction of fixed capital and the lengthening of the production period for industry 1 necessitates an increase in the percentage mark-up of that industry relative to industries 2 and 3, other things being the same in the three industries. In other words, a higher capital-output ratio leads to a higher percentage mark up. Secondly, higher depreciation charges per unit of capacity output lead to a higher percentage mark-up.[13]

The answer to the second question is: Yes, we have. We have three pieces of evidence, two from U.K. manufacturing industry and one from U.S. manufacturing and some other nations.

(1) From the econometric work on the relationship between the percentage mark-up on the one hand and the degree of industrial concentration, intensity of advertising, and capital-sales ratio on the other, there is evidence of a significant and positive relationship between the percentage mark-up and capital-sales ratio[14]. Since a_{11}

and a^0_{31}, after multiplying each of them by its price (equilibrium or otherwise), are components of 'capital' in the capital-sales ratio of industry 1 it follows that a higher $P_{3,0}$ leads to higher mark-up.

(2) There is evidence, from U.K. manufacturing, on the relationship between the percentage mark-up and the rate of corporate tax which suggests that in the short run (up to a mean lag of one and a half years) firms shift nothing of the increase in the tax to price. Afterwards, it is fully passed to the latter in the form of higher mark-up[15]. Since higher corporate tax payments have the same effect on net profit as the effect of an increase in depreciation allowance due to higher capital costs, it follows that the increase in production period in industry 1 and the increase in the price of the machine (i.e. $P_{3,0}$) lead to an increase in 'capital' and that increase finds itself reflected in a higher mark-up (equation 5.24 of Ch.5.)

(3) Again, from U.K. manufacturing, there is evidence that firms increase their mark-ups after the rate of increase of material cost, and to some extent labour cost per unit, passes a give rate, or threshold[16]. That evidence, though it is probably more decisive for a sample of price leaders, is not based on any specific variable whether being an increase in corporate tax rate, capital costs, or greater degree of greediness on the part of the "business leaders".

Taken together, the above three pieces of evidence and the analysis which we presented in chapter 5 on the determination of the mark-up in oligopolistic market structure, lead one to venture the following conclusions. (1) the increased production period and the presence of fixed capital in industry 1 is associated with higher mark-up in that industry. The rigid mark-up resistance mechanism takes care of the inflationary effect of the increase in $P_{3,0}$ over time. The argument can be extended to cover a more general system. (2) the presence of fixed capital and multiperiod production processes (in the present closed economy model) do not invalidate the conclusion that in an advanced capitalist economy, price inflation is initiated either by higher mark-up or by higher money wage rate. I shall say a little more on the mark-up as a link in section 8.3. below.

8.2. Fixed capital and multiperiod production processes introduced into the physical system:

The aim of this section is to move one step further in the attempt at tracing the links between the price level and the level of employment, and as a result to trace the relationship between the rate of price inflation and the rate of unemployment. It is a preparatory section which serves the following two sections.

We start by approaching the problem of introducing fixed capital and multiperiod production processes into the circulating capital physical system in two steps. In the first step we abstract from fixed capital and concentrate the analysis on a production system which incorporates a single multiperiod production process. In the second step we introduce fixed capital into the latter system.

8.2.1. The physical system with a multiperiod production process but no fixed capital:

At the beginning of the last section I argued that the assumption that production period is the same for each industry is unrealistic. One piece of evidence on that comes from U.K. manufacturing where the ratio of maximum production period (for Electrical Engineering Industry) to the minimum production period (Clothing and Footwear Industry) is 2.5

(Coutts, 1978, p.40). This means that in a realistic formulation of the physical system that fact must be taken into consideration. Here, two questions arise:

(1) Why do we have to tackle the problem of nonuniformity of production periods at a time when our original problem is the study of price inflation under oligopoly capitalism ?

(2) If there were a good reason for tackling that problem, what should we do about it?

The answer to the first question is simple. We cannot speak of 'the' rate of unemployment without transforming the physical system in such a way that all the relevant flows are expressed with reference to a common period of time. The answer to the second question, which will occupy us in the remaining parts of this and the next subsections, is to transform the original system into an alternative one characterised by a uniform production period. As before (see subsection 8.1.2) the transformation is based on the von Neumann formulation of the economic system. We divide the longest period production process into a series of fictitious processes the length of each is equal to the shortest production period in the original system. Each of the fictitious processes produces a fictitious product associated with fictitious price.

Suppose the economy is composed of three industries only, the first of which is characterised by having a production period whose length is three times that of the other two industries. The latter are characterised by having identical production periods of a standard length. Instead of using words to describe the two systems we present them in the following scheme (table 4)

Table 4: showing the original and the transformed production processes

original system

Industry	1	2	3
1	a_{11}	a_{12}	a_{13}
2	a_{21}	a_{22}	a_{23}
3	0	0	0
labour	ℓ_1	ℓ_2	ℓ_3

transformed system

Industry	1^a	1^b	1^c	2	3
1^a	0	b_{11}	0	0	0
1^b	0	0	b_{22}	0	0
1^c	a_{11}	0	0	a_{12}	a_{13}
2	a_{21}	0	0	a_{22}	a_{23}
3	0	0	0	0	0
labour	ℓ_1^a	ℓ_1^b	ℓ_1^c	ℓ_2	ℓ_3

It is clear from the above table that what we have done is no more than divide industry 1 in the original system into three subindustries. This in turn led to the expansion of the original system from being a 3X3-industry system to a 5X5-industry system. The latter, named the 'transformed system', has the prominent characteristic that it is of uniform production period. It should be mentioned that the transformed system is based on a set of simplifying assumptions (e.g. the output of the fictitious industry is exclusively used in the adjacent industry and, apart from labour, nothing else). Now let us formalise the above scheme.

let:
$$\begin{bmatrix} 0 & b_{11} & 0 & 0 & 0 \\ 0 & 0 & b_{22} & 0 & 0 \\ a_{11} & 0 & 0 & a_{12} & a_{13} \\ a_{21} & 0 & 0 & a_{22} & a_{23} \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix} = A^* \qquad (8.54)$$

$$\begin{bmatrix} \ell_1^a & \ell_1^b & \ell_1^c & \ell_2 & \ell_3 \end{bmatrix} = \underline{\ell}^* \qquad (8.55)$$

$$\begin{bmatrix} x_1^a & x_1^b & x_1^c & x_2 & x_3 \end{bmatrix}' = \underline{x}^* \qquad (8.56)$$

and $$\begin{bmatrix} 0 & 0 & D_1^* & D_2^* & D_3^* \end{bmatrix}' = \underline{D}^* \qquad (8.57)$$

It follows that:

$$\underline{x}^* = (I-A^*)^{-1}\underline{D}^* \qquad (8.58)$$

and $$N = \underline{\ell}^{*\prime}(I-A)^{-1}\underline{D}^* \qquad (8.59)$$

where N is the level of private employment in the above 5X5 system. It is useful to write equation 8.59 in the following way:

$$N = \underline{\ell}^*\{I + A^* + (A^*)^2 + \ldots + (A^*)^{n-1}\}\underline{D}^* \qquad (8.60)$$

Equation 8.60 is based on the Kaleckian-Keynesian theory of employment where the level of employment depends on the planned level of (gross) output. The latter depends on the level of final demand. What woudl be the time path of N if $\underline{D}^*$ were to increase by $\Delta\underline{D}^* = [0\ \ 0\ \ 1\ \ 0\ \ 0]'$ and then remain at its new level ? Under the assumption of constant returns to scale, no shortage of labour of any type, and no inventory replenishment we can trace the time path of N in simple terms. Assume that $\Delta\underline{D}^*$ occurred during period 0 . The level of employment at the beginning of period 1 is $N_0 + \underline{\ell}^*\Delta\underline{D}^*$. The level of employment at the beginning of period 2 is equal to $N_0+\underline{\ell}^*\Delta\underline{D}^*+\underline{\ell}^*A^*\Delta\underline{D}^*$ + (the demand-output-employment effect of $\underline{\ell}^*\Delta D^*$). At the beginning of period

3 the level of employment is: $N_0 + \underline{\ell}\Delta\underline{D}^* + \underline{\ell}^* A^* \Delta\underline{D}^* + \underline{\ell}^*(A^*)^2 \Delta\underline{D}^* +$ (the combined demand-output-employment effect of $\underline{\ell}^*\Delta\underline{D}^*$, $\underline{\ell}^* A^* \Delta\underline{D}^*$), etc... The equilibrium level of employment, under the above set of assumptions is not $\underline{\ell}^*(I-A^*)^{-1}(\underline{D}^* + \Delta\underline{D}^*)$. It is greater, which we may call N^*. Replenishing the depleted level of inventory raises the equilibrium level of employment further via a cyclical time path of N. The introduction of fixed capital to the system complicates things further.

The above digression shows that the von Neumann formulation of the physical system simplifies handling the problem of multiperiod production processes without affecting our earlier analysis of the employment effect of $\Delta\underline{D}^*$.

8.2.2. The physical system with multiperiod production process and a single machine:

A variable rate of price inflation is a symptom of disequilibrium within the economic system. This is so because in analysing the inflationary process we should have a definite formulation of all sides of the economic system: the price system, the physical system, and the financial system. Since the three systems are interconnected, a variable rate of price inflation under the above condition negates the presence of a state of equilibrium in the physical system.[17] Under these circustances, one needs a formulation of the physical system (with or without fixed capital) which is a reflection of the disequilibrium state of the system as a whole. To get a version of such a formulation, we shall make the following assumptions.

(i) Industry 1 is the only industry which uses fixed capital (a single machine). The technical life of the machine is equivalent to the the production period in that industry. The latter is assumed to be three standard periods.

(ii) Industries 2 and 3 buy no inputs from industry 3 which produces the machine. The latter is used in industry 1 for replacement and capacity expansion purposes.

(iii) The depreciation coefficient of the machine, denoted by δ, is given.

Granted these assumptions, of which assumption (iii) is crucial, the new scheme takes the following form (table 5):

Table 5: showing the commodity balances of the transformed system

	commodity inputs					final demand			
industry	1^a	1^b	1^c	2	3	W*	C*	G*	I*
1^a	0	$b^b_{11}x_1$	0	0	0	0	0	0	I^a_1
1^b	0	0	$b_{22}x^c_1$	0	0	0	0	0	I^b_1
1^c	0	0	0	$a_{12}x_2$	$a_{13}x_3$	W^*_1	C^*_1	G^*_1	$\bar{I}^c_1$
2	$a_{21}x^a_1$	0	0	$a_{22}x_2$	$a_{23}x_3$	W^*_2	C^*_2	G^*_2	$\bar{I}^*_2$
3	0	0	0	0	0	0	0	0	$\delta m\sum\limits_k x^k_1+m\sum\limits_k(x^k_1-x^{kq}_1)$
labour	$\ell^a_1x^a_1$	$\ell^b_1x^b_1$	$\ell^c_1x^c_1$	ℓ_2x_2	ℓ_3x_3	---	---	---	---

industry	ΔV*	gross output
1^a	ΔV^a_1	x^a_1
1^b	ΔV^b_1	x^b_1
1^c	ΔV^c_1	x^c_1
2	ΔV_2	x_2
3	ΔV_3	x_3
labour	---	N

In the above scheme industries 1^a, 1^b and 1^c are, originally, industry 1 whose production period is composed of three standard periods. Industry 3 is the one which supplies no material inputs to the rest. Its speciality is limited to the production of machines at a rate of $\delta m \sum\limits_k x^k_1 + m \sum\limits_k (x^k_1 - x^{kq}_1)$ per standard period. δ is the depreciation coefficient, m is the capital-output ratio, x^k is the actual level of sub-industry k, x_1^{kq} is the capacity output of sub-industry k, and ΔV_j is the actual change in the level of inventory in industry j.

We can formalise the above scheme as follows:

$$x_1^a = b_{11}x_1^b + I_1^a + \Delta V_1^a \tag{8.61}$$

$$x_2^b = b_{22}x_1^c + I_1^b + \Delta V_1^b \tag{8.62}$$

$$x_1^c = a_{12}x_2 + a_{13}x_3 + W_1^* + C_1^* + G_1^* + \bar{I}_1^c + \Delta V_1^c \tag{8.63}$$

$$x_2 = a_{21}x_1^a + a_{22}x_2 + a_{23}x_3 + W_2^* + C_2^* + G_3^* + \bar{I}_2^* + \Delta V_2 \tag{8.64}$$

$$x_3 = \delta m \sum_k x_1^k + m \sum_k (x_1^k - x_1^{kq}) + \Delta V_3 \tag{8.65}$$

In matrix form, system 8.61 - 8.65 becomes:

$$\underline{x} = A^*\underline{x} + (\underline{W}^* + \underline{C}^* + \underline{G}^* + \underline{I}^* + \Delta\underline{V}) \tag{8.66}$$

with
$$A^* = \begin{bmatrix} 0 & b_{11} & 0 & 0 & 0 \\ 0 & 0 & b_{12} & 0 & 0 \\ 0 & 0 & 0 & a_{12} & a_{13} \\ a_{21} & 0 & 0 & a_{22} & a_{23} \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}, \quad \underline{I}^* = \begin{bmatrix} I_1^a \\ I_1^b \\ \bar{I}_1^c \\ \bar{I}_2^* \\ \delta m \sum_k x^k + m \sum_k (x_1^k - x_1^{kq}) \end{bmatrix},$$

$$\Delta\underline{V} = \begin{bmatrix} \Delta V_1^a \\ \Delta V_1^b \\ \Delta V_1^c \\ \Delta V_2 \\ \Delta V_3 \end{bmatrix}$$ and $\underline{W}^*$, $\underline{C}^*$, $\underline{G}^*$ carries the usual meanings

The behavioural version of the identity 8.66 which corresponds to the behavioural equation 6.12 of chapter 6, is the following:

$$\underline{x}_t = \underline{x}^{sa}_{t-1} - \lambda(\underline{V}_{t-1} - \underline{V}^{*}_{t-1}) \qquad 1 > \lambda > 0 \tag{8.67}$$

with $\underline{V}_t$ being the actual level of inventory at the end of period t . $\underline{V}^{*}_t$ is the desired level of inventory at the end of period t .Equation (8.67) can be rewritten as:

$$\underline{x}_t = A^{*}\underline{x}^{sa}_{t-1} + \underline{D}^{*}_{t-1} - \lambda(\underline{V}_{t-1} - \underline{V}^{*}_{t-1}) \tag{8.68}$$

$$\Rightarrow \underline{x}_t = (I-A^{*})^{-1}\underline{D}^{*}_{t-1} - \lambda(\underline{V}_{t-1} - \underline{V}^{*}_{t-1}) \tag{8.69}$$

which is the same as equation 6.16 of chapter 6 (except for the stars appearing on A and $\underline{D}_{t-1}$ of equation 8.69).

$$N_t = \underline{\ell}^{*}\underline{x}_t + L_{gt} \tag{8.70}$$

where $\underline{\ell}^{*}\underline{x}_t$ and L_{gt} are the level of employment in the capitalist and the government sectors in period t , respectively. Some of the implications of the expanded version of equation 8.70 above are mentioned in section 8.3 below.

8.3. The price system and the physical system combined:

To take equation 8.70 above as a link between the level of employment output and price inflation, we need one further point to be made explicit. In considering the relation between the physical system and the price system, we should ignore all fictitious prices. As far as fixed capital is concerned, we have already assumed that the machine, which is solely produced in industry 3, is installed and used in industries 1^a, 1^b and 1^c. This means that I^a_1 $I^b{}_1$ and $\bar{I}^c_1$ depend on the rate of capacity utilization, among other things, in the fictitious industries. This is so because we have already assumed that each industry within industry 1 is constrained by the machine-shift constraint. Since actual levels of output in each of the two industries are constrained by the capacity output of the machine, it follows that I_1^a, I_1^b and $\bar{I}_1^c$ themselves depend on x_1^a , x_1^{aq} ;x_1^b , x_1^{bq}; and x_1^c, x_1^{cq} respectively. This argument enables us to write I_1^a, $I^b{}_1$ and $\bar{I}_1^c$ as follows:

$$I_1^a = f^a(x_1^a - x_1^{aq}) \tag{8.71}$$

$$I_1^b = f^b(x_1^b - x_1^{bq}) \tag{8.72}$$

$$\bar{I}_1^c = f^c(x_1^c - x_1^{cq}) \tag{8.73}$$

As for $\bar{I}_1^c$ and $\bar{I}_2^*$, they are exogenously determined (see "Note on investment demand" in Ch.6).

The above argument, together with that of of section 6.2.2 of chapter 6 above, enbles one to write equation 8.70 above as follows:

$$N_t^* = \underline{\ell}^*(I-A^*)^{-1}\left\{\begin{bmatrix} 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1/_{P_{1,t-1}} & 0 & 0 \\ 0 & 0 & 0 & 1/_{P_{2,t-1}} & 0 \\ 0 & 0 & 0 & 0 & 1/_{P_{3,t-1}} \end{bmatrix}\right. \Bigg[$$

$$\begin{bmatrix}0\\0\\\beta_1\\\beta_2\\0\end{bmatrix} W_{t-2}N_{t-2} + \begin{bmatrix}0\\0\\\lambda_1\\\lambda_2\\0\end{bmatrix} C^{c}_{t-1} + \begin{bmatrix}0\\0\\\phi_1\\\phi_2\\\phi_3\end{bmatrix} G^{m}_{t-1} \Bigg]$$

$$\left.\begin{bmatrix}I^{a}_{1t}\\I^{b}_{1t}\\\bar{I}^{c}_{1}\\\bar{I}^{*}_{2}\\I^{*}_{3t}\end{bmatrix}\right\} - \lambda\underline{\ell}^{*}(\underline{V}_{t-1} - \underline{V}^{*}_{t-1}) + \frac{1}{w_t}\,\phi_4 G^{m}_{1,t} \qquad (8.74)$$

with $I^{*}_{3t} = \delta m \sum_k x^{k} + m\sum_k (x^{k}_{1,t-1} - x^{kq}_{1})$ (8.75)

Equation 8.74 above is really a complicated one. Unfortunately, one cannot relax assumptions for greater realism without a greater degree of complexity. That equation tells us the following:

(1) The level of employment (in man-hours) in period t cannot be determined without knowledge of all commodity prices, the level of the wage bill, planned capitalist consumption expenditure, government expenditure and the vector level of investment demand in physical terms; given the structural quantities $\underline{\theta}$, $\underline{\lambda}$ and $\underline{\phi}$.

(2) A lower money wage rate which is not associated with a corresponding and immediate lowering of the prices of wage goods would have a negative employment effect[18], contrary to the assertions of the conventional "wisdom".

(3) Current investment orders do not depend on current level of commodity prices and current money wage rates. They are pre-determined relative to period 't'.

(4) The change in the actual level of inventory plays an explicit role in the determination of gross output and therefore employment.

8.4 Some comments:

Equation 8.74 is the link between price inflation and the level of employment, and as a result it is a link between the rate of price inflation and the rate of unemployment. However, that equation is based on a less restrictive set of assumptions than equation 6.32 of chapter 6. The similarity between the two equations implies that we can repeat the analysis on the initiation, continuity etc. of price inflation and the conclusions of chapter 6, using equation 8.74 above. The question one might legitimately like to ask is this: What have we gained from the introduction of fixed capital and multiperiod production processes (though in a very simple way, which can be generalised) to the circulating capital model of chapter 6 ? The answer is "not much", except the following:

(i) Under the assumption that the economy is closed, and abstracting from retail trade, we are now in a position to say that in advanced capitalist economies the roots of price inflation are not in the production relations. The issue is deeper than that. Social relations must be involved because conflict over income distribution is involved. Price inflation can be initiated by an increase in the mark-up in a specific industry or by an increase in money wage rate (for whatever reason) in a specific industry. The new element which the present chapter sheds some light on is that in the presence of multiperiod production processes and fixed capital, the mark-up (r_j in the present model) takes over as the "cost" link between the industry whose production period is lengthened and uses fixed capital and the remaining industries in the economy. In the open economy (chapter 9 below) the exchange rate and the foreign currency prices of imports must be added to the set of initiating factors of the inflationary process, which we identified in the closed economy case. In both cases money supply has nothing to do with the initiation of this monetary phenomenon.

(ii) The inter-industrial <u>circulation capital</u> model is a powerful tool for the analysis of price inflation in the economies under consideration. It conveys the essence of the inflationary process of a more general model.

However, the extended model presented in this chapter has a long way to go, to approximate reality.

Notes to Chapter 8

[1]A useful introductory material on the introduction of fixed capital into the circulating capital price system is found in Mainwaring (1984), Ch.11, For a more complicated analysis, see: Roncaglia (1978), pp.36-48, and Baldone (1980).

[2]This section is heavily dependent on Morishima (1969), Ch. VI.

[3]The reader is reminded that a^n_{ij}, ℓ^n_j, and P^n_j do not mean a_{ij}, ℓ_j and P^n_j each raised to the power n. n here is a superscript.

[4]Morishima, ibid, pp. 91-92

[5]The asumption that the machine is needed for the production of all the n+1 'goods' implies that a^j_{31} can replace a^i_{31} in any of the n+1 processes ($i \neq j$). This in turn necessitates the replacement of the first n+1 equations by $(n+1)^2$ equations. Such expansion of the above system complicates things without adding any thing substantial. As a result we have abstracted from that complication (see appendix 6 for the matrix formulation of the price system of a simple case). In any case, if the system were in a state of equilibrium, the number of processes must be equal to the number of prices. This theorem reduces the number of equations considerably. See: Mainwaring, Ibid., pp. 135-143.

[6]The reader is referred to appendix (6) for the matrix formulation of the above system under the assumption that n=3.

[7]In Harcourt (1982), pp.28-32, a similar conclusion is arrived at via a simplified, shorter and self contained treatment, though in a different context. There, the reader finds analysis in terms of level differences of commodity prices (at each point in time) resulting from the application of HCP rule in one hypothetical economy and the application of RCP rule in another economy identical to the first in all other aspects.

[8]See appendix (7) for derivations.

[9]The following analysis is almost entirely based on Coutts, K. et al, (1978), Ch.3.

[10]See appendix 8

[11]See appendix 9.

[12]Sylos-Labini, (1974), pp.5-7; see also ch.5, equations 5.23 and 5.24.

[13]Op.cit.

[14]Chapter 5, pp.115-119 and Weiss (1974).

[15]See Coutts, K. et.al,(1978), Ch.5.

[16]Bird (1983).

[17]See chapter 10, pp.264-268.

[18]See also Morishima (1984), pp.208-211.

Chapter 9: The Open Economy

9.1 Introductory Note[1]:

The analysis of price inflation conducted so far is based on the assumption (among others) that the economy is closed. That assumption should be no more than a conceptual device that enables the analyst to focus his attention on the possible internal forces which initiate, or affect the speed of, price-inflation in an advanced capitalist economy. That assumption must be abandoned once that mission is completed.

One can learn from Keynes[2] who was able to show that, for a closed economy, it is possible for unemployment equilibrium to exist and persist. That granted, then opening the economy superimposes a set of external factors on the internal factors which gave rise to unemployment equilibrium. By applying this method to analysis of price inflation, it was possible for me to show that an "advanced" capitalist economy can develop a state of hyper-inflation on its own. A fortiori, when that economy becomes an integrated part of a global economic system the set of factors which initiate the inflationary process, or change the speed at which price/ wage inflation is running, is expanded to include an external subset. Once the external set of factors is admitted to the analysis, it becomes necessary for the analyst to first: identify clearly these factors, secondly, show clearly how these factors affect the speed of price inflation or initiate the inflationary process, and thirdly, show how internally initiated price inflation gets 'exported' and then can be 'imported'. Let me first start with the set of questions which I am going to answer in the present chapter:

(1) How do we adapt the closed system such that at least some of the main characteristics of an open advanced capitalist economy are taken into consideration ?

(2) What are the essential differences between the closed system and the open system, as far as the inflationary process is concerned ?

(3) How do we analyse price inflation in the open system ?

and (4) What do we gain from that analysis ?

The answers to these questions are the subject matter of the remaining sections of this chapter.

9.2 The open system: a formal presentation:

Let us make the following, simplifying, assumptions: i) All 'capital' is of circulating nature and sectoral production periods are identical. ii) Industry 1 is the only industry which uses an imported (complementary) input. iii) The economy is small relative to the global system such that its demand for imports does not affect world prices. iv) The exchange rate, defined as the domestic currency price of one unit of foreign currency, and denoted by $\bar{e}$, is given. v) Financial capital movements do not affect the physical system. vi) No tariffs or subsidies exist. And vii) All firms follow the historic cost pricing rule. The other crucial assumptions which we assumed in chapter 6, p.127 still hold. Granted these assumptions, we can now proceed to formalise our open system as follows:

9.2.1. The price/wage system

$$P_{1t} = (a_{11}P_{1,t-1}+a_{21}P_{2,t-1}+a_{31}P_{3,t-1}+a_{m1}\bar{e}P^{m}_{1,t-1}+\ell_1 w_{t-1})(1+r_1) \qquad (9.1)$$

$$P_{2t} = (a_{12}P_{1,t-1}+a_{22}P_{2,t-1}+a_{32}P_{3,t-1}+\ell_2 w_{t-1})(1+r_2) \qquad (9.2)$$

$$P_{3t} = (a_{13}P_{1,t-1}+a_{23}P_{2,t-1}+a_{33}P_{3,t-1}+\ell_3 w_{t-1}(1+r_3) \qquad (9.3)$$

$$w_t = w_{t-1}\left[(1+\frac{P_{t-1}-P^e_{t-1}}{P_{t-2}})(\frac{P^e_t}{P_{t-1}})(1+g)\right]^{k(U_t,T)} \qquad (9.4)$$

where a_{m1} is the imported input coefficient, $\bar{e}$ is the exchange rate, P^m

is the foreign currency price of the imported input, and T is an index of workers' power. The meaning of the other notation is the same as was assigned in chapter 6, except for the fact that P_t, the price level index, now includes consumers' imports.

9.2.2. The physical system:

Corresponding to the above price system, we have the following open economy physical system and employment equation:

$$\underline{x}_t^{open} = \underline{x}_{t-1}^{sales.open} - \lambda \left(\underline{V}_{t-1}^{open} - \underline{V}_{t-1}^{*\ open}\right) \qquad 0 < \lambda < 1 \qquad (9.5)$$

$$\underline{x}_t^{open} = \begin{bmatrix} \underline{X} \\ \underline{M} \end{bmatrix}_{t-1}^{sales} - \lambda \left(\underline{V}_{t-1}^{open} - \underline{V}_{t-1}^{*\ open}\right) = \begin{bmatrix} A & \underline{0} \\ A^m & \underline{0} \end{bmatrix} \begin{bmatrix} \underline{X} \\ \underline{M} \end{bmatrix}_{t-1}^{sales} + \begin{bmatrix} \underline{D}^* \\ \underline{0} \end{bmatrix}_{t-1} - \lambda \begin{bmatrix} \underline{V}_t - \underline{V}_t^* \\ \underline{V}_t^M - \underline{V}_t^{*M} \end{bmatrix} \qquad (9.6)$$

$$\Rightarrow \qquad \underline{x}_t = (I-A)^{-1}\underline{D}_{t-1}^* - \lambda(\underline{V}_{t-1} - \underline{V}_{t-1}^*) \qquad (9.7)$$

and $$\underline{M}_t = A^m (I-A)^{-1}\underline{D}_{t-1}^* - \lambda\left(\underline{V}_{t-1}^M - \underline{V}_{t-1}^{*M}\right) \qquad (9.8)$$

and $$N_t = \underline{\ell}[I-A]^{-1}\underline{D}_{t-1}^* - \lambda\underline{\ell}\left(\underline{V}_{t-1} - \underline{V}_{t-1}^*\right) + L_{gt} \qquad (9.9)$$

with

$\underline{x}_t = [x_{1t}\ x_{2t}\ x_{3t}]'$ Gross output vector (9.10)

$\underline{M}_t = [M_{1t}\ M_{2t}\ M_{3t}]'$ Imports vector (9.11)

$\underline{D}_t^{*}+ = [D_{1t}^*\ D_{2t}^*\ D_{3t}^*]'$ Final demand vector, for domestically produced goods (9.12)

$\underline{V}_t^M = [V_{1t}^M\ V_{2t}^M\ V_{3t}^M]'$ Actual inventories vector of imported goods, at the end of period t.

$\underline{V}_t^{*M} = [V_{1t}^{*M}\ V_{2t}^{*M}\ V_{3t}^{*M}]'$ Desired inventories vector of imported goods at the end of period t.

$$A = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{11} & a_{12} & a_{13} \end{bmatrix} \qquad (9.13)$$

$$A^m = \begin{bmatrix} a_{m1} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix} \qquad (9.14)$$

It should be emphasised that matrix A must include no imported inputs[3]. On the other hand, vector $\underline{D}_t^*$ must now include the subvector of exports.

9.2.3. Credit money and the government sector:

As is the case with the closed economy, the open economy monetary relations are the following (see Chapter 7, especially sections 7.6-7.7)

$$\Delta H_t^G = (\text{def})_t = G_{1t}^m - R_t \tag{9.15a}$$

$$\Delta H_t = \Delta H_t^G + \Delta H_t^{Bank} \tag{9.15b}$$

$$H_t = H_{t-1} + \Delta H_t \tag{9.16}$$

$$M_t^p = \left[\frac{1+\varepsilon}{\sigma+\varepsilon}\right] H_t \tag{9.17}$$

$$M_{dt} = m_0 + m_1 Y_t^m - m_2 i_t \tag{9.18}$$

$$\dot{\ell}_t = L\left(M_t^{d,s}; M_t^{s,s}; \bar{i}^*\right) \tag{9.19}$$

Let us further assume (again for simplicity) that output of sectors 1 and 2 is supplied for domestic use only; that of sector 3 is differentiated from foreign output and partially exported. The volume of exports depends on the level of home currency price (which depends on the technology and distributional factors), the exchange rate $\bar{e}$, and demand abroad[4].

Having specified the open economy price system, the wage equation, the physical system, and sketched a specification of the money and the government sectors, we are now in a position to analyse the inflationary process in that economy with a reasonable degree of clarity. The reader will notice that our formulation of the open system is based on rejecting the idea that the perfectly competitive market theory, and marginalism in general, should be the starting point. That rejection seems to me inevitable if one wants to model an advanced capitalist economy (which is by definition an open economy) in a way that approximates the relevant realities of that economy as a second step in the series of steps which are supposed to lead to (a) scientific knowledge on the laws according to which price inflation gets initiated, spreads, etc. (b) a set of policy prescriptions designed to control it without further injustice, i.e. without letting the distribution of national income change in such a way that one section of the society or another becomes worse off.

9.3 A simplified theoretical analysis:

The theoretical analysis presented below is limited to two cases: Case I, for the inflationary effect of a once and for all increase in the foreign currency price of the imported input under a regime of fixed exchange rate; Case II for the inflationary effect of devaluation. A more general case is deferred to the following section.

