A MODEL OF THE TRADE CYCLE

1. THE following pages do not attempt to put forward any "new" theory of the Trade Cycle. The theory here presented is essentially similar to all those theories which explain the Trade Cycle as a result of the combined operation of the so-called "multiplier" and the investment demand function as, *e.g.*, the theories put forward in recent years by Mr. Harrod and Mr. Kalecki.[1] The purpose of the present paper is to show, by means of a simple diagrammatic apparatus, what are the necessary and sufficient assumptions under which the combined operation of these two forces inevitably gives rise to a cycle.

2. The basic principle underlying all these theories may be sought in the proposition—a proposition that is really derived from Mr. Keynes' *General Theory*, although not stated there in this form—that economic activity always *tends* towards a level where Savings and Investment are equal. Here the terms Savings and Investment are used, of course, in a sense different from the one according to which they are always and necessarily equal—in the *ex-ante*, and not the *ex-post* sense. Investment *ex-ante* is the value of the *designed* increments of stocks of all kinds (*i.e.*, the value of the net addition to stocks plus the value of the aggregate output of fixed equipment), which differs from Investment *ex-post* by the value of the undesigned accretion (or decumulation) of stocks. Savings *ex-ante* is the amount people intend to save—*i.e.*, the amount they actually *would* save if they correctly forecast their incomes. Hence *ex-ante* and *ex-post* Saving can differ only in so far as there is an unexpected change in the amount of income earned.

If *ex-ante* Investment exceeds *ex-ante* Saving, *either ex-post* Investment will fall short of *ex-ante* Investment, *or ex-post* Saving will exceed *ex-ante* Saving; and both these discrepancies will induce an expansion in the level of activity. If *ex-ante* Investment falls short of *ex-ante* Saving *either ex-post* Investment will exceed *ex-ante* Investment, *or ex-post* Saving will fall short of *ex-ante* Saving, and both these discrepancies will induce a contraction. This must be so, because a reduction in *ex-post* Saving as compared with *ex-ante* Saving will make consumers spend less on consumers' goods, an excess of *ex-post* Investment over *ex-ante*.

[1] Harrod, *The Trade Cycle*; Kalecki, "A Theory of the Business Cycle," *Review of Economic Studies*, February 1937, reprinted in *Essays in Theory of Economic Fluctuations*.

Investment (implying as it does the accretion of unwanted stocks) will cause entrepreneurs to spend less on entrepreneurial goods; while the total of activity is always determined by the sum of consumers' expenditures and entrepreneurs' expenditures. Thus a discrepancy between *ex-ante* Saving and *ex-ante* Investment must induce a change in the level of activity which proceeds until the discrepancy is removed.

3. The magnitudes of both *ex-ante* Saving and *ex-ante* Investment are themselves functions of the level of activity, and both vary positively with the level of activity. Thus if we denote the level of activity (measured in terms of employment) by x, both S and I (*ex-ante* Savings and Investment) will be single-valued functions of x [1] and both $\frac{dS}{dx}$ and $\frac{dI}{dx}$ will be positive. The first of these expresses the basic principle of the "multiplier" (that the marginal propensity to consume is less than unity),[2] and the second denotes the assumption that the demand for capital goods will be greater the greater the level of production.[3]

If we regard the $S(x)$ and $I(x)$ functions as *linear*, as in the absence of further information one is inclined to do, we have two possibilities:—

(i) $\frac{dI}{dx}$ exceeds $\frac{dS}{dx}$, in which case, as shown by Fig. 1,[4] there can be only a single position of unstable equilibrium, since above

[1] S and I are, of course, both functions of the rate of interest in addition to the level of activity. But the rate of interest, at any rate in the first approximation, could itself be regarded as a single valued function of the level of activity, and thus its influence incorporated in the $S(x)$ and $I(x)$ functions. (It is not necessary to assume, in order that $\frac{dI}{dx}$ should be positive, that the rates of interest —short and long term—are *constant*. We can allow for *some* variation as the rates of interest, to be associated with a change in investment and incomes, provided this variation is not large enough to prevent the change in incomes altogether. All that we are excluding here is a banking policy which so regulates interest rates as to keep the level of incomes constant.)

