Inventories,Windfalls and A Non-tatonnement Process in an Aggregate Disequilibrium Model with the Loanable Funds Theory

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Koichi MIYAZAKI September 20, 1978

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Introduction

Here are summarized some characteristics of the model set forth in this paper.

The model below is based on the loanable funds theory. The reason for formulating so is that this theory is necessary in order to analyze disequilibrium adjustment in the short run of the economy with inventory and the discrepancy between the actual and intended investment taken in consideration.

The model below incorporates the additional cash (m^s) as a parameter: firstly the model in this paper is different from the usual Keynes' model in that it deals with the *additional* flow of cash instead of the existing stock of money: secondly in that it deals with *cash* instead of M_1, M_2 etc. In modeling so, it is made possible for us to position the *multiplicative credit creation* in the framework of a static simple macro-economic model, which has not been done before. Moreover in doing so, it is made possible

that the rediscount policy and the lending policy of the Central Bank are appropriately positioned in a macroeconomic model: they are essentially forms of *lending of cash* from the government to the private firms to invest.

The model in this paper is based crucially on that in "the General Theory" [1] by J. M. Keynes, but I discard the liquidity preference theory in this paper. I will present an analysis which takes in full consideration the interaction between the real and financial aspects of macroeconomic transaction, which Keynes treated not in the book, but rather in "the Treatise on Money" [2]. I think that Keynes did not give up the ideas set forth in the Treatise when he wrote the General Theory.

The analysis below is concerned with how the economy behaves when it is carried out of equilibrium: a disequilibrium adjustment process. Hicks's "the Crisis in Keynesian Economics" [3] is suggestive in this respect. Throughout this paper the fixprice economy is considered.

The Role of Cash

Here I consider the definition of $\dot{m}^s$, or the incremental cash supply of the government, which will appear in the model below.

There are three ways in the closed economy for the government to supply additional cash: (1) the case of lending newly printed cash from the Central Bank to the commercial banks, (2) the case of the open-market operations by the Central Bank, and (3) the case of the government's deficit expenditure which is financed by newly printed cash (or by the government's borrowing from the Central Bank).

Since we assume away in this paper the government bond and

the government's deficit expenditure, the cases (2) and (3) do not arise in our model here, and m^s is assumed to be supplied only in the form of lending in the case (1).

The additional cash or high-powered money which is lent from the Central Bank to the commercial banks will ultimately be lent out to the private firms. There always happens a multiplier effect of credit creation from the additional cash supply, and it means that the ultimate expansion of credit amounts to a multiplier times the additional cash supply through the channel of (1). It follows that the lending from the commercial banks to the private firms will be created ultimately in an at least substantially greater amount than the initial additional supply of cash. Hence when we see the economy after the multiplicative expansion has been completed, the initial additional supply of cash has been totally lent to the firms to finance a part of their new investment. The remaining part of the new investment may have been financed also by borrowing from the households, but it mainly consists of the lending of the banks through the multiplier expansion of credit.

It is assumed that variable m^s, or *the additional supply of cash,* is defined unambiguously as the net addition to the stock of 'high-powered money', distinct from the so-called M_1, M_2 or the near money.

The amount of m^s represents only a small part of the borrowing by the firms. The remaining part of the firms' borrowing is assumed to be lent from the households, through or not through the commercial banks: (1) the firms may borrow directly from the households (*not* through the banks) in the forms of issuing stocks, private bonds etc., and (2) they may borrow from the households through the banks in the forms of issuing private bonds to the banks, borrowing in short or long terms directly from the banks,

etc.

I assume that the sum of these additional borrowing by the firms from the households through or not through the commercial banks is always equal to the excess of the total investment (or the actual payment to the I sector, to be exact) over the additional cash supply m^s. This is a mere identity, and is not anything more than a theoretical definition.

However the households, or their financial representative the commercial banks, or both won't lend to the firms more than a certain amount of funds additionally which is governed by (1) the elements of the households, and (2) the elements of the commercial banks.

The elements of the households to restrict lending to the firms are: (1) the demand for cash of the households for the speculative motive stressed by Keynes, out of a given amount of savings, and (2) the limit of desirability of holding stocks or private bonds caused by the lowness of the rates of interest, or in other words by the expensiveness of the market prices of the stocks or private bonds. Take these elements one by one.

Firstly consider the speculative motive of the households. In Keynes' General Theory it may be the firms as well as the banking system and the households that hold cash for the speculative motive. However I assume in this paper that the firms do not usually hold cash, and that it is only the households or their representative the banks that hold cash for this motive. It must be stressed here that the households do not lend the whole part of their savings to the firms through or not through the banks: they lend only a part of it to the firms, and the remaining part of the savings stays within the households in the form of cash within the banks in the form of cash reserves.

However the part of the savings which is lent to the firms directly or indirectly from the households is largely governed by the amount of the total savings: the total savings sets as least an upper bound to the lending to the firms from the households. Moreover the proportion of the part of the savings which is lent to the firms may be assumed to be largely governed by the rate of interest and the higher (lower) is the rate the greater (smaller) proportion of the savings will be lent to the firms directly or indirectly.