9.3.1. Case I: A once and for all increase in the world price of one imported input

We start this case by assuming that money wage rate, w, remains at its initial level during the period in which the economy undergoes a state of disequilibrium. Now, the assumption that materials and direct labour inputs per unit of output are constant in the short run[5] means that the increase in P_1^m at the beginning of period t leads to a smaller percentage increase in the price of commodity 1 at the beginning of period t+1 . This in turn leads to a smaller percentage increase in prices of commodities 2 and 3 , at the beginning of period t+2 . This mild inflationary process continues until the system settles at a new equilibrium position defined by the following set of equations:

$$\underline{P}^E = (\underline{a}^* . \bar{e} . P_1^m + \underline{\ell} w)(I+\hat{R})[I-A(I+\hat{R})]^{-1} \tag{9.20}$$ [6]

$$N^E = \underline{\ell}(I-A)^{-1}\underline{D}^E + L_g \tag{9.21}$$

$$M_d = M_s \quad \text{(demand for money equal to actual money supply)} \tag{9.22}$$

where $\underline{P}^E = [P_1^E \; P_2^E \; P_3^E]$, the new equilibrium price vector, $\underline{a}^* = [a_{m1} 0 \; 0]$

$\hat{R} = \begin{bmatrix} r_1 & 0 & 0 \\ 0 & r_2 & 0 \\ 0 & 0 & r_3 \end{bmatrix}$, $\underline{\ell} = [\ell_1 \; \ell_2 \; \ell_3]$, N^E and $\underline{D}^E$ are the new equilibrium[7] levels of employment and final demand (vector), respectively. L_g is the level of employment in the government sector.

Now, since money wage rate w did not change in response to higher commodity prices, by assumption, it follows that the new equilibrium levels of gross output and employment are <u>lower</u> than their initial levels <u>so long as real demand by the government is maintained at its initial level</u>. This must be the case because the decline in the real wage rate (w/p), given the level of real demand by the government, leads to a decline in the actual volume of sales of wage goods, a decline in the actual level of output, a decline in the total number of hours worked[8], and as a result a decline in the actual number of working men. The assumption that $\bar{e}$ is fixed means that the foreign currency price of commodity 3 is increasing, and as a result, demand for that commodity must have been decreasing. This in turn means their output must have been decreasing and as a result "N" must have been decreasing. The later decrease is to be superimposed on the negative employment effect of the lower level of w/p to which we have just referred.

As for the balance of payments effect, assumed to be the same as the balance of trade in the present model, it is defined as follows:

$$B_t = P_{3t}X_{3t}^{EX} - \bar{e}P_{1t}^{m}M_{1t} - \gamma C_t \tag{9.23}$$

where: X_{3t}^{EX} = quantity of exports of commodity 3 (the only exportable), M_1 = quantity of imports of the imported imput, and γ is the fraction of current consumption expenditures C_t devoted by the society to the imports of consumer goods. To analyse the balance of payments effect of a once and for all increase in P_1^m from the beginning of period t, I propose to conduct the analysis in three steps:

First, look at the immediate effect of an increase in P_1^m

Second, look at the effect of higher P_1^m in the transitional period, and finally

Third, look at the effect of this higher P_1^m when the system settles (if it can settle at all) at its new equilibrium position.

I shall focus my attention on the immediate effect of the once and for all increase in P_1^m and leave the discussion of the other two points for the moment. From equation 9.23 we can get:

$$dB = P_{3t}dX_{3t}^{EX} - \bar{e}\,M_{1t}dP_{1t}^{m} - \gamma dC_t. \tag{9.24}$$

Assuming, for simplicity, that both the first and last terms are zeroes, it is clear that the immediate effect of the increase in P_1^m on the balance of payments is to worsen it. The negative income effect of deterioration of living standards of the working class, other things remaining the same, reduces the extent of the deterioration of the balance of payments, and can possibly reverse its state from deficit into surplus.

As for the demand for money, M_{dt} (= actual supply), its new equilibrium level can be lower than its initial equilibrium level if the reduction in real output is proportionately lower than the increase in commodity prices.

Let us now relax the assumption that $K(U_t, T) = 0$ and hence relax the assumption that the money wage rate is given. Instead, let us assume that the money wage rate is determined according to the general wage equation 9.4 above. Assume further that real demand by the government is revised at the beginning of each period such that the initial level of employment is maintained. Can we still say that the once and for all increase in P_1, at the beginning of period t, initiates an inflationary process characterised by a declining rate of price inflation ? Let us see.

The assumption that material and direct labour inputs per unit are fixed in the short run enables one to write the price system as follows[9]:

$$\dot{P}_{1t} = v_{11}\dot{P}_{1,t-1} + v_{21}\dot{P}_{2,t-1} + v_{31}\dot{P}_{3,t-1} + v_{m1}\dot{P}^{m}_{1,t-1} + a_1\dot{w}_{t-1} \qquad (9.25)$$

$$\dot{P}_{2t} = v_{12}\dot{P}_{1,t-1} + v_{22}\dot{P}_{2,t-1} + v_{32}\dot{P}_{3,t-1} + a_2\dot{w}_{t-1} \qquad (9.26)$$

$$\dot{P}_{3t} = v_{13}\dot{P}_{1,t-1} + v_{23}\dot{P}_{2,t-1} + v_{33}\dot{P}_{3,t-1} + a_3\dot{w}_{t-1} \qquad (9.27)$$

where $\dot{P}_{jt} = \Delta P_{jt}/P_{j,t-1}$; and v_{ij}, v_{m1}, and a_j are constants with

$0 \leqslant v_{ij}, v_{m1}, a_j < 1 \quad i,j = 1,2,3.$

Now at the beginning of period t the system emerges from last period's equilibrium position and enters its first period of disequilibrium with $\dot{P}^m_{1t} > 0$, $\dot{P}_{jt} = \dot{w}_t = 0$. This means that at the beginning of period $t+1$ we have:

$$\dot{P}_{1,t+1} = v_{m1}\dot{P}^m_{1t}. \tag{9.28}$$

At the beginning of period $t+2$ prices of sectors 2 and 3 together with the money wage rate increase by a maximum of less than $P_{1,t+1}$. At the beginning of period $t+3$ price of industry 1 increases by less than the maximum of $\dot{P}_{2,t+2}$, $\dot{P}_{3,t+2}$, and $\dot{w}_{t+2}$. The process goes on until:

$$\dot{P}_{1,t+Q} = \dot{P}_{2,t+Q} = \dot{P}_{3,t+Q} = \dot{w}_{t+Q} = 0 \tag{9.29}$$

where Q is a large number.

From the above analysis we notice that $\dot{P}_{1t}$ is decreasing over time. This means that while absolute price levels (excluding the price of the imported commodity) and money wage rate are all increasing over time, they are converging to a definite equilibrium level. That level makes the proportionate increase in commodity prices and the money wage rate exactly equal to the initial proportionate increase in the foreign currency price of the imported input. It may be noted that, in the present case, convergence to an equilibrium price level is associated with a return of the terms of trade (defined as the ratio of the foreign currency price index of commodities 2 and 3 to the foreign currency price index of the imported input a_{m1}) to their initial level. In other words, convergence to the equilibrium price vector is concomitant with the movement of income distribution towards its initial configuration[10]. This must be the case for the following reasons:

(a) We have maintained the assumption that the degrees of monopoly represented by the mark-ups, are (approximately) given.

(b) We have maintained the assumption that government's action, via the variation of its real expenditures, keeps the level of employment fixed at its initial level, which in turn implies that the function $K(U_t, T)$ of equation 9.4 is kept constant, given the 'degree of monopoly power' of the working class T.

and (c) We maintained the assumption that the increase in the price of the imported input is a once and for all increase, occurring at the beginning of period t .

The issue of what is happening to the demand for and supply of money should not be left out of the analysis. A constant rate of price inflation implies, among other things, a constant rate of wage inflation. Constant rates of price/wage inflation imply that U (equation 9.4) is constant. Constant U implies, in the present model, constant or increasing level of gross outputs, material input and employment. This in turn means that:

a) The material bill is increasing at a constant rate;

b) The wage bill is increasing at a constant rate.

For the last two points to happen, firms, at the beginning of each period, must be able to pay for the material bill and the wage bill for the corresponding level of output of that period. To be able to do that, the banking system must have been ready to supply the necessary amount of money (credit or overdraft) at a predetermined interest rate. Interest payments come from the increased level of nominal profit. The process goes on so long as the system remains on the steady state path of price/wage inflation. When the banking system is restricted (for whatever reasons) in making bank advances especially to the business sector, firms in need of liquidity will face a liquidity crisis, leading to higher interest rates, lower production commitments, and possibly bankruptcy with further adverse output/employment consequences (see chapter 7).

Needless to say, the rate of price inflation, and as a result, the rate of wage inflation, would stabilize at the same rate of increase of the price of the imported input if the price of the latter were to keep increasing at a constant rate. This in turn implies that the domestic rate of price inflation is fully anticipated by both sides of the conflict[11].

9.3.2 Case II: Devaluation:

In this case we assume that devaluation (defined as an increase of $\bar{e}$) is a once and for all measure undertaken by the monetary authority at the beginning of period t to remove or reduce a balance of payments deficit. In the present analysis, the balance of payments and trade balance are, by assumption, the same (no financial capital flows, interest flows or profit flows) and the assumption that devaluation is a once and for all measure implies that we abstract from instability problems associated with devaluation. The first thing which must be specified before we start the analysis is the kind of complementary measures undertaken by the government designed to accompany devaluation. One measure is to "freeze" both money wage rate and commodity prices[12]. The other extreme measure is to do nothing as far as the money wage rate and domestic commodity prices are concerned. Let us assume that no price/wage policy is adopted by the government except the policy that they are left alone. Now, since devaluation is defined as an increase in $\bar{e}$ which in turn means a specific increase in $a_{m1}\bar{e}P_1^m$ given

P_1^m and a_{m1} and since the same increase can be stated as an increase in $a_{m1}\bar{e}P_1^m$ given $a_{m1}\bar{e}$, it follows that the inflationary effect of devaluation is essentially a repeated version of the previous case.

How does devaluation lead to lower foreign currency prices of exports and higher home currency prices of imports ? How does that lead to an improvement in the balance of payments of the devaluating country and, finally, Is that improvement permanent ?

To answer the first question[13], we shall maintain the simplifying assumption that the only exportable commodity is commodity 3. Now, we know that when the pound, say, is devalued by x% at the beginning of period t , the price of commodity 1 increases by v_{m1}.x% at the beginning of period t+1 . This in turn leads to smaller percentage increase in the price of the exportable commodity 3 at the beginning of period t+2 . Since the foreign currency price of that commodity is $(1/\bar{e})P_{3,t}$, it follows that at the beginning of both period t and period t+1 the foreign currency price of commodity 3 must go down by the full extent of the devaluation. At the beginning of period t+2 the cheapening of the same commodity in the world market will be partially cancelled by the increase in its price domestically. At the beginning of period t+3 that cheapening will be further eroded by the further increase in the domestic price of that commodity etc.

The assumption that the imported input is of complementary nature and enters into the production process in a rigid way means that devaluation per se has no effect on the initial level of the imports bill expressed in foreign currency. We are left with one thing to satisfy Marshall-Lerner condition, i.e. price elasticity of exports must be greater than unity. If this condition (elasticity greater than unity) were satisfied then a temporary improvement in the balance of payments could be achieved regardless of the reduction in the mark-up of commodity 3, caused by the historic cost pricing policy of the firms in the exportables industry, 3. We say temporary for two reasons:

(1) Under the mark-up pricing law, and so long as P_1^m is kept unchanged, the price effect of devaluation is gradually cancelled via the gradual increase of $(1/\bar{e})P_3$.

(2) Assume that price elasticity of exports is greater than unity, then a given percentage increase in the volume of exports necessitates a given percentage increase in gross output of industry 3. But that increase cannot take place unless gross output of industry 1, which uses an imported complementary input, increases by a specific percentage. Although the latter percentage must be smaller than the former[14] the increase of the output of industry 1 cannot happen without importing an amount of $a_{m1}\Delta X_1$ of the imported input. The latter quantity can be smaller if a limited 'factor' substitutability is possible. If the same imported input were to go to industry 3, then total quantity of the imported input must be greater, reducing further the initially positive effect of devaluation.

In other words, the analysis of devaluation can be clearer when we think of the problem on three levels, i.e.

(1) The immediate level of devaluation, when the above two effects are ruled out;

(2) The transitional level, when the "mark-up effect" and the "input-output effect" are taken into consideration;

(3) The equilibrium level, i.e. to see this effect of devaluation on the balance of payments when the system settles at the new equilibrium position.

Using our previous formulation, we have:

$$B_t^f = \frac{1}{\bar{e}} P_{3t} X_{3t}^{EX} - P_{1t}^m M_{1t} - \frac{1}{\bar{e}} yC_t \tag{9.30}$$

where B_t^f = balance of payments expressed in foreign currency. The immediate effect of devaluation can be expressed as follows:

$$dB_t^f = \frac{1}{\bar{e}} P_{3t} dX_{3t}^{EX} + P_{3t} X_{3t}^{EX} \left(\frac{-1}{(\bar{e})^2}\right) - P_{1t}^m dM_{1t} - y \frac{1}{\bar{e}} dC_t$$

$$+ yC_t \frac{1}{(\bar{e})^2} \tag{9.31}$$

$$dB_t^f = \frac{1}{\bar{e}} \left(P_{2t} dX_{3t}^{EX} - ydC_t\right) + \frac{1}{(\bar{e})^2} \left(yC_t - P_{3t} X_{3t}^{EX}\right)$$

$$(\text{because } dM_{1t} = 0) \tag{9.32}$$

The effect of devaluation on the first term would be positive. If the second term were negative, an improvement in the balance of payments would be possible so long as it is smaller, in absolute terms, than the positive value of the first term. The Marshall-Lerner Condition guarantees that improvement, but once we "allow" time to pass, the alleged improvement would be doubtful.

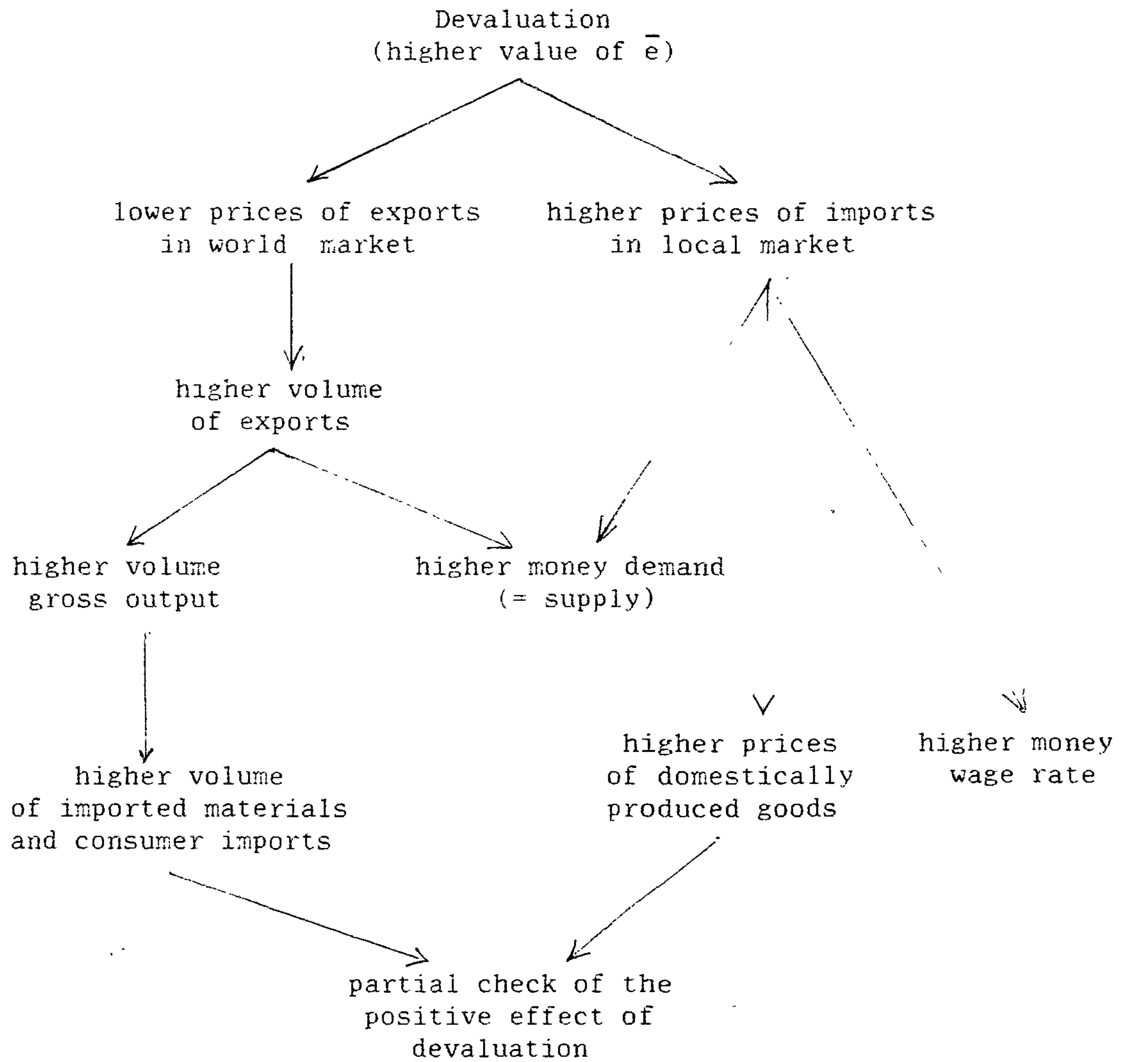
Thus the 'mark-up effect', together with the 'input-output effect' lead one to conclude that the favourable effect of devaluation is of short duration. 'How short ?' It depends on, among other things:

a) the proportion of firms applying historic cost pricing rule;

b) the speed of switching from historic cost pricing to replacement cost pricing rule; and

c) the speed of intersectoral repercussions.

How do we link devaluation to the conflict theory of price inflation ? The answer is simple. Assume that devaluation has led to a favourable effect on the balance of payments, especially at the early periods following the disequilibrium measure - devaluation. Assume further that, apart from devaluation per se and apart from supplying the necessary amounts of money reserves to back up that change, the government has adopted the policy of taking no economic action whatsoever before and after the devaluation. These assumptions grant us the following schematic relationship;


Devaluation
(higher value of $\bar{e}$)
lower prices of exports
in world market
higher prices of imports
in local market
higher volume
of exports
higher volume
gross output
higher money demand
(= supply)
higher volume
of imported materials
and consumer imports
higher prices
of domestically
produced goods
higher money
wage rate
partial check of the
positive effect of
devaluation

The argument behind the above relationship can be summarised as follows:

Devaluation leads to a <u>simultaneous</u> decrease in exports' prices and increase in imports' prices. This, in turn, is followed by <u>simultaneous</u> increase in each of the following variables:

(1) the volume of exports

(2) the stock of actual money supply

(3) commodity prices,

and (4) the money wage rate.

The first effect leads to a higher level of gross output and, as a result of that, a lower rate of unemployment. Commodity prices go up due to the rigid mark-up resistance mechanism, while money wage rates go up due to Real Wage Resistance mechanism. Both mechanisms may be strengthened shortly after devaluation due to the resulting higher rate of capacity utilization represented by a lower rate of unemployment. With money supply acting as validating mechanism, the rigid mark-up resistance mechanism ensures that the activated conflict over the reduced volume of surplus is resolved in price/wage inflation. The larger is the extent of devaluation (i.e. the higher is the percentage increase in $\bar{e}$) the smaller is the volume of the surplus left for division amongst different social classes. Thanks to <u>the timing of price fixing after money wage agreement</u>, the rigid mark-up resistance, continuously succeeds in breaking the Real Wage Resistance mechanism. The rigid mark-up resistance, together with the pattern of timing ensure that all claims over the distribution of the remaining surplus are coercively reconciled through faster rates of price inflation. Therefore, ceteris paribus, the more drastic is the devaluation measure, the more acute is the "shortage" of the social surplus, the more difficult becomes the reconciliation of the conflicting claims over that surplus, the more relevant becomes price inflation as a means for "resolving" that conflict. Hence, the less effective is devaluation as a corrective measure for balance of payments deficit. Based on the preceeding analysis, one can safely say that, under Oligopoly capitalism, devaluation is self defeating as a measure for reducing or eliminating balance of payment deficit; unless, of course, accompanied by a set of governmental measures which accentuate injustice.

9.4 Further Theoretical analysis:

In the previous section, the analysis was based on a number of assumptions, some of which are very unrealistic. In order to give the analysis greater flavour of realism, some of the simplifying abstractions are removed in the present section. The assumption that no import substitutes exist, is scrapped. I shall also pay greater attention to the role of the money wage rate in the inflationary process. Finally, I shall say something on the cruciality of the other set of assumptions which I stated on page 224 above.

9.4.1 Import substitutes and the money wage rate

Unfortunately, the abstraction from import substitutes, together with the lip service given to the role of the money wage rate in the previous analysis of inflation did not succeed in helping to draw an appealing economic picture of the society whose fabric has contracted an externally initiated price/wage inflation. In the remaining parts of this section I shall reformulate the model in such a way that the above simplifving abstractions are removed (though in a simplifying way).

My aim is to examine the sensitivity of the previous section's analysis and conclusions to the removal of both abstractions.

Let commodity 1, assumed to be produced for domestic use only, be produced by combining domestically produced inputs and labour with two imported inputs, one of them competitive while the other is complementary. Let the complementary input be different from that imported by industry 2 and 3. The competitive imported input is assumed to compete with the output of industry 2 only. Industry 3 combines domestically produced inputs and labour with one imported input of complementary nature only, to produce predominantly (non primary) exportable commodity.

As for consumer imports, we shall maintain the assumption that the fraction of wages and that of capitalists' consumption allocations spent on consumer imports are fixed and identical for both classes.

Granted these assumptions, the new formulation of the system becomes as follows:

$$P_{1t} = [a_{11}P_{1,t-1}+(a_{21}\theta_1 P_{2,t-1}+(1-\theta_1)a_{21}^{m}\bar{e}P^{m}_{2,t-1})+a_{31}P_{3,t-1}$$

$$+a_{m1}\bar{e}P^{m}_{1,t-1} + \ell_1 w_{t-1}](1+r_1) \qquad (9.33)$$

$$P_{2t} = [a_{12}P_{1,t-1}+a_{23}P_{3,t-1}+a_{m2}\bar{e}P^{m}_{2,t-1}+\ell_2 w_{t-1}](1+r_2) \qquad (9.34)$$

$$P_{3t} = [a_{13}P_{1,t-1}+a_{23}\ P_{2,t-1}+a_{33}P_{3,t-1}+\bar{a}^{m}_{m3}eP_{3,t-1} + \ell_3 w_{t-1}](1+r_3)$$

(9.35)

$$w_t = w_{t-1}\left\{\left[1+\frac{P_{t-1}-P^{e}_{t-1}}{P_{t-2}}\right]\left[\frac{P^{e}_{t}}{P_{t-1}}\right](1+\bar{g})\right\}^{K(U_t,T)} \qquad (9.36)$$

$$N_t = \underline{\ell}(I-A)^{-1}\underline{D}^{*}_{t-1} - \lambda\underline{\ell}(\underline{V}_{t-1} - \underline{V}^{*}_{t-1}) + L_{g,t} \qquad (9.37)$$

$$M_{dt} = m_0 + m_1 Y^{m}_{t} - m_2\ \bar{i}_t \qquad (9.38)$$

$$M^{p}_{t} = \left(\frac{1+\varepsilon}{\sigma+\varepsilon}\right) H_t \qquad (9.39)$$

where P_t in equation 9.36 is the consumer price index based on a basket of commodities, some of them are imported; θ_1 is a switch function and m means imported.

The appearance of the switch function θ_1 in equation 9.33 needs explanation. We define the function θ_j as follows:

$$\theta_j = G_j(\bar{e}P^m_{jt}/P_{jt};J_j) \qquad 0 \leqslant \theta_j \leqslant 1 \qquad (9.40)$$

where, as before, $\bar{e}$ = the given exchange rate, P^m_j = the foreign currency price of the imported input j, P_j is the local currency price of the domestically produced commodity j, and J_j = the necessary time for the firm to switch to the imported input and vice versa.

The simultaneous appearance of domestic and imported inputs of competitive nature may be justified on more than one ground, all resting on the hypothesis that imported inputs are differentiated from similar but domestically produced inputs. Being differentiated from the domestically produced inputs, they allow the seller to pass their increased price to the buyer and at the same time allow him to plan a switch to an alternative cheaper input. Evidence from the U.K., U.S., Japan, Italy and West Germany seem to support that argument[15].

9.4.2 Theoretical analysis

In the above system, price inflation can be initiated by one or a combination of the following factors:

1) An increase in the mark-up in industry j.

2) An increase in the money wage rate, without being initiated by higher prices of imported wage goods (i.e. due to an increase in g, equation 9.36).

3) An increase of the world price of one, or more, of the imported inputs.

4) An increase in the world price of imported wage good(s).

and 5) Devaluation.

Of course, some of the above initiating factors can be seen as the expression of a resurgence of social conflict over income distribution created by the appearance of inflationary conditions in the society. The latter can be the result of one (or a combination of) the following: export-led expansion; expansionary fiscal policy; expansionary monetary policy associated with relaxing the binding collateral constraint on those sections of the society which are affected by that. Finally, it can be due to an inwards movement of financial capital.

The word 'expansion' should not mean any expansion. Expansion in the presence of low rate of capital utilization and massive multisectoral unemployment is unlikely to lead to price/wage inflation or wage/price inflation, unless foreign industries which supply primary inputs are experiencing a high rate of capacity utilization.

Let us return to the direct initiators of the inflationary process of which we have selected the third. Suppose that:

(1) So long as the rate of price inflation is less than 100% the government maintains the initial rate of unemployment, through an informed revision of the values of the policy parameters, (η, f) in the government expenditure function $G^m_{1t} = G^m_{1,t-1}\left[\frac{P^e_t}{P_{t-1}}\right]^n (1+f)$;

(2) the central bank has enough foreign exchange reserves to meet trade deficit for a large number of periods, and

(3) the shock to the system, assumed initially in a state of accidental equilibrium, came from a permanent increase in the real (home currency) price of the complementary imported input of industry 1, with all other foreign currency prices of the remaining imported inputs be kept at their initial levels for several periods after the shock.

Now, the response of the system to the continuous increase in $\bar{e}P_1^m$ (assuming $\bar{e}$ is fixed) is to develop an inflationary process via the equation system 9.33-9.40 characterised by the following:

1) Continuous increase in all domestic prices and money wage rate,

2) Continuous increase in government expenditures in nominal terms,

and 3) Continuous reduction of the value of the function θ_1 until it reaches zero.

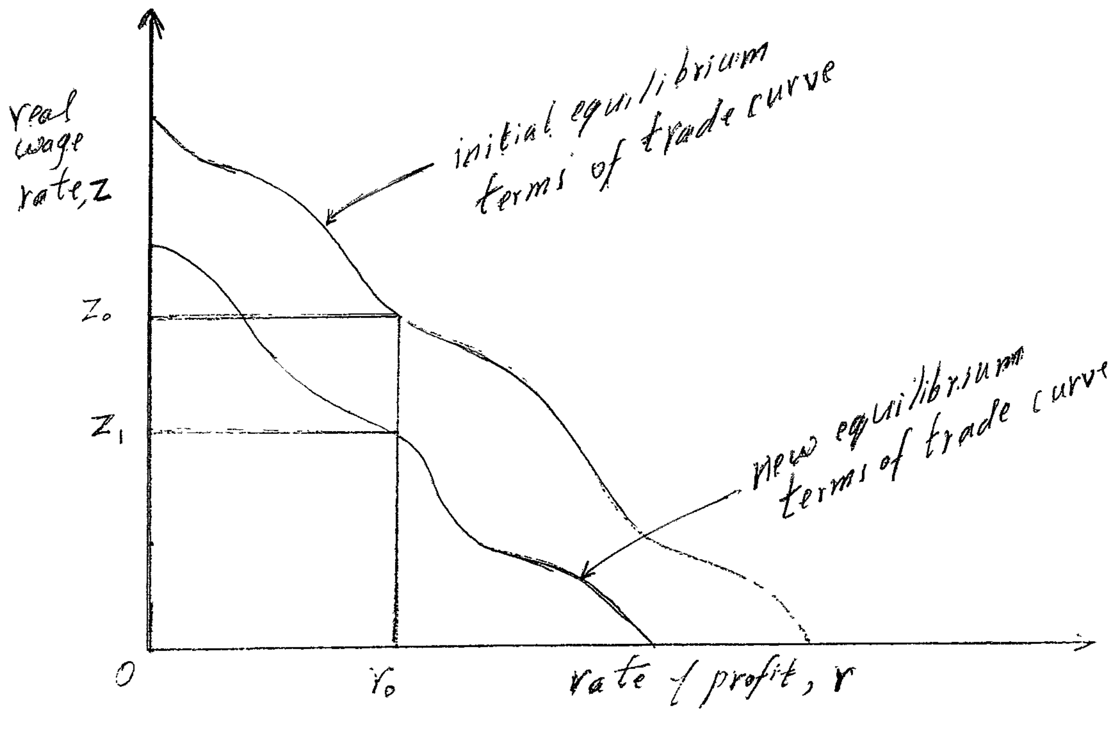
After a number of periods, and when the rate of price inflation stabilises, the price system takes the following matrix form[16]

$$\underline{P}_t = (1+\phi)^t \left\{\bar{e}\underline{P}_o^m A^m(I+\hat{R}) + \underline{w}_o\hat{L}(I+\hat{R})\right\}(I-B)^{-1} \qquad (9.41)$$

where ϕ is the rate of external inflation; $\underline{P}_o^m$ = a row vector of prices of imported inputs at their initial equilibrium level; A^m is a coefficient matrix of imported inputs all of complementary nature; $\hat{R}$ is the (new) diagonal mark-up matrix; $\underline{w}_o$ = row vector of initial equilibrium sectpra; money wage rate(s); $\hat{L}$ is a (new) diagonal matrix of labour input coefficients, $B = A(I+\hat{R})$ with A being the (new) technical coefficient matrix of domestically produced inputs.

The constant rate of price inflation of ϕ is a necessary and sufficient condition for the absence of a conflict over the distribution of the new and lower level of real national income. The workers are worse off in absolute and relative terms, as it could be easily seen by comparing the new real wage rate z_1, with the old z_0 at the given rate of profit r_0 [assuming that $r_j = \eta_j y$ with r being the economy-wise rate of profit] in figure 14 below[17]:

Figure 14



Should the workers resist, in one way or another, the reduction in their real wages, and should $\hat{R}$ remain the same, unanticipated price inflation must emerge, and as a result of that, the actual rate of inflation must accelerate[18]. Suppose the actual rate of price inflation gradually approached the 100% threshold and then passed it. The government will step in now. There are many ways the government intervenes in order to bring the now accelerating price/wage spiral under control. A planned crisis, which acts (among other things) as an instrument for weakening Real Wage Resistance through the planned creation of a terrorizing rate of unemployment (leading $K(U_t,T)$ of equation 9.36 to zero) is better than the collapse of the monetary system and the resulting institutional changes which are harmful to the esteem and the pockets of the "business leaders" and their faithful appendages[19]. As for "how does that crisis happen ?", "how does it bring trade unions to their knees ?" and "how does the planned crisis put the price/wage spiral under control ?"; these are questions we have already addressed (see pp.45-50 and section 7.4 of Ch.7 above).

Simple as it is, the above analysis can be based on a less restrictive set of assumptions. Along these lines[20] I tend to explain what was happening in the advanced capitalist economies in the early seventies. Especially after 22-23 December 1973 when the representatives of OPEC countries met in Tehran to lead the late Shah of Iran to announce on 23rd December an increase of the posted price of the Arabian "marker crude" from $3.036 (at the beginning of October 1973) to $11.651[21].

