

**THE PROBLEM OF  
CREDIT POLICY**

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**PURCHASING POWER AND TRADE DEPRESSION  
MONEY AND PRICES (Contribution to "What  
Everybody Wants to Know About Money,"  
edited by G. D. H. Cole)  
SOCIALIST CREDIT POLICY**

THE PROBLEM OF  
**CREDIT POLICY**

By  
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TO  
MY MOTHER

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- §2. Mr. Keynes' use of the terms Normal Income, Saving, and Investment in his *Treatise on Money* is examined and criticised.
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## PREFACE

In the introductory pages of my book *Purchasing Power and Trade Depression* I wrote as follows:—

“ . . . Finally I have stated very shortly my view as to the nature of the banking policy which should be pursued if these variations in productive activity are to be avoided. I am perfectly aware that this is the least detailed and satisfactory part of the book. All that I have been able to do in the space and time available is to state what I believe to be the correct general principle of monetary policy and not to explain its detailed application to existing banking systems or to defend it from the various theoretical criticisms to which I know it will be subjected. . . . I hope to complete this unfinished work as soon as possible and make apparent the full reasoning behind, and the detailed meaning of, the solution to the problem of credit policy which I believe has been brought within our reach by the varied work on monetary theory that has been published in the last few years.”

The present book has been written in fulfilment of this intention. I still believe that it has become possible in recent years for the economist to state much more clearly than ever before what can and what should be done in the realm of credit policy to secure and maintain indefinitely full employment and a maximum of productivity. It may be true that the wisdom necessary to implement a carefully chosen and scientifically valid credit policy is still lacking. But the primary task—the task of the investigator and the economist—has been carried many steps nearer to a final conclusion.

During the last five years there has been much bitter controversy in the field of monetary theory: it cannot even

now be said that all the controversies are resolved or that all the bitterness is gone. On the contrary, much that I myself say in the course of this book will seem merely foolish and wrong-headed to many people whose opinions are worthy of attention. Yet I cannot help feeling that a great advance has been made, that the agreement among economists about policy is more important than they realise, and that it is high time that those who debate and control policy should have at their disposal some of the positive results to which contemporary monetary analysis directly leads.

The practical purpose of this book is therefore to set forth certain conclusions about credit policy which I believe to follow logically from the recent theoretical analysis of credit expansion and contraction and to discuss the methods by which the correct policy or policies could in practice be implemented.

The theoretical interest of the book lies in the attempt to analyse the significance of certain types of contract in the price system, and in particular of long period contracts in the market for the primary factors of production. The discussion of monetary theory and credit policy has in my opinion been too much dominated by the assumption of price-flexibility. For the Theory of Value and for the diagnosis of the problems of relative production and the distribution of available resources between employments, the assumption of free real adjustment has been exceedingly useful. But in the analysis of *policy* and most especially for an account of credit policy such presuppositions are misleading and dangerous. I have therefore done my best to contrast the results which follow when the prices of the factors of production move freely with those that can be deduced when contractual or rigid wage rates, land rents and debenture interests are taken into consideration.

I have also attempted the difficult task of discovering the effects of placing new money in the hands of consumers rather than in the hands of producers. This is a field of economic theory which has hitherto been left exclusively to the mercy of the monetary crank and propagandist.

The book falls into two Parts. In the first I have set forth

a general analysis of monetary dynamics. All theories of credit policy must ultimately be based upon some system of formal analysis and I have attempted to introduce into my own system some account of the significance of contract elements and consumers' credits. From this examination, if it is correct, two conclusions of great importance for credit policy emerge. They are stated at the conclusion of Part I. In the second half of the book I discuss the question of the practical execution of this policy, the statistical series by which it will be possible to reveal movement in the important monetary quantities and the instruments by which these movements can be controlled. In the last Chapter of the book I discuss, more briefly, the further question of desirable changes and reforms in the institutions of credit provision and management.

In the writing of this book I have been indebted in the main, as will be obvious, to the body of written work in the English language by Professor Hayek and Mr. Keynes and Mr. Robertson. I feel a particular indebtedness to the penetrating contributions of Mr. Robertson to the discussion of monetary policy and to Mr. Harrod's recent work on the same subject. For more personal help in the criticism and amendment of the manuscript I have to thank, and that very warmly, Mr. Barrett Whale of the London School of Economics, Mr. Harold Barger and Mr. Hugh Gaitskell of University College, London. Mr. R. G. D. Allen of the School has been kind enough to express part of my argument in mathematical terms for me, and his contribution is included in the appendix.

I have written in the hope that what I have to say will be of some little use in guiding the hands of those who, by their control of the means of payment, rule the human destinies of the modern world, and that the views here expressed may cast a brief ray of light upon the broken seas and darkness of our common economic life.