Secondly consider the limit on the desirability of holding stocks or private bonds arising from the lowness of the rate of interest. The higher is the rate of interest the greater amount of additional stocks or private bonds the households desire to hold.

Next the elements of the commercial banks which restrict lending to the firms are: (1) the legal reserve ratio of the cash reserve to the demand deposits, and (2) the banks' motivation for profits to lend to the firms which is largely governed by the rate of interest.

The legal reserve ratio puts an upper bound to the proportion of the total deposits which is lent to the firms *indirectly* from the households. Therefore it puts a constraint to the proportion of the total (current) savings which is lent to the firms from the households.

The rate of interest largely governs how much the banks will lend out of a given amount of additional deposits which the households lend to them. Therefore it indirectly governs the proportion of the (current) savings which is lent to the firms.

In summary, given the total savings S(Y), the households are willing to lend, through or not through the commercial banks, a certain proportion of the savings, say, b(i), to the firms. The proportion b(i) is an increasing function of the rate of interest, denoted

by i. I assume that $1>b(i)>0$ holds for all levels of the rate of interest. Then the lending schedule of the households is equal to b(i).S(Y), given *the actual income Y* and *the actual rate of interest i.*

The government is assumed to lend always the amount m^s to the firms additionally, and so m^s is assumed to constitute always a realized part of the additional (or new) lending to the firms.

However the lending schedule of the households b(i).S(Y) is not always realized even when the actual rate and income are i and Y, resp., because the demand for loan may be less than $b(i).S(Y)+m^s$ at the rate i. In such a case the households hold additional cash over and above the amount that they think optimal. In such a case they hold cash additionally which amounts to $(1—b(i)).S(Y)+\alpha$ where (1—b(i)).S(Y) denotes the amount of additional cash they regard as optimal, and the notation α (>0) denotes the excess of the scheduled lending b(i).S(Y) over the actual lending. In this way the additional cash plays a role of *the residual of the savings after the lending.* On the supply side of additional cash, the supply is constantly m^s. Certainly there happens a gap between the demand for and supply of additional cash in that case of 'under-lending', but since there is the stock of already issued cash M circulating in the economy, and since the part of the savings which remains as the residual after lending out of the savings can absorb a part of this stock of cash together with the newly issued cash (m^s), it would be no question as to where the part α comes from in that case.

The excess α of the amount of additional cash that the households actually hold over and above the amount of it that they regard as optimal may be positive or negative.

Theory of Credit Creation

In our model m^s corresponds to a part of real investment, and so the total stock of cash M corresponds to a part of the total real capital. Therefore we see that the sum of the real values of the total cash and the total private bonds should be equal to the total capital. If it were assumed that 'cash' is something completely separated from the 'real capital' or 'real investment', it follows that 'savings' is completely separated from 'cash', because the savings just corresponds to the real investment or the addition to the real capital. But is not it a little too queer to assume that savings is not related to cash at all? Certainly savings has the same nature as consumption does in that it is made out of income, but savings is different from consumption in the respect that it is a thing to be accumulated but consumption is not. The total stock of cash is also an accumulated value. It would be natural to assume that savings and m^s are related to each other.

It is remarkable that Keynes neglects away completely the relation between savings and the stock of money, which seems to be due to his static assumption of neglecting the accumlation of capital. In order to be more realistic in this respect savings should be closely related to the stock of money. Savings is an increase in wealth and 'money' is also a form of wealth, and so is the cash. At least a part of S must correspond to the additional cash m^s.

At first the additional cash m^s is lent from the Central Bank to the firms through the commercial banks, and it will come partly to be deposited into the commercial banks, partly to be held by the households. Assume however that it is totally deposited to the banks for simplicity. Then m^s (the increase in cash) becomes the first stage of the 'credit creation'. m^s creates a multiplier times as

much 'credit' as the m^s, *including* m^s itself. An important consequence of this fact is that m^s corresponds to a part of the firms' *new* borrowing and therefore the firms' *new investment.*

Secondly it is not the credit *'reproduction'* but the credit *'creation'* that we are considering here as multiplicative. In the process of the so-called multiplicative credit creation, the lending to the firms is *increased* by an amount a multiplier times as much as m^s. *The process of multiplicative credit expansion is nothing but the process of creating the firms' new borrowing or therefore new investment.*

Integrating these two respects, I may say the following: m^s (the additional cash) corresponds to a part of the firms' *new* borrowing or *new* investment, and at the same time, the total 'credit *creation*' which is created multiplicatively by the initial m^s just corresponds to the total of the firms' *new* borrowing, or *new investment.*

Assumptions

(1) *The Loanable Funds Theory*

I assume that the rate of interest is determined by the loanable funds theoretic mechanism: by the flows of demand for and supply of additional loanable funds.