The reader will remember that in the present case, while the initiator of the inflationary process was external (an increase in P_1^m) the workers bore the major burden of its control. This is one of the highly recommended ways for the control of price inflation in some academic circles today (1986); inside the capitalist centres and in the so-called Developing Countries.

Once more, the above analysis and conclusions is based on a model which, to a great extent, misrepresents a real world advanced capitalist economy. However, introducing fixed capital; multiperiod production processes; different pricing rules; sectoral wage equations;

variable mark-ups; movements of finance capital; indirect taxes; and retail trade; into that simple system, complicate (and lengthen) things very much while adding little insight into what we have said so far.

9.5 Summary and closing note:

In this chapter, the closed economy assumption is relaxed. The simple model which we formulated in chapter 6 is expanded to incorporate essential elements of the open advanced capitalist economy. It has been shown that the open economy is more vulnerable to price inflation than the closed economy. Production technique, consumers' imports, and the exchange rate impose a degree of interdependence between capitalist centres and the rest of the world economy. This interdependence enlarges the set of factors which initiate, or change the speed of, price inflation in comparison with the set which belongs to the closed economy world. This important difference must be taken into consideration before adopting any policy measure for the control of inflation. We shall handle some policy issues in a later chapter.

Notes to chapter 9

[1]The theoretical foundation of the analysis which will follow in this and in the remaining sections of this chapter is Steedman (1979a, 1979b).

[2]Keynes (1936).

[3]Gupta and Steedman (1971), pp.21-23.

[4]Mainwaring (1977), p.84.

[5]Sylos-Labinin (1979a) p.6. See also appendix 10 footnote (2).

[6]See appendix 5 for the derivatin of the general form of which equation (9.20) is a special case.

[7]It is assumed that the physical system is equipped with enough equilibriating "parameters" and institutions.

[8]See appendix 4 for detailed analysis.

[9]See appendix 10 for derivation.

[10]For a deep analysis of the relationship between income distribution and the term of trade, see: Metcalfe and Steedman (1979).

[11]See appendix 5 for proof.

[12]In August 1971 President Nixon took that measure before the first devaluation of the dollar in December 1971.

[13]See Morishima (1984), pp.107-111.

[14]Morishima and Nosse in : Morishima (1972), ed. pp.96-102.

[15]Coutts, et. al. (1978), Ch.7; Sylos-Labini, (1979a).

[16]See appendix 5.

[17]See chapter 3 page 62 for a mathematical expression of a simpler case.

[18]See also Rowthorn (1977).

[19]See Kalecki (1971), Ch.12.

[20]See also Rowthorn's Macro analysis in Rowthorn, Ibid.

[21]The Financial Times, December 24th, 1973; See also Penrose (1978), pp.502-504 for the background of the "oil shock".

Chapter 10: The Working of the Model : Some Simulations

10.1 The questions to be addressed:

This chapter, which is basically a numerical exercise, addresses three questions. The first is: does the inter-industrial model of price inflation proposed in this thesis work;i.e. produces numbers with some economic sense ? Second, if yes, can one go one step further and say anything on the existence of a relationship between price inflation and inter-class or intra-class income distribution ? And third, can one say anything on causality in the inflationary spiral ? Our analysis of these questionsis based on an inter-industrial model of price inflation which is slightly more general than the model formulated in chapter 6.

10.2 The model and the cases to be simulated:

As was the case in chapter 6, our closed economy is composed of three parts. The first part is the price/wage system and the mark-up equation. The second part is the physical system, the employment equation, and the labour force equation. The third part is the financial system and the government sector.

10.2.1 The price/wage system and the mark-up equation:

$$P_{jt} = (a_{1j}P_{1,t-1} + a_{2j}P_{2,t-1} + a_{3j}P_{3,t-1} + \ell_j w_{t-1})(1+r_j) \qquad (10.1)$$

$$j=1,2,3$$

$$w_t = w_{t-1}\left\{\left[1 + \frac{P_{t-1} - P^e_{t-1}}{P_{t-2}}\right]\left[\frac{P^e_t}{P_{t-1}}\right](1+g)\right\}^{\alpha} \qquad (10.2)$$

$$0 \leqslant g < 1 \qquad 0 \leqslant \alpha \leqslant 1$$

$$r_j = \bar{r}_j \qquad j = 1,2,3 \qquad (10.3)$$

$$P^e_t = P_{t-1} + \delta(P_{t-1} - P_{t-2}) \qquad 0 < \delta < 1 \qquad (10.4)$$

10.2.2 The physical system, the employment equation, and the labour force equation:

$$\underline{x}_t = \underline{x}_{t-1}^{sales} - \lambda(\underline{V}_{t-1} - \underline{V}_{t-1}^{*}) \qquad (10.5)$$

$$\underline{x}_t^{sales} = A\underline{x}_t^{sales} + \underline{D}_t \qquad (10.6)$$

$$\underline{D}_t = \left\{ \hat{\underline{P}}_t \,[\underline{\theta} \quad C_{w,t} + \underline{\lambda}\, C_{c,t} + \underline{\phi}_1 G_{1,t}^{m}] + \underline{\bar{I}}^{*} \right\} \qquad (10.7)$$

where $\quad C_{w,t} = \sum_{j=1}^{g} w_{j,t-1} N_{j,t-1}$

$$C_{ct} = (1-s)(1-\tau)\Pi_{t-1} \qquad (10.8)$$

$$\underline{V}_t^{*} = \gamma\underline{x}_{t-1}^{sales} \qquad 0 < \gamma < 1 \qquad (10.9)$$

$$N_t = \underline{\ell}\ \underline{x}_t + \phi_4 \frac{1}{w_t} G_{1t}^{m} \text{ (the employment equation)} \qquad (10.10)$$

$$L_t = (1 + G)^t L_0 \text{ (Labour force equation)} \qquad (10.11)$$

10.2.3 The financial system and the government sector:

$$M_{dt} = m_o + m_1 Y_t^{m} - m_2\bar{i} \quad \text{(demand for money equation)} \qquad (10.12)$$

$$M_t^{P} = \left(\frac{1+\varepsilon}{\sigma+\varepsilon}\right)(H_{t-1} + \Delta H_t) \text{ (potential money supply equation)} \qquad (10.13)$$

$$\Delta H_t = (Def)_t + \Delta H_t^{Bank} \qquad (10.14)$$

$$(Def)_t = G_{1t}^{m} - R_t \qquad (10.15)$$

$$G_{1t}^{m} = G_{1,t-1}^{m} \left(\frac{P_t^{e}}{P_{t-1}}\right)^{\eta} (1 + \beta U_{t-1}) \qquad (10.16)$$

$$R_t = \tau\, \Pi_{t-1} \qquad (10.17)$$

Equations 10.1–10.17 form an economic model in which money supply is treated as endogenous variable in the strict sense. Following Kalecki (1971), we shall maintain that assumption throughout. To simplify, we shall assume that both the commercial banks and the nonbank public hold no Treasury bills. This assumption is implied in equations 10.15–10.17.

Let us first have a look at table 6 which clarifies the crucial assumption(s) upon which each case of the following simulations is based.

Table 6 showing the cases to be simulated

Case Simul -ated	Initiating cause with (1) form of real wage resistance and (2) government recation function
I	A once and for all increase in the mark-up in industry 1 (call it "the mark-up shock") given (1) the money wage rate $[w_t = w_{t-1}]$ (2) real government expenditures $G^m_{1t} = \left[G^m_{1,t-1}\left(\frac{P_t}{P_{t-1}}\right)\right]$
II	The mark-up shock with (1) $w_t = w_{t-1}\left[\frac{P_{t-1}}{P_{t-2}}\right]$ (2) $G^m_{1t} = G^m_{1,t-1}\left(\frac{P_t}{P_{t-1}}\right)$
III	The mark-up shock with (1) $w_t = w_{t-1}\left\{\left(1 + \frac{P_{t-1} - P^e_{t-1}}{P_{t-2}}\right)\left(\frac{P^e_t}{P_{t-1}}\right)\right\}^{\alpha}$ (2) $G^m_{1t} = G^m_{1,t-1}\left(\frac{P_t}{P_{t-1}}\right)$ (3) $\alpha = 1$
IV	The mark-up shock with (1) $w_{jt}=w_{j,t-1}\left\{\left(1 + \frac{P_{t-1} - P^e_{t-1}}{P_{t-2}}\right)\left(\frac{P^e_t}{P_{t-1}}\right)\right\}^{\alpha_j}$ (2) $G^m_{1t} = G^m_{1,t-1}\left(\frac{P_t}{P_{t-1}}\right)$ (3) $0 < \alpha_j \leqslant 1$, $j = 1,2,3,g$
V	The mark-up shock with (1) $w_{jt}=w_{j,t-1}\left\{\left(1 - \frac{P_{t-1} - P^e_{t-1}}{P_{t-2}}\right)\left(\frac{P^e_t}{P_{t-1}}\right)\right\}^{\alpha_j}$ (2) $G^m_{1t} = G^m_{1,t-1}\left(\frac{P_t}{P_{t-1}}\right)(1 + \beta U_{t-1})$ (3) $\alpha_j = 1, \quad 0 < \beta < 1$
VI	$G^m_{1,t} = G^m_{t,t-1}\left(\frac{P_t}{P_{t-1}}\right)(1 + \beta U_{t-1})$ with all mark-ups and money wage rates remaining at their initial levels.

In the above table, the first five cases are no more than a gradual complication of a single case. In that case the initiation of the inflationary process is exclusively due to a once and for all increase in the mark-up in industry 1. I shall leave out the over discussed (in macro terms) case when the inflationary process is initiated by the workers' side of the conflict ($\Rightarrow g > 0$, equation 10.2). As for the sixth case in the table it may be interpreted as a simple reprsentation of a purely post-Keynesian counter cyclical economic policy.

10.3 Structural quantities, variables, and numerical values:

From system 10.1-10.17, we obtain the following structural quantities, endogenous/exogenous variables, and purely endogenous variables.

10.3.1 The Technical Co-efficients:

a_{ij} = units of output of industry i needed to produce one unit of gross output of industry j, i,j = 1,2,3.

ℓ_j = unit of necessary direct labour time per unit of gross output of industry j. j = 1,2,3.

10.3.2 Proportions

θ_j = the proportion of the aggregate wage bill which is spent on commodity j; $\sum_{j=1}^{3} \theta_j = 1$

λ_j = the proportion of capitalists' consumption spent on commodity j; $\sum_{j=1}^{3} \lambda_j = 1$

ϕ_j = the proportion of government expenditure on goods and services which goes to commodity j; $\sum_{j=1}^{4} \phi_j = 1$

10.3.3 Scalars and policy parameters:

g = workers militancy parameter

δ = expectations formation coefficient

λ = fraction of undesired inventories which is reflected in planned output change

s = fraction of after-tax profit saved by capitalists.

γ = coefficient of desired inventories per unit of sales

m_i = coefficients of the demand for money function, $i = 0,1,2$

τ = rate of gross profit tax

η, β = government policy parameters

G = rate of growth of labour force

Out of the above list of structural and policy parameters the following are of crucial importance: λ, s, γ, η, β, and G. The numerical values of the first three must be close to the actual values of an advanced capitalist economy. The first and the third (i.e. the fraction of undesired inventories and the rate of desired inventories per unit of sales, respectively) give rise to cyclical movement of real national income.[1] The second (i.e. the marginal propensity to save by capitalists, s) is of crucial importance because a sufficiently low value of "s" is capable of reversing the negative employment effect of the lower real wage rate caused by the higher mark-up(s).

10.3.4 The variables of the system:

(a) The exogenous variables:

r_j = $\bar{r}_j$, the percentage mark-up in industry j; $j = 1,2,3$.

i = $\bar{i}$, the basic rate of interest.

L = Labour force (in man-hours).

(b). The endogenous variables of the system:

P_j = price of commodity j

w_j = money wage rate in industry j or in the government sector

P = Laspeyres (consumer) price index

P^e = expected price index

W^I = aggregate index of money wage rate

M_d = demand for money (= actual money supply)

M_d^I = index of demand for money (= index of actual money supplv)

x_j = gross output of industry j.

x_j^{sales} = sales of output of industry j

v_j = end of period actual inventories in industry j

v_j^* = end of period desired inventories in industry j

v^I = Laspreyres quantity index of inventories

D_j = final demand for the output of industry j

N_j = level of employment (man-hour) in industry j

L_g = level of employment in the government sector.

N = aggregate level of employment

U = the rate of unemployment $\left(\frac{L-N}{L}\right)$

W_j = the total wage bill in industry j or in the government sector

Π_j = gross profit realised in industry j

W = aggregate wage bill in the economy

Π = aggregate gross profit realised in the capitalist sector

Y^m = nominal national income

K^m = nominal value of physical capital stock plus the wage bill of the workers engaged in prouction lines ($K^m = \underline{P}A\underline{x} + w\underline{\ell}\underline{x}$ in the present circulating capital system)

W_j/W = share of total wage bill of industry j, or the government sector, in the aggregate wage bill.

W/Y = share of wages in national income

Π/Y = share of profit in national income

$\pi = \dfrac{\Pi}{\underline{P}A\underline{X} + w\underline{\ell x}}$, a measure of actual rate of profit in the capitalist sector as a whole.

(c) Policy variables:

G_1^m = nominal government expenditures on goods and services.

Def = budget deficit financed by "borrowing" from the central bank.

G_1^m and Def are policy ariables because the first depends on the values assigned to η and β in the government reaction function 10.16, while the second depends on the way the government finances the budget deficit.

Of the above list of variables ten are relevant for addressing the three questions set out earlier. These are:

$P,\ W^I,\ M_d^I,\ \dfrac{\Delta P}{P},\ \dfrac{\Delta W^I}{W^I},\ \dfrac{\Delta M^I}{M^I},\ U,\ \dfrac{W_j}{W},\ \dfrac{W}{Y}$, and π .

10.3.5 <u>Numerical values assigned to the structural quantities, the numerical values of the exogenous variables, and the initial equilibrium values of the endogenous variables</u>:

For the sake of tidiness, we shall use matrix notation alongside scalar notation in assigning numerical values to the structural quantities.

(a) Scalars:

$\delta = 0.50$; $\lambda = 0.25$; $\gamma = 0.04$; $s = 0.54$; $m_o = 80$; $m_1 = 0.40$; $m_2 = 75$; $\tau = 0.387$; $G = 0.0015$.

(b) Policy parameters: $\eta = 1$; as for β, its numerical value depends on the case simulated.

(c) Vectors:

$$\begin{bmatrix}\theta_1\\\theta_2\\\theta_3\end{bmatrix} = \begin{bmatrix}0.10\\0.50\\0.40\end{bmatrix}; \quad \begin{bmatrix}\lambda_1\\\lambda_2\\\lambda_3\end{bmatrix} = \begin{bmatrix}0.075\\0.649\\0.276\end{bmatrix}; \quad \begin{bmatrix}\phi_1\\\phi_2\\\phi_3\\\phi_4\end{bmatrix} = \begin{bmatrix}0.000\\0.409\\0.361\\0.230\end{bmatrix}; \quad \begin{bmatrix}\ell_1\\\ell_2\\\ell_3\end{bmatrix}' = \begin{bmatrix}0.04\\0.57\\0.50\end{bmatrix}$$

(d) Technical Coefficients Matrix:

$$A = \begin{bmatrix}a_{11} & a_{12} & a_{13}\\a_{21} & a_{22} & a_{23}\\a_{31} & a_{32} & a_{33}\end{bmatrix} = \begin{bmatrix}0.41 & 2.57 & 0.50\\0.03 & 0.29 & 0.05\\0.02 & 0.29 & 0.25\end{bmatrix}$$

(e) Initial values of the variables which are exclusively exogenous:

$\bar{r}_j = 0.10$, $L_o = 210.3$

$\bar{i} = 0.125$

(f) Initial equilibrium values of endogenous variables:

$P_{1,0} = 1.439$ $\quad w_{1,0} = 5.00$ $\quad w_{g,0} = 5.00$

$P_{2,0} = 13.338$ $\quad w_{2,0} = 5.00$

$P_{3,0} = 5.896$ $\quad w_{3,0} = 5.00$

$P_0 = 100.00$ $\quad w_0^I = 100.00$ $\quad M_0^I = 100.00$ $\quad V_0^I = 100.00$

$Y_0 = 1293.3$ $\quad W_0 = 955.5$

$\dfrac{W_0}{Y_0^m} = 73.9\%$ $\quad \dfrac{\Pi_0}{Y^m} = 26.1\%$ $\quad \dfrac{\Pi_0}{K^m} \simeq 10\%$ $\quad \dfrac{W_{1,0}}{W_o} = 16.9\%$

$\dfrac{W_{2,0}}{W_0} = 33.99\%$ $\quad \dfrac{W_{3,0}}{W} = 45.97\%$ $\quad \dfrac{W_{g,0}}{W} = 3.14\%$

$G_{1,0}^m = 130.5$; $\quad R_0 = 130.5$

$x_{1,0} = 811.43$ $\quad x_{2,0} = 114.50$ $\quad x_{3,0} = 176.56$

$V_{1,0} = V_{1,0}^* = 32.46$ $\quad V_{2,0} = V_{2,0}^* = 4.58$ $\quad V_{3,0} = V_{3,0}^* = 7.06$

$N_0 = 191.1$

10.3.6 The input-output matrix, the labour input vector and the crucial structural quantities; the sources of their numerical values:

Both the core of the system, i.e. the input-output matrix and the labour input vector came from Pasinetti (1977, p.101)[2]. The Perron-Forbenius root of that matrix is approximately 0.674. Thus the maximum rate of physical surplus, and the maximum rate of profit[3], is approximately 0.484. Therefore, the system is viable. As a result, if the initial equilibrium rate of profit (in the present exercise it is the same as the percentage mark-up) were 10%, then the money wage rate and all commodity prices must be positive.

As for the value of "s", it is close to the U.K. value estimated by Surrey (1970, pp.104-105). The value of "y" is close to that estimated by Trivedi (1970, p.529) for U.K. manufacturing. Both values are based on quarterly data. Finally, the value of λ is assumed to be 0.25.

The initial equilibrium values of the endogenous variables of the system 10.1-10.17 are based on the aforesaid numerical values assigned to the set of crucial structural quantities.

10.4 Some Simulations:

The reader might like to have a second look at table 6 page 253 for more details on each of the cases presented below. It is important to keep in mind that in all (inflationary) simulations presented below, the inflationary process is initiated by a once and for all increase in the mark-up in industry 1 from an initial value of 1.10 to 1.15. The increase is assumed to have taken place at the beginning of period 1.

10.4.1 Case I: Constant money wage rate:

In the present case, the system's reaction to the aforesaid increase in the mark-up in industry 1 is as follows (table 7).

Table 7 showing the reaction of the system's main variables to the increase in the mark-up in industry 1 given the money wage rate.[(1)]

Time period t	Price by Industry			Price index P	Price inflation %	Money wage rate by Industry			Govt. Sector w_g	Money wage index W^I	Wage inflation %				
	P_1	P_2	P_3			w_1	w_2	w_3			For the whole economy	Industry 1	Industry 2	Industry 3	Govt. Sector
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0	1.439	13.338	5.896	100.00	0.00	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
1	1.504	13.339	5.896	100.46	0.46	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
2	1.535	13.524	5.932	101.62	1.15	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
3	1.557	13.681	5.970	102.62	0.98	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
4	1.573	13.805	6.000	103.41	0.77	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
5	1.586	13.901	6.025	104.02	0.60	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
6	1.596	13.975	6.044	104.50	0.46	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
7	1.604	14.033	6.058	104.87	0.36	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
8	1.610	14.078	6.070	105.16	0.27	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
9	1.614	14.112	6.079	105.39	0.21	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
10	1.618	14.139	6.086	105.56	0.16	5.000	5.000	5.000	51000	100.00	0.00	0.00	0.00	0.00	0.00
15	1.627	14.206	6.103	105.99	0.41	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
20	1.629	14.225	6.108	106.11	0.11	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
25	1.630	14.231	6.109	106.15	0.04	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
30	1.630	14.232	6.109	106.16	0.01	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
35	1.630	14.232	6.109	106.16	0.00	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
40	1.630	14.233	6.109	106.16	0.00	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
45	1.630	14.233	6.109	106.16	0.00	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
50	1.630	14.233	6.109	106.16	0.00	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00

(1) The reader might wish to consult Table 6 for further details.

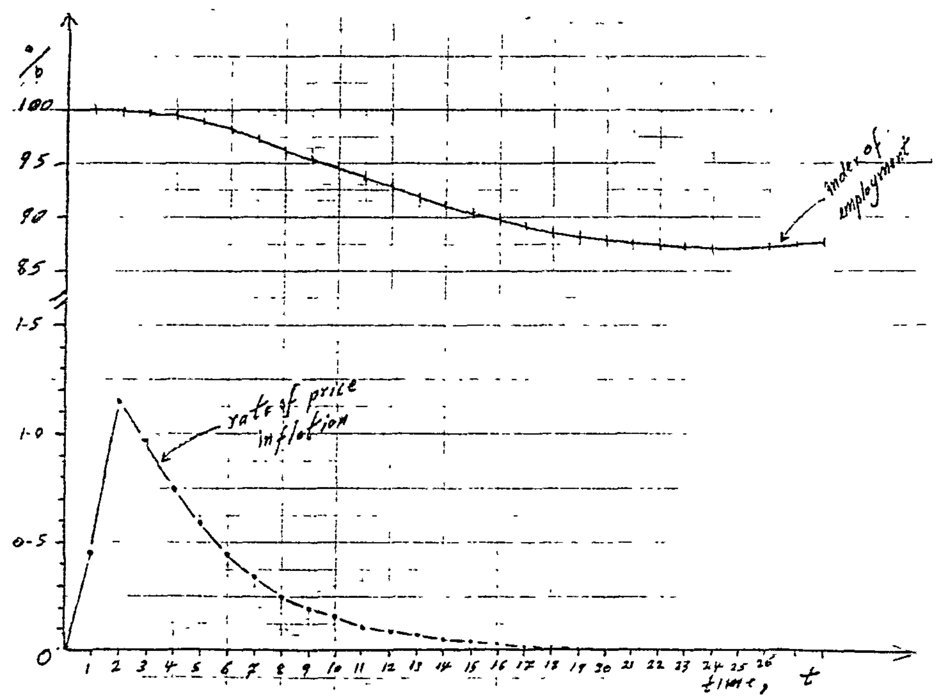
Table 7 (continued)

Time period t	Labour force	Level of Employment	Rate of unemployment	Income contribution			Wage bill distribution %				Demand for money	Money inflation %	Govt. expenditures	Net national product at current prices	Quantity index of inventories
				Workers' share %	Capitalists' share %	Rate of profit	Industry 1	Industry 2	Industry 3	Govt. Sector					
	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0	210.315	191.085	0.0914	73.87	26.13	0.0991	16.90	33.99	45.97	3.14	587.93	0.00	130.50	1293.33	100.00
1	210.630	191.118	0.0926	70.98	29.02	0.1146	16.90	33.93	45.96	3.16	590.53	0.44	131.10	1299.82	99.99
2	210.946	191.187	0.0937	70.59	29.41	0.1152	16.89	33.97	45.94	3.19	596.58	1.02	132.61	1314.95	109.52
3	211.263	190.592	0.0978	70.52	29.48	0.1144	16.77	33.93	46.02	3.23	599.64	0.51	133.92	1322.59	101.14
4	211.580	191.309	0.0958	70.14	29.86	0.1157	16.74	33.97	46.04	3.24	605.52	0.98	134.95	1337.30	123.14
5	212.897	189.350	0.1064	70.18	29.82	0.1148	16.72	33.91	46.08	3.30	602.97	-0.42	135.75	1330.92	125.61
6	212.215	188.764	0.1105	69.94	30.06	0.1157	16.70	33.86	46.12	3.32	603.60	0.11	136.38	1332.51	146.41
7	213.533	186.353	0.1232	70.02	29.98	0.1148	16.69	33.82	46.11	3.38	598.52	-0.84	136.86	1319.80	148.73
8	212.852	185.263	0.1296	69.85	30.15	0.1155	16.68	33.80	46.12	3.41	596.77	-0.29	137.24	1315.43	165.34
9	213.171	182.754	0.1427	69.95	30.05	0.1147	16.67	33.77	46.10	3.46	590.64	-1.03	137.53	1300.09	165.24
10	213.491	181.482	0.1499	69.82	30.18	0.1152	16.67	33.74	46.10	3.49	587.79	-0.48	137.75	1292.97	176.29
15	215.097	173.060	0.1954	69.93	30.07	0.1143	16.65	33.66	46.02	3.68	565.49	-3.79	138.32	1237.23	167.39
20	216.715	168.726	0.2214	69.89	30.11	0.1145	16.64	33.61	45.98	3.78	553.50	-2.12	138.48	1207.25	142.76
25	218.345	166.715	0.2365	69.92	30.08	0.1143	16.64	33.59	45.95	3.82	547.83	-1.02	138.52	1193.08	113.17
30	219.988	166.540	0.2430	69.88	30.12	0.1146	16.64	33.58	45.95	3.83	547.37	-0.08	138.53	1191.92	96.15
35	221.643	166.770	0.2476	69.88	30.12	0.1146	16.64	33.59	45.95	3.82	548.04	0.12	138.54	1193.61	86.60
40	223.310	167.182	0.2513	69.86	30.14	0.1147	16.64	33.59	45.96	3.81	549.24	0.22	138.54	1196.60	84.35
45	224.990	167.410	0.2559	69.86	30.14	0.1147	16.64	33.59	45.96	3.81	549.90	0.12	138.54	1198.25	84.20
50	226.682	167.552	0.2608	69.85	30.15	0.1147	16.64	33.59	45.96	3.80	550.31	0.07	138.54	1199.28	85.34

As is obvious from column 2-6, the hidden increase in the mark up in industry (1) initiates a mild inflationary process from the beginning of period (1). Since it is a means of production, the increase in the price of commodity 1 gets transmitted in the form of higher production cost to the other two industries via the input-output matrix. Since all the other mark-ups are (approximately) unchanged, and since all commodities are basics by assumption, it follows that the increase in the price of commodity 1 at the beginning of period 1 leads the whole price system to take off. One result of that is an increase in the general price level "P" by 0.46% in period 1, by 1.15% in period 2; 0.98% in period 3, 0.77% in period 4, etc. until it peters out in period 35 (see column 6 and figure 10.1 below). By that time, all prices stabilise at their new equilibrium level and structure. The initial price structure was 0.2441 2.2622 1.0000. The new structure is: 0.2668 2.3293 1.0000. As for the relative "price of labour" using commodity 3 as a standard of value, it went down from an initial value of 0.8480 to 0.8186. As is clear from column 12, there is no wage inflation under the present case. Let us now go a little below the surface and consider some of the implications of this mild price inflation.

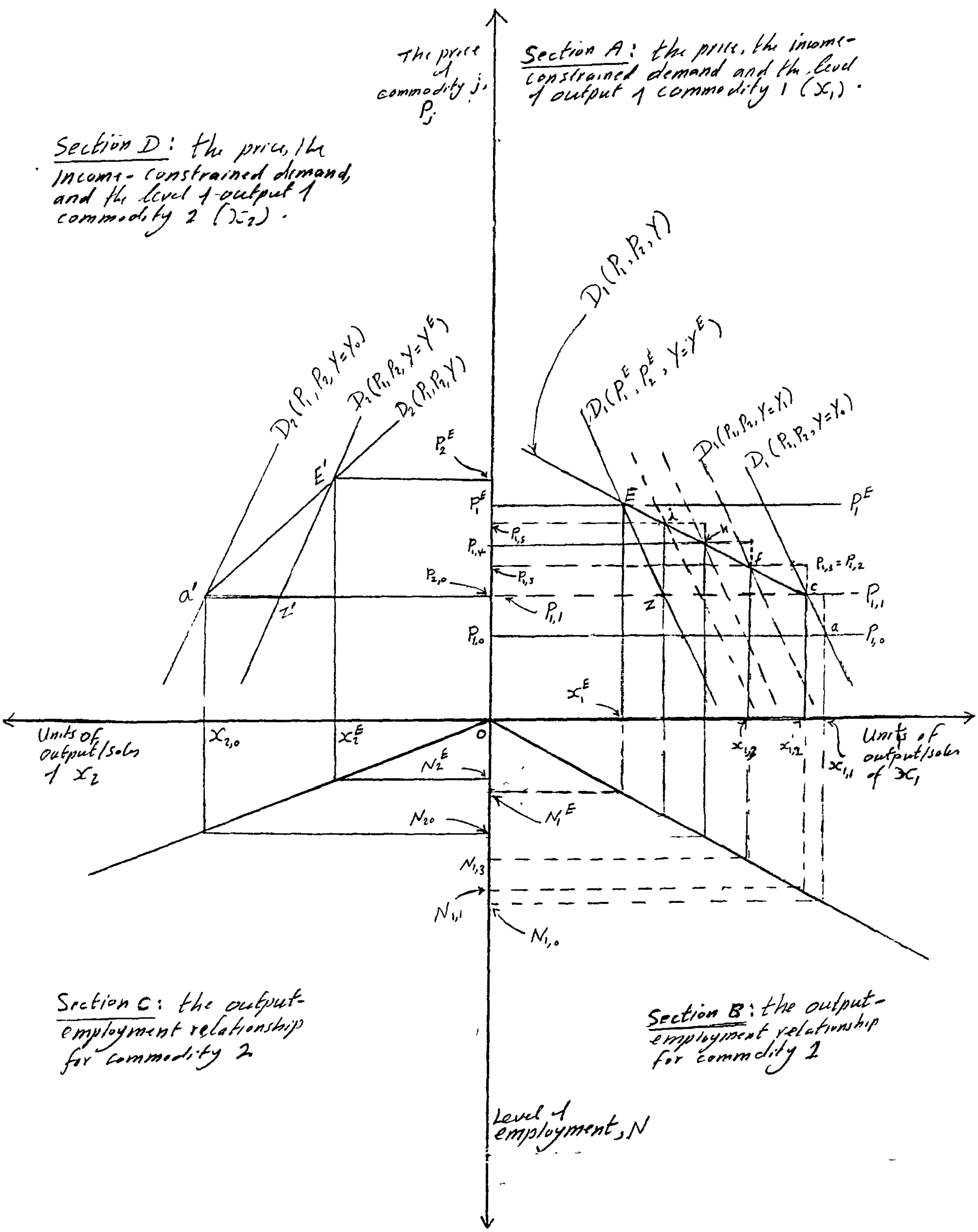
The assumption that the initial real demand by the government is maintained (i.e. $G^m_{1t} = G^m_{1t-1} \left(\frac{P_t}{P_{t-1}}\right)^{\eta} (1+\beta U_{t-1})$ with $\eta = 1, \beta = 0$) together with the assumption that the money wage rate remains unchanged (columns 7-10) have three implications. The first is that the government's role as an employers is neutralized. The second implication is that income distribution shifts in favour of profit. And finally, with commodity prices moving towards their equilibrium levels, the real wage rate, the workers' demand for wage goods, the level of output and the level of employment all have to be moving downwards (all represented in column 18). The equilibrium level of employment is approached after commodity prices reached their equilibrium levels (columns 2-6 and 18; Figure 15 below).