E. F. M. Durbin.

*The London School of Economics.*

*April, 1935.*



## APPENDIX

- NOTE 1. Professor Hayek's doctrine of an Asymmetry between the effects of an increase in the Rate of Saving and an increase in the Rate of Expenditure.
- NOTE 2. Mr. Keynes' use of the terms Normal Income, Saving, and Investment in his *Treatise on Money*.
- NOTE 3. Mr. Robertson's definition and use of the term Hoarding.

### NOTE 1. PROFESSOR HAYEK'S DOCTRINE OF ASYMMETRY.

“ . . . Let us first consider the course of changes in voluntary Saving, that is, simple shifts of demand between consumers' goods and producers' goods . . . suppose that consumers save and invest an amount of money equivalent to one fourth of the income of that period. We may assume further that these savings are made continuously, *exactly as they can be used for building up the new process of production*. The proportion of the demand for consumers' goods to the demand for intermediate products will then ultimately be changed (n.b. reduced) from 40:80 to 30:90 or 1:2 to 1:3. The additional amounts of money available for the purchase of intermediate products must now be *so applied that the output of consumers' goods may be sold for the reduced sum of thirty now available for that purpose . . .*”

Hayek, *Prices and Production*, pp. 45-46.

And then,

“ Speaking generally, it might be said that the effects of a relative increase in the demand for consumers' goods (i.e. a fall in the Rate of Saving) are the reverse of the effects of an increase in the relative demand for producers goods (i.e. a rise in the Rate of Saving) . . . *There are, however . . . important differences.*”

“The relative rise in the prices of (mobile) producers' goods will make the larger processes (i.e. new investment) un-

profitable. . . . *But while the non-specific goods, in particular the services of workmen in those higher stages, have thus been thrown out of use because their amount has proved insufficient and their prices too high for the profitable carrying through of the long processes of production, it is by no means certain that all those which can no longer be used in the old processes can immediately be absorbed in the short processes. Quite the contrary: the shorter processes will only gradually absorb all the available producers' goods as the product progresses towards consumption and as the necessary intermediate products come forward*".

Hayek, *Prices and Production*, pp. 81-3.

The argument of these passages is anything but plain. They do however suggest that Professor Hayek is advancing two propositions that are radical to his theory of the Trade Cycle and which—true or false—are of interest to the general theory of money. The two propositions are:—

1. That it is always possible to *increase* the Rate of Saving without creating more unemployment than would be caused by any other change in relative demands. Whatever unemployment may appear can be traced directly to contractual frictions and is not likely to differ appreciably in amount from that which would arise from an equal proportionate change in demand between foodstuffs and clothes for example.

2. But that a *reduction* in the Rate of Saving results in a quite different and much more serious type of disequilibrium that cannot be traced to contractual rigidities but which is due to the more fundamental technical nature of capitalist production. For now unemployment will be due to the fact that the mobile resources can only be absorbed slowly into the consumption good industries because ". . . the shorter processes will have to be started *at the very beginning and will only gradually absorb all the available resources* as the product progresses towards consumption and as the necessary intermediate products come forward."

There is therefore, according to Professor Hayek, an asymmetry between the effects of an alteration of consumers' tastes which results in an *increase* in the output of

capital and the alteration that involves a *reduction* in the output of capital.

The probability that such an asymmetry exists is not very great at first sight. A change in the Rate of Saving either upwards or downwards implies little more, in a regularly advancing economy, than a rise in the output of one group of industries and a fall in the output of another group. Any change in the real structure of production can only proceed as an alteration in the relative outputs of the machine and consumption good industries is achieved, and once that process is finished the main process of adjustment is complete. The change in relative outputs can however itself only be secured by a movement of mobile resources from one industry to another and any kind of temporal price contact will delay and frustrate that movement. But this will be true just as much of a movement of resources into the capital good industries—required by an increase in the Rate of Saving—as of a movement into the consumption good industries—required by a fall in the Rate of Saving. Any asymmetry between the two movements would be entirely accidental and not at all organic. Yet Professor Hayek believes that an organic asymmetry exists.

It would exist if one of Professor Hayek's pictures of the rise and fall in the Rate of Saving had any counterpart in reality. If the process of increased saving could be accurately represented by Professor Hayek's picture (see p. 84) of a society abandoning the less direct method of producing consumption goods *altogether* and beginning the construction of a vast new machine that would ultimately yield a larger output of final income upon the basis of an insufficient accumulated stock of consumption goods a fundamental asymmetry might indeed exist, for it would then be sensible to suppose that when the stock proved insufficient a most profound and almost impossible adjustment of the economy would be required. The producers would be forced to abandon their great machine altogether, and begin from the very beginning to pick berries in a wood. Whatever may be the virtues of such a picture in illuminating Professor Hayek's theory of cyclical fluctuation it is a radically inaccurate

picture of the results of changing the Rate of Saving in an economy adapted to any regular process of accumulation. If the Rate of Saving in a community goes up from 5 per cent to 10 per cent of final income, it is of the first importance to realise:—

1. That *no* stock of consumption goods is built up or can be exhausted.
2. That it is not even necessary that the physical output of consumption goods should decline by a single point. Since the Rate of Saving is continuous the output of consumption goods will be rising steadily and the transfer of resources to the capital good industries is not necessarily large enough to override the secular increase in consumption.
3. A reduction in the Rate of net Saving does not occasion in any way at all the use of shorter or less capitalistic methods of production but merely a reduction in the rate at which more capitalistic methods of production are introduced. Arguments that are constructed to explain a change in the average period of production involving a consumption of capital—whether right or wrong—are quite irrelevant to an examination of the effects of a change in the Rate of Saving.