The demand for additional loan consists only of the firms' investment demand: they need to borrow just the amount they want to invest. Given the set of investment opportunities, the demand for (additional) loan is a decreasing function of the rate of interest, which is denoted as I(i).

The supply of (additional) loan to the firms consists only of that from the households and that from the government. The supply of loan by the government is assumed constant, denoted by

m^s. This is always equal to the addition to the stock of cash. I assume that this part (m^s) of the total supply of loan (calling instead of 'additional loan' for short, as below) is always realized: that there is always enough demand for loan to use this part (m^s) of the total supply, and that this part of lending is always realized.

The supply of loan by the households comes from the savings of the households. It is assumed to be a fraction of the savings, the fraction being dependent on the rate of interest, denoted by b(i), where $0<b(i)<1$. Since the savings is denoted by S(Y), the supply of loan by the households is b(i).S(Y), where Y denotes the actual income.

The equilibrium condition in the loan market is

$$m^s+b(i).S(Y)=I(i) \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

(2) *The General Equilibrium Conditions*

The demand for consumption goods depends only on the actual income Y. The demand for consumption goods is denoted by C(Y), where the function C(.) has the same form as the usual consumption function.

The effective demand for investment goods is assumed always equal to *the payment* by the firms in both sectors *to the investment goods sector* (denoted by 'the I sector' in the following). Since this payment is monetary, it cannot be greater than the supply of loan at the actual rate of interest. The (not necessarily effective) demand for investment goods distinct from the effective demand for the I goods is always equal to I(i), and it is not totally effective if the supply of loan at the actual rate of interest is less than that. The effective demand for I goods or the payment to the I sector is always equal to minimum.(I(i), $m^s+(i).S(Y)$).

On the supply side the supply of consumption goods is always

equal to C(Y), or to the demand for it. We assume that there is no lag of output so far as the consumption goods is concerned.

The supply of investment goods is assumed to be forthcoming as much as there is effective demand. Behind it there is the assumption that there is a plenty of inventories to absorb any increase in the effective demand.

In summary the total effective demand for commodities is always equal to the expression

$$C(Y)+\text{minimum.}\,(I(i),\ m^s+b(i).S(Y)),$$

and is always equal to the total supply of commodities.

However this effective demand is *not* always equal to the actual income Y, because the effective demand may contain unintended fall or rise in inventories. The income Y is always equal to the total production, but the effective demand may or may not be equal to it, because a change in the effective demand is followed by a change in the production only with a lag.

In full equilibrium we have the following equations satisfied:

$$I(i)=m^s+b(i).S(Y) \quad \ldots\ldots\ldots\ldots\ldots(1)$$

$$I(i)=S(Y) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

The equation (2) means that the firms are satisfied in the sense that there is not any unintended change in inventories, and therefore that the intended investment I(i) is just equal to the actual investment S(Y). (About the definitions of the intended and actual values, see p. 18～20 below.)

In full equilibrium the effective demand is equal to the actual income because in full equilibrium the equation (2) holds and so there holds the equation $C(Y)+I(i)=Y$, but the left-hand side $C(Y)+I(i)$ is equal to the effective demand in full equilibrium since the equation (1) holds then. Therefore in full equilibrium the effective demand is equal to the actual income or production.

(3) *Inventories*

I assume that there is not any inventory of consumption goods, but that there is that of investment goods. I assume that in the case of consumption goods there is as much production of it as there is demand.

The inventory of investment goods is assumed to be increasing at a constant rate per unit of time. The constant increase in inventories constitutes a part of the production of investment goods. The increase is called 'the inventory' for short in the following. This inventory will increase or decrease when there is an unintended fall or rise in the payment to the I sector.

(4) *Windfalls*

I assume that whenever there is an unintended change in inventory, there is a windfall of the same amount. When there is an unintended rise in inventory, there is a windfall loss of the same amount, and when there is an unintended fall in inventory, there is a windfall profit of the same amount. The reason is that an unintended change in the payment to the I sector takes the form of an unintended change in the revenue to the I sector, whereas the production in the I sector lags behind the change of the payment to it. The I sector receives the changed revenue and pays to the productive factors a greater or less amount than the revenue by the amount of the unintended change in inventory. The windfalls are the monetary counterparts to the unintended changes in inventory.

When there happens a windfall loss, *the payment to the I sector* becomes less than the cost of production in the I sector. The production in the I sector cannot decrease very rapidly. It

decreases only gradually, because it takes a while for the information of a demand reduction for the I goods to get known to all through the production process in this sector. It means that the cost of production continues to be paid at the same level as before. Therefore the I sector cannot help but borrow the excess of the cost of production over the payment to the I sector.