Figure 15



It is important, perhaps, that the above dynamic adjustment process of prices, output and employment is clarified. We shall conduct that clarification with reference to a diagrammatical presentation of a simple two-industry rather than a three-industry economy. Also we shall abstract from the somewhat cyclical movement of the relevant quantities. The generalization to a more complex economy is not difficult once the principles upon which the simple case based are clarified. Let us first start with a look at figure 16 below.[4]

Figure 16



The price of commodity j, P_j
Section A: the price, the income-constrained demand and the level of output of commodity 1 (x_1).
Section D: the price, the income-constrained demand, and the level of output of commodity 2 (x_2).
Section C: the output-employment relationship for commodity 2
Section B: the output-employment relationship for commodity 1
Units of output/sales of x_2
Units of output/sales of x_1
Level of employment, N

In the figure, section A represents industry 1. The vertical axis measures the price per unit of commodity 1 (always fixed at the beginning of period t). The units of x_1 are measured on the horizontal axis. $D_1(P_1, P_2)$ is the demand curve for commodity 1 associated with a given level of disposable income, Y, for the relevant period. $D_1(P_1, P_2, Y)$ is the constrained demand curve for commodity 1. Section B of the figure represents the output-employment relation (employment is in man-hours) for commodity 1. It defines a linear relationship between x_1 and N_1, the level of employment. Of course, the linear relationship between x_1 and N_1 does not mean that labour time is the only input needed to produce commodity 1.

Section C of the figure represents the output employment relation for commodity 2. The price-output-sales relationship for that commodity is represented by section D in the same figure.

Now, in section A, the initial equilibrium price per unit of x_1 is $P_{1,0}$. Since $P_{1,0}$ is a point on $D_1(P_1, P_2, Y_0)$ curve, it is clear that the $P_{1,0}$, $x_{1,0}$ combination is conditional upon a given initial level of disposable income Y_0. With the assumption that the money wage rate is given, the increase in the mark-up in industry 1 shifts the price line bodily upwards from $P_{1,0}$ $P_{1,0}$ to $P_{1,1}$ $P_{1,1}$.

The increase in P_1 from $P_{1,0}$ to $P_{1,1}$ at the beginning of period 1 (given Y at Y_0) reduces the quantity sold of commodity 1 to $x_{1,2}$. If we assume that last period's sales determine the planned level of output and employment for this period and all output is produced as planned, then the lower level of sales during period 1 leads to an actual level of output of $x_{1,2}$ which is fixed at the beginning of period 2. Since the income effect of the lower level of employment of period 2 is felt during period 3, it follows that the quantity sold during period 2 is the same as that of period 1. At the beginning of period 3, and in response to the increase in the price of commodity 2, P_1 increases to $P_{1,3}$. The negative effect on demand of the latter combined with leftwards shift of the demand curve due to the negative income effect of the lower level of employment in period 2 lead to the following configuration:

$$P_1 = P_{1,3}$$

$$x_1 = x_{1,3}$$

$$N_1 = N_{1,3}$$

The adjustment process continues until the price system converges to its equilibrium level with $P_1 = P_1^E$ and $P_2 = P_2^E$. Correspondingly, $D_1 = D_1(P_1^E, P_2^E, Y^E)$ and $N_1 = N_1^E$. Similarly, $D_2 = D_S(P_1^E, P_2^E, Y^E)$ and $N_2 = N_2^E$. It should be noted that in the present case the presence of an exogenously determined level of real demand by the government implies that there is a limit to the leftwards shift of the D_1 curve. As a result, the equilibrium price-quantity levels P_1^E, x_1^E will be associated with an equilibrium level of employment, in industry 1, of N_1^E.

Now, if we join the points c, f, h, i, etc, we then get a special demand curve for commodity 1. It is the income-constrained dynamic demand curve $D_1(P_1,P_2,Y)$ for that commodity.

The corresponding constrained demand curve for commodity 2 is $D_2(P_1,P_2,Y)$ in section D of the figure from which we have omitted the individual demand curve which lies between $D_2(P_1,P_2,Y_0)$ and $D_2(P_1^E,P_2^E,Y^E)$. It should be noted that if the increase in P_1 from $P_{1,0}$ to $P_{1,2}$ were associated with no change in the price of commodity 2 (implying a lower percentage mark-up per unit) the constrained demand curve for commodity 1 will be az (not drawn), and that for commodity 2 would be a′z′.

May I remind the reader that the analysis in the preceding paragraphs is based on a model in which there is only circulating capital ? However, the introduction of fixed capital into the analysis, by assuming that commodity 1 uses a machine produced by another industry (chapter 8 above) as well as material inputs and direct labour, imposes a capacity constraint on the output of industry 1. These complications together with the complications which follow from the opening of the economy do not affect the conclusion to which the above analysis leads. That conclusion is that, under oligopoly capitalism, a disequilibrium price vector implies a disequilibrium quantity vector.

Thus, under the present case the data generated suggest that the model of price inflation proposed in this thesis does produce numbers with some economic sense. The once and for all increase in the mark-up in industry 1 initiated a mild inflationary process. That process is associated with a zero rate of wage inflation (column 12), a declining rate of price inflation (column 6) and a shift in income distribution in favour of profit (columns 20-22). The maintenance of governmental real demand at its initial level lies behind the sectoral redistribution of the lower level of the employed section of the labour force in favour of the government sector (columns 23-26). The factor which initiated the inflationary process is not the increase in "money supply" on which I am going to say more later. Rather, it is the increase in the mark-up in industry 1.

Let us now see the reaction of the same system to the same disturbance under the second case.

10.4.2 Case II: Simple wage indexation:

First the data (Table 8):

Table 8 showing the reaction of the system's main variables to the increase in the mark-up in Industry 1 associated with a uniform simple wage indexation.(1)

Time period t	Price by Industry P_1	Price by Industry P_2	Price by Industry P_3	Price index P	Price inflation %	Money wage rate by Industry w_1	Money wage rate by Industry w_2	Money wage rate by Industry w_3	Money wage rate Govt. Sector w_g	Money wage index W^I	Wage inflation % For the whole economy	Wage inflation % Industry 1	Wage inflation % Industry 2	Wage inflation % Industry 3	Wage inflation % Govt. Sector
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0	1.439	13.338	5.896	100.00	0.00	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
1	1.504	13.339	5.896	100.46	0.46	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
2	1.535	13.524	5.932	101.62	1.15	5.023	5.023	5.023	5.023	100.46	0.46	0.46	0.46	0.46	0.46
3	1.558	13.696	4.982	102.76	1.13	5.081	5.081	5.081	5.091	101.62	1.15	1.15	1.15	1.15	1.15
4	1.578	13.867	6.050	104.01	1.21	5.138	5.138	5.138	5.138	102.76	1.13	1.13	1.31	1.13	1.13
5	1.598	14.037	6.120	105.26	1.21	5.200	5.200	5.200	5.200	104.01	1.21	1.21	1.21	1.21	1.21
6	1.618	14.209	6.194	106.55	1.22	5.263	5.263	5.263	5.263	105.26	1.21	1.22	1.22	1.21	1.21
7	1.638	14.382	6.269	107.84	1.22	5.327	4.327	5.327	5.327	106.55	1.22	1.22	1.22	1.22	1.22
8	1.658	14.558	6.346	109.16	1.22	5.392	5.392	5.392	6.392	107.84	1.22	1.22	1.22	1.22	1.22
9	1.678	14.735	6.423	110.49	1.22	5.448	5.458	5.458	5.458	109.16	1.22	1.22	1.22	1.22	1.22
10	1.698	14.915	6.501	111.83	1.22	5.524	5.524	5.524	5.524	110.49	1.22	1.22	1.22	1.22	1.22
15	1.804	15.846	6.907	118.82	6.24	5.869	5.869	5.869	5.869	117.39	6.24	6.24	6.24	6.24	6.24
20	1.917	16.835	7.339	126.24	6.24	6.236	6.236	6.236	6.236	124.72	6.24	6.24	6.24	6.24	6.24
25	2.037	17.887	7.797	134.12	6.24	6.625	6.625	6.625	6.625	132.51	6.24	6.24	6.24	6.24	6.24
30	2.164	19.004	9.284	142.50	6.24	7.039	7.039	7.039	7.039	140.78	6.24	6.24	6.24	6.24	6.24
35	2.299	20.190	8.801	151.40	6.24	7.479	7.479	7.479	7.479	149.57	6.24	6.24	6.24	6.24	6.24
40	2.443	21.451	9.351	160.85	6.24	7.946	7.946	7.946	7.946	158.91	6.24	6.24	6.24	6.24	6.24
45	2.595	22.791	9.935	170.89	6.24	8.442	8.442	8.442	8.442	168.84	6.24	6.24	6.24	6.24	6.24
50	2.757	24.214	10.555	181.57	6.24	8.969	8.969	8.969	8.969	179.38	6.24	6.24	6.24	6.24	6.24

(1) The reader may wish to consult Table 6 for further details.

Table 8 (continued)

Time period t	Labour force	Level of Employment	Rate of unemployment	Income contribution: Workers' share %	Capitalists' share %	Rate of profit	Wage bill distribution %: Industry 1	Industry 2	Industry 3	Govt. Sector	Demand for money	Money inflation %	Govt. expenditures	Net national product at current prices	Quantity index of inventories
	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0	210.315	191.085	0.0914	73.87	26.13	0.0991	16.90	33.99	45.97	3.14	587.93	0.00	130.50	1293.33	100.00
1	210.630	191.118	0.0926	70.98	29.02	0.1146	16.90	33.98	45.96	3.16	590.53	0.44	131.10	1299.82	99.99
2	210.946	191.159	0.0938	70.59	29.41	0.1152	16.90	33.98	45.95	3.18	596.58	1.02	132.61	1314.95	109.52
3	211.263	190.503	0.0983	70.66	29.34	0.1140	16.78	34.00	46.04	3.19	600.39	0.64	134.11	1324.48	92.87
4	211.580	191.957	0.0927	70.50	29.50	0.1150	16.75	34.00	46.08	3.17	610.83	1.74	135.73	1350.57	99.43
5	211.897	191.556	0.0960	70.62	29.38	0.1142	16.74	33.96	46.14	3.17	616.13	0.87	137.37	1363.83	89.50
6	212.215	192.526	0.0928	70.50	29.50	0.1149	16.74	33.94	46.17	3.16	625.57	1.53	139.04	1387.42	95.22
7	212.533	192.187	0.0957	70.61	29.39	0.1143	16.74	33.94	46.16	3.16	631.34	0.92	140.74	1401.84	87.15
8	212.852	193.036	0.0931	70.50	29.50	0.1149	16.74	33.94	46.17	3.15	640.70	1.48	142.45	1425.25	92.98
9	213.171	192.731	0.0959	70.59	29.41	0.1144	16.75	33.94	46.16	3.15	646.74	0.94	144.19	1440.35	86.75
10	213.491	193.455	0.0939	70.49	29.51	0.1149	16.75	33.95	46.17	3.14	655.97	1.43	145.94	1463.43	92.39
15	215.097	193.827	0.0989	70.56	29.44	0.1145	16.75	33.95	46.16	3.13	693.75	5.76	155.06	1557.89	90.73
20	216.715	194.480	0.1026	70.50	29.50	0.1148	16.75	33.96	46.16	3.12	734.92	5.93	164.74	1660.80	97.87
25	218.345	194.378	0.1098	70.54	29.46	0.1146	16.76	33.96	46.16	3.13	776.03	5.59	175.03	1763.58	98.55
30	219.988	194.501	0.1159	70.52	29.48	0.1148	16.76	33.96	46.16	3.12	820.56	5.74	185.96	1874.90	101.75
35	221.643	194.347	0.1232	70.54	29.46	0.1146	16.76	33.96	46.16	3.13	866.76	5.63	197.57	1990.39	101.31
40	223.310	194.369	0.1296	70.53	29.47	0.1147	16.76	33.96	46.16	3.13	916.57	5.75	209.91	2114.93	102.20
45	224.990	194.290	0.1365	70.54	29.46	0.1147	16.76	33.96	46.16	3.13	969.03	5.72	223.02	2246.08	101.55
50	226.682	194.310	0.1428	70.53	29.47	0.1147	16.76	33.96	46.16	3.13	1025.23	5.80	236.94	2386.58	101.79

The reader will notice how immense is the difference in the reaction of the system to the same inflationary "shock" when even a simple version Hicks' Real Wage Resistance Mechanism is introduced into it. From period 7 onwards, the economic system shows the following symptoms:

(i) a constant rate of wage inflation of 1.22% (column 12)

(ii) a constant rate of price inflation of 1.22% (column 6)

(iii) a growth rate of money supply of around 1.20% (column 28)

and (iv) a shift in income distribution in favour of profit (columns 20–22)

One other feature of the present case is that instead of stabilzing at a lower level, aggregate employment went up from its initial level of 191.1 and stabilized (more or less) at 194.3 (see column 18). Comparative static equilibrium analysis implies that so long as the capitalists' marginal propensity to consume is lower than the workers', the hgher mark-up, cet.par., must be associated with a lower equilibrium level of employment. Why then did we get a result which runs counter to the predictions of the comparative static analysis ? The answer is simple.

The reader will remember that the factor which initiated the inflationary process is a once and for all increase in the mark-up in industry 1. The reader will also remember that we have hypothesised that all firms are applying the historic cost pricing rule.

When the mark-up in industry 1 went up at the beginning of period 1, the price of commodity 1 went up at the beginning of the same period. All other prices and the money wage rate remain unchanged during that period. At the beginning of period 2, two things happen. First the prices of commodities 1, 2 and 3 go up exclusively due to the increase in the price of commodity 1 which took place at the beginning of period 1. Second there is an increase in the money wage rate in all industries, due to the increase in the price of commodity 1 in period 1, <u>and at the same time</u> a partial and temporary erosion of the mark-ups of commodities 2 and 3 exclusively due to the lagged response of the two prices to current wage increases. There will also be a partial and temporary erosion of the new mark-up in industry 1. The lagged response of those prices to the current compensatory increase in money wage rate led to a temporary reversal of the lower real wage rate. This in turn led to an increase in aggregate real demand by the workers which in turn led to the slight improvement in the aggregate level of employment. However, the rigid mark-up resistance guarantees that the new (equilibrium) income distribution is in favour of profit.[5]

Let us leave the present case at this point and proceed to further complications by considering the reaction of the economic system to the same inflationary shock when Hicks' RWR mechanism takes a more complex form.

10.4.3 <u>Case III: price anticipations by the workers</u>:

Under the present case (see also table 6) the wage equation is the following:

$$W_t = W_{t-1}\left\{\left(1 + \frac{P_{t-1} - P^e_{t-1}}{P_{t-2}}\right)\left(\frac{P^e_t}{P_t}\right)\right\} \tag{10.18}$$

with $P^e_{t-1} = P_{t-1} + 0.50\,(P_{t-1} - P_{t-2})$ (10.19)

First, the data (table 9)

Table 9 showing the reaction of the system's main variables to the increase in the mark-up in Inudstry 1 associated with uniform wage equation incorporating inflationary expectations by the workers.(1)

Time period t	Price by Industry			Price index P	Price inflation %	Money wage rate by Industry			Govt. Sector w_g	Money wage index W^I	Wage inflation %				
	P_1	P_2	P_3			w_1	w_2	w_3			For the whole economy	Industry 1	Industry 2	Industry 3	Govt. Sector
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0	1.439	13.338	5.896	100.00	0.00	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
1	1.504	13.339	5.896	100.46	0.46	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
2	1.535	13.524	5.932	101.62	1.15	5.035	5.035	5.035	5.035	100.69	0.69	0.69	0.69	0.69	0.69
3	1.558	13.703	5.989	102.84	1.20	5.110	5.110	5.110	5.110	102.20	1.50	1.50	1.50	1.50	1.50
4	1.580	13.891	6.068	104.24	1.36	5.173	5.173	5.173	5.173	103.45	1.22	1.22	1.22	1.22	1.22
5	1.602	14.078	6.147	105.62	1.33	5.247	5.247	5.247	5.247	104.95	1.44	1.44	1.44	1.44	1.44
6	1.624	14.270	6.232	107.07	1.37	5.316	4.316	5.316	5.316	106.33	1.32	1.32	1.32	1.32	1.32
7	1.646	14.464	6.316	108.52	1.35	5.391	4.391	5.391	5.391	107.82	1.40	1.40	1.40	1.40	1.40
8	1.668	14.661	6.402	110.00	1.37	5.463	5.463	5.463	5.463	109.27	1.35	1.35	1.35	1.35	1.35
9	1.691	14.861	6.489	111.50	1.36	5.539	4.539	5.539	5.539	110.78	1.38	1.38	1.38	1.38	1.38
10	1.714	15.064	6.578	113.03	1.37	5.614	5.614	5.614	5.614	112.29	1.36	1.36	1.36	1.36	1.36
15	1.835	16.123	7.041	120.97	7.02	6.011	6.011	6.011	6.011	120.21	7.05	7.05	7.05	7.05	7.05
20	1.964	17.261	7.539	129.52	7.07	6.436	6.436	6.436	6.436	128.73	7.09	7.09	7.09	7.09	7.09
25	2.103	18.485	8.074	138.70	7.09	6.894	6.894	6.894	6.894	137.88	7.11	7.11	7.11	7.11	7.11
30	2.253	19.800	8.649	148.58	7.12	7.387	7.387	7.387	7.378	147.73	7.14	7.14	7.14	7.14	7.14
35	2.414	21.215	9.268	159.20	7.15	7.916	7.916	7.916	7.916	158.33	7.18	7.18	7.18	7.18	7.18
40	2.587	22.738	9.933	170.63	7.18	8.486	8.486	8.486	8.486	169.73	7.20	7.20	7.20	7.20	7.20
45	2.773	24.376	10.650	182.92	7.20	9.100	9.100	9.100	9.100	182.00	7.23	7.23	7.23	7.23	7.23
50	2.974	26.140	11.421	196.16	7.24	9.761	9.761	9.761	9.761	195.21	7.26	7.26	7.26	7.26	7.26

(1) The reader might wish to consult table 6 for further details.

Table 9 (continued.)

Time period t	Labour force	Level of Employment	Rate of unemployment	Income contribution: Workers' share %	Income contribution: Capital-ists' share %	Income contribution: Rate of profit	Wage bill distribution %: Industry 1	Wage bill distribution %: Industry 2	Wage bill distribution %: Industry 3	Wage bill distribution %: Govt. Sector	Demand for money	Money inflation %	Govt. expenditures	Net national product at current prices	Quantity index of inventories
	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0	210.315	191.085	0.0914	73.87	26.13	0.0991	16.90	33.99	45.97	3.14	587.93	0.00	130.50	1293.33	100.00
1	210.630	191.118	0.0926	70.98	29.02	0.1146	16.90	33.98	45.96	3.16	590.53	0.44	131.10	1299.82	99.99
2	210.946	191.145	0.0939	70.59	29.41	0.1152	16.90	33.98	45.96	3.17	596.58	1.02	132.61	1314.95	109.52
3	211.263	190.473	0.0984	70.73	29.27	0.1138	16.78	34.00	46.05	3.17	600.77	0.70	134.20	1325.42	88.73
4	211.580	192.319	0.0910	70.60	29.40	0.1148	16.75	34.00	46.10	3.15	613.12	2.06	136.03	1356.29	91.63
5	211.897	192.326	0.0924	70.70	29.30	0.1142	16.74	33.97	46.15	3.14	620.30	1.17	137.84	1374.25	81.24
6	212.215	193.481	0.0883	70.62	29.38	0.1147	16.75	33.96	46.17	3.12	631.20	1.76	139.73	1401.49	83.04
7	212.533	193.673	0.0887	70.68	29.32	0.1143	16.75	33.96	46.17	3.12	639.36	1.29	141.62	1421.91	76.45
8	212.852	194.618	0.0857	70.61	29.39	0.1148	16.75	33.97	46.17	3.11	649.99	1.66	143.56	1448.47	78.95
9	213.171	194.844	0.0860	70.65	29.35	0.1145	16.76	33.97	46.17	3.10	658.57	1.32	145.51	1469.93	75.15
10	213.491	196.619	0.0837	70.60	39.40	0.1148	16.76	33.98	46.17	3.09	669.01	1.58	147.50	1496.01	78.22
15	215.097	197.273	0.0829	70.62	29.38	0.1147	16.77	33.99	46.18	3.06	716.57	7.11	157.87	1614.92	81.79
20	216.715	198.395	0.0845	70.59	29.41	0.1148	16.77	34.00	46.19	3.04	766.16	6.92	169.02	1738.89	91.66
25	218.345	198.700	0.0900	70.62	29.38	0.1147	16.77	34.01	46.19	3.04	816.64	6.59	181.01	1865.09	96.90
30	219.988	198.904	0.0958	70.61	29.39	0.1147	16.77	34.01	46.19	3.04	870.58	6.61	193.89	1999.95	101.42
35	221.643	198.896	0.1026	70.63	29.37	0.1147	16.77	34.01	46.19	3.03	927.74	6.57	207.75	2142.85	102.47
40	223.310	198.980	0.1090	70.62	29.38	0.1147	16.77	34.01	46.19	3.03	989.67	6.68	222.67	2297.67	103.31
45	224.990	199.037	0.1154	70.63	29.37	0.1147	16.77	34.01	46.19	3.03	1056.21	6.72	238.72	2464.01	102.92
50	226.682	199.173	0.1214	70.63	29.37	0.1147	16.77	34.01	46.19	3.03	1128.28	6.82	255.99	2644.20	102.90

The data presented in the above table have four prominent features. First, there is an accelerating rate of wage inflation (column 12). Second, there is an accelerating rate of price inflation (column 6). Third, there is an accelerating average growth rate of money demand (column 28). And, fourth, irrespective of their more complex RWR, the workers are incapable of bringing income distribution back to its initial state (columns 20-22). The above features are so prominent that some of them might tempt an instrumentalist to formulate and "test" a "model" of "wage-price inflation" with demand for money (equal to actual money supply) and money wage rate acting (among others) as independent variables. We will leave him to do so and move to another interesting case in which workers' bargaining "power" is different in each industry (or sector).

10.4.4 Case IV: Sectoral differences in workers' bargaining power:

In the present case we maintain the assumption that the form of the wage equation in each industry or sector is the same. Differences in workers' bargaining "power" are expressed in terms of differences in the numerical value assigned to the exponent of the wage equation 10.2 In other words, our industry-specific wage equation is as follows:

$$W_{jt} = W_{j,t-1}\left\{\left[1 + \frac{P_{t-1} - P^e_{t-1}}{P_{t-2}}\right]\left[\frac{P^e_t}{P_{t-1}}\right]\right\}^{\alpha_j} \qquad (10.20)$$

$$j = 1, 2, 3, g$$

$$P^e_t = P_{t-1} + \delta(P_{t-1} - P_{t-2}) \qquad (10.21)$$

with $\alpha_1 = 1.00$, $\alpha_2 = 0.95$

$\alpha_3 = 0.60$, $\alpha_g = 0.40$

$\delta = 0.50$

The reaction of the system to the same increase in the mark-up in industry 1 is presented in table 10 below:

Table 10 Showing the reaction of the system's main variables to the increase in the mark-up in Industry 1 associated with an industry-specific wage equation.(1)

Time period t	Price by Industry			Price index P	Price inflation %	Money wage rate by Industry			Govt. Sector w_g	Money wage index wI	Wage inflation %				
	P_1	P_2	P_3			w_1	w_2	w_3			For the whole economy	Industry 1	Industry 2	Industry 3	Govt. Sector
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0	1.439	13.338	5.896	100.00	0.00	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
1	1.504	13.339	5.896	100.46	0.46	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
2	1.535	13.524	5.932	101.62	1.15	5.035	5.033	5.021	5.014	100.54	0.54	0.69	0.66	0.42	0.28
3	1.558	13.702	5.981	102.78	1.14	5.110	5.105	5.066	5.044	101.71	1.17	1.50	1.42	0.90	0.60
4	1.580	13.885	6.042	104.04	1.22	5.169	5.160	5.100	5.067	102.62	0.89	1.14	1.09	0.68	0.46
5	1.601	14.059	6.099	105.23	1.14	5.234	5.222	5.139	5.092	103.63	0.98	1.26	1.19	0.75	0.50
6	1.621	14.230	6.157	106.40	1.12	5.292	5.277	5.173	5.115	104.53	0.87	1.11	1.06	0.67	0.44
7	1.640	14.394	6.213	107.53	1.06	5.350	6.332	5.207	5.137	105.44	0.87	1.11	0.05	0.66	0.44
8	1.659	14.554	6.266	108.62	1.02	5.406	5.385	5.240	5.158	106.30	0.81	1.03	0.98	0.62	0.41
9	1.677	14.707	6.318	109.68	0.97	5.460	5.436	5.271	5.179	107.13	0.79	1.00	0.95	0.60	0.40
10	1.695	14.856	6.368	110.70	0.93	5.512	5.485	5.301	5.199	107.93	0.75	0.95	0.90	0.57	0.38
15	1.774	15.527	6.591	115.29	4.15	5.746	5.706	5.435	5.286	111.53	3.34	4.25	4.03	2.53	1.67
20	1.840	16.088	6.777	119.12	3.32	5.941	5.890	5.545	5.357	114.52	2.68	3.39	3.22	2.02	1.34
25	1.895	16.554	6.931	122.30	2.67	6.103	6.043	5.636	5.415	116.99	2.16	2.73	2.60	1.64	1.08
30	1.941	16.941	7.058	124.93	2.15	6.238	6.169	5.710	5.463	119.03	1.74	2.21	2.09	1.31	0.89
35	1.978	17.259	7.162	127.10	1.74	6.348	6.273	5.770	5.501	120.70	1.40	1.73	1.69	1.05	0.70
40	2.009	17.522	7.247	128.88	1.40	6.439	6.358	5.820	5.532	122.08	1.14	1.47	1.36	0.87	0.56
45	2.035	17.737	7.318	130.35	1.14	6.514	6.428	5.860	5.558	123.21	0.93	1.16	1.10	0.69	0.47
50	2.056	17.914	7.375	131.55	0.92	6.575	6.486	5.893	5.579	124.13	0.75	0.94	0.90	0.56	0.38

(1) The reader may wish to consult Table 6 for further details.

Table 10 (continued)

Time period t	Labour force	Level of Employment	Rate of unemployment	Income contribution			Wage bill distribution %				Demand for money	Money inflation %	Govt. expenditures	Net national product at current prices	Quantity index of inventories
				Workers' share %	Capital-ists' share %	Rate of profit	Industry 1	Industry 2	Industry 3	Govt. Sector					
	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0	210.315	191.085	0.0914	73.87	26.13	0.0991	16.90	33.99	45.97	3.14	587.93	0.00	130.50	1293.33	100.00
1	210.630	181.118	0.0926	70.98	29.02	0.1146	16.90	33.98	45.96	3.16	590.53	0.44	131.10	1299.82	99.99
2	210.946	191.171	0.0937	70.59	29.41	0.1152	16.92	34.01	45.89	3.17	596.58	1.02	132.61	1314.95	109.52
3	211.263	190.549	0.0980	70.69	29.31	0.1139	16.86	34.11	45.85	3.18	600.49	0.65	134.13	1324.72	91.31
4	211.580	192.191	0.0916	70.51	29.49	0.1150	16.87	34.18	45.79	3.17	611.39	1.81	135.77	1351.97	98.16
5	211.897	191.846	0.0946	70.57	29.43	0.1144	16.89	34.19	45.74	3.18	616.39	0.82	137.32	1364.48	91.55
6	212.215	192.610	0.0924	70.42	29.58	0.1150	16.92	34.21	45.69	3.17	624.53	1.32	138.85	1384.82	99.23
7	212.533	192.133	0.0960	70.47	29.53	0.1146	16.95	34.24	45.62	3.19	628.85	0.69	140.32	1395.62	96.27
8	212.852	192.505	0.0956	70.35	29.65	0.1151	16.98	34.27	45.56	3.19	635.48	1.06	141.75	1412.21	104.85
9	213.171	191.844	0.1000	70.39	29.61	0.1147	17.01	34.30	45.49	3.20	638.85	0.53	143.13	1420.63	104.20
10	213.491	191.886	0.1012	70.28	29.72	0.1151	17.04	34.33	45.43	3.21	644.12	0.82	144.46	1433.80	112.68
15	215.097	188.564	0.1234	70.22	29.78	0.1148	17.14	34.43	45.13	3.29	656.81	1.97	150.45	1465.53	127.92
20	216.715	184.841	0.1471	70.10	29.90	0.1149	17.23	34.51	44.88	3.38	663.63	1.04	155.45	1482.58	138.30
25	218.345	180.981	0.1711	70.06	29.94	0.1147	17.30	34.57	44.67	3.47	666.12	0.38	159.60	1488.81	134.72
30	219.988	178.057	0.1906	69.99	30.01	0.1148	17.35	34.61	44.50	3.55	668.57	0.37	163.04	1494.93	128.05
35	221.643	175.754	0.2070	69.95	30.05	0.1147	17.39	34.64	44.36	3.60	670.64	0.31	165.87	1500.11	118.44
40	223.310	174.173	0.2200	69.90	30.10	0.1148	17.43	34.67	44.25	3.65	673.23	0.39	168.19	1506.57	110.90
45	224.990	172.974	0.2312	69.87	30.13	0.1148	17.46	34.70	44.16	3.68	675.59	0.35	170.10	1512.47	104.54
50	226.682	172.109	0.2407	69.83	30.17	0.1148	17.48	34.72	44.09	3.71	677.86	0.34	171.67	1518.15	100.34

The first feature of the present case is the declining rate of price/wage inflation (columns 6 and 12) regardless of its anticipation by the workers. The reason for that is simple. The assumption that α_2, α_3 and α_g are all less than one implies that the workers in industries 2 and 3 and in the government sector are unable to fully recoup the real wage loss inflicted upon them by the higher mark-up. The second related feature of the present case is that the initial class conflict over income distribution is transformed via the inflationary spiral into a simultaneous inter-class and intra-class conflict over the distribution of the cake. The end result is (see columns 20-26) a two-dimensional change in income distribution. First, there is a change in income distribution in favour of profit (columns 21,22) Second, there is a change in the distribution of the aggregate wage bill in favour of the most powerful section of the working class (columns 23-26). Here, it is the weak sections in our hypothetical society which paid the price of a declining rate of price inflation.

10.4.5 Case V: an accelerating rate of price inflation associated with a counter-cyclical government policy:

The present case is the same as case III above except for one important complication (see table 6). Here, the government's economic policy is represented by the following reaction function:

$$G^m_{1t} = G^m_{1,t-1} \left(\frac{P_t}{P_{t-1}}\right) (1+\beta U_{t-1}) \qquad 0 < \beta < 1 \qquad (10.22)$$

Since P_t is a weighted index of P_{1t}, P_{2t} and P_{3t}, it follows that the government is assumed to be very knowledgeable about commodity prices at the beginning of each period. This is a simplifying assumption. Let us now see how the system reacts to the same increase in the mark-up in industry 1 (table 11).