There is therefore no relevance in Professor Hayek's picture of the Bigger Machine and there is—as far as the argument has led us—nothing more required by a fall in the Rate of Saving than a transfer of resources between two related employments.

But there is a more profound source of misunderstanding to which Professor Hayek is led by the identification of the abstract temporal and value stages of his diagram with the industrial stages of the real structure of production. What Professor Hayek appears to think is that the "top stages" of the triangle, which are characterised as we have seen by the remarkable property of using no intermediate products at all, do exist in the real world. He has said that "it is always possible to start a new stage"—because it requires no intermediate products to do so. Increased saving can therefore

always take place by two men and a dog embarking upon a new operation in hitherto intact forest. To increase the production of later stages however, raw materials and machines—two types of intermediate product—are always required. Slight indications of this point of view are to be found in *Prices and Production* (see pp. 72-7 and p. 82). Professor Hayek says for example: "Goods in the lower stages of production will generally be of a more specific character . . ."—carrying with it the suggestion that the earlier or more capitalistic stages have a smaller and smaller equipment of specific factors until in the "ultimate" stages of production no specific factors are to be found at all.

Nothing could of course be more untrue. There is no conceivable sense in which the stages more distant from the production of consumption goods employ less specialised factors. On the contrary the earlier stages of raw material production and the actual stages concerned with the manufacture of machinery contain the most intricate and powerful of modern machines, while the later stages of assembly and manufacture contain a large proportion of unskilled and mobile labour. If there is any general difference in the balance between specific and non-specific factors it is in the opposite direction to the one that Professor Hayek supposes although there is almost certainly no such general difference. And, needless to say, there is no single stage in a modern economy that is or can be started without intermediate products. New types of machines are manufactured by existing machines—that is all.

Professor Hayek has been misled by too literal an interpretation of his own diagram. In the real world there is just the same combination of mobile with immobile labour and capital in the stages where output can be increased by a rise in the Rate of Saving as there is in the industries where output will be increased by a fall in the Rate of Saving. Adjustment to the two positions is therefore identical and unemployment will arise from the existence of contract frictions just as much as if the Rate of Saving rises as if it falls—indeed, more so if the demand for capital is derived from the demand for consumption goods. There is therefore no

important difference or asymmetry arising from the technical conditions of production although such an asymmetry may exist in the opposite direction to the one Professor Hayek imagines, but for quite different reasons. In so far as the supposed asymmetry is necessary to Professor Hayek's theory of the Trade Cycle, that theory itself is invalidated by this mistake.<sup>1</sup>

NOTE 2. MR. KEYNES' USE OF THE TERMS NORMAL INCOME, SAVING AND INVESTMENT.

Mr. Keynes' position on price and income policy is not easy to determine. In the *Treatise on Money* he does not describe the conditions of monetary equilibrium in terms of the price level of final output at all, but in terms of "an equality between Saving and Investment". In certain passages however, he interprets this to mean a general stability of purchasing power or prices. Thus in discussing the significance of equilibrium he writes:—

"If therefore the banking system can regulate the amount which it lends in such a way that the market-rate of interest is equal to the natural rate, then the value of investment will be equal to the volume of saving, total profits will be zero, the price of output as a whole will be at an equilibrium level, and there will be no motive moving productive resources between the production of consumption goods and the production of capital goods unless or until the purchasing power of money is also at an equilibrium level. *The condition for the stabilisation of purchasing power is, therefore, that the banking system should behave in this way and according to this criterion.*"<sup>2</sup>

And again, when dealing with Mr. Robertson's defence of cyclical fluctuations he speaks of stable prices as the plain cure for such fluctuations:—

"I conclude, therefore, that Mr. Robertson's contentions though they deserve serious attention, are not sufficient

<sup>1</sup> M. A. Abrams' *Money* repeats this type of argument in detail.

<sup>2</sup> *Treatise on Money*, Vol. I, p. 158. Italics mine.

to dispose of the *prima facie* presumption in favour of aiming at the stability of purchasing power as a general rule, in preference to the oscillations of the Credit Cycle."

It is scarcely open to dispute that we should prefer a stability of purchasing power *relatively* to the wild price fluctuations of the Trade Cycle; it is by no means clear that this relative stability will be obtained by rigid price stabilisation policies—as I have already argued in the text of this book.