It is the firms in the final stage of production of I goods that first come to know the reduction in demand for the I goods, and it is also these firms that start to decrease production first. But they usually cannot decrease production at the same rate as the payment to the I sector decreases, because these firms in the final stage of production do not add as much value as the whole process in the I sector does. These firms in the final stage of I goods production is faced with the reduction of payment as a decrease in the revenue to them which corresponds to all the value added in the stages of production all through the sector. Therefore the firms in the final stage of production can only reduce their own employment which constitutes only a small proportion in the initial revenue reduction. At this stage employment in the I sector has not yet reduced by the full amount of the initial reduction in the payment to the I sector. It may be very soon that the firms in the final stage of production reduce the order for the half-products to which they add value. However they have to pay to the firms in the preceding stages in the I goods production the amount of the value of half-products they already have ordered, because the half-products have to be pre-ordered to be supplied to them since it takes a while to produce them. Therefore they will have to borrow the excess of the amount that they have to pay to the firms in the preceding stages over and above the amount they can pay out of the now reduced revenue they receive from the sales of I goods.

This is the reason why the I sector has to borrow the amount of the windfall loss. The assumption that the firms do not hold money stock makes it impossible for them to finance the windfall loss out of their own stock of money.

About windfall profits I assume that they are not paid as dividends, or paid for any kinds of goods. It is the same thing to assume that windfall profits stay within the firms. Moreover I assume that windfall profits is not used by the firms to finance any increase in employment or to finance windfall losses afterwards. This assumption is made only for the sake of analytical simplicity.

(5) *Transactions in the Loan Market and the Rate of Interest*

(5-1) *A Graphical Exposition*

Let's assume that the economy is in full equilibrium so that the eqs. (1) and (2) are satisfied. In *Fig. 1,* there are depicted the

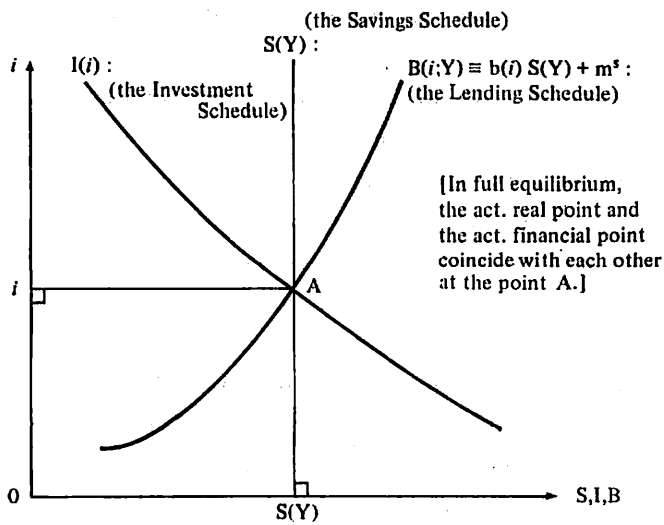

Fig.1 (The Full Equilibrum Situation)

schedules I(i) or the investment schedule, $b(i).S(Y)+m^s$ or the lending schedule and S(Y) or the savings schedule, on the plane with the axes measuring the amount of loan and the rate of interest. We know that I(i) is a downward sloping curve, and that $b(i).S(Y)+m^s$ is an upward sloping curve, but that S(Y) is a vertical line, since these curves are depicted with the actual income assumed constant. The three curves intersect at the same point A, since the economy is in full equilibrium or in general equilibrium. Remark that the lending schedule depends on the level of income: it shifts when the income changes. The investment schedule is assumed not to shift when the income changes. The savings schedule is assumed to shift when the income changes. The initial equilibrium of the rate of interest and the actual income are denoted by i and Y, respectively. I assume in the following disequilibrium analysis that the economy is initially in full equilibrium, so that its position is just like in *Fig. 1.*

Then let's imagine that some of the curves have shifted so that

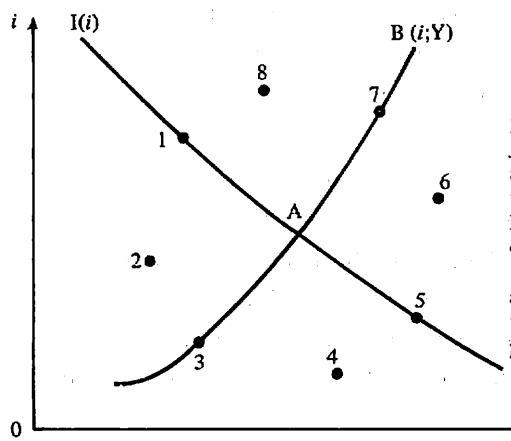

Fig. 2 (Various Disequilibrium Situations in the Loan Market)

the economy has been taken out of equilibrium. There are two sets of cases of disequilibrium: the case when the eq. (1) is not satisfied, and the case when the eq. (2) is not satified. Let's consider the former case, or the case of disequilibrium in the market. There are infinitely many disequilibrium positions in the loan market, but they can be classified into 8 cases depicted in *Fig. 2.* The classification is done in such a way as to distinguish whether the *actual* loan transaction is located to the right or left of the investment or the lending schedules, and whether it is located on either of the curves or not.