Table 11 showing the reaction of the system's main variables to the increase in the mark-up in Industry 1 associated with a uniform wage equation incorporating inflationary expectations by the workers and counter-cyclical economic policy. (1)

Time period t	Price by Industry			Price index P	Price inflation %	Money wage rate by Industry			Govt. Sector w_g	Money wage index w^I	Wage inflation %				
	P_1	P_2	P_3			w_1	w_2	w_3			For the whole economy	Industry 1	Industry 2	Industry 3	Govt. Sector
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0	1.439	13.338	5.896	100.00	0.00	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
1	1.504	13.339	5.896	100.46	0.46	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
2	1.535	13.524	6.932	101.62	1.15	5.035	5.035	5.035	5.035	100.69	0.69	0.69	0.69	0.69	0.69
3	1.558	13.703	5.989	102.84	1.20	5.110	5.110	5.110	5.110	102.20	1.50	1.50	1.50	1.50	1.50
4	1.580	13.891	6.068	104.24	1.36	5.173	5.173	5.173	5.173	103.45	1.22	1.22	1.22	1.22	1.22
5	1.602	14.078	6.147	105.62	1.33	5.247	5.247	5.247	5.247	104.95	1.44	1.44	1.44	1.44	1.44
6	1.624	14.270	6.232	107.07	1.37	5.316	5.316	5.316	5.316	106.33	1.32	1.32	1.32	1.32	1.32
7	1.646	14.464	6.316	108.52	1.35	5.391	5.391	5.391	5.391	107.82	1.40	1.40	1.40	1.40	1.40
8	1.668	14.661	6.402	110.00	1.37	5.463	5.463	5.463	5.463	109.27	1.35	1.35	1.35	1.35	1.35
9	1.691	14.861	6.489	111.50	1.36	5.539	5.539	5.539	5.539	110.78	1.38	1.38	1.38	1.38	1.38
10	1.714	15.064	6.578	113.03	1.37	6.614	5.614	5.614	5.614	112.29	1.36	1.36	1.36	1.36	1.36
15	1.835	16.123	7.041	120.97	7.02	6.011	6.011	6.011	6.011	120.21	7.05	7.05	7.05	7.05	7.05
20	1.964	17.261	7.539	129.52	7.07	6.436	6.436	5.436	6.436	128.73	7.09	7.09	7.09	7.09	7.09
25	2.103	18.485	8.074	138.70	7.09	6.894	6.894	6.895	6.894	137.88	7.11	7.11	7.11	7.11	7.11
30	2.253	19.800	8.649	148.58	7.12	7.387	7.387	7.387	7.387	147.73	7.14	7.14	7.14	7.14	7.14
35	2.414	21.215	9.268	159.20	7.15	7.916	7.916	7.916	7.916	158.33	7.18	7.18	7.18	7.18	7.18
40	2.587	22.738	9.933	170.63	7.18	8.486	8.486	8.486	9.486	169.73	7.20	7.20	7.20	7.20	7.20
45	2.773	24.376	10.650	182.92	7.20	9.100	9.100	9.100	9.100	182.00	7.23	7.23	7.23	7.23	7.23
50	2.974	26.140	11.421	196.16	7.24	9.761	9.761	9.761	9.761	195.21	7.26	7.26	7.26	7.26	7.26

(1) The reader might wish to consult Table 6 for further details.

Table 11 (Continued)

Time period t	Labour force	Level of Employment	Rate of unemployment	Income contribution			Wage bill distribution %				Demand for money	Money inflation %	Govt. expenditures	Net national product at current prices	Quantity index of inventories
				Workers' share %	Capital-ists' share %	Rate of profit	Industry 1	Industry 2	Industry 3	Govt. Sector					
	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0	210.315	191.139	0.0912	73.88	26.12	0.0991	16.90	33.93	45.96	3.17	588.04	0.01	131.68	1293.60	100.00
1	210.630	191.288	0.0918	70.99	29.01	0.1145	16.89	33.97	45.94	3.20	590.93	0.49	132.89	1300.83	98.87
2	210.946	191.454	0.0924	70.62	29.38	0.1151	16.88	33.96	45.93	3.22	597.34	1.09	135.04	1316.86	106.68
3	211.263	190.997	0.0959	70.76	29.24	0.1137	16.77	33.98	46.02	3.24	602.12	0.80	137.29	1328.80	84.50
4	211.580	193.065	0.0875	70.64	29.36	0.1147	16.74	33.98	46.07	3.22	615.09	2.15	139.82	1361.22	84.45
5	211.897	193.371	0.0874	70.73	29.27	0.1141	16.72	33.94	46.12	3.23	623.13	1.31	142.30	1381.33	73.45
6	212.215	194.832	0.0819	70.66	29.34	0.1146	16.72	33.92	46.14	3.22	634.93	1.89	144.88	1410.83	73.37
7	212.533	195.386	0.0807	70.72	29.28	0.1142	16.72	33.92	46.14	3.22	644.20	1.46	147.44	1433.99	65.27
8	212.852	196.695	0.0759	70.65	29.35	0.1146	16.72	33.93	46.14	3.21	655.96	1.83	150.07	1463.39	66.12
9	213.171	197.328	0.0743	70.69	29.31	0.1144	16.72	33.93	46.14	3.21	665.83	1.51	152.68	1488.09	61.06
10	213.491	198.508	0.0702	70.64	29.36	0.1147	16.72	33.93	46.14	3.21	677.59	1.77	155.35	1517.48	62.83
15	215.097	202.353	0.0592	70.66	29.34	0.1146	16.72	33.94	46.14	3.20	732.87	8.16	169.01	1655.68	63.17
20	216.715	205.594	0.0513	70.64	29.36	0.1147	16.71	33.95	46.15	3.19	790.99	7.93	183.48	1800.97	73.48
25	218.345	207.797	0.0483	70.66	29.34	0.1146	16.71	33.95	46.15	3.19	850.31	7.50	198.96	1949.27	81.23
30	219.988	209.674	0.0469	70.66	29.34	0.1147	16.70	33.94	46.15	3.20	913.33	7.41	215.67	2106.82	88.62
35	221.643	211.190	0.0472	70.68	29.32	0.1146	16.69	33.94	46.15	3.22	980.05	7.31	233.81	2273.62	92.06
40	223.310	212.735	0.0474	70.69	29.31	0.1146	16.69	33.93	46.15	3.23	1052.41	7.38	253.57	2454.52	94.51
45	224.990	214.247	0.0477	70.70	29.30	0.1146	16.68	33.93	46.15	3.25	1130.59	7.43	275.09	2649.98	95.10
50	226.682	215.866	0.0477	70.71	29.29	0.1146	16.67	33.92	46.14	3.26	1215.84	7.54	298.54	2863.10	95.70

As is clear from the above table, the once and for all increase in the mark-up in industry 1 threw the whole system into a turmoil. There is a declining rate of unemployment associated with an accelerating rate of wage inflation and an accelerating rate of price inflation. The demand for money is increasing faster than the rate of price/wage inflation (columns 6, 12 and 28). What differentiates the present case from case III above is that in the present case the government is following an expansionary economic policy ($\eta = 1$ and $\beta = 0.05$ in equation 10.16) guided by last period's rate of unemployment regardless of the presence of a conflict over income distribution which is resolving itself into an accelerating rate of price inflation.

What initiated the accelerating rate of price/wage inflation under the present case ? Is it the increase in money supply ? Is it Hick's Real Wage Resistance ? Or is it the "higher oil price" ?

To the superficial analyst, it is the increase in "money supply". To the misguided econometrician "it depends". To the imperialist anti-trade unionist, it is Real Wage resistance. The point I want to make here is that the aggregate indices of inflation tell us nothing about what initiates the inflationary process whatever the results of the econometric "tests" which are based on them.

10.4.6 Case VI: Price/wage control associated with a counter-cyclical government policy:

In this highly theoretical case, neither the mark-up(s) nor money wage rate(s) deviate from their initial equilibrium values. It is only the government expenditures which change in a counter-cyclical way. The necessary condition for that policy to materialize is that the numerical values of both η and β in equation 10.16 are positive with $\eta = 1$ and $0 < \beta < 1$. In other words, we have:

$$G_{1t}^{m} = G_{1,t-1}^{m} \left(\frac{P_t}{P_{t-1}}\right)^{\eta} (1+\beta U_{t-1}) \tag{10.23}$$

$$\eta = 1, \quad 0 < \beta < 1 \tag{10.24}$$

As before, the value we assigned to β is 0.05. Let us now see the reaction of the system to that policy (table 12):

Table 12 showing the reaction of the system's other variables to a counter-cyclic economic policy when all prices and the money wage rate remain at their initial equilibrium levels. (1)

Time period	Price by Industry			Price index	Price inflation	Money wage rate by Industry			Govt. Sector	Money wage index	Wage inflation %				
t	P_1	P_2	P_3	P	%	w_1	w_2	w_3	w_g	WI	For the whole economy	Industry 1	Industry 2	Industry 3	Govt. Sector
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0	1.439	13.338	5.896	100.00	0.00	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
1	1.439	13.339	5.896	100.00	0.00	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
2	1.439	1.3339	5.897	100.00	0.00	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
3	1.439	13.339	5.897	100.00	0.00	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
4	1.439	13.339	5.897	100.00	0.00	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
5	1.439	13.338	5.896	100.00	0.00	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
6	1.439	13.338	5.896	100.00	0.00	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
7	1.439	13.338	5.896	100.00	0.00	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
8	1.439	13.338	5.896	100.00	0.00	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
9	1.439	13.338	5.896	100.00	0.00	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
10	1.439	13.338	5.896	100.00	0.00	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
15	1.439	13.338	5.896	100.00	0.00	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
20	1.439	13.338	5.896	100.00	0.00	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
25	1.439	13.338	5.896	100.00	0.00	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
30	1.439	13.338	5.896	100.00	0.00	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
35	1.439	13.338	5.896	100.00	0.00	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
40	1.439	13.338	5.896	100.00	0.00	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
45	1.439.	13.338	5.896	100.00	0.00	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00
50	1.439	13.338	5.896	100.00	0.00	5.000	5.000	5.000	5.000	100.00	0.00	0.00	0.00	0.00	0.00

(1) The reader might wish to consult Table 6 for further details.

Table 12 (continued)

Time period t	Labour force	Level of Employment	Rate of unem-ployment	Income contribution: Workers' share %	Income contribution: Capital-ists' share %	Income contribution: Rate of profit	Wage bill distribution %: Industry 1	Wage bill distribution %: Industry 2	Wage bill distribution %: Industry 3	Wage bill distribution %: Govt. Sector	Demand for money	Money inflation %	Govt. expendi-tures	Net national product at current prices	Quantity index of invent-ories
	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0	210.315	191.139	0.0912	73.88	26.12	0.0991	16.90	33.98	45.96	3.17	588.04	0.01	131.68	1293.60	100.00
1	210.630	191.260	0.0920	73.89	26.11	0.0991	16.89	33.97	45.95	3.18	588.37	0.06	132.28	1294.43	98.87
2	210.946	191.398	0.0927	73.89	26.11	0.0990	16.89	33.97	45.95	3.19	588.73	0.06	132.89	1295.31	97.18
3	211.263	191.609	0.0930	73.90	26.10	0.0990	16.89	33.96	45.94	3.21	589.28	0.09	133.51	1296.70	95.73
4	211.580	191.833	0.0933	73.90	26.10	0.0990	16.88	33.96	45.94	3.22	589.86	0.10	134.13	1298.15	93.80
5	211.897	192.130	0.0933	73.90	26.09	0.0990	16.88	33.96	45.94	3.23	590.65	0.13	134.75	1300.12	92.19
6	212.215	192.436	0.0932	73.91	26.09	0.0990	16.88	33.95	45.94	3.24	591.46	0.14	135.38	1302.14	90.26
7	212.533	192.805	0.0928	73.91	26.09	0.0990	16.87	33.95	45.93	3.25	592.44	0.17	136.01	1304.60	88.68
8	212.852	193.180	0.0924	73.91	26.09	0.0990	16.87	33.95	45.93	3.25	593.44	0.17	136.64	1307.09	86.90
9	213.171	193.607	0.0918	73.91	26.09	0.0990	16.87	33.94	45.93	3.26	594.58	0.19	137.27	1309.94	85.49
10	213.491	194.035	0.0911	73.91	26.09	0.0990	16.86	33.94	45.93	3.27	595.72	0.19	137.90	1312.80	83.95
15	215.097	196.496	0.0865	73.92	26.08	0.0990	16.85	33.93	45.92	3.30	602.32	1.11	141.01	1329.30	79.09
20	216.715	199.125	0.0812	73.92	26.08	0.0991	16.83	33.92	45.92	3.33	609.38	1.17	144.01	1346.94	77.42
25	218.345	201.733	0.0761	73.92	26.08	0.0991	16.82	33.91	45.92	3.35	616.38	1.15	146.88	1364.46	78.31
30	219.988	204.202	0.0718	73.93	26.07	0.0991	16.81	33.90	45.92	3.37	623.02	1.08	149.63	1381.05	80.37
35	221.643	206.532	0.0682	73.93	26.07	0.0991	16.80	33.89	45.92	3.39	629.28	1.00	152.28	1396.69	82.90
40	223.310	208.730	0.0653	73.94	26.06	0.0991	16.79	33.89	45.91	3.41	635.18	0.94	154.84	1411.45	85.27
45	224.990	210.839	0.0629	73.95	26.05	0.0990	16.78	33.88	45.91	3.43	640.84	0.89	157.35	1425.59	87.40
50	226.682	212.879	0.0609	73.95	26.05	0.0990	16.77	33.87	45.91	3.45	646.31	0.85	159.81	1439.28	89.18

The most prominent features of the system under the present case are three. Firstly, price equilibrium is associated with a more or less an unchanging inter-class income distribution (columns 20-22). Secondly, all physical quantities (except inventories) are expanding (all represented by column 18); and thirdly, the expanding economy is in a state of quantity disequilibrium.

10.5 On causality in the analysis of price inflation:

The analysis presented in chapters 6-9 together with the above simple simulations has two important implications for causality in the analysis of price inflation under today's capitalism. The first is related to the logical side of causality, away from the shield of econometrics. The second implication relates to the shield of econometrics itself.

As for the logical side of causality, I propose that Addison et al's (1980) "remote" and "proximate" causes, and Cobham's (1981) "causal field" be replaced by clearer terms. The inter-industrial analysis of price inflation, according to which conflict over income distribution resolves itself in price inflation, presents the reader with a field of causality which is composed of two sub sets. The first is the subset of initiating causes. Its elements are four:[6]

(i) the mark-up

(ii) the money wage rate

(iii) the exchange rate, and

(iv) the foreign currency price of imported inputs and/or consumer goods.

The second is the subset of causes which perpetuates or even worsens the inflationary experience. The elements of this subset of causes are four:

(i) Real Wage Resistance

(ii) Rigid Mark-up Resistance

(iii) Switching pricing rules, and

(iv) Rigid Foreign Resistance

The recognition of that differentiation is important for "[t]he understanding of inflation...." (Lipsey, 1981) per se. It becomes more important when the analyst addresses the policy question for its control. This is so because the policy package designed to control price inflation cannot be implemented without involving the members of the society which is experiencing the phenomenon.

In all the inflationary simulations presented above, the initiating factor was the (hidden) higher mark-up in industry 1. The perpetuating and/or the worsening causes were two. The first is the rigid mark-up resistance. The second is the Real Wage Resistance, which took various forms of wage indexation (cases II, III, IV and V). "Money supply" was neither an initiating cause nor a perpetuating cause. It was no more than a validating factor. Insufficient attention given to the mark-up[7] as an initiating cause has important theoretical and practical implications. It is easy for the analyst who has been kept in the dark about the Kalecki-Leontief-Sraffa approach to economic analysis to slip into the wrong causality in his study of the phenomenon. This can easily happen if the analyst has been brought up on (among others) a macroeconomic approach to the analysis of price inflation. Having gained confidence in macroeconomics and econometrics, when asked to "study" "inflation", he will almost certainly start with a chunk of aggregative indices similar to those generated under cases II, III, IV or V. Using his "human capital stock" of economics and econometrics, he will construct a macroeconometric "model" of price inflation. When his econometric results reach their "satisfactory" level, it is very likely that he moves to the next logical and dangerous step, the policy implications. The result of that big step would be a set of policy prescriptions to "control" the phenomena. The end result of that policy can be a greater degree of economic inequality, a larger poverty stricken section of the society, and as a result, more alienation, hopelessness and deprivation.

Constraints of time and length force me to omit a section of this chapter which would have studied the modelling "value" of Sim's (1972) causality test and Mizon's (1984) encompassing test, using the data set generated under cases II-V above. I only say here that the aggregative indices of price inflation tell us nothing about what initiated the inflationary spiral in the first place. Since causality and encompassing tests are based on these indices (mediated by a reduced form formulation), they are in no way capable of identifying any of the initiating factors which lie underneath the increasing aggregative indices of inflation. Thus, the two "tests" are useless as far as the "identification" problem is concerned. One can even say that the application of procedural rationality to modelling price/wage inflation makes both "tests" redundant. If one were to insist on the idea that an improvement upon existing and competing "models of inflation" cannot be obtained without the encompassing "principle", then I would suggest a further look at section 4.5 of Chapter 4 above.

10.6 Concluding note

I conclude this chapter by summarizing my answers to the three questions addressed at its beginning. Firstly, the model of price inflation proposed in this thesis does work numerically making some nontheological economic sense. Secondly, price inflation and income distribution are inseparable. Thirdly, the Kalecki-Leontieff-Sraffa approach to economic analysis leads the analyst to a clearer causality field composed of two subsets: the subset of initiating factors and the subset of perpetuating and/or worsening factors. Since the initiating factors do not show themselves in the aggregative indices of inflation, the latter are useless in identifying the initiating set of causes. The inter-industrial analysis of price inflation is a powerful tool for identifying both subsets of the causality field.

Notes to chapter 10

[1]See Ackley (1961), pp. 355-358.

[2]Semmler (1984, p.138) used the same matrix and the same labour input vector to "...discuss the effect of changes in the coefficients of production on relative values and prices of production".

[3]In all simulations, I paid no attention to stock appreciation in working out the actual rate of profit in the capitalist sector.

[4]The following diagram (and analysis) is based on the assumption that indifference curves (if one would like to believe in them) are L-shaped. That assumption is not a prerequisite for the conclusions reached.

[5]In the next case I shall not pay attention to the similar employment effect which features in that case. The reader might wish to have a look at Goodwin's (1983a p.308) "note" for a concise but implicit analysis of the positive employment effect of a temporary shift in income distribution in favour of wages at less than full employment.

[6]By identifying the mark-up with the "rate of return on bonds" Morishima (1984, especially pp.258-261) indirectly assumed that the nominal rate of interest is an initiating factor.

[7]Many economists miss, neglect or even ignore this point emphasised by Means (1975).

Chapter 11: Some Conditional Conclusions and Suggestions For Further Research

11.1 Some Conditional Conclusions

The main conclusions to which this work leads, and which might warrant some attention, are the following:

(i) or greater understanding of the roots and the process of price inflation today, a basic methodological change will have to take place. The macroeconomic approach to the analysis of that difficult monetary phenomenon must be abandoned. The gap created by abandoning that approach must be filled by the surplus-based inter-industrial approach.

(ii) The replacement of the macroeconomic approach by the inter-industrial approach is a necessary and sufficient condition for revealing the key role the input-output matrix plays in the analysis of the inflationary process. However, for the study of price inflation under oligopoly capitalism it is necessary for the analyst to clothe that matrix with the main economic institutions which are characteristic of oligopoly capitalism as a distinct economic order.

(iii) Under oligopoly capitalism, the roots of an accelerating rate of price inflation are three: (1) an increase in the mark-up in a single industry, or in an industry group; (2) an increase in money wage rate in a single industry, or in an industry group; and (3) an increase in the local currency price of an imported input and/or an imported wage good in a single industry, or in an industry group. The input-output matrix, the rigid mark-up resistance, the Real Wage Resistence and the rigid foreign resistence are no more than mechanisms by means of which the initiated conflict over income distribution is resolved into price inflation. The switch from the historic cost pricing (HCP) rule to the replacement cost pricing (RCP) rule worsens the inflationary experience, but does not initiate it.

(iv) Although an accelerating rate of price inflation is of rather easy occurrence in advanced capitalist economies, its control is much harder. The latter involves (among other things) a change in inter-class and/or intra-class income distribution.

(v) Unless careful attention is given to the three roots of price inflation mentioned above, the economic policy chosen to confront it could aggravate the degree of economic inequality in the society. If that were to happen, i.e. control and greater economic inequality, then the policy-maker could say no more than that his policy had succeeded in creating the economic conditions according to which one socio-economic group is forced to give economic concessions to another. The reduced rate of price/wage inflation is a byproduct of those concessions.

These are the main conclusions arising from this thesis. They are conditional conclusions because they depend on the validity of the crucial assumptions upon which the model which led to these conclusions is based. The question now is "Where do we go from here ?"

11.2 <u>Suggestions for further research</u>:

In chapter 1 of this thesis I emphasised that this work should be thought of as being exploratory. This means that the five conclusion cited above should be taken as starting points for further research <u>within the analytic framework proposed in this thesis</u>. That may be undertaken in two related directions. The first involves more relaxations of the assumptions upon which the model of this thesis is based. The result is, of course, a greater degree of generality of the model. For example, in every case analysed above, I maintained the assumption that workers' bargaining power, sectoral or otherwise, is unchanging. This is clearly an unrealistic assumption. The same thing applies to the mark-up. Also, liquidity shortage associated with a higher basic rate of interest leads the financially weaker firms either to bankruptcy or to merger with another bigger and stronger firm who introduces some "rationalization" into the former. In both cases the core of the system i.e. the input-output matrix, cannot remain the same, as is assumed throughout this thesis. When I introduced fixed capital in chapter 8, I introduced it in a very simple fashion within the closed economy context. When I opened the economy in chapter 9, I abstracted from fixed capital and multiperiod production processes. These are examples of important abstractions which reveal important gaps in the model which need to be filled. This work must thus be taken as no more than a skeleton proposal.

The other direction in which further research may be undertaken is of an empirical (preferably non-econometric) nature. For example, further research may be undertaken in order to get realistic answers to the following questions: how pervasive is the target rate of return pricing in British manufacturing and retailing today ? Do leading firms, in a given industry, switch from HCP to RCP when price inflation gets under way in the economy ? How do firms incorporate interest charges on working capital needs in their current production cost, and how do changes in those charges lead them to revise the planned level of current output produced by existing production facilities ? How do firms and trade unions form their price expectations, etc. ? These are examples of questions whose answers form separate research projects of different lengths. It would be of immense benefit to the students, to the responsible teachers, to the policy makers and to the society as a whole if a section of postgraduate students were to be engaged in research projects involving answers to questions of such a nature.

I close this thesis by saying that price inflation is a serious subject. It is time for economists to take it more seriously. Abandoning the macroeconomic approach to its analysis is a step in that direction.

Appendices

Appendix 1

This appendix is devoted to the derivation of equation 3.11 on page 62 above. I first reproduce equations 3.1-3.3 for convenience.

$$P_{1t} = (a_{11}P_{1t} + a_{21}P_{2t} + M_1\bar{e}P^M_{3t} + \ell_1 w_t)(1+r_1) \qquad (A.1.1)$$

$$P_{2t} = (a_{12}P_{1t} + a_{22}P_{2t} + M_2\bar{e}P^M_{3t} + \ell_2 w_t)(1+r_2) \qquad (A.1.2)$$

$$w_t = P_{1t}w_1^* + P_{2t}w_2^* + \bar{e}P^M_{3t}w_3^* \qquad (A.1.3)$$

The definitions of the variables and the constants are those given to them on page 61 above.

In matrix form, system A.1.1 - A.1.3 can be written as follows:

$$\underline{P}_t = (\underline{P}_t A + \underline{M}\bar{e}P^M_{3t} + \underline{\ell}w_t)(I+\hat{R}) \qquad (A.1.4)$$

$$w_t = \underline{P}_t\underline{w}^* + \bar{e}P^M_{3t}w_3^* \qquad (A.1.5)$$

Now, system A.1.4 - A.1.5 can be written, after eliminating the time subscript, as follows:

$$\underline{P} = \underline{P}A(I+\hat{R}) + \underline{M}\bar{e}P^M_{3t}(I+R) + \underline{\ell}w_t(I+\hat{R}) \qquad (A.1.6)$$

With $r_1 = r_2$, $I+\hat{R}$ becomes $I(1+r)$. This enables me to write equation A.1.6 as follows:

$$\underline{P} = \underline{P}A(1+r) + \underline{M}\bar{e}P^M_{3t}\,(1+r) + \underline{\ell}w(1+r) \qquad (A.1.7)$$

$$\underline{P}[I-A(1+r)] = \underline{M}\bar{e}P^M_{3t}(1+r) + \underline{\ell}w(1+r) \qquad (A.1.8)$$

$$\underline{P} = \bar{e}P^M_3\,(1+r)\,\underline{M}[I - A(1+r)]^{-1} + w(1+r)\underline{\ell}\,[I-A(1+r)]^{-1} \qquad (A.1.9)$$

Let:

$$(1+r)\,\underline{M}[I-A(1+r)]^{-1} = [M_1(r) \quad M_2(r)] \qquad (A.1.10)$$

and let:

$$(1+r)\underline{\ell}[I-A(1+r)]^{-1} = [L_1(r) \quad L_2(r)] \tag{A.1.11}$$

Therefore

$$[P_1 \quad P_2] = \bar{e}P_3^M \; [M_1(r) \quad M_2(r)] + [wL_1(r) \quad wL_2(r)] \tag{A.1.12}$$

Therefore

$$P_1 = \bar{e}P_3^M \, M_1(r) + wL_1(r) \tag{A.1.13}$$

$$P_2 = \bar{e}P_3^M \, M_2(r) + wL_2(r) \tag{A.1.14}$$

In terms of labour commanded prices, equations A.1.13 - A.1.14 become as follows:

$$P_{1,w} = \left(\frac{\bar{e}}{w}\right) P_3^M \, . \, M_1(r) + L_1(r) \tag{A.1.15}$$

$$P_{1,w} = \left(\frac{\bar{e}}{w}\right) P_3^M \, . \, M_2(r) + L_2(r) \tag{A.1.16}$$

or

$$P_{1,w} = P_3 \, . \, M_1(r) + L_1(r) \tag{A.1.17}$$

$$P_{2,w} = P_3 \, . \, M_2\,(r) + L_2(r) \tag{A.1.18}$$

with $P_3 = \left(\frac{\bar{e}}{w}\right) P_3^M$

Also, equation A.1.5 becomes

$$\underline{P}_w \, \underline{w}^* + e' P_3^M \, w_3^* = 1 \tag{A.1.19}$$

with $e' = \frac{\bar{e}}{w}$ (A.1.20)

Since the economy is assumed to be "small", it follows that the following conditions must be satisfied:

$$P_{1,w} = e' P_1^X \, , \quad P_3 = e' P_3^M \tag{A.1.21}$$

$$\Rightarrow \qquad e' = \frac{P_{1,w}}{P_1^X} = \frac{P_3}{P_3^M} \tag{A.1.22}$$

Therefore

$$P_3 = \left(\frac{P_3^M}{P_1^X}\right) . P_{1,w} \qquad \text{(A.1.23)}$$

Substituting in A.1.17 and A.1.18 we get:

$$P_{1,w} = \left(\frac{P_3^M}{P_1^X}\right) P_{1,w} \cdot M_1(r) + L_1(r) \qquad \text{(A.1.24)}$$

$$P_{1,w} = \left(\frac{P_3^M}{P_1^X}\right) P_{1,w} M_1(r) = L_1(r) \qquad \text{(A.1.25)}$$

$$P_{1,w} \left[1 - \left(\frac{P_3^X}{P_1^X}\right) M_1(r)\right] = L_1(r) \qquad \text{(A.1.26)}$$

$$P_{1,w} \left(\frac{P_1^X}{P_3^M}\right) \left[1 - \left(\frac{P_3^M}{P_1^M}\right) M_1(r)\right] = \left(\frac{P_1^X}{P_3^M}\right) L_1(r) \qquad \text{(A.1.27)}$$

or: $$P_{1,w} \; [\pi - M_1(r)] = \pi \, L_1(r) \qquad \text{(A.1.28)}$$

with $\pi = \frac{P_1^X}{P_3^M}$, (= units of commodity 3 imported per unit exported of commodity 1;= terms of trade) (A.1.29)

therefore:

$$P_{1,w} = \frac{\pi L_1(r)}{[\pi - M_1(r)]} \qquad \text{(A.1.30)}$$

Substituting A.1.29 in A.1.23 we get:

$$P_3 = \frac{1}{\pi} P_{1,w} \qquad \text{(A.1.31)}$$

$$\Rightarrow P_3 = \frac{L_1(r)}{[\pi - M_1(r)]} \qquad \text{(A.1.32)}$$

$$e' = \frac{1}{P_3^M} \left[\frac{L_1(r)}{[\pi - M_1(r)]}\right] \text{ (using A.1.22 and A.1.32)} \qquad \text{(A.1.33)}$$

Now, suppose that

$$w_1^* = \theta_1 z \ , \ w_2^* = \theta_2 z \ , \ w_3^* = \theta_3 z \qquad (A.1.34)$$

where θ_1, θ_2, θ_3 are constant weights of the two domestically produced commodities, 1 and 2, and the important commodity 3, respectively, with

$$\theta_1 + \theta_2 + \theta_3 = 1 \qquad (A.1.35)$$

and z is the real wage rate, which can be one of the three commodities.

By substitution, equation A.1.19 becomes:

$$\underline{P}_w \underline{\theta} z + e' P_3^M \theta_3 z = 1 \qquad (A.1.36)$$

or
$$z = \frac{1}{P_{1,w}\theta_1 + P_{2,w}\theta_2 + P_3\theta_3} \qquad (A.1.37)$$

We have from equation A.1.32:

$$P_3 = \frac{L_1(r)}{[\pi - M_1(r)]} \qquad (A.1.38)$$

Substituting A.3.38 in A.3.17 we get:

$$P_{1,w} = \frac{L_1(r) \ . \ M_1(r)}{\pi - M_1(r)} + L_1(r) \qquad (A.1.39)$$

or
$$P_{1,w} = \frac{L_1(r).M_1(r) + [\pi - M_1(r)]L_1(r)}{[\pi - M_1(r)]} \qquad (A.1.40)$$

Substituting A.1.38 in A.1.15 we get

$$P_{2,w} = \frac{L_1(r).M_2(r)}{[\pi - M_1(r)]} + L_2(r) \qquad (A.1.41)$$

or
$$P_{2,w} = \frac{L_1(r).M_2(r) + [\pi - M_1(r)].L_2(r)}{[\pi - M_1(r)]} \qquad (A.3.42)$$

therefore:

$$z = \frac{1}{\left[\frac{L_1(r).M_1(r) + [\pi - M_1(r)].L_1(r)}{[\pi - M_1(r)]}\right]\theta_1 + \left[\frac{L_1(r).M_2(r) + [\pi - M_1(r)].L_2(r)}{[\pi - M_1(r)]}\right]\theta_2 + \left[\frac{L_1(r)}{[\pi - M_1(r)]}\right]\theta_3}$$

.... (A.1.43)

$$z = \frac{\pi - M_1(r)}{\{L_1(r).M_1(r)-[\pi-M_1(r)].L_1(r)\}\theta_1-\{L_1(r).M_2(r)-[\pi-M_1(r)].L_2(r)\}\theta_2-L_1(r).\theta_3} \qquad \text{.......... (A.1.44)}$$

$$z=\frac{\pi - M_1(r)}{\{L_1(r)M_1(r)\theta_1+\pi\theta_1L_1(r)-L_1(r)M_1(r)\theta_1\}-\{L_1(r)M_2(r)\theta_2-\pi\theta_2L_2(r)-\theta_2L_2(r)M_1(r)\}-L_1(r)\theta_3} \qquad \text{.......... (A.1.45)}$$

$$z = \frac{\pi - M_1(r)}{\pi\theta_1.L_1(r) + \theta_2.L_1(r).M_2(r) - \pi\theta_2.L_2(r) - \theta_2.L_2(r).M_1(r) - L_1(r).\theta_3} \qquad \text{.......... (A.1.46)}$$

Adding and subtracting $\theta_1.L_1(r).M_1(r)$ to and from the denominator of A.1.46.

we get:

$$z=\frac{\pi - M_1(r)}{\{\theta_3L_1(r)-\theta_1L_1(r)M_1(r)+\theta_2L_1(r)M_2(r)\}-\{\pi\theta_1L_1(r)-\pi\theta_2L_2(r)-\theta_1L_1(r)M_1(r)-\theta_2L_2(r)M_1(r)\}} \qquad \text{.......... (A.1.47)}$$

$$z = \frac{\pi - M_1(r)}{L_1(r)[\theta_3+\theta_1.M_1(r)-\theta_2.M_2(r)]+\pi[\theta_1.L_1(r)-\theta_2.L_2(r)]-M_1(r)[\theta_1.L_1(r)-\theta_2.L_2(r)]} \qquad \text{.......... (A.1.48)}$$

or $$z = \frac{\pi - M_1(r)}{L_1(r)[\theta_3 + \underline{M}(r)\underline{\theta}] - \pi\underline{L}(r)\underline{\theta} - M_1(r)\underline{L}(r)\underline{\theta}} \qquad \text{.......... (A.1.49)}$$

where $\underline{M}(r) = [M_1(r) \;\; M_2(r)]$, $\underline{L}(r) = [L_1(r) \;\; L_2(r)]$, $\underline{\theta} = [\theta_1 \;\; \theta_2]$

therefore

$$z = \frac{\pi - M_1(r)}{L_1(r)[\theta_3 - \underline{M}(r)\underline{\theta}] - [\pi - M_1(r)]\underline{L}(r)\underline{\theta}} \qquad \text{........... (A.1.50)}$$

Equation A.1.50 is the same as which is equation 3.11 on page 62 above. In a viable system (which is the system analysed by Bulmer-Thomas), $[\pi-M_1(r)] > 0$, and both $\underline{M}(r)$ and $\underline{L}(r)$ are positive, and increasing functions of r .