The precise relation between an equality of Saving and Investment as defined by Mr. Keynes and the price level of final output is not easy to determine. The answer depends first upon the interpretation of the nature of the Fundamental Equations ( $P = \frac{E}{O} + \frac{I' - S}{R}$ ,  $\pi = \frac{E}{O} + \frac{I - S}{O}$ ) and then upon the interpretation of the conception of the Normal Income.

In the first place, if the Equations are simply statements of the monetary determinants of the existing price level and are another way of saying that P and I would be different if any of the other terms were other than they are, then they tell us nothing about the nature of equilibrium policy and nothing about the fate of prices in periods long enough for O to change. In this respect the Equations are purely statical in type and do not provide tools for a dynamic analysis as Mr. Keynes claims for them.

But if, in the *second* place, they are meant to represent average flows over a period of time, then we are at liberty to ask what would happen to prices if Saving and Investment are equated for a period. Since Saving is defined as the difference between *Normal Income* and the expenditure upon Consumption goods, the answer to such a question depends upon the interpretations of the conception of Normal Income. This is, however, no easy task. Normal profits is literally defined by Mr. Keynes (p. 125) as the profits which will cause the entrepreneurs to embark upon no change in the scale of output and therefore no change in the quantity of fixed capital.

"... For my present purpose I propose to define the 'normal' remuneration of entrepreneurs at any time as that rate of remuneration which, if they were open to make new bargains with all the factors of production at the currently prevailing rates of earnings, would leave them under no motive either to increase or decrease their scale of operations."

The maintenance of Normal Income would thus prevent the setting up of any new capital, would prevent any investment from occurring and would render all saving completely abortive.

This is such a strange conception that many of those who have read Mr. Keynes' *Treatise* have assumed that the correct interpretation of his conception of "Normal Income" was that income which would maintain full employment in the absence of autonomous monetary change and in the absence of a "wastage of Savings". In these circumstances Normal Income would be constant for a constant population since there would be no new money to bid up the prices of the factors of production while there would be no wastage of savings to reduce them. But on this interpretation it is certain that an equality between Saving and Investment would not permit of constant unit prices, since if all the Normal Income which is not spent on Consumption Goods is spent on new capital the total price of total output is constant. Any increase in physical efficiency such as will be produced by the accumulation of capital will necessarily be accompanied by a fall in unit cost and unit price. There therefore seems to be no sensible way in which the maintenance of monetary equilibrium requires the maintenance of static prices even on Mr. Keynes' assumptions.

NOTE 3. MR. ROBERTSON'S DEFINITION AND USE OF THE TERM HOARDING.

"I assume the existence of a period of time to be called a 'day' which is finite but nevertheless so short that the income which a man received on a given day cannot be allocated during its course to any particular use. A man's



disposable income . . . is thus the money received not on that day but on the previous one.

"A man is said to be *hoarding* if he takes steps to raise the proportion which he finds existing at the beginning of any day between his money stock and his disposable income. . . .

" . . . We may turn now to a somewhat different case, to which Mr. Keynes has invited particular attention. In this case entrepreneurs, instead of reducing their expenditure to match the reduction in a position to do so by selling securities to the public, whose saving takes from the start the form of purchasing these securities and not of adding to its money stock. But the scale of securities by consumption entrepreneurs indicates that they realise that their income received on day 1, and at disposal on day 2, will only be  $M_b - X$  (=increase in saving); their action, therefore, in ensuring by the Sale of Securities, that their money stocks at the beginning of day 2 shall be  $M_b$  (*i.e.*, more than it would have been) constitutes hoarding. . . . Thus the fall in  $P$  may equally be ascribed to the Hoarding of the Consumption entrepreneurs."—D. H. Robertson's "Saving and Hoarding" *Economic Journal*.

In Section 4.2 (p. 171) of Chapter V, I had reason to mention:—

(1) That Mr. Robertson's original definition of hoarding—the accumulation of idle stocks of cash and credit—made it equivalent to a reduction in Transaction Velocity. Money which would otherwise have exchanged against output or securities of some kind does not exchange against anything at all.

(2) That on this definition of hoarding many changes involving a disturbance of monetary equilibrium by the reduction of prices below the level of existing contracted money costs cannot be described as due to Hoarding. The accumulation of balances in a lengthening structure of production, in so far as it is financed by borrowing, will not lead to a fall in Transaction Velocity although it will force down the Income Velocity of money.

From the above quotations it is clear that Mr. Robertson wishes to change his definition in two ways:—

1. By drawing a distinction between the *money stock* or quantity of money received in any period of time and the volume of *disposable income* available for expenditure during that period. As long as the velocity of circulation is not infinite there must be some period of time, however short, between the receipt of money and the expenditure of money—a period in which a given unit of money can pass through one exchange but not through two exchanges. Within these unit periods there must exist a distinction between money received and money spent.<sup>1</sup>

2. By defining Hoarding with reference to this distinction. Hoarding thus becomes “any process which will increase the proportion between a man’s Money Stock and his Disposable Income in any unit period of time.”