In disequilibrium in the loan market, I assume the following behavioral assumptions as to how the actual loan transaction point behaves in each case. The assumptions are a comprehensive statement of the actual transaction point's behavior, which applies to the disequilibrium analysis in the following section.

(5-2) *Behavior of the Loan Transaction*

Let's use the following abbreviations: *the act. LT.* instead of the actual (additional) loan transaction, *the act. rate* instead of the actual rate of interest, *the int. I.* instead of the value of the investment schedule at the act. rate I(i), *the int. Le.* instead of the value of the (additional) lending schedule at the act. rate and the actual income, $b(i).S(Y)+m^s$.

The act. LT. may be different from the int. Le. or the int. I: the act. LT. can be carried out even when it is different from the amounts which are desired by the lenders or borrowers at the act. rate and the actual income. The act. LT. exists even when the int. Le. and the int. I. are not equal to each other: the act. LT. can be carried out even when there is a gap between the int. Le. and the int. I.

However I assume moreover that the act. LT. cannot be greater

than either of the int. Le. or the int. I. except for a very short time: it must usually be less than or equal to both of the int. Le. and the int. I. The reason to adopt this assumption is obvious: both demand and supply put upper bounds to actual transaction because nobody will lend or borrow more than what he intends to lend or borrow, even though it may happen that he cannot actually lend or borrow up to the amount that he desires to lend or borrow. And this reasoning also applies to the additional lending-borrowing transactions with which we are concerned here.

By this assumption the cases 4 to 8 in *Fig. 2* are obviously unrealistic to hold for a long time. I assume therefore that in these cases 4 to 8 in *Fig. 2* the act. LT. has to be discretely reduced at least until it reaches the smaller of the int. Le. and the int. I. at the act. rate, whereas the act. rate stays constant until the discrete quantitative adjustment finishes. In any case of 4 to 8, the actual point depicting the act. LT. and the act. rate discretely reaches the position like that depicted as the cases of 1, 2 and 3 in *Fig. 2.* It is assumed that it is only after the quantity reduction of loan transaction that the act. rate comes to be adjusted: the shift(s) of the loan supply or demand curve(s) *to the left* is first revealed as the strengthening of quantitative constraint(s).

In the case 2 in *Fig. 2,* there are two cases: the case where the act. rate is higher than the rate at the intersection of the two curves, and the case where the act. rate is lower than or equal to the rate at the intersection. In either of these cases I assume that the act. LT. jumps to the smaller of the int. Le. and the int. I. and that the act. rate stays at the same level at least until this jump is finished.

(5-3) *Changes of the Rate of Interest*

If the economy is in the case 1 in *Fig. 2,* the lenders will bid

down the act. rate to the level of the intersection of the two curves, because they are not satisfied by the act. LT. The borrowers will accept the fall of the act. rate, *because they are indifferent between the original point and the intersection point, both being on the investment schedule.*

If the economy is in the case 3 of *Fig. 2,* the reverse will happen. The borrowers will bid up the act. rate and the lenders will accept it.

I assume that such changes of the act. rate are discrete or abrupt and not continuous. The act. LT. changes discretely corresponding to the change of the rate. In summary the actual financial point in the cases 1 or 3 in *Fig. 2* is assumed to jump to the intersection of the investment and lending schedules.

(6) *Definitions of Investment and Savings*

(6-1) *The Intended Investment and the Payment to the I Sector*

In our model the intended investment is defined by I(i), where i denotes the act. rate. The payment to the I sector cannot exceed the int. I., because the economic agent to invest and to pay to the I sector is the same: the firms in both sectors.

Since we assumed (see p. 11 above) that the firms can obtain however much investment goods they want as far as they can finance it, or in other words that there is a plenty of inventory of investment goods so that when there is an increase in payment for the goods, there is that much of the goods forthcoming, the payment to the I sector is always equal to the value of the increment of the total capital. It is equal to the value of investment goods which is sold by the I sector, and it contains a part corresponding to the unitended fall in inventory of investment goods. The

quantity of the goods sold by the I sector is equal to the increase in the real capital which is in use or ready to use in both sectors' production, and it is always equal to the payment to the I sector which is less than or equal to the int. I. (See also P. 10–13.)

(6-2) *The Intended and Actual Savings*

In our model there is not any distinction between the intended and actual savings. The actual savings, or *the act. S.* for brevity, is defined by S(Y), where Y denotes the actual income. Since Y is always equal to the total production and C(Y) is always equal to the production of consumption goods, S(Y) which is defined by Y−C(Y) is always equal to the production of investment goods. Therefore the act. S. is always equal to the production of investment goods, and hence to the act. I., as seen just below.

(6-3) *The actual Investment*

In our model the actual investment, or the act. I. for brevity, is defined by the production of investment goods. The production of investment goods is always equal to the act. savings, and so the act. I. is always equal to the act. S.