[2] $\frac{dS}{dx}$ is, of course, the reciprocal of Mr. Keynes' investment multiplier, which is defined as $\frac{1}{1-\frac{dC}{dx}}$, where $\frac{dC}{dx} = 1 - \frac{dS}{dx}$.

[3] This assumption should not be confused with the "acceleration principle" (of Prof. J. M. Clark and others), which asserts that the demand for capital goods is a function of the *rate of change* of the level of activity, and not of the level of activity itself. The theory put forward below is thus not based on this "acceleration principle" (the general validity of which is questionable), but on a much simpler assumption—*i.e.*, that an increase in the current level of profits increases investment demand.

[4] In Fig. 1, as in all subsequent diagrams, the level of activity is measured along Ox and the corresponding value of *ex-ante* Investment and Saving along Oy.

the equilibrium point $I > S$, and thus activity tends to expand, below it $S > I$, and hence it tends to contract. If the S and I functions were of this character, the economic system would always be rushing either towards a state of hyper-inflation with full employment, or towards a state of complete collapse with zero employment, with no resting-place in between. Since recorded experience does not bear out such dangerous instabilities, this possibility can be dismissed.

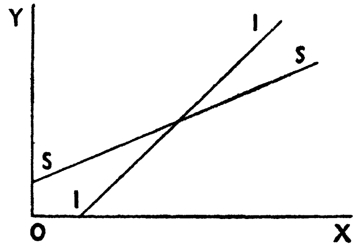

FIG. 1.

(ii) $\frac{dS}{dx}$ exceeds $\frac{dI}{dx}$, in which case, as shown in Fig. 2, there will be a single position of stable equilibrium. (This, I believe, is the assumption implied in Mr. Keynes' theory of employment.) If the economic system were of this nature, any disturbance, originating either on the investment side or on the savings side,

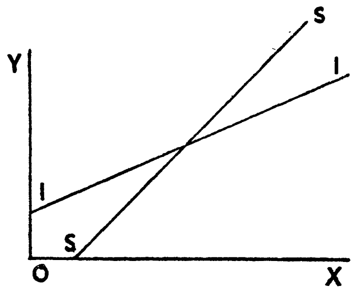

FIG. 2.

would be followed by the re-establishment of a new equilibrium, with a stable level of activity.[1] Hence this assumption fails in the opposite direction : it assumes *more* stability than the real world appears, in fact, to possess. Also, if there is any justification in the contention of the "accelerationists," the possibility of $\frac{dI}{dx}$

[1] Except in so far as the existence of time-lags of adjustment might prevent, on certain assumptions, the new equilibrium from being reached. Cf. Appendix below.

being greater than $\frac{dS}{dx}$, at any rate for certain values of x, cannot be excluded. For $\frac{dI}{dx}$ could be many times greater than dx, while $\frac{dS}{dx}$ can never be more than a fraction of dx.

4. Since thus neither of these two assumptions can be justified, we are left with the conclusion that the $I(x)$ and $S(x)$ functions cannot both be linear, at any rate over the entire range. And, in fact, on closer examination, there are good reasons for supposing that neither of them is linear.

(*a*) In the case of the investment function it is probable that $\frac{dI}{dx}$ will be *small*, both for low and for high levels of x, relatively to its "normal" level. It will be small for low levels of activity

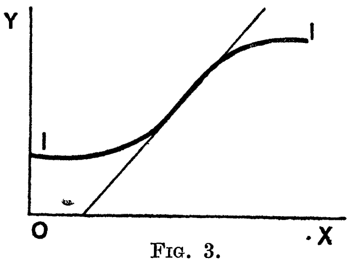

Fig. 3.

because when there is a great deal of surplus capacity, an increase in activity will not induce entrepreneurs to undertake additional construction: the rise in profits will not stimulate investment. (At the same time, the level of investment will not be zero, for there is always some investment undertaken for long-period development purposes which is independent of current activity.) But it will also be small for unusually high levels of activity, because rising costs of construction, increasing costs and increasing difficulty of borrowing will dissuade entrepreneurs from expanding still faster—at a time when they already have large commitments. Hence, given some "normal" value of $\frac{dI}{dx}$, appropriate for "normal" levels of activity, the $I(x)$ function will deviate from linearity in the manner suggested in Fig. 3.