The new definition separates the idea of “hoarding” from any necessary immobilisation of cash or credit and some new term must be found for those changes. These changes are cases of “hoarding” but not the only cases of “hoarding”. Many further types of disequilibrium will be brought under the terms of the new definition. As was explained in the text of this book, all cases of the accumulation of balances—either by individuals or new firms—will become cases of hoarding because in every such case there is an addition to the relevant Money Stock which is not paralleled by an increase in the Disposable Income.

I have explained my reasons for not basing a systematic analysis upon the new definition<sup>2</sup> and here I wish to examine Mr. Robertson’s contention that all forms of monetary disequilibrium can be expressed in terms of it. Mr. Robertson believes, as the above quotations show, that the case in which

<sup>1</sup> It is of course important to realise that the “disposable income” or money expended by individuals during any one unit period may be influenced by the *anticipation* of future money stocks. People may borrow in Period 1 because they expect to receive more money in Period 2. Disposable income may therefore be larger through borrowing and credit operations than the Money Stock of the previous period. But this does not alter the validity of the distinction between Stock and Disposable Income. Such a distinction must exist as soon as Transaction Velocity is less than infinite.

<sup>2</sup> See Chapter V, §4.

the producers who are making losses sell securities in order to maintain dividends can be described as a case of hoarding by them. Here I must express a doubt. I believe that Mr. Robertson has neglected the current fall in Income which they experience.

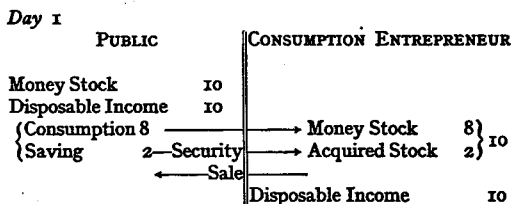
Turning to the quotations, it is in the first place of interest to note that there is a subtle change of emphasis between the actual definition and the use of the conception to analyse the supposed example. In the definition Hoarding takes place if a man "raises the proportion which he *finds existing* on any day" while in the analysis "the consumption entrepreneurs realise that their income *will only be*" a reduced sum and they take anticipatory measures to prevent the situation from arising. This is a significant difference. The definition of Hoarding does not imply foresight or anticipatory action, while the analysis implies both.

As an example of this process, suppose that on Day 0 the public holds a certain Money Stock derived from their money receipts of that day and also a Disposable Income equal to their money stock and derived from the money stock received on the previous day. They spend the whole of their Disposable Income on Day 0, which becomes the Money Stock of the entrepreneurs manufacturing consumption goods. They also hold an equal Disposable Income, so that the ratio between the Stock and Disposable Income of the potential hoarders is 1. The monetary position is then this:—

| <i>Day 0</i>      | PUBLIC |   | CONSUMPTION ENTREPRENEUR |
|-------------------|--------|---|--------------------------|
| Money Stock       | 10     |   |                          |
| Disposable Income | 10     |   |                          |
| Expended on       |        |   |                          |
| Consumption Goods | 10     | → | Money Stock      10      |
|                   |        |   | Disposable Income    10  |

On Day 1 the public save 2 units out of their Disposable Income instead of spending the whole of it upon consumption

goods and with this money they buy the securities that are sold by the entrepreneurs making consumption goods with a view to maintaining their dividends payments. The entrepreneurs by this measure maintain their Money Stock equal to their Disposable Income:—



Thus the consumption entrepreneurs have done nothing to *increase* the proportion between Money Stock and Disposable Income—which remains at 10:10, or 1 throughout the process.

It is however true that they have taken steps to make the proportion larger than it would have been. They have maintained it at 10:10 when it would otherwise have fallen to 10:8 but they have taken no steps to make it greater than it was. It is of course open to Mr. Robertson to call any process that makes the proportion between Money Stock and Disposable Income higher than it would have been without such action a process of Hoarding. But since the sale of output by entrepreneurs just as much as the sale of securities, will make the proportion of their Money Stock to their Disposable Income higher than it would have been without the sale this definition reduces any process of sale whatever to a process of Hoarding. This would surely be an over general use of the term and the conclusion must be that all types of possible monetary disequilibrium cannot be brought under Mr. Robertson's new definition.

It is of interest to note that if the consumption sale does not take place until Day 2 Hoarding on Mr. Robertson's definition will take place. On Day 1 no security sales will

take place but the Money Stock of the entrepreneurs will decline:—

*Day 1*

| PUBLIC               |   | CONSUMPTION ENTREPRENEUR |
|----------------------|---|--------------------------|
| Money Stock 10       |   |                          |
| Disposable Income 10 |   |                          |
| Consumption 8        | → | Money Stock 8            |
| (Saving 2)           |   |                          |
|                      | ↓ | Disposable Income 10     |

The savings will either be hoarded in the Financial Circulation or the entrepreneurs making capital goods will receive them. The entrepreneurs making consumption goods will involuntarily "dishoard". On Day 2 their Disposable Income will fall to 8, and if they sell securities they will sharply increase the proportions between Stock and Income and will consequently hoard.