Since θ_1, θ_2, θ_3 are positive constants by assumption, it immediately follows that z and r are inversely related, given π, with the latter being the terms of trade (see equation A.1.29).

Therefore, equation A.1.50 defines the wage-profit trade-off for our "small" open economy. It is the same as equation "6" in: Metcalf, J.S. and Steedman, I., "Growth and Distribution In An Open Economy", in: Steedman (1979b), p.208. The only difference between the two equations is that in Metcalf and Steedman's equation, $\underline{A}_1(r)$ replaces $\underline{L}(r)$, ω_3 replaces θ_3; and $\underline{\omega}$ replaces $\underline{\theta}$ in equation A.1.50 above.

Appendix 2

This appendix is devoted to the derivation of equation 5.3 of chapter 5, reproduced below for convenience.

$$\frac{P_k - m_k}{P_k} = \frac{H_k}{\eta_k}(1 + \alpha_k) \qquad \text{(A.2.1)}$$

H_k = Herfindal's index of industrial concentration.

η_k = price elasticity of demand

α_k = a measure of "conjectural variation"

All variables are for commodity k. May I say that the derivation of the above equation is no more than an expansion of Cowling's (1982, pp.33-34) derivation of the same equation.

(1) Assumptions:

There are n firms in the industry. Each firm has a flat marginal cost curve up to the point of physical capacity-output limit. Each firm is facing a downwards sloping demand curve for its output, and wants to fix its mark-up at a price which maximizes its short term total net profits. Needless to say that all firms produce the same commodity.

(2) Derivation:

Let $\Pi_{ik} = P_k X_{ik} - C_{ik} X_{ik} - F_{ik}$ (A.2.2)

Π_{ik} = total net profits

X_{ik} = volume of sales

C_{ik} = marginal cost

F_{ik} = fixed cost

and P_k = price of commodity k.

All variables are for firm i in the industry producing commodity k.

Maximising Π_{ik} with respect to X_{ik}, we get:

$$\frac{\partial \Pi_{ik}}{\partial X_{ik}} = P_k + X_{ik}\left(\frac{\partial P_k}{\partial X_k}\right)\left(\frac{\partial X_k}{\partial X_{ik}}\right) - C_{ik} = 0 \qquad (A.2.3)$$

$$P_k - C_{ik} = - X_{ik}\left(\frac{\partial P_k}{\partial X_k}\right)\left(\frac{\partial X_k}{\partial X_{ik}}\right) \qquad (A.2.4)$$

$$\frac{(P_k - C_{ik})X_{ik}}{P_k X_k} = \left(\frac{-X_{ik}^2}{P_k X_k}\right)\left(\frac{\partial P_k}{\partial X_k}\right)\left(\frac{\partial X_k}{\partial X_{ik}}\right) \qquad (A.2.5)$$

$$= \left(\frac{-X_{ik}^2}{X_k^2}\right)\left(\frac{X_k}{P_k}\right)\left(\frac{\partial P_k}{\partial X_k}\right)\left(\frac{\partial X_k}{\partial X_{ik}}\right) \qquad (A.2.6)$$

$$= -\left(\frac{X_{ik}}{X_k}\right)^2 \left[\frac{1}{\left(\frac{\partial X_k}{\partial P_k}\right)\left(\frac{P_k}{X_k}\right)}\right]\left(\frac{\partial X_k}{\partial X_{ik}}\right) \qquad (A.2.7)$$

$$\frac{(P_k - C_{ik})X_{ik}}{P_k X_k} = -\left(\frac{X_{ik}}{X_k}\right)^2 \left(\frac{1}{\eta_k}\right)\left(\frac{\partial X_k}{\partial X_{ik}}\right) \qquad (A.2.8)$$

$$\frac{\partial X_k}{\partial X_{ik}} = \frac{\partial\left(\sum_{i=1}^{n} X_{ik}\right)}{\partial X_{ik}} \qquad (A.2.9)$$

$$= \frac{\partial\left(\sum_{i=1}^{n-1} X_{ik}\right)}{\partial X_{ik}} + \frac{\partial X_{ik}}{\partial X_{ik}} \qquad (A.2.10)$$

$$= \frac{\sum_{i=1}^{n-1} \partial X_{ik}}{\partial X_{ik}} + 1 \qquad (A.2.11)$$

or: $$\frac{\partial X_k}{\partial X_{ik}} = \lambda_{ik} + 1 \qquad (A.2.12)$$

$$\therefore \quad \frac{(P_k - C_{ik})X_{ik}}{P_k X_k} = -\left(\frac{X_{ik}}{X_k}\right)^2 \left(\frac{1}{\eta_k}\right)(1+\lambda_{ik}) \tag{A.2.13}$$

$$\frac{\sum_{i=1}^{n}(P_k - C_{ik})X_{ik}}{P_k X_k} = \sum_{i=1}^{n}\left(\frac{X_{ik}^2}{X_k^2}\right)\frac{1}{\eta_k} - \frac{\sum_{i=1}^{n} X_{ik}^2 \lambda_{ik}}{\eta_k X_k^2} \tag{A.2.14}$$

$$H_k = \sum_{i=1}^{n}\left(\frac{X_{ik}}{X_k}\right)^2 = \frac{\sum_{i=1}^{n} X_{ik}^2}{X_k^2} \tag{A.2.15}$$

$$H_k X_k^2 = \sum_{i=1}^{n} X_{ik}^2 \tag{A.2.16}$$

$$\Rightarrow \quad X_k^2 = \frac{\sum_{i=1}^{n} X_{ik}^2}{H_k} \tag{A.2.17}$$

$$\therefore \quad \frac{\sum_{i=1}^{n}(P_k - C_{ik})X_{ik}}{P_k X_k} = -\left[H_k\left(\frac{1}{\eta_k}\right) + \frac{H_k\left(\sum_{i=1}^{n} X_{ik}^2\lambda_{ik}\right)}{\eta_k\left(\sum_{i=1}^{n} X_i^2\right)} \Leftrightarrow\right] \tag{A.2.18}$$

$$\therefore \quad \frac{\sum_{i=1}^{n}(P_k - C_{ik})X_{ik}}{P_k X_k} = -\frac{H_k}{\eta_k}\left(1 + \frac{\sum_{i=1}^{n} X_{ik}^2\lambda_{ik}}{\sum_{i=1}^{n} X_{ik}^2}\right) = -\frac{H_k}{\eta_k}(1+\lambda_k) \tag{A.2.19}$$

Appendix 3[1]

The aim of this appendix is to derive equation 5.24 of Chapter 5, under two cases. The first case is based on the assumption that industry 1 uses the machine produced by industry 3, while the production period is the same for all industries. The second case, slightly more complicated, is based on the assumption that industry 1, while still using the same machine, is characterised by a multi-period production process.[2]

Case I:

Suppose all machines, old and new, are being used in industry 1 under a specific shift system. This assumption, together with system (8.1.1 - 8.1.n+1) of Chapter 8 lead to the following total depreciation charges F_j per period of time.

$$F_j = (P_{3,0}a_{31}^{0} - P_{3,1}\ a_{31}^{1})x_1^{*} + (P_{3,1}\ a_{31}^{1} - P_{3,2}\ a_{31}^{2})x_1^{*}$$
$$+\ldots+(P_{3,n-1}a_{31}^{n-1} - P_{3,n}a_{31}^{n-1})x_1^{*} + P_{3,n}a_{31}^{n}\ x_1^{*} \qquad (A.3.1)$$

$P_{3,k}$ = the theoretical price of the machine of vintage k

a_{31}^{k} = machine-standard output ratio, with the machine being of vintage k

x_1^{*} = the standard level of output of industry 1.

Equation A.3.1 implies:

$$F_j = P_{3,0}a_{31}^{0}x_1^{*} \qquad (A.3.2)$$

At the beginning of each period, the money value of the physical capital stock is as follows:

$$K_1 = K_1(1) + K_1(2) + K_1(3) \qquad (A.3.3)$$

with:

$$K_1(1) = \sum_{k=0}^{n} a_{31}^{k}P_{3,k}x_1^{*} \qquad (A.3.4)$$

$$K_1(2) = \sum_{k=0}^{n} (a_{11}^k P_1 + a_{21}^k P_2) x_1^* \qquad (A.3.5)$$

$$K_1(2) = n(a_{11}P_1 + a_{21}P_2)x_1^* \qquad (A.3.6)$$

The equivalence of equations A.3.5 and A.3.6 is based on the assumption that the efficiency of the machine is the same for each process within industry 1. n is the number of production processes producing the <u>total</u> volume of output of industry 1.

$$K_1(3) = n\ell_1 w x_j^* \qquad (A.3.7)$$

The unit variable cost is m, with

$$m = a_{11}P_1 + a_{11}P_2 + \ell_1 w \qquad (A.3.8)$$

Thus the mark-up equation becomes as follows:

$$r_1 = \frac{\dfrac{P_{3,0}a_{31}^0 x_1^*}{nx_1^c} + \pi_1^* \left(\dfrac{K_1}{nx_1^c}\right)}{m\left[\dfrac{x_1^*}{x_1^c}\right]} \qquad (A.3.9)$$

x_1^c = technical capacity/shift output of industry 1.

<u>Case II</u>:

This case deals with the derivation of the mark-up equation when in addition to using the machine produced by industry 3, industry 1 is characterised by being a multiperiod production process. We shall assume that the length of the production period is the same as the length of time periods the machines technically lasts.

These assumptions, together with system 8.9.1 - 8.9.n+1 of chapter 8 lead to the following mark-up equation:

$$r_1 = \frac{P_{3,0}a^0_{31}\,\dfrac{x^*_1}{nx^c_1} + \pi^*_1\left[\dfrac{K_1}{nx^c_1}\right]}{m\left[\dfrac{x^*_1}{x^c_1}\right]} \qquad \text{(A.3.10)}$$

With:

$$K_1 = K_1(1) + K_1(2) + K_1(3) + K_1(4) \qquad \text{(A.3.11)}$$

$$K_1(1) = \sum_{k=0}^{n} a^k_{31}P_{3,k}x^*_1 \qquad \text{(A.3.12)}$$

$$K_1(2) = n(a_{11}P_1 - a_{21}P_2)x^*_1 \qquad \text{(A.3.13)}$$

$$K_1(3) = n\ell_1 wx^*_1 \qquad \text{(A.3.14)}$$

$$K_1(4) = \sum_{i=1}^{n} b_{ii}P^i_1x^*_1 \qquad \text{(A.3.15)}$$

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[1]In this appendix I used the notation "n" instead of $\bar{n}$ which I used in equation 5.24 of chapter 5.

[2]May I remind the reader that a^k_{ij} and P^k_j do not mean that a_{ij} and P_j each raised to the power k. k here is a superscript.

Appendix 4

Some of the macroeconomic implications of a once and for all increase (decrease) in money wage rate

This appendix deals with the process whereby a once and for all increase (decrease) in money wage rate, such that all gross profit margins are squeezed (increased) but not reduced to zero, leads the economy to higher (lower) equilibrium levels of employment and output with all commodity prices controlled (or freezed). The conclusions arrived at can in principle help in handling (or worsening) the problem of unemployment and poverty in advanced capitalist economies today.

Outline:

(1) Introductory note

(2) Assumptions and some concepts

(3) Analysis

(4) Special cases

(5) Summary and conclusions

(6) Proofs and some reconciliations

(1) Introductory note

One of the important conclusions arrived at by Kalecki and Keynes is that an increase in investment expenditure by ΔI generates a series of incomes and savings such that the equilibrium increase in real national income generates an amount of savings, ΔS, exactly equal to the initial increase in investment. In other words, the increase in investment 'finances' itself. The underlying assumptions for such an argument to hold are the following:

a) no labour shortage appears during the period within which investment multiplier is operating,

b) excess productive capacity,

c) mark-up pricing rule,

d) no shortage of liquidity, and

e) a closed economy, or an open economy with exports equals imports.

In a recent note, Goodwin (1983a) argued that in the presence of massive unemployment, excess capacity, and mark-up pricing, an initial increase in the money wage rate, given all other goods prices, generates an amount of aggregate profit exactly equal to the initial increase in the wage bill ΔW (caused by the initial increase in money wage rate) given that s_w and s_c are zero and unity respectively. The first is the average propensity to save by wage earners while the second is the average propensity to save by capitalists. In a later part of the same note, Goodwin extends the argument to a more general case where an initial increase in the <u>real</u> wage rate leads, in equilibrium, to higher level of employment, output and aggregate real profits. The questions addressed in this appendix are the following:

1. How does the initial increase in the wage bill, caused by an increase in money wage rate by say 1%, given all commodity prices P_1, $P_2, \ldots P_n$, generate an equivalent increase in aggregate savings not only for the case when $s_w = 0$ and $s_c = 1$, but for the case where $0 < s_w < s_c < 1$?
2. Is the equilibrium increase in aggregate profits, $\Delta\pi$, in general, smaller, equal to or greater than the initial increase in the wage bill, ΔW ?

3. Is the new equilibrium level of employment, in general, greater than its initial level ?

The remaining pages of this appendix are devoted to the answers to these questions.

(2) Assumptions and some concepts:

The assumptions upon which the analysis is based are the following:

(i) closed economy

(ii) no labour shortage of any type whenever labour input is needed

(iii) excess capacity in all industries

(iv) mark-up pricing is the rule in all industries, and is not directly affected by the state of excess demand.

(v) money supply is endogenous

(vi) the percentage increase in money wage rate is such that all mark-ups are squeezed but none is reduced to zero

(vii) no taxes of any type

Gross profit fraction per unit of sales:

Let us start with the concept of gross profit fraction per unit of sales, $\bar{v}$. Using assumption iv above, P_j, the price of commodity j, is expressed as follows:

$$P_j = (m_j+a_j)(1+r_j) \tag{A.4.1}$$

where m_j is material cost per unit of output, a_j is direct labour cost per unit of output and r_j is the percentage mark-up for commodity j.

From equation A.4.1, again using assumption iv, we get the following equation:

$$\frac{P_j-(m_j+a_j)}{P_j} = \frac{r_j}{1+r_j} = v_j \tag{A.4.2}$$

$$\Rightarrow \quad P_j - (m_j+a_j) = v_jP_j \tag{A.4.3}$$

$$\text{or} \quad \pi_j = v_jP_j \tag{A.4.4}$$

Equation A.4.4 has the interpretation that each unit sold of commodity j embodies (among other things) a fraction v_j of its value as gross profit margin denoted by π_j. Applying equation A.4.4 to total equilibrium quantity of sales of commodity j , Q_j^*, and then summing for all commodities, we get:

$$\Pi^* = \sum_{j=1}^{n} \pi_j Q_j^* = \sum_{j=1}^{n} v_j P_j Q_j^* \tag{A.4.5}$$

where $\sum_{j=1}^{n} \pi_j Q_j^*$ is gross profit in the economy during the given period.

In this appendix, the asterix refers to the equilibrium value or quantity.

Let
$$\bar{v} = \frac{\sum_{j=1}^{n} v_j P_j Q_j^*}{\sum_{j=1}^{n} P_j Q_j^*} \tag{A.4.6}$$

where $\bar{v}$ is what I call gross profit fraction per unit of sales. From equation A.4.5 and equation A.4.6 we get:

$$\Pi^* = \bar{v} \sum_{j=1}^{n} P_j Q_j^* \tag{A.4.7}$$

and

$$\Delta\Pi = \bar{v} \sum_{j=1}^{n} P_j \Delta Q_j \tag{A.4.8}$$

using assumption iv .

Equation A.4.8 is applicable to wage goods, luxury goods, and other produced goods, and is going to play a central role in the analysis that follows. It should be mentioned that the treatment of $\bar{v}$ and $\bar{\theta}$ (below) as constants is based on the assumption that workers' and capitalists' expenditures are distributed in fixed proportions among outputs of different industries.

Direct Labour Cost per Unit of Sales

When all "factor prices" are given, the mark-up pricing law implies that labour cost per unit is a fixed fraction of its price. Formally:

$$P_j = (1+r_j)(m_j+a_j) \tag{A.4.9}$$

which implies

$$\frac{m_j}{a_j} = \alpha_j \tag{A.4.10}$$

which is, of course, the ratio of materials cost to direct labour cost per unit of commodity j. α_j is constant by assumption. We can rewrite equation A.4.10 as:

$$m_j = \alpha_j a_j \tag{A.4.11}$$

Substituting in equation A.4.9 , we get:

$$P_j = (1+r_j)(1+\alpha_j)a_j \tag{A.4.12}$$

from which we get

$$\frac{a_j}{P_j} = \frac{1}{(1+r_j)(1+\alpha_j)} = \theta_j \tag{A.4.13}$$

Equation A.4.13 implies that direct labour cost per unit of commodity j is a fixed fraction of the price of commodity j. Thus,

$$a_j = \theta_j P_j \tag{A.4.14}$$

On average, using equilibrium quantities Q_j^* as weights, we get:

$$\bar{\theta} = \sum_{j=1}^{n} a_j Q_j^* / \sum_{j=1}^{n} P_j Q_j^* \tag{A.4.15}$$

implying that:

$$W^* = \sum_{j=1}^{n} a_j Q_j^* = \bar{\theta} \sum_{j=1}^{n} P_j Q_j^* \tag{A.4.16}$$

and

$$\Delta W = \sum_{j=1}^{n} a_j \Delta Q_j = \bar{\theta} \sum_{j=1}^{n} P_j \Delta Q_j \tag{A.4.17}$$

The assumption that $\bar{v}$ and $\bar{\theta}$ are constant, implies that material cost per unit is constant and equal to $(1-\bar{\theta}_j\bar{v}_{-j})P_j$. On average, we have $M^* = (1-\bar{\theta}-\bar{v}) \sum_{j=1}^{n} P_j Q_j^*$ and $\Delta M = (1-\bar{\theta}-\bar{v}) \sum_{j=1}^{n} P_j \Delta Q_j$.

(3) Analysis[1]

Having set the assumptions, of which ii to vi are crucial, and formulated the necessary concepts for the analysis, we are in a position to address each of the three questions raised on pages 311-312 under the assumption that $0 < s_w < s_c < 1$.

Given all commodity prices, the increase in money wage rate (not necessarily in all industries) leads to an initial increase in the wage bill W by ΔW. This increase in W leads to an increase in workers' actual spending on wage goods by $(1-s_w)\Delta W$. Sales of wage goods increase by the same amount and, as a result, a gross profit of $v(1-s_w)\Delta W$ is generated in the capitalist sector.[2] We assume that the increase in the volume of sales is taken to be permanent by producers. Furthermore, we assume that firms keep stocks of finished goods and materials for emergencies, and in the next period they change actual production such that its new level is higher than the previous level by an amount equivalent to the unexpected increase in the volume of sales whether being final output or materials. In order to keep the analysis at a less complicated level we shall rule out replenishing inventories, whose effect is to amplify the wave of higher economic activity created by the initial increase in the wage bill.

The response of the producers to the increase in the volume of sales of wage goods by $(1-s_w)\Delta W$ is an upwards revision of their input demand (labour and materials). This entails the following:

a) an increase in aggregate wage bill by $\theta(1-s_w)\Delta W$.

b) an increase in materials bill by $(1-\theta-v)\Delta W$.

On the other hand, the amount of gross profit realised from the additional sales of wage goods, which is $v(1-s_w)\Delta W$, leads to an increase in capitalists' spending on consumption goods by $v(1-s_c)(1-s_w)\Delta W$. This increase in the volume of sales of consumption goods has a similar production and employment effect as that of $(1-s_w)\Delta W$. From the above description, we conclude that the initial increase in the wage bill has a first round spending effect of $(1-s_w)\Delta W$; a second round of spending of $[\theta(1-s_w) + v(1-s_c) + (1-\theta-v)](1-s_w)\Delta W$; a third round of $[\theta(1-s_w) + v(1-s_c) + (1-\theta-c)]^2(1-s_w)\Delta W$,....until the nth round of spending defined as:

$$[\theta(1-s_w) + v(1-s_c) + (1-\theta-v)]^{n-1}(1-s_w)\Delta W.$$

In equilibrium, i.e. when all the upwards revisions of the output of the wage goods, the luxury goods, the materials and the level of employment are completed, we have the following relations:[3]

Equilibrium increase in sales is:

$$\Delta\text{Sales} = \left[\frac{1}{s_w\theta + s_c v}\right](1-s_w)\Delta W \qquad \text{(A.4.18)}$$

Equilibrium increase in aggregate wage bill:

$$\Delta W^* = \left[1 + \frac{\theta(1-s_w)}{s_w\theta + s_c v}\right]\Delta W \qquad \text{(A.4.19)}$$

Equilibrium increase in gross profit:[4]

$$\Delta\Pi^{*} = \left[\frac{1}{s_w \frac{\theta}{v} + s_c}\right](1-s_w)\Delta W \qquad (A.4.20)$$

Equilibrium increase in society's savings is:

$$\Delta S^{*} = \Delta S_w^{*} + \Delta S_c^{*} = \Delta W \qquad (A.4.21)$$

The above four equations have the following implications:

(a) the increase in money wage rate, which is a real increase, did not lead to a lower level of employment as the protagonists of the marginal productivity theory of employment would love to see. On the contrary, the increase in real wage rate led, via the positive change in the volume of sales and output, to a higher level of employment. A reasonable 'factor' substitutability through the switching "on" and/or "off" of usable production processes does not invalidate this conclusion.

(b) The initial reduction of gross profit due to the initial increase in the money wage rate is not permanent. It would be more than recouped if the workers save nothing out of their wages and capitalists' saving propensity, s_c, is positive but less than one.

(c) The argument that the initial increase in the wage bill will be at the expense of the society's savings is fallacious. According to equation A.4.21 , the initial increase in the wage bill 'finances itself'.

(4) Special Cases:

In this section, we consider some special cases which may be of interest. Consider the case when $s_w = 0$ and $s_c = 1$. In this case, equations A.4.18 to A.4.21 are reduced to the following:

$$\Delta \text{Sales} = \frac{1}{v}\Delta W \qquad (A.4.22)$$

$$\Delta W^{*} = (1 + \frac{\theta}{v})\Delta W \qquad (A.4.23)$$

$$\Delta\Pi^{*} = \Delta W \tag{A.4.24}$$

$$\Delta S^{*} = \Delta S_c^{*} = \Delta\Pi^{*} = \Delta W \tag{A.4.25}$$

Goodwin's 'simplest possible' case can be summarised as follows: the initial increase in the wage bill by ΔW wile it has a positive effect on the equilibrium level of employment, its effect on gross profits and society's savings is nil. The initial profit 'loss' is fully recouped and saved.

Consider another case where workers' marginal propensity to save is zero ($s_w = 0$) and that of the capitalists is positive, but less than unity (i.e. $0 < s_c < 1$). Here equations A.4.18 to A.4.21 are reduced to the following:

$$\Delta \text{Sales} = \frac{1}{s_c v} \Delta W \tag{A.4.26}$$

$$\Delta W^{*} = \left(1 + \frac{1}{s_c v}\right)\Delta W \tag{A.4.27}$$

$$\Delta\Pi^{*} = \frac{1}{s_c} \Delta W \tag{A.4.28}$$

$$\Delta S^{*} = \Delta S_c^{*} = \Delta W \tag{A.4.29}$$

In this case, the initial increase in the wage bill, caused by a once and for all increase in money wage rate - given all commodity prices takes the economy to a new equilibrium position characterised by:

a) higher level of employment

b) higher level of gross profits, and to a lesser extent net profit

c) greater economic efficiency,(through a higher rate of capacity utilization) associated with greater degree of economic equality.

(6) Summary and Conclusions

The table presented below summarises the equilibrium response of the aggregate wage bill, the aggregate profit and the level of employment to a once and for all increase in the money wage rate, given all prices, for each of the cases discussed above.

Case	Saving propensity	Change in the wage bill	Change in gross profit	Change in employment
I	$s_w = 0,\ s_c = 1$	positive	nil	positive
II	$s_w = 0,\ 0 < s_c < 1$	positive	positive	positive
III	$0 < s_w < s_c < 1$	positive	uncertain	positive

The most likely two cases to be met in reality are case II and case III. In the former case the response of the system to the aforesaid change is to generate both greater aggregate profits and a higher level of employment provided that "money" is made available whenever needed. In the latter case the employment effect is positive but the profit effect is uncertain. It would be positive if the value of the expression

$\dfrac{1 - s_w}{s_w \frac{\theta}{v} + s_c}$ were greater that unity. In both cases, it is very likely

that the higher rate of capacity utilization, resulting from the demand effect of higher money wage rate (remember that all commodity prices assumed unchanged) will affect the level of investment positively.

The question one might like to ask is this: What have we gained from the analysis of the present appendix ? The answer is "not much". Keynes and Kalecki more than four decades ago showed that investment 'finances' itself. What I did is no more than show that the initial increase in the wage bill 'finances' itself by following the mark-up/excess capacity route to the conclusion.[5,6] As for the profit-employment effect of a once and for all increase in money wage rate, given all other prices, the argument is essentially Kalecki's argument put forward explicitly by him in 1971 [Kalecki, 1971, Ch.14]. My main attempt in this appendix was to deal with the Kaleckian profit-employment effect in a rigorous way by directly starting with the mark-up pricing/excess capacity law. This in turn enables me to say that in the presence of massive unemployment, excess capacity and the mark-up pricing law, a policy package of price control, conditional wage increases (i.e. lowering the mark-ups but not reducing them to zero), public expenditure programme, and an expansionary monetary policy is capable, in principle, to reduce unemployment and poverty in advanced capitalist economies today. A less radical policy package is: price control, public expenditure programme and expansionary monetary policy.

The conclusions we arrived at would remain essentially the same if the higher real wage rate were the result of a proportionately higher increase in money wage rate than the average increase in commodity prices, so long as massive unemployment and excess capacity prevail in the economy.[7] The neoclassical theory of employment suggests that a lower real wage rate must be achieved if a higher level of employment were to materialise under today's oligopoly capitalism. It is time to stop teaching that theory to the future decision makers....

(7) Proofs and reconciliations

This part of the appendix is devoted to the proofs of equations A.4.18-A.4.21 and to the proof of the equivalence of equation A.4.20 and Davidson's (1978, P.113) equation "$\Delta P = \left[\dfrac{1}{s_w \frac{\alpha}{1-\alpha} + s_c}\right] \Delta I_g$" after replacing $(1-s_w)\ \Delta W$ by ΔI_g .

(1) $\Delta \text{Sales} = \left[\frac{1}{s_w\theta + sv_c}\right] (1-s_w)\Delta W$ (A.4.30)

<u>Proof</u>:

Given all commodity prices $P_1, P_2, \ldots, P_n$, the increase in money wage rate inflates the initial wage bill by ΔW, of which $s_w\Delta W$ is saved and $(1-s_w)\Delta W$ is consumed. The latter expression is composed of the following expressions:

$\theta(1-s_w)\Delta W$ the wage bill, of which $s_w\theta(1-s_w)\Delta W$ is saved and $\theta(1-s_w)^2\Delta W$ is consumed.

$v(1-s_w)\Delta W$ the gross profit, of which $s_c v(1-s_w)\Delta W$ is saved and $(1-s_c)v(1-s_w)\Delta W$ is consumed.

$(1-\theta-v)(1-s_w)\Delta W$ material bill.

This means that the next round of spending is composed of the following expression:

$$\theta(1-s_w)^2\Delta W+(1-s_c)v(1-s_w)\Delta W+(1-\theta-v)(1-s_w)\Delta W = [\theta(1-s_w)+v(1-s_c)+(1-\theta-v)](1-s_w)\Delta W$$

$$= y(1-s_w)\Delta W \qquad \text{(A.4.31)}$$

where $y = \theta(1-s_w)+v(1-s_c)+(1-\theta-v)$

The expression $y(1-s_w)\Delta W$, being sales of produced commodities, is composed of the following components:

$\theta y(1-s_w)\Delta W$ the wage bill, of which $s_w\theta y(\%1-s_w)\Delta W$ is saved by the working class and

$\theta y(1-s_w)^2\Delta W$ is consumed by the same class.

$vy(1-s_w)\Delta W$ the gross profit, of which $s_c vy(1-s_w)\Delta W$ is saved by the capitalist class and

$(1-s_c)vy(1-s_w)\Delta W$ is consumed by the same class

$(1-\theta-v)y(1-s_w)\Delta W$ the material bill.