(*b*) In the case of the savings function, the situation appears to be exactly the other way round: $\frac{dS}{dx}$ is likely to be relatively *large*, both for low and high levels of activity, as compared with its normal level. When incomes are unusually low, savings are cut drastically, and below a certain level of income they will be negative. When incomes are unusually high, people are likely to save not only a higher amount, but also a larger proportion of their income.[1] These tendencies, for society as a whole, are likely to be reinforced by the fact that when activity is at a low level, an increasing proportion of workers' earnings are paid out of capital funds (in the form of unemployment benefits); while when activity is at a high level, prices will tend to rise relatively to wages, there will be a shift in the distribution of incomes in favour of profits, and thus an increase in the aggregate propensity to save. Hence $\frac{dS}{dx}$ will deviate from its normal level in the manner suggested in Fig. 4.

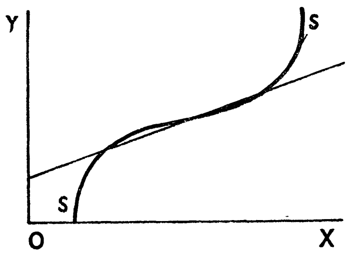

FIG. 4.

In what follows it will be assumed that the two functions conform to these criteria. But, as the reader will note, our analysis would remain valid even if only *one of the two* functions behaved in the manner suggested, while the other was linear.

5. Given these assumptions about the behaviour of the savings and investment functions, and assuming further that the *normal value* of $\frac{dI}{dx}$ is greater than the normal value of $\frac{dS}{dx}$, the situation will be one of multiple equilibria, as shown in Fig. 5. A and B (in the diagram) are both stable positions, for at points below A or B, $I > S$, hence activity tends to expand; above it $S > I$, hence activity tends to contract. C is an unstable position in both directions, and hence not a possible position of equilibrium. The significance of point C is simply that if activity happens to be above C, there will be a process of expansion which will come to a halt at B; if it happens to be below C, there will be a process of contraction until equilibrium is reached at A.

[1] Thus there is something like a "customary standard of living" based on the "normal level" of incomes, and, corresponding to it, there is a certain normal rate of savings. If incomes are much below it, individuals will attempt to maintain their standard of living by consuming capital; if incomes are much above it, they will tend to save a disproportionate amount.

Hence the economic system can reach stability either at a certain high rate of activity or at a certain low rate of activity. There will be a certain depression level and a certain prosperity level at which it offers resistance to further changes in either direction. The key to the explanation of the Trade Cycle is to be found in the fact that each of these two positions is stable only *in the short period*: that as activity continues at either one of these levels, forces gradually accumulate which sooner or later will render that particular position unstable. It is to an explanation of the nature of these forces that we must now turn.

6. Both $S(x)$ and $I(x)$ are "*short-period*" functions—*i.e.*, they assume the total amount of fixed equipment in existence, and hence the amount of real income at any particular level of

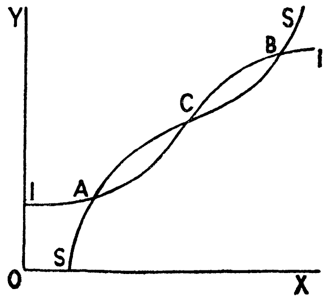

FIG. 5.

activity, as given. As these factors change in time, the S and I curves will shift their position; but according as activity is high or low (equilibrium is at B or at A) they will shift in different ways.

(i) When activity is high (equilibrium at B), the level of investment is high, the total amount of equipment gradually increases, and so, in consequence, the amount of consumers' goods produced at a given level of activity. As a result the S curve gradually shifts upwards (for there will be more consumption, and hence more saving, for any given activity); for the same reason the I curve gradually falls. (The accumulation of capital, by restricting the range of available investment opportunities, will tend to make it fall, while new inventions tend, on the whole, to make it rise. But the first of these factors is bound to be more powerful after a time.) As a result, the position of B is gradually shifted to the left and that of C to the right, thus reducing the level of activity somewhat and bringing B and C nearer to each other (see Fig. 6, "Stage II").