*Day 2*

| PUBLIC               |   | CONSUMPTION ENTREPRENEUR |
|----------------------|---|--------------------------|
| Money Stock 10       |   |                          |
| Disposable Income 10 |   |                          |
| Consumption 8        | → | Money Stock 8            |
| Saving 2             | → | Acquired Stock 2         |
|                      | ← |                          |
|                      | ↓ | Disposable Income 8      |

Consumption entrepreneurs have raised the critical proportion from 8:10 to 10:8!

It is the anticipatory nature of the action in Mr. Keynes' case which has been too much for Mr. Robertson's definition.

NOTE 4. A MATHEMATICAL NOTE ON THE ARGUMENT OF CHAPTER II §2. By Mr. R. G. D. Allen.

*(The general effects of monetary expansion)*

The production process considered in the following algebraic treatment is the simplified one defined in Chapter II §2 above. It is assumed that there are  $n$  stages of production and that the consumers' outlay, together with any injections of new money, passes through from the earlier to the later stages of production taking equal periods of time

from one stage to the next. The effect of the injection of new money into the productive system will be examined in two cases, i.e. the case of a single injection at a given stage and the case of a constant rate of injection over time also at a given stage.

Case I. *A single injection of new money.*

An amount  $\frac{a}{m}$  of new money is injected, in the first period of time, at the  $(n-m+1)$ th stage of production. Denote by  $x_r$  the increment of this new money in the Consumers' Income in the  $r$ th period of time ( $r=1, 2, 3, \dots$ ). The conditions of the problem then give

$$\left. \begin{aligned} x_1 &= \frac{a}{m} \\ x_2 &= \frac{a}{m} \\ x_3 &= \frac{a}{m} + \frac{I}{n} x_1 \\ x_4 &= \frac{a}{m} + \frac{I}{n} (x_1 + x_2) \\ &\dots\dots\dots \\ x_m &= \frac{a}{m} + \frac{I}{n} (x_1 + x_2 + \dots\dots\dots + x_{m-2}) \\ x_{m+1} &= \frac{I}{n} (x_1 + x_2 + \dots\dots\dots + x_{m-1}) \\ &\dots\dots\dots \\ x_{n+1} &= \frac{I}{n} (x_1 + x_2 + \dots\dots\dots + x_{n-1}) \end{aligned} \right\} \dots\dots\dots (1)$$

and for all later periods ( $r \geq n+2$ )

$$x_r = \frac{I}{n} (x_{r-n-1} + x_{r-n} + \dots\dots\dots + x_{r-2}) \dots\dots\dots (2)$$

The increments of the new money at all stages of the production process can be expressed in terms of the values of  $x_r$  at various periods of time.

For  $r \geq n+2$

$$x_{r-1}; \frac{n-1}{n} x_{r-2}; \frac{n-2}{n} x_{r-3}; \dots\dots\dots; \frac{2}{n} x_{r-n-1}; \frac{1}{n} x_{r-n}$$

represent the increments of new money in the successive stages of production in the  $r$ th period. The sum of these increments, together with the increment of consumers' income, is equal to the total injection, i.e.

$$x_r + x_{r-1} + \frac{n-1}{n} x_{r-2} + \frac{n-2}{n} x_{r-3} + \dots + \frac{2}{n} x_{r-n+1} + \frac{1}{n} x_{r-n} = a \quad (3)$$

Finally, the percentage price changes in the successive stages of production in the  $r$ th period are proportional to

$$x_{r-1}; x_{r-2}; x_{r-3}; \dots; x_{r-n+1}; x_{r-n} \quad (4)$$

It follows, at once, that the variation over time of the increment of new money in any productive stage is similar to the variation of the increment of new money in the Consumers' Income. An adequate description of the diffusion of the new money through the production process is thus obtained by considering the variation of  $x_r$  over time. The variation of  $x_r$  over the first  $(n+1)$  periods of time is given by (1). This variation assumes an up-down-up or wave like form and the shape of the wave depends primarily on the value of  $m$ . The smaller is the value of  $m$ , i.e. the later in the production process is the injection of the new money, the more violent is the initial wave variation in the value of  $x_r$ .