These in turn make the next spending round which is made up of the following expression:

$y^2(1-2_w)\Delta W$

This in turn leads to the next spending round made up of

$y^3(1-s_w)\Delta W$

$\vdots$

etc

Summing all terms leads to:

$$\Delta Sales = (1-s_w)\Delta W + y(1-s_w)\Delta W + \ldots$$
$$\ldots + y^{n-1}(1-s_w)\Delta W \quad (A.4.32)$$

$$\Delta Sales = (1+y+y^2+ \ldots + y^{n-1})(1-s_w)\Delta W \quad (A.4.33)$$

$$\Delta Sales = \frac{1}{1-y}(1-s_w)\Delta W \quad (A.4.34)$$

$$\Delta Sales = \frac{1}{1-[\theta(1-s_w) + v(1-s_c) + (1-\theta-v)]}(1-s_w)\Delta W \quad (A.4.35)$$

$$\therefore \quad \Delta Sales = 1 + \left[\frac{1}{s_w\theta + s_c v}\right](1-s_w)\Delta W \quad (A.4.36)$$

(which is equation A.4.18)

(2) $$\Delta W^* = \left[1 + \frac{\theta(1-s_w)}{s_w\theta + s_c v}\right]\Delta W \quad (A.4.37)$$

Proof:

From the "round" analysis above we have:

$$\Delta W^* = \Delta W + \theta(1-s_w)\Delta W + \theta y(1-s_w)\Delta W + \theta y^2(1-s_w)\Delta W \quad (A.4.38)$$

$$\Delta W^* = \Delta W + (1+y+y^2 + \ldots + y^{n-1})\ \theta(1-s_w)\Delta W \quad (A.4.39)$$

$$\Delta W^* = \Delta W + \left[\frac{1}{s_w\theta + s_c v}\right]\theta(1-s_w)\Delta W \quad (A.4.40)$$

$$\Delta W^* = \left[1 + \frac{\theta(1-s_w)}{s_w\theta + s_c v}\right]\Delta W \quad (A.4.41)$$

(which is equation A.4.19)

(3) $\Delta\Pi^* = \left[\dfrac{1}{s_w \frac{\theta}{v} + s_c}\right] (1-s_w)\Delta W$ (A.4.42)

Proof:

$$\Delta\Pi^* = v(1-s_w)\Delta W + vy(1-s_w)\Delta W + vy^2(1-s_w)\Delta W + \ldots$$

$$\ldots + vy^{n-1}(1-s_w)\Delta W \quad (A.4.43)$$

$$\Delta\Pi^* = (1+y+y^2+ \ldots + y^{n-1})v(1-s_w)\Delta W \quad (A.4.44)$$

$$\Delta\Pi^* = \frac{1}{1-y} v(1-s_w)\Delta W \quad ((A.4.45)$$

$$\Delta\Pi^* = \frac{v}{s_w\theta + s_c v} (1-s_w)\Delta W \quad (A.4.46)$$

$$\Delta\Pi^* = \left[\frac{1}{s_w \frac{\theta}{v} + s_c}\right](1-s_w)\Delta W \quad (A.4.47)$$

(which is equation A.4.20)

(4) $\Delta S^* = \Delta s^* + \Delta s_c^* = \Delta W$ (A.4.48)

Proof:

$$\Delta S_w^* = s_w\Delta W + s_w\theta(1-s_w)\Delta W + s_w\theta y(1-s_w)\Delta W + S_w\theta y^2(1-s_w)\Delta W + \ldots$$

$$+ s_w y^{n-2}(1-s_w)\Delta W \quad (A.4.49)$$

$$\Delta S_w^* = s_w\Delta + \left[s_w\theta(1-s_w)\Delta W \frac{1}{s_w\theta + s_c v}\right] \quad (A.4.50)$$

$$\Delta S_c^* = s_c v(1-s_w)\Delta W + s_c vy(1-s_w)\Delta W + s_c vy^2(1-s_w)\Delta W + \ldots,$$

$$\ldots + s_c vy^{n-1}(1-s_w)\Delta W \quad (A.4.51)$$

$$\Delta S_c^* = s_c v(1-s_w)\Delta W \frac{1}{s_w\theta + s_c v} \quad (A.4.52)$$

$$\Delta S_w^* + \Delta S_c^* = s_w\Delta W + \frac{1}{s_w\theta + s_c v}[s_w\theta(1-s_w)\Delta W + s_c v(1-s_w)\Delta W] \quad (A.4.53)$$

$$= s_w\Delta W + (1-s_w)\Delta W \quad (A.4.54)$$

Therefore:

$$\Delta S^{*} = \Delta W \tag{A.4.55}$$

(5) The proof that:

$\Delta\Pi^{*} = \left[\dfrac{1}{s_w \frac{\theta}{v} + s_c}\right](1-s_w)\Delta W$ is equivalent to Davidson's (1978, p.113) equation:

" $\Delta P = \left[\dfrac{1}{s_w \frac{\alpha}{1-\alpha} + s_c}\right]\Delta I_g$ " except for the presence of

$(1-s_w)\Delta W$ in place of ΔI_g.

From the equation:

$$\Delta\Pi^{*} = \left[\frac{1}{s_w \frac{\theta}{v} + s_c}\right](1-s_w)\Delta W \tag{A.4.56}$$

we have:

$$\frac{\theta}{v} = \frac{1}{(1+r)(1+a)} \Big/ \frac{1}{(1+r)} = \frac{1}{r(1+a)} = \frac{1}{r\phi}\ ;\ \phi = 1 + a \tag{A.4.57}$$

using equations (A.4.2), (A.4.10) and (A.4.13).

$$Y = (1+r)(W+M) - M \tag{A.4.58}$$

(Y = gross private income, M = aggregate materials bill)

$$Y = W+r(W+M) \tag{A.4.59}$$

$$\frac{Y}{W} = 1+r(1 + \frac{M}{W}) = 1 + r\phi \tag{A.4.60}$$

Utilizing Davidson's assumption that $\frac{W}{Y} = \alpha$, we can write:

$$1+ r\phi = \frac{1}{\alpha} \tag{A.4.61}$$

or

$$\alpha(1+r\phi) = 1 \tag{A.4.62}$$

$$\Rightarrow r = \frac{1-\alpha}{\alpha\phi} \tag{A.4.63}$$

From A.4.63 , A.4.57 and A.4.56 we get:

$$\Delta\Pi^* = \left[\frac{1}{s_w \frac{\alpha}{1-\alpha} + s_c}\right] (1-s_w)\Delta W \qquad \text{(A.4.64)}$$

The last equation is Davidson's equation "(5)" of Money and the Real World, except for the presence of $(1-s_w)\Delta W$ in place of ΔI_g.

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[1]In the analysis that follows, time is abstracted from. However, it can be taken into account if we assume that the full adjustment of money supply, employment, and output takes place in, say, 52 weeks. In such a case the standard period of analysis, during which a single dose of expenditure is translated into finished goods, may be one week, two weeks or more. The 'period' during which equilibrium may be restored is one year.

[2]The new values of $\bar{\theta}$ and $\bar{v}$ are θ and v respectively.

[3]Proofs are at the end of the end of the appendix.

[4]A more precise expression for equation (A.4.20) is the following:

$d\Pi^* \dfrac{\partial \Pi^*}{\partial W} \cdot dW + \dfrac{\partial \Pi^*}{\partial (\frac{\theta}{v})} d(\frac{\theta}{v})$. After a number of manipulations, we get:

$$d\Pi^* = \left[\frac{1}{s_w \dfrac{\alpha}{1-\alpha} + s_c}\right]\left\{(1-s_w)dW - \left[\frac{s_w}{\alpha s_w + (1-\alpha)s_c}\right]\left[\frac{d\alpha}{1-\alpha}\right](I_g + A)\right\}$$

where $\alpha = \dfrac{\theta}{v}$ = labour share in natinal income; I_g = gross investment; and A is an exogenous expenditur component. We assume that s_w and $d\alpha$ are

so small that $\left[\dfrac{s_w}{\alpha s_w + (1-\alpha)s_c}\right]\left[\dfrac{d\alpha}{1-\alpha}\right]$ is practically zero.

[5]In the UK, the rate of unemployment and the rate of capacity utilisation in the manufacturing sector, over the period 1970-1979, were as follows:

Year:	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Rate of unemployment	2.5%	3.2%	3.6%	2.6%	2.6%	3.9%	5.3%	5.8%	5.8%	5.7%
Rate of capacity utilisation	92.9%	89.6%	89.7%	91.6%	85.2%	80.9%	84.4%	84.3%	83.6%	83.0%

See: Cowling (1982,, p.351). An unemployment rate of 13% in the UK now (1986) leads one to expect a lower rate of capacity utilisation for some time to come until excess capacity is eliminated in one way or another. That 'expectation' is based on a sample of 25 observations on the rate of unemployment and the rate of capacity utilisation in UK manufacturing (1955-1979) and 34 observations on the rate of unemployment and the rate of (industrial) capacity utilisation in the US (1920-1939, 1950-1963).

For both samples, the simple correlation coefficient between the two variables is estimated as -85%, approximately. On the macro level, excess capacity is the rule in W. Germany, Netherlands, UK, and the US. See: Knoester and Sinderen (1984, p.89).

[6]In all the cases discussed, $\Delta\Pi^* = \Delta W^* + \Delta C^* - \Delta S^*$, where C^* is capitalists' consumption expenditures at their initial equilibrium level.

[7]The general case of higher real wage rate (i.e. when the once and for all increase in money wage rate is associated by a simultaneous but less than proportionate increase in all commodity prices) can be reduced to a case equivalent to the one analysed. The way to be handled is as follows. Let $w' = w^o(1+\phi)$, and $P'_j = P^o_j(1+y)$. Dividing w' by P'_j we get

$$(w'/P'_j = \left[w^o/P^o_j\right]\left[\frac{1+\phi}{1+y}\right] \; ; \; 0 < y < \phi < 1.$$

$$= \left[\frac{1}{P^o_j}\right]\left[w^o\left(\frac{1+\phi}{1+y}\right)\right]$$

$$= \frac{w''}{P^o_j}$$

Appendix 5

This appendix is mainly devoted to the derivation of a more general version of equation 6.37 of chapter 6. Let the economy be represented by the following technology: A, A^m and $\hat{L}$ where A is an nxn technical coefficient matrix of domestic inputs; A^m is an mxn technical coefficient matrix of the (complementary) imported inputs; and $\hat{L}$ is an nxn diagonal matrix of labour input coefficients.

Using the technology specified above, we can formulate the open economy price system as follows:

$$\underset{-}{P}_t = \left[\underset{-}{P}_{t-1}A + \bar{e}\underset{-}{P}^m_{t-1}A^m + \underset{-}{w}_{t-1}\hat{L}\right](I+\hat{R}) \qquad (A.5.1)$$

where $\underset{-}{P}_t$ is a 1xn row vector of domestic prices, $\bar{e}$ is the given exchange rate, $\underset{-}{P}^m_t$ is a 1xm row vector of prices of imported inputs, $\underset{-}{w}_t$ is a 1xn row vector of the heterogeneous labour input, and $\hat{R}$ is an nxn diagonal matrix whose elements are the sectoral percentage mark-ups. Equation A.5.1 is a linear first order difference equation whose solution can be obtained by the method of backwards substitution. Let us rename equation A.5.1 as follows:

$$\underset{-}{P}_t = \underset{-}{P}_{t-1}B + \underset{-}{C}^*_{t-1} \qquad A.5.2$$

where $B = A(I+\hat{R})$ and $\underset{-}{C}^*_{t-1} = \left[\bar{e}\underset{-}{P}^m_{t-1}A^m + \underset{-}{w}_{t-1}\hat{L}\right](I+\hat{R})$. From equation A.5.2 we have:

$$\left.\begin{aligned} \underset{-}{P}_{t-1} &= \underset{-}{P}_{t-2}B + \underset{-}{C}^*_{t-2} \\ \underset{-}{P}_{t-2} &= \underset{-}{P}_{t-3}B + \underset{-}{C}^*_{t-3} \\ &\cdots \quad \cdots \\ &\cdots \quad \cdots \\ \underset{-}{P}_1 &= \underset{-}{P}_oB + \underset{-}{C}^*_o \end{aligned}\right\} \qquad (A.5.3)$$

If we substitute the expressions of system A.5.3 one at a time in equation A.5.2 , we get the following equation:

$$\underline{P}_t = \underline{P}_o B^t + \underline{C}^*_{t-1} + \underline{C}^*_{t-2} B + \underline{C}^*_{t-3} B^2 + \ldots + \underline{C}^*_o B^{t-1} \tag{A.5.4}$$

If we assume that imports' prices are increasing at the same constant rate as the sectoral money wage rates, then we can write:

$$\underline{C}^*_t = (1 + \theta)\underline{C}^*_{t-1} \tag{A.5.5}$$

or $$\underline{C}^*_t = (1 + \theta)^t \underline{C}^*_o \tag{A.5.6}$$

with $$\underline{C}^*_o = \left[\bar{e}\underline{P}^m_o A^m + \underline{w}_o \hat{L}\right](1+\hat{R}) \tag{A.5.7}$$

and from equations A.5.4 and A.5.6 we get:

$$\underline{P}_t = \underline{P}_o B^t + (1+\theta)^{t-1}\underline{C}^*_o + (1+\theta)^{t-2}\underline{C}^*_o B + (1+\theta)^{t-3}\underline{C}^*_o B^2 + \ldots$$
$$\ldots + (1+\theta)\underline{C}^*_o B^{t-2} + \underline{C}^*_o B^{t-1} \tag{A.5.8}$$

$$(1+\theta)\underline{P}_{t-1} = (1+\theta)\underline{P}_o B^{t-1} + (1+\theta)^{t-1}\underline{C}^*_o + (1+\theta)^{t-2}\underline{C}^*_o B + (1+\theta)^{t-3}\underline{C}^*_o B^2 + \ldots$$
$$\ldots + (1+\theta)\underline{C}^*_o B^{t-2} \tag{A.5.9}$$

$$\underline{P}_t - (1+\theta)\underline{P}_{t-1} = \underline{P}_o B^t - (1+\theta)\underline{P}_o B^{t-1} + \underline{C}^*_o B^{t-1} \tag{A.5.10}$$

or $$\underline{P} - (1+\theta)\underline{P}_{t-1} = \left[\underline{P}_o B - (1+\theta)\underline{P}_o + \underline{C}^*_o\right] B^{t-1} \tag{A.5.11}$$

Now, our inter-industrial analysis of price inflation began with the assumption that the economic system is capable of generating a surplus, i.e. it is productive. If we further assume that the maximum value of each element of the diagonal matrix $I+\hat{R}$ is less than the inverse of the Perron-Forbenius root of matrix A, it follows that:[1]

$$\lim_{t \to \infty} B^{t-1} = \underline{0} \tag{A.5.12}$$

where $\underline{0}$ is the null matrix.

Using equation A.2.12, we can then say that after sufficient period of time equation A.2.11 will be reduced to:

$$\underline{P}_t - (1+\theta)\underline{P}_{t-1} = \underline{0} \qquad (A.5.13)$$

which in turn means that:

$$\frac{P_{1,t} - P_{1,t-1}}{P_{1,t-1}} = \frac{P_{2,t} - P_{2,t-1}}{P_{2,t-1}} = \ldots\ldots = \frac{P_{n,t} - P_{n,t-1}}{P_{n,t-1}} = \theta \qquad (A.5.14)$$

Equation A.5.14 implies that when price inflation is fully anticipated, the economy (and, in the present case, the world economy) will be characterised by a constant rate of price inflation. I can show you that. Let $\underline{P}_t$, $\underline{P}^a_t$, and $\underline{P}^u_t$ be the actual price vector, the anticipated price vector, and the vector of unanticipated changes in prices respectively. By definition, we have

$$\underline{P}^u_t = \underline{P}_t - \underline{P}^a_t \qquad (A.5.15)$$

$$\Rightarrow \underline{P}_t = \underline{P}^a_t + \underline{P}^u_t \qquad (A.5.16)$$

A fully anticipated rate of price inflation implies that $\underline{P}^u_t = \underline{0}$, which in turn implies

$$\underline{P}_t = \underline{P}^a_t = \underline{P}_t B + \underline{C}^*_t \quad \text{(using A.5.2)} \qquad (A.5.17)$$

$$\underline{C}^*_t = \underline{C}_t + \underline{M}_t \qquad (A.5.18)$$

with:

$$\underline{C}_t = \bar{e}\underline{P}^m_t A^m(I+\hat{R}) \ ; \ \underline{M}_t = \underline{w}_t L(I+\hat{R}) \qquad (A.5.19)$$

$$\therefore \quad \underline{P}_t = [(1+\theta)^t \underline{C}_o + (1+\theta)^t \underline{M}_o](I-B)^{-1} \qquad (A.5.20)$$

$$\underline{P}_t = (1+\theta)^t [\underline{C}_o + \underline{M}_o](I-B)^{-1} \qquad (A.5.21)$$

$$\underline{P}_t = (1+\theta)(1+\theta)^{t-1}[\underline{C}_o + \underline{M}_o](I-B)^{-1} \qquad (A.5.22)$$

$$P_t = (1+\theta)\underline{P}_{t-1} \qquad (A.5.23)$$

from which equation A.5.14 follows immediately.

In order to deal with the case where the rate of wage inflation is faster than the rate of increase of imports' prices we shall assume once more that the economy has already "placed itself" on the fully anticipated price inflation path. In such a case, equation A.5.2 takes the following form:

$$\underline{P}_t = \underline{P}_t B + \underline{C}_t + \underline{M}_t \tag{A.5.24}$$

with $$\underline{C}_t = \bar{e}\underline{P}_t^m A_m (I+\hat{R}) \tag{A.5.25}$$

and $$\underline{M}_t = \underline{w}_t \hat{L}(I+\hat{R}) \tag{A.5.26}$$

Let λ be the rate of wage inflation, and ϕ be the rate of increase of imports' prices. The assumption that both variables, i.e. money wage rate and imports prices, are increasing at different but constant rates of λ and ϕ, respectively, enables us to write $\underline{C}_t$ and $\underline{M}_t$ as follows:

$$\underline{C}_t = (1+\lambda)\underline{C}_{t-1} \tag{A.5.27}$$

$$\underline{M}_t = (1+\phi)\underline{M}_{t-1} \tag{A.5.28}$$

or $$\underline{C}_t = (1+\lambda)^t \underline{C}_o \tag{A.5.29}$$

and $$\underline{M}_t = (1+\phi)^t \underline{M}_o \tag{A.5.30}$$

Substituting of equations A.5.30 and A.5.29 into equation A.5.24 we get:

$$\underline{P}_t = \underline{P}_t B + (1+\lambda)^t \left(\bar{e}\underline{P}_o^m A^m\right)(I+\hat{R}) + (1+\phi)^t \underline{w}_o \hat{L}(I+\hat{R}) \tag{A.5.31}$$

$$\underline{P}_t = (1+\lambda)^t \left(\bar{e}\underline{P}_o A^m\right)(I+\hat{R})(I-B)^{-1} + (1+\phi)^t \underline{w}_o \hat{L}(I+\hat{R})(I-B)^{-1} \tag{A.5.32}$$

$$\underline{P}_t = (1+\lambda)^t \left[\bar{e}\underline{P}_o^m A^m (I+\hat{R})(I-B)^{-1} + \left(\frac{1+\phi}{1+\lambda}\right)^t \underline{w}_o \hat{L}(I+\hat{R})(I-B)^{-1}\right] \tag{A.5.33}$$

with ϕ being less than λ.

After sufficient number of time periods the expression $\left(\frac{1+\phi}{1+\lambda}\right)^t$ becomes negligible leading to:

$$\underline{P}_t = (1+\lambda)^t \left[\bar{e}\underline{P}_o^m A^m (I+\hat{R})(I-B)^{-1} \right] \tag{A.5.34}$$

which implies that:

$$\underline{P}_t = (1+\lambda)\underline{P}_{t-1} \tag{A.5.35}$$

Clearly, the rate of price inflation will be dominated by the rate of wage inflation which is, by assumption, larger than the rate of increase of imports' prices. In the opposite case, i.e.when the rate of wage inflation is lower than the rate of increase of imports' prices, the rate of price inflation will be dominated by the latter.

The case of accelerating rate of price inflation is not difficult to handle. Assume the economy is closed ($A^m = \underline{0}$) and the rate of wage inflation is accelerating at a rate of β with $\lambda_t = \lambda_o(1+\beta)^t$. Under these circumstances the 'equilibrium' price vector takes the following form:

$$\underline{P}_t = (1+\lambda_o)g(t)\underline{w}_o\hat{L}(I+\hat{R})(I-B)^{-1} \tag{A.5.36}$$

which implies:

$$\underline{P}_t = (1+\lambda_o)g(t)\underline{P}_{t-1} \tag{A.5.37}$$

where g(t) is an increasing function of time. In this case the economy is approaching or undergoing the state of hyper-inflation.

---

[1]See Pasinetti, L.L., 1977, Lectures on the Theory of Production, Macmillan, London (paperback), Mathematical Appendix, Sections 9-11.

Appendix 6

$$
(1+r)\left\{
\begin{bmatrix}
0 & 0 & 0 & a_{11} & a_{21} & a_{31}^{0} & 0 & 0 & 0 \\
0 & 0 & 0 & a_{11} & a_{21} & 0 & a_{31}^{I} & 0 & 0 \\
0 & 0 & 0 & a_{11} & a_{21} & 0 & 0 & a_{31}^{II} & 0 \\
0 & 0 & 0 & a_{11} & a_{21} & 0 & 0 & 0 & a_{31}^{III} \\
b_{11} & 0 & 0 & 0 & 0 & a_{31}^{0} & 0 & 0 & 0 \\
b_{11} & 0 & 0 & 0 & 0 & 0 & a_{31}^{I} & 0 & 0 \\
b_{11} & 0 & 0 & 0 & 0 & 0 & 0 & a_{31}^{II} & 0 \\
b_{11} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & a_{31}^{III} \\
0 & b_{22} & 0 & 0 & 0 & a_{31}^{0} & 0 & 0 & 0 \\
0 & b_{22} & 0 & 0 & 0 & 0 & a_{31}^{I} & 0 & 0 \\
0 & b_{22} & 0 & 0 & 0 & 0 & 0 & a_{31}^{II} & 0 \\
0 & b_{22} & 0 & 0 & 0 & 0 & 0 & 0 & a_{31}^{III} \\
0 & 0 & b_{33} & 0 & 0 & a_{31}^{0} & 0 & 0 & 0 \\
0 & 0 & b_{33} & 0 & 0 & 0 & a_{31}^{I} & 0 & 0 \\
0 & 0 & b_{33} & 0 & 0 & 0 & 0 & a_{31}^{II} & 0 \\
0 & 0 & b_{33} & 0 & 0 & 0 & 0 & 0 & a_{31}^{III} \\
0 & 0 & 0 & a_{12} & a_{22} & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & a_{13} & a_{23} & 0 & 0 & 0 & 0
\end{bmatrix}
\begin{bmatrix}
p_1^{1} \\ p_1^{2} \\ p_1^{3} \\ p_1 \\ p_2 \\ p_{3,0} \\ p_{3,1} \\ p_{3,2} \\ p_{3,3}
\end{bmatrix}
+ w
\begin{bmatrix}
\ell_1^{0} \\ \ell_1^{I} \\ \ell_1^{II} \\ \ell_1^{III} \\ \ell_2^{0} \\ \ell_2^{I} \\ \ell_2^{II} \\ \ell_2^{III} \\ \ell_3^{0} \\ \ell_3^{I} \\ \ell_3^{II} \\ \ell_3^{III} \\ \ell_4^{0} \\ \ell_4^{I} \\ \ell_4^{II} \\ \ell_4^{III} \\ \ell_2 \\ \ell_3
\end{bmatrix}
\right\}
=
\begin{bmatrix}
b_{11} & 0 & 0 & 0 & 0 & 0 & a_{31}^{I} & 0 & 0 \\
b_{11} & 0 & 0 & 0 & 0 & 0 & 0 & a_{31}^{II} & 0 \\
b_{11} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & a_{31}^{III} \\
b_{11} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & b_{22} & 0 & 0 & 0 & 0 & a_{31}^{I} & 0 & 0 \\
0 & b_{22} & 0 & 0 & 0 & 0 & 0 & a_{31}^{II} & 0 \\
0 & b_{22} & 0 & 0 & 0 & 0 & 0 & 0 & a_{31}^{III} \\
0 & b_{22} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & b_{33} & 0 & 0 & 0 & a_{31}^{I} & 0 & 0 \\
0 & 0 & b_{33} & 0 & 0 & 0 & 0 & a_{31}^{II} & 0 \\
0 & 0 & b_{33} & 0 & 0 & 0 & 0 & 0 & a_{31}^{III} \\
0 & 0 & b_{33} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & a_{31}^{I} & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & a_{31}^{I} & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & a_{31}^{III} \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0
\end{bmatrix}
\begin{bmatrix}
p_1^{1} \\ p_1^{2} \\ p_1^{3} \\ p_1 \\ p_2 \\ p_{3,0} \\ p_{3,1} \\ p_{3,2} \\ p_{3,3}
\end{bmatrix}
$$

More compactly we have: $(1+r)(A'\underline{p}'+w\underline{\ell}') = B'\underline{p}'$; which is the transpose of equation 8.12 of chapter 8.

Appendix 7

This appendix is devoted to the proof that

$$\left\{a_{11}P_1+a_{21}P_2+w\sum_{k=0}^{n}\ell_1^k\right\}(1+r) + a_{31}^0P_{3,0}(1+r)^n + F = P_1 \tag{A.7.1}$$

$$F = (a_{11}P_1+a_{21}P_2)[(1+r)^n-(1+r)] + w\,\{\ell_1^o(1+r)^n+ \ell_1^1(1+r)^{n-1}+\ell_1^2(1+r)^{n-2}+$$

$$+ \ell_1^{n-1}(1+r)^2+\ell_1^n(1+r) - \sum_{k=0}^{n}\ell_1^k(1+r)\} \tag{A.7.2}$$

We start with the first n+1 equations of system 8.9-8.11, reproduced below for convenience.[1]

$$(a_{11}P_1+a_{21}P_2-a_{31}^0P_{3,0} + \ell_1^0w)(1+r) = b_{11}P_1^1+a_{31}^1P_{3,1} \tag{A.7.3.1}$$

$$(b_{11}P_1^1+0+a_{31}^1P_{3,1}+\ell_1^1w)(1+r) = b_{22}P_1^2+a_{31}^2P_{3,2} \tag{A.7.3.2}$$

$$\vdots$$

$$(b_{n-1,n-1}P_1^{n-1}+0+a_{31}^{n-1}P_{3,n-1}+\ell_1^{n-1}w)(1+r) = b_{nn}P_1^n+a_{32}^nP_{3,n} \tag{A.7.3.n}$$

$$(b_{nn}P_1^n+0+a_{31}^nP_{3,n}+\ell_1^nw)(1+r) = P_1 \tag{A.7.3.n+1}$$

Multiply the first equation by $(1+r)^{n-1}$, the second by $(1+r)^{n-2}$ etc. The last equation (i.e. equation A.7.3.n+1) is multiplied by unity. The result to which that multiplication leads is the following system of equations:

$$(a_{11}P_1+a_{21}P_2+a_{31}^0P_{3,0}+\ell_1^0w)(1+r)^n= (b_{11}P_1^1+a_{31}^1P_{31})(1+r)^{n-1} \quad\ldots\ldots(A.7.4.1)$$

$$(b_{11}P_1^1+0+a_{31}^1P_{3,1}+\ell_1^1w)(1+r)^{n-1} = (b_{22}P_1^2+a_{31}^2P_{3,2})(1+r)^{n-2} \quad\ldots\ldots(A.7.4.2)$$

$$\vdots$$

$$(b_{n-1,n-1}P_1^{n-1}+0+a_{31}^{n-1}P_{3,n-1}+\ell_1^{n-1}w)(1+r)^2 = (b_{nn}P_1^n+a_{31}^nP_{3,n})(1+r) \quad\ldots\ldots(A.7.4.n)$$

$$(b_{nn}P_1^n+0+a_{31}^nP_{3,n}+\ell_1^nw)(1+r) = P_1 \qquad (A.7.4.n+1)$$

The sum of both sides of system A.7.4 leads to the following equation:

$$(a_{11}P_1+ a_{21}P_2+a_{31}^0P_{3,0}+\ell_1^0w)(1+r)^n + \ell_1^1w(1+r)^{n-1}+\ell_1^2(1+r)^{n-2} + \dots + \ell_1^{n-1}w(1+r)^2+\ell_1^nw(1+r) = P_1 \qquad (A.7.5)$$

$$(a_{11}P_1+a_{21}P_2+\ell_w^0)(1+r)^n+a_{31}^0P_{3,0}(1+r)^n+\ell_1^1w(1+r)^{n-1} + \ell_1^2(1+r)^{n-2} + \dots + \ell_1^{n-1}w(1+r)^2+\ell_1^nw(1+r) = P_1 \qquad (A.7.6)$$

$$(a_{11}P_1+a_{21}P_2+w\sum_{k=0}^{n}\ell_1^k)(1+r) - (a_{11}P_1+a_{21}P_2+w\sum_{k=0}^{n}\ell_1^k)(1+r)$$
$$+ (a_{11}P_1+a_{21}P_2+\ell_1^0w)(1+r)^n+a_{31}^0P_{3,0}(1+r)^n + \ell_1^1w(1+r)^{n-1} +$$
$$+ \ell_1^2(1+r)^{n-2}+ \dots +\ell_1^{n-1}w(1+r)^2+\ell_1^nw(1+r) = P_1 \qquad (A.7.7)$$

$$(a_{11}P_1+a_{21}P_2+w\sum_{k=0}^{n}\ell_1^k)(1+r) - (a_{11}P_1+a_{21}P_2+w\ell_1^0+w\sum_{k=1}^{n}\ell_1^k)(1+r)$$
$$+ (a_{11}P_1+a_{21}P_2+\ell_1^0w)(1+r)^n+a_{31}^0P_{3,0}(1+r)^n + \ell_1^1w(1+r)^{n-1}$$
$$\ell_1^2(1+r)^{n-2} + \dots + \ell_1^{n-1}w(1+r)^2+\ell_1^nw(1+r) = P_1 \qquad (A.7.8)$$

$$(a_{11}P_1+a_{21}P_2+w\sum_{k=0}^{n}\ell_1^k)(1+r)+(a_{11}P_1+a_{21}P_2+\ell_1^0w)(1+r)^n-(a_{11}P_1+a_{21}P_2+w\ell_1^0)(1+r)$$
$$+ a_{31}^0P_{3,0}(1+r)^n - w\sum_{k=1}^{n}\ell_1^k(1+r) + \ell_1^1w(1+r)^{n-1}+\ell_1^2(1+r)^{n-2}$$
$$+ \dots + \ell_1^{n-1}w(1+r)^2 + \ell_1^nw(1+r) = P_1 \qquad (A.7.9)$$

$$(a_{11}P_1+a_{21}P_2+w\sum_{k=0}^{n}\ell_1^k)(1+r) + (a_{11}P_1+a_{21}P_2)[(1+r)^n-(1+r)]$$
$$+ a_{31}^0P_{3,0}(1+r)^n + \ell_1^0w(1+r)^n + \ell_1^1w(1+r)^{n-1} + \ell_1^2w(1+r)^{n-2}$$

$$+ \ldots + \ell_1^{n-1} w(1+r)^2 + \ell_1^n w(1+r) - w \sum_{k=0}^{n} \ell_1^k (1+r) = P_1 \qquad \text{(A.7.10)}$$

$$\therefore \quad P_1 = (a_{11}P_1 + a_{21}P_2 + w \sum_{k=0}^{n} \ell_1^k)(1+r) + (a_{11}P_1 + a_{21}P_2)[(1+r)^n - (1+r)]$$

$$+ a_{31}^0 P_{3,0}(1+r)^n + w\{\ell_1^0(1+r)^n + \ell_1^1(1+r)^{n-1} + \ell_1^2(1+r)^{n-2}$$

$$+ \ldots + \ell_1^{n-1}(1+r)^2 + \ell_1^n(1+r) - \sum_{k=0}^{n} \ell_1^k(1+r)\} \qquad \text{(A.7.11)}$$

<u>or</u> $$P_1 = (a_{11}P_1 + a_{21}P_2 + w \sum_{k=0}^{n} \ell_1^k)(1+r) + a_{31}^0 P_{3,0}(1+r)^n + F \qquad \text{(A.7.12)}$$

with $F = (a_{11}P_1 + a_{21}P_2)[(1+r)^n - (1+r)] + w\{\ell_1^0(1+r)^n + \ell_1^1(1+r)^{n-1}$

$$+ \ell_1^2(1+r)^{n-2} + \ldots + \ell_1^{n-1}(1+r)^2 + \ell_1^n(1+r) - \sum_{k=0}^{n} \ell_1^k(1+r)\}$$

(A.7.13)

---

[1] The reader is reminded once more that a_{ij}^k, ℓ_j^k and P_j^k do not mean that a_{ij}, ℓ_j, and P_j each raised to the power k. k here is a superscript.