The critical point is reached when, on account of these movements, the I and S curves become tangential and the points B and C fall together (" Stage III "). At that point equilibrium becomes unstable in a downward direction, since in the neighbourhood of the point $S > I$ in both directions. The level of activity will now fall rapidly, on account of the excess of *ex-ante* Savings over *ex-ante* Investment, until a new equilibrium is reached at A where the position is again stable.[1, 2]

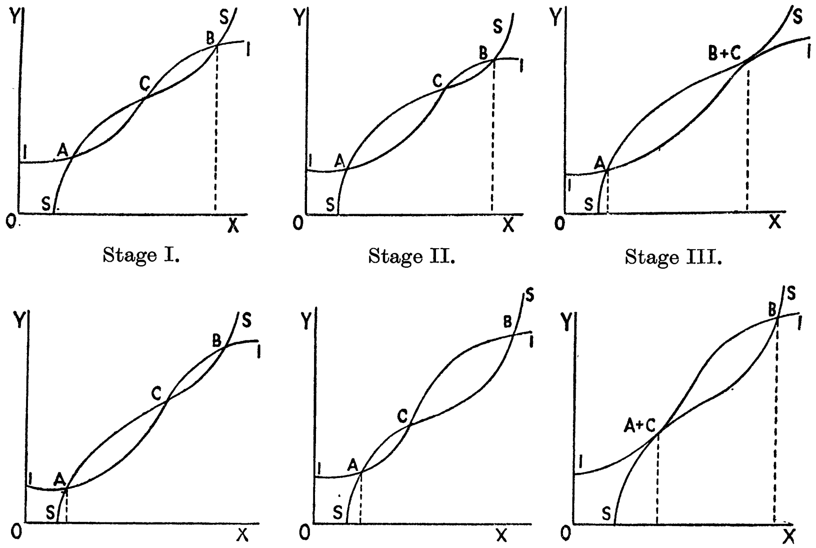

FIG. 6.—THE TRADE CYCLE.

(ii) When activity is low, the movement of the I and S curves will tend to be in the opposite direction. For if at the level of investment corresponding to A investment is not sufficient to cover replacement, so that *net* investment in industrial plant and equipment is negative,[3] investment opportunities gradually

[1] The route followed in the transition from B to A might be either along the I curve or the S curve, according to whether *ex-post* Saving is adjusted to *ex-ante* Investment, or *ex-post* Investment to *ex-ante* Saving—*i.e.*, according as the disappointment of expectations occurs on the side of incomes, or in the level of entrepreneurial stocks.

[2] The fall in the rate of activity during the transition need not be very rapid, and may even take some years. This is because both entrepreneurs and consumers take some time to adjust their scale of purchases to their changed rate of earnings. If the process is at all prolonged, the two curves will be back at their " normal " position (as shown in Fig. 5 or " Stage IV " in Fig. 6) by the time point A is reached.

[3] It is not necessary, of course, that *total* net investment should be negative, since investment can take forms (such as armaments, etc.) whose construction does not reduce the available opportunities for the future.

accumulate and the I curve will shift upwards; and this tendency is likely to be reinforced by new inventions. For the same reason, the gradual decumulation of capital, in so far as it causes real income per unit of activity to fall, will lower the S curve.[1] These movements cause the position of A to shift to the right and that of C to shift to the left (thus separating B and C and bringing A and C nearer to each other), involving a gradual improvement in the level of activity (Stages IV and V). This will proceed until A and C fall together (the two curves again become tangential), when a new critical situation is reached; the position becomes unstable in an upward direction, since $I > S$ on either side of the equilibrium point; an upward cumulative movement will follow which can only come to rest when position B is reached (Stage VI). Thereafter the curves gradually return to the position shown in Stage I, and the cyclical movement is repeated.