The changes in the value of  $x_r$ , after the initial wave, conform to the relation (2). The increment in the Consumers' Income in any period is simply the arithmetic average of the corresponding increments in the  $n$  periods up to the period last but one before the one considered. The initial wave-like variation of  $x_r$  is thus persistent through time but the amplitude of the wave is continually damped down as time goes on. As  $r$  tends to infinity and the damping continues indefinitely, the value of  $x_r$  must tend to become constant. The limiting constant value of  $x_r$  is given by letting  $r$  tend to infinity in (3), i.e. it is given by the value  $x$  where

$$x + x + \frac{n-1}{n} x + \frac{n-2}{n} x + \dots + \frac{2}{n} x + \frac{1}{n} x = a$$

$$\text{Hence, } x \left\{ 1 + \frac{x}{n} (1+2+3+\dots+n) \right\} = a$$

$$\text{i.e. } x \left\{ 1 + \frac{1}{2}x(n+1) \right\} = a$$

The limiting value of  $x_r$  is thus

$$x = \frac{2a}{n+3}$$

which represents the permanent increment of new money in the Consumers' Income after the oscillations have died down. The form of the oscillations depends on the stage at which the injection of new money takes place but the permanent increment in the Consumers' Income is dependent only on the number of stages and not on the stage of injection.

It remains to consider the relations of the price increases at the various stages of production and the way in which the relations change as time goes on. From (4), the percentage price increases in the  $r$ th period are proportional to the  $n$  values of the increments in the consumers' income in the  $n$  periods immediately before the  $r$ th. The extent to which the percentage price increases differ in any period is thus indicated by the amplitude of the wave-like oscillation of  $x_r$  in the preceding  $n$  periods. There are considerable differences in the price increases at the various stages of production at first but these differences tend to disappear and, in the limit when the oscillations have died down, all prices are increased by a fixed percentage proportional to  $2a/n+3$ .

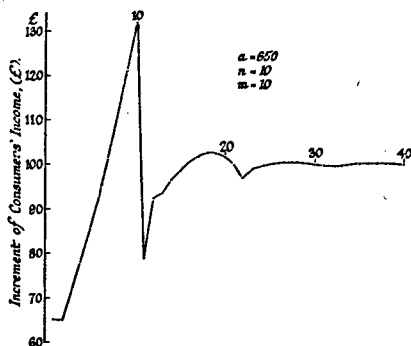
The extent of the damping down of the oscillations of the amount of new money at any production stage and the tendency to uniform percentage price increases throughout the production process are best illustrated by the construction of actual numerical examples. A production process consists of ten stages and £650 of new money is injected into the system. In the limit, the consumers' income is increased by a constant amount £100, while the additional money in the various production stages varies regularly from £10 at the highest stage to £100 at the first stage. In this way, the prices at all stages are increased by the same



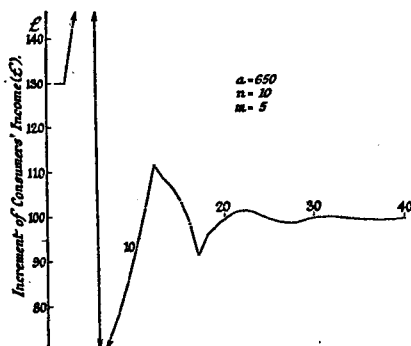
percentage amount. This limiting result is quite independent of the stage at which the new money is injected. But the oscillation in the increment of new money at any stage and the damping down of the oscillation as time goes on is dependent primarily on the stage of injection of the new money. Two cases can be taken for illustration:

- (i) injection at the sixth of the ten production stages  
( $n=10, m=5$ )
- (ii) injection at the first of the ten production stages  
( $n=10, m=10$ ).

The injection in the first case is in the middle of the production process and in the second case at the level of the Consumers' Outlay. The oscillation in the values of the increment of new money in the Consumers' Income, which is typical of the increment at any production stage, is then shown by the two graphs below.



(Graph I.  $a = \pounds 650, n = 10, m = 5$ .)

(Graph 2.  $a = \pounds 650$ ,  $n = 10$ ,  $m = 10$ .)

The rapidity with which the new money becomes diffused through the system can be illustrated by giving, in these two cases, the maximum variation in the percentage price increases at the various production stages in the 15th, in the 25th and in the 50th periods. We find:

|           | Maximum variation of % price increases |             |             |
|-----------|--|-------------|-------------|
|           | 15th period                            | 25th period | 50th period |
| Case (i)  | 115%                                   | 11.6%       | 0.1%        |
| Case (ii) | 53%                                    | 5.7%        | 0.07%       |

**Case II. A constant rate of injection of new money.**

An amount  $\pounds a$  of new money is injected into the production process at the  $(n-m+1)$ th stage of production in every period of time. If  $\pounds x_r$  is the increment of new money in the consumers' income at the  $r$ th period, the conditions of the problem give

$$\left. \begin{aligned}
 x_1 &= \frac{a}{m} \\
 x_2 &= \frac{2a}{m} \\
 x_3 &= \frac{3a}{m} + \frac{I}{n} x_1 \\
 x_4 &= \frac{4a}{m} + \frac{I}{n} (x_1 + x_2) \\
 &\dots\dots\dots \\
 x_m &= a + \frac{I}{n} (x_1 + x_2 + \dots + x_{m-2}) \\
 &\dots\dots\dots \\
 x_{n-1} &= a + \frac{I}{n} (x_1 + x_2 + \dots + x_{n-1})
 \end{aligned} \right\} \dots\dots\dots (5).$$

and, for  $r \geq n+2$ ,

$$x_r = a + \frac{I}{n} (x_{r-n-1} + x_{r-n} + \dots + x_{r-2}) \dots\dots\dots (6).$$