The definition of the act. I. is based on the notion that the unintended fall in inventory in the I sector is 'disinvestment' from the I sector's point of view. The sale of investment goods from the I sector to both sectors is 'investment' from both sectors' point of view. Therefore the act. I. is equal to the payment to the I sector *less* the 'disinvestment' or the unintended fall in inventory.

(6-4) *The Actual (Additional) Loan Transaction (The Act. LT.)*

The act. LT. (the actual lending-borrowing or loan transaction) is always equal to the sum of the payment to the I sector and the windfall loss. If there is no windfall loss, it is equal to the payment to the I sector only. Symbolically

(the act. LT.)= (the payment to the I sector)
plus (max.(0, the windfall loss)).

The act. LT. consists of two parts: the part of the borrowing that is borrowed by the two sectors to pay to the I sector for goods, and the part of the borrowing that is borrowed by the I sector to pay to the productive factors in the I sector for the part of the productive service corresponding to the windfall loss. The second part of these exists only when there is windfall loss, and does not exist when there is windfall profit.

(7) *Real Quantity Adjustment*

Whenever there is an excess of the actual payment to the I sector over the act. I., there is the unintended fall in inventory of the I goods of the same amount as the excess, and whenever there is an excess of the act. I. over the actual payment to the I sector there is the unintended rise in inventory of the same amount as the excess.

When there is an *unint. fall in Inv.* (for brevity instead of *the unintended fall in inventory of the I goods*), the production of I goods, or the act. I., is assumed to increase continuously up to the payment to the I sector.

When there is an *unint. rise in Inv.*, there arises the corresponding windfall loss of the same amount, which the I sector must finance by additional borrowing. There arises two cases: (1) when the windfall loss can be financed by borrowing, namely when there holds [(the payment to the I sector) plus (max. (0, the windfall loss)] is not greater than (the int. Le.), then the act. I. is assumed to fall continuously down to the payment to the I sector. It means that when the windfall loss can be financed together with the payment to the I sector by the int. Le., the unint. rise in Inv., and

therefore the windfall loss, is assumed to be reduced gradually (or continuously) by a continuous reduction of production.

(2) When the windfall loss cannot be financed, namely the above inequality does not hold, then the act. I. is assumed to fall discretely down to some level at which the windfall loss can be financed together with the payment to the I sector by the int. Le.

(8) *The Priority of Inventory Adjustment to Interest Adjustment*

Finally I assume that the firms in both sectors adjust (1) the inventory, and (2) the borrowing to finance payment to the I sector including adjustment of the act. rate *not* simultaneously. Moreover I assume for simplicity that they adjust the inventory first, and adjust the borrowing to finance payment to the I sector *after* the inventory adjustment is completed. In the case of downward adjustment of the act. rate, I assume that the firms do not accept the fall of the act. rate until the inventory adjustment is completed.

Non-tâtonnement Process Analysis

In this section some cases of autonomous shift(s) of the schedules are dealt: it will be shown how the economy out of equilibrium moves in each case. The fundamental behavioral assumptions are all listed up above, and so the following analysis is a mere application of the assumptions to each case of change. By the help of graphs, the working of our model will become clear in the following exercises.

(1) *The Shift of I(i) to I(i)+x* When I(i) shifts to I(i)+x, the situation of the case 3 in *Fig. 2* arises: the act. point is on the lending schedule but there is excess demand for loan. *Fig. 3* shows this act. point by A. The point B is the intersection of the two schedules, demand for and supply of loan. This figure represents

the situation just after the shift. What happens? Firstly the act. rate is bid up discretely by the firms, the act. LT. rises also discretely. The payment to the I sector rises discretely, and the int. I. rises from I(i) to I(i')+ x, also discretely, where i and i' denote the act. rate before and just after the shift, resp.

However the act. I. has not started to rise *just after* the shift. There appears the windfall profit in the I sector. Is this truly an actual situation? The essential point here is that the households are willing to lend a *greater* amount out of the *same* amount of savings if the firms bid up the act. rate, and that *they are willing to do so out of the act. savings forthcoming from the income which is at the same level just after the shift as that before it.*

Since I assumed that m^s is always fully lent to the firms to finance investment, the act. LT. is increased by the same amount as that by which the households increase their lending.

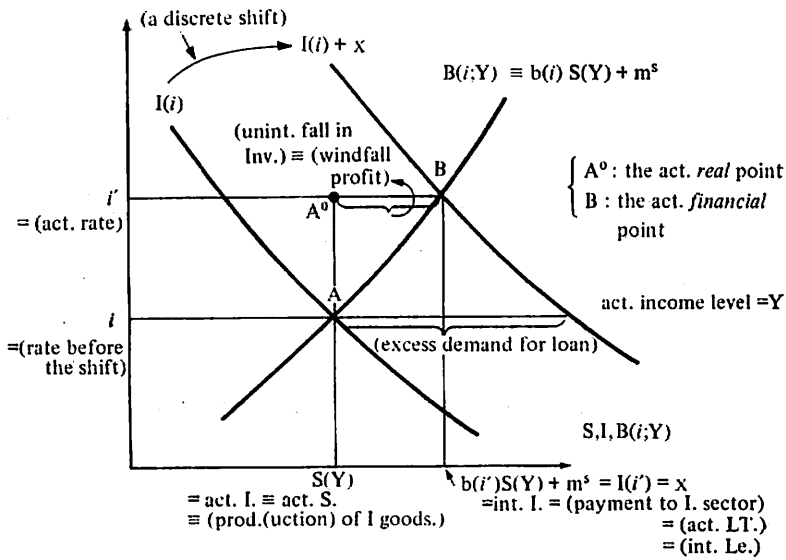

Fig. 3 (The situation just after the shift)