7. The necessary and sufficient assumptions under which the combined operation of the saving and investment functions inevitably generate a cyclical movement which nowhere tends to come to rest, can therefore be set out as follows :—

(1) The "normal value" of $\frac{dI}{dx}$, valid for normal levels of activity, must be *greater* than the corresponding value of $\frac{dS}{dx}$.

(2) The "extreme values" of $\frac{dI}{dx}$, valid for abnormally high or abnormally low levels of activity, must be *smaller* than the corresponding values of $\frac{dS}{dx}$.

(3) The level of investment at the upper equilibrium point must be sufficiently large for the $I(x)$ function to *fall* (in time) relatively to the $S(x)$ function; and at the lower equilibrium point it must be sufficiently small for the $I(x)$ function to *rise* (in time) relatively to the $S(x)$ function. In other words, the position of zero net investment must fall within the limits set by the levels of investment ruling at $B + C$ and $A + C$, in Stage III and Stage VI, respectively.

If condition (1) did not obtain, equilibrium at C (which is in fact the "normal" equilibrium position) would be stable, instead

[1] It is possible that even if net investment is negative, real output per head should gradually rise in time (on account of the introduction of superior or more "capitalistic" processes of production during the depression), as a result of which S would tend to rise rather than fall. But this makes no difference so long as the I curve rises faster than the S curve.

of unstable; equilibrium would tend to get established there, and, once established, the shifts in the I and S curves, due to capital accumulation or decumulation, would merely lead to gradual changes in the level of activity until a position of stationariness is reached; they would not generate cyclical movements. If condition (2) was not satisfied (at any rate as regards *low* levels of activity) [1] the system, as we have seen, would be so unstable that capitalism could not function at all. Finally, if condition (3) did not obtain, the cyclical movements would come to a halt at some stage, owing to a cessation of the movements of the $S(x)$ and $I(x)$ functions.

This is not to suggest that in the absence of these three conditions cyclical phenomena would be altogether impossible. Only they would have to be explained with the aid of different principles; they could not be accounted for by the savings and investment functions alone.

8. In fact, conditions (1) and (2) are almost certain to be satisfied in the real world; doubt could only arise in connection with condition (3). It can be taken for granted, of course, that net investment will be *positive* while equilibrium is at position B; but it is by no means so certain that net investment will be *negative* while equilibrium is at position A.[2] It is quite possible, for example, that savings should fall rapidly at a relatively early stage of the downward movement, so that position A is reached while net investment is still positive. In that case the S and I curves will still move in the same direction as at B, with the result that the position A is gradually shifted to the left, until net investment becomes zero. At that point the movements of the I and S curves will cease; the forces making for expansion or contraction come to a standstill. Alternatively, we might assume that net investment at A is initially negative, but in the course of the gradual improvement, the position of zero net investment is reached before the forces of cumulative expansion could come into operation—*i.e.*, somewhere during Stages IV and V, and *before* the cycle reaches Stage VI. In this case, too, the cyclical movement will get into a deadlock.

[1] It is possible that the point B should be situated *beyond* the position of full employment—*i.e.*, that in the course of the upward movement the state of full employment should be reached before *ex-ante* Savings and Investment reach equality. In that case the upward movement would end in a state of cumulative inflation, which in turn would, sooner or later, be brought to a halt by a rise in interest rates sufficient to push the point B inside the full-employment barrier. From then onwards the cyclical movement would proceed in exactly the same manner as described.

[2] The term " net investment " here is used in the sense defined in § 6 (ii).

Hence the forces making for expansion when we start from a state of depression are not so certain in their operation as the forces making for a down-turn when we start from prosperity; the danger of chronic stagnation is greater than the danger of a chronic boom. A boom, if left to itself, is certain to come to an end; but the depression might get into a position of stationariness, and remain there until external changes (the discovery of new inventions or the opening up of new markets) come to the rescue.