The increments of new money at the various stages of production in the  $r$ th period ( $r \geq n+2$ ) are

$$\begin{aligned}
 &x_{r-1}; \frac{n-1}{n} x_{r-2}; \dots; \frac{m-1}{n} x_{r-n+m}; a + \frac{m}{n} x_{r-n+m-1}; \\
 &\dots; \frac{2a}{m} + \frac{2}{n} x_{r-n+1}; \frac{a}{m} + \frac{I}{n} x_{r-n}
 \end{aligned}$$

The sum of these increments, together with the increment in Consumers' Income is equal to the total injection of new money up to the  $r$ th period. So

$$\begin{aligned}
 &x_r + x_{r-1} + \frac{n-1}{n} x_{r-2} + \dots + \frac{2}{n} x_{r-n+1} + \frac{I}{n} x_{r-n} + \\
 &\frac{a}{m} (1 + 2 + \dots + m) = ra
 \end{aligned}$$

i.e.

$$\begin{aligned}
 &x_r + x_{r-1} + \frac{n-1}{n} x_{r-2} + \dots + \frac{2}{n} x_{r-n+1} + \frac{I}{n} x_{r-n} = \\
 &\left(r - \frac{m+1}{2}\right) a \dots\dots\dots (7).
 \end{aligned}$$

The percentage price increases at the successive stages of production in the  $r$ th period are proportional to

$$x_{r-1}; x_{r-2}; \dots; x_{r-nm}; \frac{an}{m} + x_{r-n+m-1}; \dots; \frac{an}{m} + x_{r-n+1}; \frac{an}{m} + x_{r-n} \dots \dots \dots (8).$$

It is again sufficient to consider the variation of the increment of new money in the Consumers' Income as typical of the variation of the increment at any production stage. The variation of  $x_r$  is given by (5) for the initial phase of  $(n+1)$  periods. This variation shows a wave-like oscillation about a rising trend and the form of the wave depends primarily on the value of  $m$ , i.e. on the stage at which the injection constantly takes place. The averaging process of the relation (6) determines the values of  $x_r$  for the later periods and shows that the oscillation of  $x_r$  about a rising trend continues through time but that these oscillations tend to die away in very much the same way as in the single injection case. Since the oscillations are about a rising trend, however, their relative importance is to be expected to decrease much more rapidly as time goes on than in the case of the single injection.

It remains to isolate the form that the trend of the values of  $x_r$  tends to assume as the oscillations die away. It is easily seen that a steady increase in the value of  $x_r$  at the rate of  $2a/n+3$  per period satisfies the essential relation (6). It is also seen that this steady growth of  $x_r$  satisfies the relation (7) when  $r$  tends to infinity. It can be taken, therefore, that the limiting form for  $x_r$  when the oscillations have died down is

$$x_r = \frac{2a}{n+3} r$$

The steady limiting growth of  $x_r$  is dependent only on the number of stages in the production process; the stage at which the injection takes place affects the extent and nature of the oscillations of the increment of new money in the Consumers' Income but not the ultimate growth of this increment.

Finally, the percentage price increases at the various stages of production are now seen to be related in a rather complex way. A study of (8) shows that there are three factors making for differences in the price increases in any period. Differences arise, in the first place, by reason of the oscillation in the value of  $x_r$  over time. These differences are of exactly the same nature as those found in the single injection case and they tend to disappear as the oscillations in the value of  $x_r$  die away. Secondly, there is a difference between the percentage price increase in any one of the higher  $m$  production stages and the percentage price increase in any one of the earlier production stages. The first price increase is higher by an amount proportional to  $an/m$  and the cause is clearly the continuous flow of newly injected money from the stage of injection up to the higher stages. The absolute amount of this difference is constant and persists through time. Finally, there are differences in the price increases due to the trend in the variation of  $x_r$  over time. Since, in any period, the percentage price increases at successively higher stages of production are proportional to earlier and earlier values of  $x_r$ , the percentage price increase at one stage tends to be greater by an amount proportional to  $2a/n+3$  than the percentage price increase at the next higher stage. The absolute amount of these differences is again constant and persistent through time. The price structure, therefore, shows differences which persist as long as the injection of the new money proceeds. But notice that these differences are of constant *absolute* amount. All the percentage price increases are increasing rapidly and steadily through time with the result that the absolute price differences tend to become of less and less relative importance.

The variation in the value of the increment of new money in Consumers' Income (or at any production stage) can be illustrated by the construction of an actual numerical example and shown by a graphical method similar to that adopted in the previous case. This is, however, scarcely necessary. All that need be noted is that the wave-like oscillation in the value of  $x_r$  is similar to that shown in the graphs above but that the oscillation takes place about a rising trend instead of about a horizontal one.

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