By the rise of the act. rate the act. LT. becomes able to rise above the level of the act. S. just after the shift, and *thus the int. I. actually diverged from the act. I. just after the shift.*

On the real side there happens the unint. fall in Inv. and the I sector sells the greater quantity of the I goods to both sectors. The greater increase in the productive capital is realized just after the shift, but the income has not started to change because there is the output lag. The act. S. therefore has not changed yet.

Fig. 4 depicts the situation in a little while after the shift. The point A′ denotes the co-ordinates of the act. S. and the act. rate. The act. rate has risen to i′.

The act. S. has been rising because the I sector has been increasing employment, since there has been unint. fall in Inv. Since I assumed that production of consumption goods adjusts to any change in demand in a moment, *the income has been rising the income multiplier times as fast as the employment in the I sector*

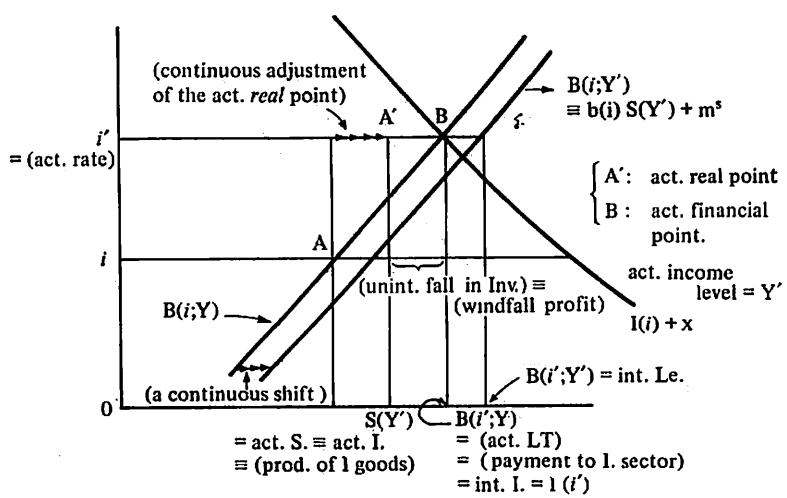

Fig. 4 (The situation a little while after the shift)

has been rising. Of course the employment in the C sector has been rising at the corresponding speed.

The payment to the I sector has been at the point B, since I assumed that the firms in both sectors do not adjust the borrowing to finance payment to the I sector until the unint. change in Inv. is adjusted away completely. In *Fig. 4,* the I sector is still obtaining the unint. fall in Inv., but it has been reducing, and is going to reduce until the point A′ reaches the point B.

As the employment increases, the act. S. rises from the level S(Y) to the level S(Y′), and *therefore the lending schedule shifts continuously from B(i; Y) to B(i; Y′),* where Y′ denotes the income at the time of *Fig. 4* The act. LT. is going on at the level of the point B, and it follows that there arises a notional excess supply of loan because the households became more willing to lend as the act. S. rose. The shift of the lending curve has been continuous

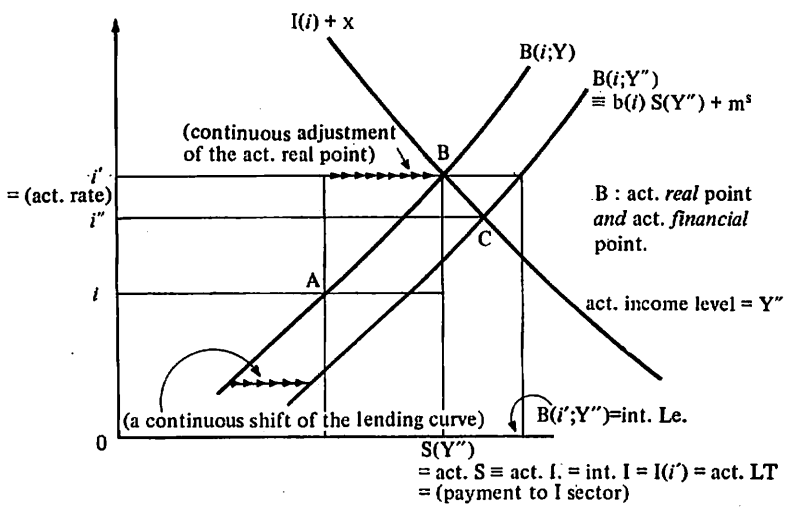

Fig. 5 (The situation after the completion of the first stage of inventory adjustment)

corresponding to the continuous rise of employment.