9. The preceding analysis offers also certain indications regarding the determination of the period and the amplitude of the Cycle. The period of the Cycle seems to depend on two time-lags, or rather time-rates of movement: (i) on the rate at which the S and I curves shift at any particular level of investment (this, of course, will vary with the level of investment, and will be faster when investment is high or low, than in the middle); (ii) on the time taken to complete a "cumulative movement"—*i.e.*, the time required for the system to travel from $B + C$ to A or from $A + C$ to B (Stages III and VI).

The second of these factors obviously depends on the velocity with which entrepreneurs and consumers adjust their expectations and thus their buying-plans to unexpected changes in the situation. The first factor, on the other hand, seems to depend on technical data, on the construction period and durability of capital goods. The shorter the construction period, the greater will be the output of capital goods, per unit period, at a given rate of investment; the shorter the life-time of capital goods, the larger will be the percentage addition to total equipment represented by a given output of capital goods. Hence the shorter the construction-period, and the lower the durability, the faster will be the rate of shift of the S and I curves at any given rate of investment; the shorter the length of the Trade Cycle.[1]

As regards the amplitude, this depends on the *shapes* of the I and S curves, which determine the distance between A and B, at their "normal" position (*i.e.*, at Stages I and IV). The amplitude will be all the smaller the shorter the range of activity over which the "normal values" of $\frac{dI}{dx}$ and $\frac{dS}{dx}$ are operative.

[1] If the "capital intensity" of investments varies in the different phases of the Cycle in an *inverse relation* to the rate of investment (*i.e.*, is less in boom periods than in depression periods), this will tend to reduce the period of the Cycle, as compared with a situation where the capital intensity is constant, since it will increase the rate of shift of the S and I curves. Conversely, if capital intensity varied *in direct relation* with the rate of investment, this would lengthen the period. Finally, if capital intensity showed a *steady increase* throughout the Cycle, this would lengthen the boom periods and shorten the depression periods.

Variations in the amplitude of successive cycles, on the other hand, seem to depend entirely on extraneous factors, such as new inventions or secular changes in habits of saving. There appears to be no necessary reason why, in the absence of such factors, the amplitude should be gradually decreasing or vice-versa.[1]

10. Our model should also enable us to throw some light on problems of economic policy. Here I confine myself to two points. (i) It appears that measures taken to combat the depression (through public investment) have much more chance of success if taken at a relatively early stage, or at a relatively late stage, than at the bottom of the depression. If taken early, the problem is merely to prevent that gradual fall in the investment function relatively to the saving function which carries the cycle from Stage II to Stage III. But, once Stage III is passed, nothing can prevent the switch-over from the *B*-equilibrium to the *A*-equilibrium, and then the problem becomes one of raising the investment demand schedule sufficiently to lift the position to Stage VI (at which the forces of expansion come into operation). The amount of public investment required to achieve this is obviously much greater in the early phase of the depression (at Stage IV) than in the later phase (at Stage V). Thus just when the depression is at its worst the difficulty of overcoming it is the greatest. (ii) The chances of "evening out" fluctuations by "anti-cyclical" public investment appear to be remote. For if the policy is successful in preventing the downward cumulative movement, it will also succeed in keeping the level of private investment high; and for this very reason the forces making for a down-turn will continue to accumulate, thus making the need for continued public investment greater. Thus, if, on the basis of past experience, the Government Authority contemplates a four years public investment plan, in the belief that thereby it can bridge the gap between one prosperity-period and the next, it is more likely that it might succeed in *postponing* the onset of the

[1] At first sight one might think that this question also depends on *endogenous* factors: that the cycle will be "damped" (amplitude of successive cycles decreasing) if the point of zero net investment is so situated that there will be net capital accumulation over the cycle as a whole, and vice versa. But this is not so. If there is net accumulation over the cycle as a whole (*i.e.*, the accumulation over the boom period exceeds the decumulation during the depression), then, in the absence of extraneous changes, the position *B* at the corresponding stages of successive cycles will be situated more and more to the left; but the position *A* will also be situated more to the left, with the result that, though there will be a gradual fall in the average level of activity, there need be no decrease in the deviations around the average. The same holds, *mutatis mutandis*, if there is net decumulation over the cycle as a whole.

depression for four years than that it will prevent its occurrence altogether.[1] If the Trade Cycle is really governed by the forces analysed in this paper, the policy of internal stabilisation must be conceived along different lines.