Appendix 8

The aim of this appendix is to extend equations 8.29-8.33 of chapter 8 such that the fractional production period is taken into consideration.

(1) Assumptions: the assumptions upon which the following derivations rest are the following: (a) all inputs, whether of initial entry or of progressively added nature, enter the production line simultaneously; (b) the units of the progressively added input are applied in equal batches at the beginning of each time interval; and (c) the wage rate is fixed before the beginning of period t. Once the money wage rate is fixed, all live labour will be priced at the newly fixed money wage rate.

(2) Diagrams: From the above assumption the following two simple diagrams follow:

Figure A.8.1

Production period and the case of progressively added labour input

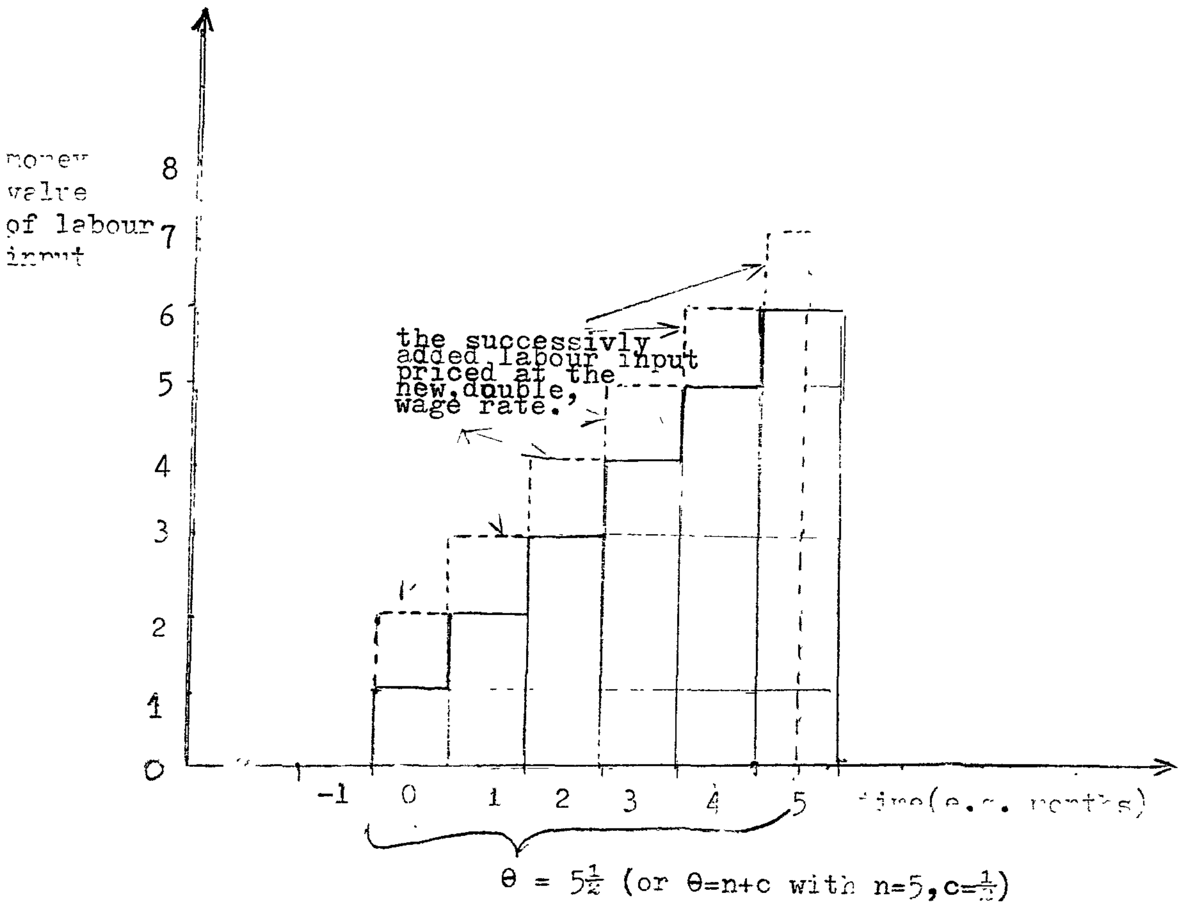
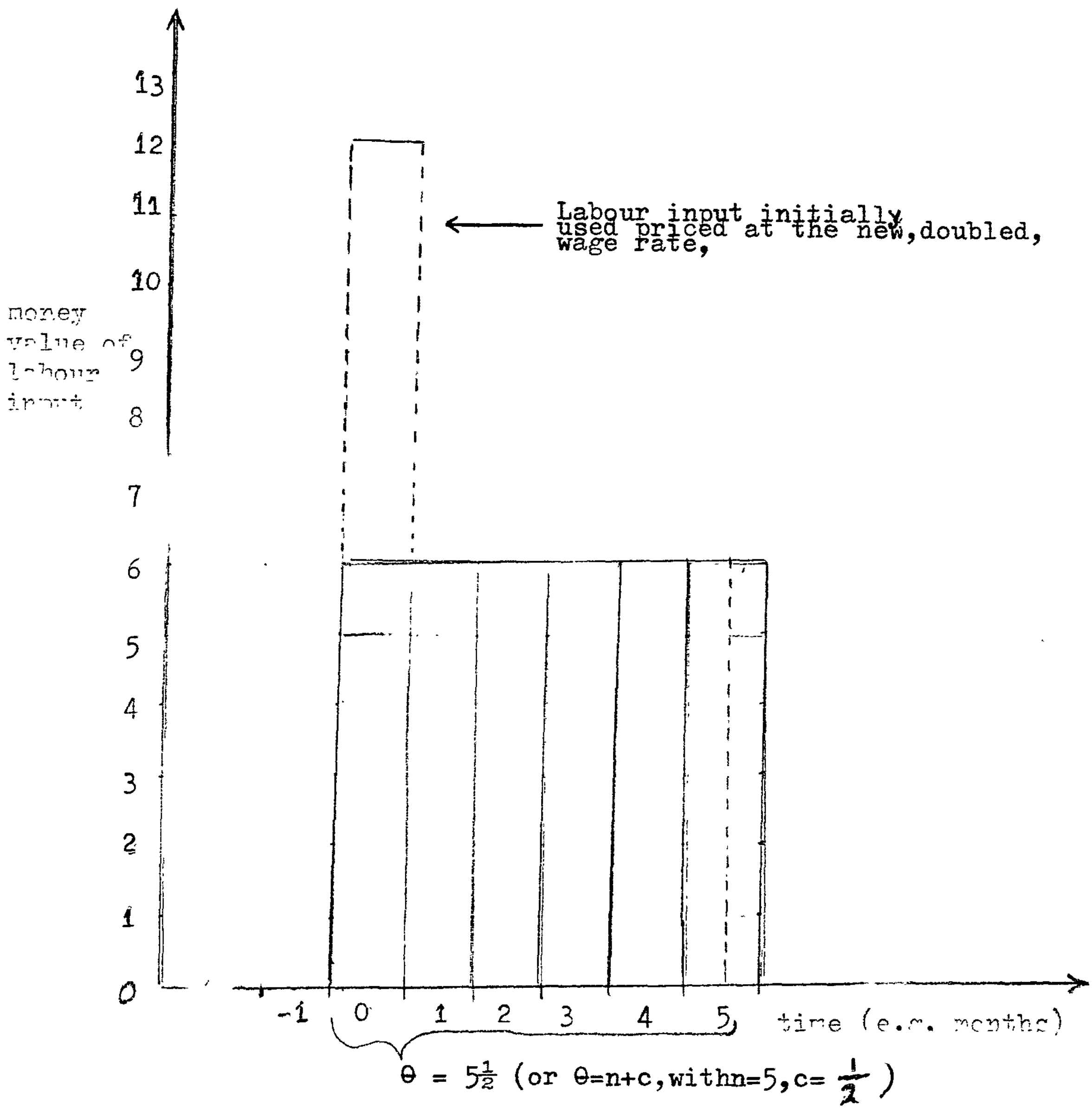


Figure A.9.2

Production period, and the case of initial entry labour input



(3) Proofs:

(i) Under the historic pricing rule, and when labour input is of the progressively added nature, we must have

$$P_t = \left[\frac{c}{\theta} w_{t-c} + \sum_{i=1}^{\theta-c} \frac{1}{\theta} w_{t-i-c}\right](1+r) \qquad (A.8.1)$$

Proof:

Using figure A.8.1 above, HCD rule implies that:

$$P_{t+c} = \left[\left(\frac{\tfrac{1}{2}}{5\tfrac{1}{2}} w_t + \frac{1}{5\tfrac{1}{2}} w_{t-1} + \frac{1}{5\tfrac{1}{2}} w_{t-2} + \frac{1}{5\tfrac{1}{2}} w_{t-3} + \frac{1}{5\tfrac{1}{2}} w_{t-4}\right.\right.$$

$$\left. + \frac{1}{5} w_{t-5}\right](1+r) \qquad (A.8.2)$$

If we replace the numerical values of the production period and its fraction by θ and c respectively, we can write equation A.8.2. as follows:

$$P_{t+c} = \left[\frac{c}{\theta} w_t + \frac{1}{\theta} w_{t-1} + \ldots + \frac{1}{\theta} w_{t-\theta}\right](1+r) \qquad (A.8.3)$$

$$\Rightarrow \quad P_t = \left[\frac{c}{\theta} w_{t-c} + \frac{1}{\theta} w_{t-1-c} + \ldots + \frac{1}{\theta} w_{t-\theta-c}\right](1+r) \qquad (A.8.4)$$

or $$P_t = \left[\frac{c}{\theta} w_{t-c} + \sum_{i=1}^{\theta-c} \frac{1}{\theta} w_{t-i-c}\right](1+r) \qquad (A.8.5)$$

As for the case when labour input is of the initial entry nature, we have:

$$P_t = w_{t-\theta}(1+r) \qquad (A.8.6)$$

(ii) Under the replacement cost pricing rule, regardless of whether labour input is of progressively added or initial entry nature, we must have:

$$P_t = w_{t-c}(1+r) \qquad (A.8.7)$$

(iii) Under average cost pricing rule, we must have:

$$P_t = 2\left[\sum_{i=0}^{\theta-c} \frac{\theta-i}{(\theta-c+1)(\theta+c)} w_{t-i-c}\right](1+r) \qquad (A.8.8)$$

This applies when labour input is of the progressively added nature. If labour input were of the initial entry nature, we must have:

$$P_t = \left[\frac{c}{\theta} w_{t-c} + \sum_{i=1}^{\theta-c} \frac{1}{\theta} w_{t-i-c}\right](1+r) \qquad (A.8.9)$$

<u>Proof of equation A.8.8</u>

From figure A.8.1, average cost pricing implies:

$$P_{t+c} = \left[\frac{5\frac{1}{2}}{18} w_t + \frac{4\frac{1}{2}}{18} w_{t-1} + \frac{3\frac{1}{2}}{18} w_{t-2} + \frac{2\frac{1}{2}}{18} w_{t-3} + \frac{1\frac{1}{2}}{18} w_{t-4} + \frac{\frac{1}{2}}{18} w_{t-5}\right](1+r) \qquad (A.8.10)$$

<u>or</u>

$$P_t = \left[\frac{\theta}{k} w_{t-c} + \frac{\theta-1}{k} w_{t-1-c} + \frac{\theta-2}{k} w_{t-2-c} + \frac{\theta-3}{k} w_{t-3-c} + \frac{\theta-4}{k} w_{t-4-c} + \frac{\theta-5}{k} w_{t-5-c}\right](1+r) \qquad (A.8.11)$$

$$P_t = \left[\sum_{i=0}^{\theta-c} \frac{\theta-i}{k} w_{t-i-c}\right](1+r) \qquad (A.8.12)$$

$$k = 1 + 2 + 3 + 4 + (\theta-c) - [\theta-c+1]c \qquad (A.8.13)$$

The expression 1 + 2 + 3 + 4 + (θ-c) is an arithmetic progression whose sume is $\frac{(\theta-c)(\theta-c+1)}{2}$

$$\therefore \quad k = \frac{(\theta-c)(\theta-c-1)}{2} - (\theta-c+1)c \tag{A.8.14}$$

$$k = \frac{(\theta-c+1)(\theta-c+2c)}{2} \tag{A.8.15}$$

$$k = \frac{(\theta-c+1)(\theta-c)}{2} \tag{A.8.16}$$

$$\therefore \quad P_t = 2\left[\sum_{i=0}^{\theta-c} \frac{\theta-1}{(\theta-c+1)(\theta-c)} w_{t-i-c}\right](1+r) \tag{A.8.17}$$

Proof of equation A.8.9:

From figure A.8.2 above we can write P_{t+c} as follows

$$P_{t-c} = \left[\frac{1}{5½} w_{t-5} + \frac{1}{5½} w_{t-4} + \frac{1}{5½} w_{t-3} + \frac{1}{5½} w_{t-2} + \frac{1}{5½} w_{t-1}\right.$$

$$\left. + \frac{½}{5½} w_{t-c}\right](1-r) \tag{A.8.18}$$

$$P_{t-c} = \left[\frac{1}{\theta} w_{t-5} + \frac{1}{\theta} w_{t-4} + \frac{1}{\theta} w_{t-3} + \frac{1}{\theta} w_{t-2} + \frac{1}{\theta} w_{t-1}\right.$$

$$\left. + \frac{½}{\theta} w_{t}\right](1-r) \tag{A.8.19}$$

with c = ½

$$\Rightarrow \quad P_t = \left[\frac{c}{\theta} w_{t-c} + \frac{1}{\theta} w_{t-c-1} + \frac{1}{\theta} w_{t-c-2} + \dots + \frac{1}{\theta} w_{t-c-5}\right](1+r)$$

.....(A.8.20)

$$P_t = \left[\frac{c}{\theta} w_{t-c} + \sum_{i=1}^{\theta-c} \frac{1}{\theta} w_{t-i-c}\right](1+r) \tag{A.8.21}$$

Needless to say that, for all cases, if one were to allow for some material inputs (thread in the production of the shoe) or direct labour to be introduced and used up in the middle of the production process, the lag structure must be modified.

Appendix 9

A note on the formation of expected input prices:

There are many decision rules available to the firm to adopt for the determination of the expected prices of its commodity input(s), P^e_{jt}. Each of these rules is either based on the extrapolative approach to the formation of price expectations or on the "rational expectations" approach.

(i) Decision rules which belong to the extrapolative approach[1]

a) The no change rule: according to this naive expectations rule, the expected input price for period t is its actual level for last period. Formally, we have:

$$P^e_{jt} = P_{j,t-1} \tag{A.9.1}$$

b) The same change rule: here, the difference between the expected input price for period "t" and its actual level in period $t-1$ is assumed to be the same as the difference between the actual input price in period $t-1$ and its actual level in period $t-2$. Formally, we have:

$$P^e_{jt} - P_{j,t-1} = P_{j,t-1} - P_{j,t-2} \tag{A.9.2}$$

c) Hicks' extrapolative rule: according to this rule, the expected input price for period t is equal to its actual level in period $t-1$ plus a fraction of the difference between its actual level in period $t-1$ and period $t-2$. Formally, we have:

$$P^e_{jt} = P_{j,t-1} + \delta(P_{j,t-1} - P_{j,t-2}) \tag{A.9.3}$$

$$0 < \delta < 1$$

d) The adoptive expectations rule: according to this rule the change in the expected input price for period t is adjusted according to the error made in expecting the same input price for period $t-1$. Formally, we have:

$$P^e_{jt} - P^e_{j,t-1} = \theta(P_{j,t-1} - P^e_{j,t-1}) \qquad \text{(A.9.4)}$$

$$0 < \theta < 1$$

e) the optimal extrapolative rule: according to this more complicated extrapolative rule, the expected price of the relevant input is worked out via an estimated Integrated Autoregressive Moving Average (ARIMA) model. Formally, we have

$$P^e_{jt} = \hat{\alpha}_1 P_{j,t-1} + \hat{\alpha}_2 P_{j,t-2} + \dots + \hat{\alpha}_k P_{j,t-k}$$

$$+ \hat{\rho}_1 \hat{\varepsilon}_{t-1} + \hat{\rho}_2 \hat{\varepsilon}_{t-2} + \dots + \hat{\rho}_k \hat{\varepsilon}_{t-k} \qquad \text{(A.9.5)}$$

In the above equation, $\hat{\alpha}_j$ and $\hat{\rho}_j$ are the estimated values of the structural parameters α_j and ρ_j respectively. $\hat{\varepsilon}_t$ is an estimated value of the moving average error term in the structural equation.

(ii) Decision rules which belong to the "rational expectations" approach[2]

According to this approach, expected input prices are formed in such a way as to be "essentially the same as the predictions of the relevant economic theory".[3] To start with, one needs to know very clearly to whom the potential service of the rational expectations hypothesis (REH) is supplied. Is the REH an advice to business men, trade unions and others, on what they ought to do in conducting their relevant daily business? Is it a representation of what they do in reality? Or is it a complementary part of a hidden ideology wrapped in a fruitless intellectual exercise in which a large section of today's economists and econometricians have indulged in for their own personal satisfaction?

Suppose that REH is an expression of what goes on in reality. What are the implications of that supposition for a "rationally expected" price vector? There are three implications. Firstly, the actual price system must be correctly represented by an econometric model; secondly, every "agent" knows of its existence, willing and able to use that model to estimate P^e_{jt} $(j=1,2,\ldots,n)$ without formidable difficulties. And, thirdly, the rationally expected price vector is the predicted, or the equilibrium price vector arrived at by transforming the "structural model" into a "reduced form" model which can be estimated by the "agent" using the available econometric methods.

A formulation parallel to Wallis (1980):

Let us assume that all firms apply the replacement cost pricing rule in fixing their commodity prices at the beginning of each period. This means every firm should wait for the others to fix their prices in order to be able to fix its own price. Since every firm is in the same position as all the other firms, the typical firm will have two alternatives. Either to keep waiting for ever, or give up waiting for the others to fix their own prices and, instead, try to make decisions based on a 'rationally expected' set of input prices. Let us simplify things and assume that the price system is the following:

$$P_{1t} = (a_{11}P^e_{1t}+a_{21}P^e_{2t}+\ell_1 w_{1t})(1+r_1)+u_{1t} \qquad (A.9.6)$$

$$P_{2t} = (a_{12}P^e_{1t}+a_{22}+P^e_{2t}+\ell_2 w_{2t})(1+r_2)+u_{2t} \qquad (A.9.7)$$

in matrix form, we have:

$$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}\begin{bmatrix} P_{1t} \\ P_{2t} \end{bmatrix} = \begin{bmatrix} 1+r_1 & 0 \\ 0 & 1+r_2 \end{bmatrix}\begin{bmatrix} a_{11} & a_{21} \\ a_{12} & a_{22} \end{bmatrix}\begin{bmatrix} P^e_{1t} \\ P^e_{2t} \end{bmatrix} + \begin{bmatrix} 1+r_1 & 0 \\ 0 & 1+r_2 \end{bmatrix}\begin{bmatrix} \ell_1 & 0 \\ 0 & \ell_2 \end{bmatrix}\begin{bmatrix} w_{1t} \\ w_{21} \end{bmatrix} + \begin{bmatrix} u_{1t} \\ u_{2t} \end{bmatrix} \qquad \text{..... (A.9.8)}$$

Let us denote the above matrices and vectors as follows:

$$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = B, \quad \begin{bmatrix} P_{1t} \\ P_{2t} \end{bmatrix} = Y_t, \quad \begin{bmatrix} 1+r_1 & 0 \\ 0 & 1+r_2 \end{bmatrix}\begin{bmatrix} a_{11} & a_{21} \\ a_{12} & a_{22} \end{bmatrix} = -A_1, \quad \begin{bmatrix} P^e_{1t} \\ P^e_{2t} \end{bmatrix} = Y^*_{1t},$$

$$\begin{bmatrix} 1+r_1 & 0 \\ 0 & 1+r_2 \end{bmatrix}\begin{bmatrix} \ell_1 & 0 \\ 0 & \ell_2 \end{bmatrix} = -\Gamma, \quad \begin{bmatrix} w_{1t} \\ w_{2t} \end{bmatrix} = x_t \quad \text{and} \quad \begin{bmatrix} u_{1t} \\ u_{21} \end{bmatrix} = u_t \qquad \text{(A.9.9)}$$

Having done that, we can rewrite system A.9.6 - A.9.7 as follows:

$$BY_t = -A_1 Y^*_{1t} + (-)\Gamma x_t, + u_t \qquad \text{(A.9.10)}$$

$$\Rightarrow \quad BY_t + A_1 Y^*_{1t} + \Gamma x_t = u_t \qquad \text{(A.9.11)}$$

System A.9.11 is exactly the same as Wallis' (1980, p.50). The rationally expected price vector is:

$$Y^*_t = -(\hat{B}+\hat{A}_1)^{-1}\, \hat{\Gamma}\, \hat{x}_t \qquad \text{(A.9.12)}$$

and in terms of the original variables, our 'rational' expected price vector is:

$$\underline{P}^e_t = -(\hat{B}+\hat{A}_1)^{-1}\hat{\Gamma}\underline{w}_t \qquad \text{(A.9.13)}$$

where $-(\hat{B}+\hat{A}_1)^{-1}\hat{\Gamma}$ are estimated by the available econometric methods and $\underline{w}_t$ is to be estimated, when it needs to be estimated, by the optimal extrapolative method of estimation. In the present model, r_j

and w_j are known, at the beginning of period t. Thus, equation A.9.13 implies that $\underline{P}_t^e$ is rationally expected price vector if and only if:

(a) both r_1 and r_2 are treated as parameters.

(b) the inflationary process is blotted out. (The inter-industrial price repercussions are instantaneous)

The first condition reflects a biased view of the way price inflation gets initiated. This view presents our 'business leaders' as an innocent group which has nothing to do with the initiation of the inflationary process and all its domestic and external repercussions. By imposing the ideology that profit margins must be taken as given, our rational economists are making fools of themselves, at least...The second condition implies that one must pay non attention to the way prices 'walk' from one industry to another in their way towards their (equilibrium) 'rationally expected' values. Neither the 'walking' nor the walking time should be of importance for us, if we were to be rational in our price expectations. Is this rationality or a defective way of thinking ?

The fruitless REH is under healthy attack [4]. A second best alternative is an extrapolative sort of price expectations, while a first best, I think, is an investigation on how price expectations are actually formed by firms and trade unions etc.

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[1] See: Heathfield (1979), pp.161-164; McDonald (1977); and Pindyck and Robinfeld (1976), pp.497-518.

[2] See Nelson (1975); Wallis (1980); and Wickens (1982).

[3] Muth (1961), quoted by Heathfield and Hartropp (1983), p.1.

[4] See: Davidson (1982-83); Gomes (1982); Heathfield and Hartropp (1983).

Appendix 10

The following pages are devoted to the derivation[1] of a generalised version of the system 9.25-9.27 reproduced below for convenience:

$$\dot{P}_{1t} = v_{11}\dot{P}_{1,t-1} + v_{21}\dot{P}_{2,t-1} + v_{31}\dot{P}_{3,t-1} + v_{m1}\dot{P}^{m}_{1,t-1} + a_1\dot{w}_{t-1} \quad (A.10.1)$$

$$\dot{P}_{2t} = v_{12}\dot{P}_{1,t-1} + v_{22}\dot{P}_{2,t-1} + v_{32}\dot{P}_{3,t-1} + a_2\dot{w}_{t-1} \quad (A.10.2)$$

$$\dot{P}_{3t} = v_{13}\dot{P}_{1,t-1} + v_{23}\dot{P}_{2,t-1} + v_{33}\dot{P}_{3,t-1} + a_3\dot{w}_{t-1} \quad (A.10.3)$$

$$0 \leqslant v_{ij},\ a_j < 1$$

$$i = 1,2,3,m; \quad j = 1,2,3$$

Assumptions:

We assume, for simplicity, that $v_{m1} = 0$ and that the price system is composed of two equations, i.e.

$$\dot{P}_{1t} = v_{11}\dot{P}_{1,t-1} + v_{21}\dot{P}_{2,t-1} + a_1\dot{w}_{t-1} \quad (A.10.4)$$

$$\dot{P}_{2t} = v_{12}\dot{P}_{1,t-1} + v_{22}\dot{P}_{2,t-1} + a_2\dot{w}_{t-1} \quad (A.10.5)$$

It is easy to generalise system (A.10.4-A.10.5) above, as we shall see below.

Derivation:

In the derivation of system A.10.1-A.10.3 , we shall limit ourselves to its first equation, then we expand and rename it such that it becomes representative of a more general system. The original price system together with the assumption that technical coefficients (material and labour input per unit) are, by definition, constant in the short-run supply us with the following set of equations:

$$P_{1t} = (a_{11}P_{1,t-1} + a_{21}P_{2,t-1} + \ell_1 w_{t-1})(1+r_1) \quad \text{(A.10.6)}$$

$$P_{1t} + \Delta P_{1t} = \left[a_{11}(P_{1,t-1} + \Delta P_{1,t-1}) + a_{21}(P_{2,t-1} + \Delta P_{2,t-1}) + \ell_1(w_{t-1} + \Delta w_{t-1})\right](1+r_1 + \Delta r_1) \quad \text{(A.10.7)}$$

$$\Delta P_{1t} = (a_{11}\Delta P_{1,t-1} + a_{21}\Delta P_{2,t-1} + \ell_1 \Delta w_{t-1})\,(1+r_1) + (a_{11}P_{1,t-1}\Delta r_1 + a_{21}P_{2,t-1}\Delta r_1 + \ell_1 w_{t-1}\Delta r_1) + (a_{11}\Delta P_{1,t-1}\Delta r_1 + a_{21}\Delta P_{2,t-1}\Delta r_1 + \ell_1 \Delta w_{t-1}\Delta r_1) \quad \text{(A.10.8)}$$

Since $\Delta P_{i,t-1}\Delta r_1$ is a small quantity, we can safely assume that it is close to zero and drop it from equation A.10.8 to get:

$$\Delta P_{1t} = (a_{11}\Delta P_{1,t-1} + a_{21}\Delta P_{2,t-1} + \ell_1 \Delta w_{t-1})\;(1+r_1) + (a_{11}P_{1,t-1}\Delta r_1 + a_{21}P_{2,t-1}\Delta r_1 + \ell_1 w_{t-1}\Delta r_1) \quad \text{(A.10.9)}$$

Now, from the mark-up pricing rule, we have:

$$\Delta P_{1t}/P_{1t} = \Delta P_{1t}/U_{1,t-1}(1+r_1) = \dot{P}_t \quad \text{(A.10.10)}$$

where $U_{1,t-1}$ is per unit variable cost based on historic cost pricing rule. Substituting equation A.10.9 in A.10.10, we get:

$$\dot{P}_{1t} = \left[\frac{a_{11}\Delta P_{1,t-1}}{U_{1,t-1}} + \frac{a_{21}\Delta P_{2,t-1}}{U_{1,t-1}} + \frac{\ell_1 \Delta w_{t-1}}{U_{1,t-1}}\right] + \left[\frac{a_{11}P_{1,t-1}\Delta r_1}{U_{1,t-1}(1+r_1)} + \frac{a_{21}P_{2,t-1}\Delta r_1}{U_{1,t-1}(1+r_1)} + \frac{\ell_1 w_{t-1}\Delta r_1}{U_{1,t-1}(1+r_1)}\right] \quad \text{(A.10.11)}$$

$$\dot{P}_{1t} = \left[\left(\frac{a_{11}P_{1,t-1}}{U_{1,t-1}}\right)\left(\frac{\Delta P_{1,t-1}}{P_{1,t-1}}\right) + \left(\frac{a_{21}P_{2,t-1}}{U_{1,t-1}}\right)\left(\frac{\Delta P_{2,t-1}}{P_{2,t-1}}\right) + \left(\frac{\ell_1 w_{t-1}}{U_{1,t-1}}\right)\left(\frac{\Delta w_{t-1}}{w_{t-1}}\right)\right] + \left[\left(\frac{a_{11}P_{1,t-1}}{U_{1,t-1}}\right)\left(\frac{\Delta(1+r_1)}{1+r_1}\right) + \left(\frac{a_{21}P_{2,t-1}}{U_{1,t-1}}\right)\left(\frac{\Delta(1+r_1)}{1+r_1}\right) + \left(\frac{\ell_1 w_{t-1}}{U_{1,t-1}}\right)\left(\frac{\Delta(1+r_1)}{1+r_1}\right)\right]$$

.....(A.10.12)

By utilising the assumption that the value of each variable input (per unit) is fixed proportion of per unit variable cost,[2] equation A.10.12 can be rewritten as:

$$\dot{P}_{1,t} = (v_{11}\dot{P}_{1,t-1} + v_{21}\dot{P}_{2,t-1} + a_1\dot{w}_{t-1}) + (v_{11}\dot{r}_1 + a_1\dot{r}_1) \qquad \text{(A.10.13)}$$

where:

$$v_{i1} = \frac{a_{11}P_{i,t-1}}{U_{1,t-1}}, \quad \dot{P}_{it} = \Delta P_{i,t-1}/P_{i,t-1}, \quad \dot{w}_{t-1} = \Delta w_{t-1}/w_{t-1}, \quad \text{and}$$

$$\dot{r}_1 = \Delta(1+r_1)/(1+r_1).$$

We can rewrite equation A.10.13 in a more useful form, i.e.

$$\dot{P}_{1t} = v_{11}\left[1 + \frac{\dot{r}_1}{\dot{P}_{1,t-1}}\right]\dot{P}_{1,t-1} + v_{21}\left[1 + \frac{\dot{r}_1}{\dot{P}_{2,t-1}}\right]\dot{P}_{2,t-1} + a_1\left[1 + \frac{\dot{r}_1}{\dot{w}_{t-1}}\right]\dot{w}_{t-1}$$

.....(A.10.14)

In the general case, we have:

$$\dot{P}_{jt} = \sum_{i=1}^{n} v_{ij}\left[1 + \frac{\dot{r}_j}{\dot{P}_{i,t-1}}\right]\dot{P}_{i,t-1} + a_j\left[1 + \frac{\dot{r}_j}{\dot{w}_{j,t-1}}\right]\dot{w}_{jt-1} \qquad \text{(A.10.15)}$$

$i,j = 1,2,\dots,n$

In the special case where $\dot{r}_j = 0$, and $w_j = w_i \quad i \neq j$, system A.10.15 is reduced to the following system:

$$\dot{P}_{jt} = \sum_{i=1}^{n} v_{ij}\dot{P}_{i,t-1} + a_j\dot{w}_{t-1} \qquad \text{(A.10.16)}$$

$i,j = 1,2,\dots,n$

Clearly, system A.10.16 is system A.10.1-A.10.3 expressed in somehow more general form.

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[1]In deriving that system, I benefited from:Sylos-Labini (1979a), pp.10-11 (footnote).

[2]Input-output tables show that sectoral material input per unit of (gross) output, in value terms of course, are stable for successive number of years when the level of aggregation is the following: Chemical and Allied, Mechanical Engineering, Electrical Engineering, Textiles, etc. See Coutts et.al. (1978), p.34 (footnote).

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