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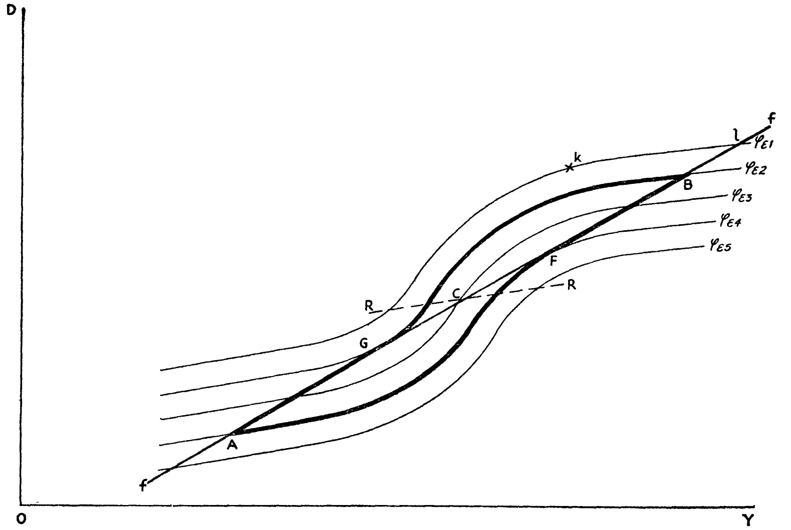
APPENDIX

It may be interesting to examine the relations of the model here presented to other models of the Trade Cycle based on similar principles. The one nearest to it, I think, is Mr. Kalecki's theory, given in Chap. 6 of his *Essays in the Theory of Economic Fluctuations.* The differences can best be shown by employing the same type of diagram and the same denotation as used by Mr. Kalecki. Let income be measured along OY, and the rate of investment decisions along OD. Let $D_t = \Phi e(Y_t)$ represent the rate of invest-



ment decisions at time t, given the quantity of equipment available. Let the family of curves Φe_1 . . . etc., represent this function for different quantities of available equipment, where e_1 represents a *smaller* quantity of equipment than e_2, and so on. Let $Y_t + \tau =$

[1] This argument is strictly valid only for a closed system; it is not valid in the case of a country which receives its cyclical impulses from abroad. For in that case the cyclical variations in the demand for exports can be taken as given irrespective of what the Government is doing; the chronological order of the "lean years" will not be altered by the attempt at suppressing them. Thus a policy of this type is much more likely to be successful in a small country, like Sweden, than in large countries, such as Britain or the United States, which themselves generate the cyclical forces and transmit them to others.

$f(D_t)$ be the level of income at time $t + \tau$ as a function of investment decisions at the time t. This is the same as our savings-function, which, for simplicity, and following Mr. Kalecki, we regard here as a straight line, independent of the amount of equipment. (τ represents the time lag between investment decisions and the corresponding income, which, as Mr. Kalecki has shown, depends partly on the construction-period of capital goods, and partly on the lag between income and consumption.) The meeting-points of Φe curves and the f curve are positions of short-period equilibrium, where Savings=Investment; the equilibrium is stable when the Φe curve cuts the f function from above, it is unstable when it cuts it from below. Let RR represent the locus of points on the Φe curves where the level of investment decisions corresponds to replacement so that *net* investment is zero. This curve is slightly *rising*, from left to right, since the higher the amount of equipment in existence, the greater the amount of investment needed for replacement. The point C represents the position of long period or stationary equilibrium, where Savings=Investment *and* net investment is zero.

Under our assumptions, where $\frac{d\Phi}{dY}$ exceeds $\frac{1}{\frac{df}{dD}}$ for certain values of Y, there must be certain levels of equipment at which the Φ curves cut the f function not once, but three times. In our diagram this will be the case if equipment is greater than e_2 and less than e_4. Given this assumption, and assuming further that the replacement level, *for the critical amounts of equipment*, falls between the limits of stability—*i.e.*, between points F and G in the diagram—the system can never settle down to a stationary equilibrium, but moves around it in a cycle. If we assume that the time-lag τ is small relatively to the time needed to reach successive Φ curves (*i.e.*, relatively to the rate at which the total quantity of equipment is increasing), so that a position of short-period equilibrium can be reached *before* significant changes occur in the amount of equipment in existence, the cyclical movement of the system will be indicated by the trajectory $AGBF$. For if we start from any arbitrary point, such as k, the cumulative forces will increase income and investment decisions until the system reaches l, and thereafter activity will move downwards (owing to the gradual accumulation of equipment) along the f line until it reaches F. At that point equilibrium becomes unstable, and a downward moving cumulative process is set up which lands the system at A. Here investment is less than replacement, and the gradual reduction in available equipment will increase activity until the system reaches G, at which the situation again becomes unstable, an upward cumulative movement follows which lands the system at B. Thus if we start from any point outside the trajectory, the system will move on to it, and the same follows if we start from any point inside. Hence, even if we started from the position of stationary long-period equilibrium (C), the unstability of the situation there must generate forces which set up a cycle.

It follows, further, that if all the fundamental data which determine the Φ and f functions—*i.e.*, tastes, technique, population, monetary policy, the elasticity of expectations, etc.—remain unchanged, the cycle would continue indefinitely with constant amplitude and period and the trend (the accumulation of capital between successive cycles) would be zero. Hence changes in the nature of successive cycles would have to be explained by dynamic changes.

In Mr. Kalecki's model $\frac{d\Phi}{dY}$ is supposed to be smaller than $\frac{1}{\frac{df}{dD}}$ throughout, hence all his positions of short-period equilibrium are *stable* positions. In this case, on our assumptions, no cycle would be generated at all; the system would gradually approach stationary equilibrium. He assumes, however, that the time-lag between investment decisions and the corresponding income is large relatively to the rate at which the amount of equipment is increasing—*i.e.*, the movements *along* a Φ curve and the movement *between* Φ curves are of comparable speed—in which case the movement toward a stationary equilibrium may " overshoot the mark "—*i.e.*, the rate of investment decisions can continue to fall, even after it is less than what corresponds to replacement, simply because the fall in income lags behind. Thus the introduction of the time-lag between investment decisions and the corresponding income could explain a cyclical movement even if the underlying situation is a stable one; though, in order that this cycle should not be highly damped (*i.e.*, that it should not peter out quickly in the absence of new disturbing factors), it is necessary to suppose (i) that the effect of current investment on total equipment should be relatively large, so that the equipment added during the period of the time-lag has a considerable influence on the rate or profit, and hence on investment decisions; (ii) that the angle enclosed by the f and ϕ functions should be small—*i.e.*, that $\frac{1}{\frac{df}{dD}}$ should but slightly exceed $\frac{d\phi}{d\gamma}$.[1]

Previous attempts at constructing models of the Trade Cycle —such as Mr. Kalecki's or Professor Tinbergen's—have thus mostly been based on the assumption of statically stable situations, where equilibrium would persist if once reached; the existence of the cycle was explained as a result of the operation of certain time-lags which prevented the new equilibrium from being reached, once the old equilibrium, for some external cause, had been disturbed. In this sense all these theories may be regarded as being derived from the " cobweb theorem." The drawback of such explanations is that the existence of an undamped cycle can

[1] Hence the positions of equilibrium in Mr. Kalecki's model, though formally stable, possess only a *low* degree of stability.

be shown only as a result of a happy coincidence, of a particular constellation of the various time-lags and parameters assumed. The introduction of the assumption of unstable positions of equilibrium at and around the replacement level provides, however, as we have seen, an explanation for a cycle of *constant amplitude* irrespective of the particular values of the time-lags and parameters involved. The time-lags are only important here in determining the *period* of the cycle, they have no significance in explaining its existence.

Moreover, with the theories of the Tinbergen–Kalecki type, the amplitude of the cycle depends on the size of the initial shock. Here the amplitude is determined by endogeneous factors and the assumption of " initial shocks " is itself unnecessary.