See the next graph *Fig. 5*. The act. S. reaches the level of the point B and the act. S. becomes equal to the int. I. However the int. Le. has risen to the level B(i'; Y''), where Y'' denotes the income at the time of *Fig. 5*. Since there is a notional excess supply of loan, the economy has entered the situation of the case 1 of *Fig. 2*.

See *Fig. 6*. Here the lenders bid down the act. rate to the level i'', and the int. I. rises discretely to the level of the point C. Thus the act. LT. rises but the act. S. stays at the level of the point B. Again, *the financial rise precedes the real rise of income, and correspondingly the rise of the int. I. precedes that of the act. I.*, but the act. rate falls this time.

There arises a discrepancy of the int. I. over the act. I., and the unint. fall in Inv. happens. The consequence of this situation is similar to that of the situation just after the shift, except that the

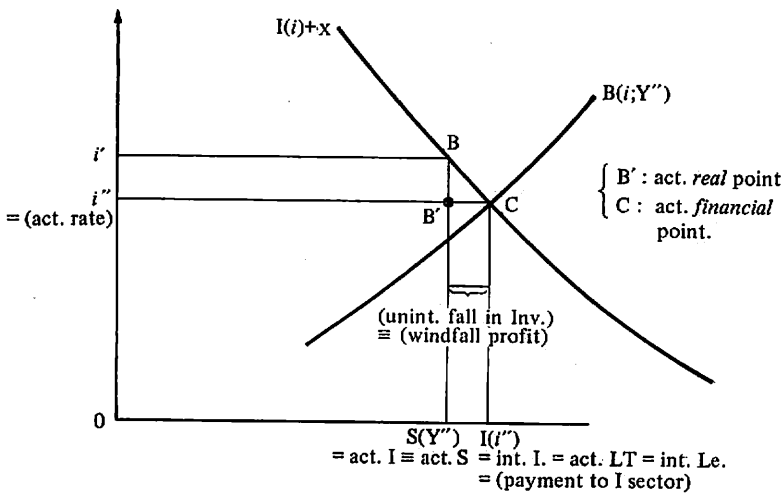

Fig. 6 (The situation just after the *discrete* fall of the act. rate from i' to i'')

direction of the act. rate's change is different.

The lending curve shift again, and *the sequence of the chase of the act. S. towards the int. I. which in turn chases the int. Le. is convergent, because the marginal propensity to lend (which is defined here by the proportion that the households are willing to lend out of any small increment of the income) is always less than the marginal propensity to save, namely b(i).s is always less than s.*

(2) *The Shift of I(i) to I(i)−x* See *Fig. 7,* which depicts the situation just after the shift of I(i) to I(i)−x. How is the shift of the investment schedule revealed? It is revealed by the payment to the I sector falling by the amount x. The firms in both sectors reduce the quantity of increase in productive capital in use or ready to put in use in production. But why is not the act. rate bid down to the level of the point D, or the intersection of the lending and investment schedules after the shift? Because *the shift of demand*

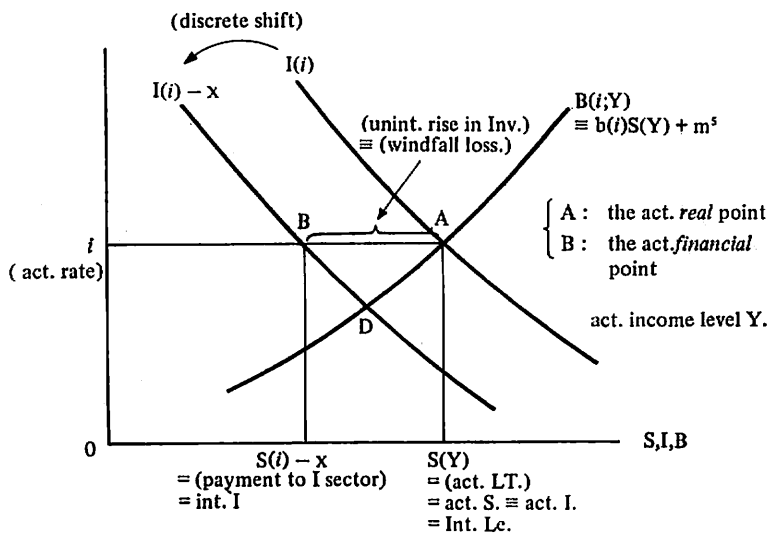

Fig. 7 (The situation just after the shift)

is not known to the lenders beforehand, and therefore the lenders do not have any motivation to try to change the act. rate until the information of the shift of the investment demand is fully conveyed by the signal of the fall of the payment to the I sector.

There arises the unint. rise in Inv. of the amount x, and the corresponding windfall loss of the same amount. Since the I sector does not change employment just after the shift, and it is assumed not to have any stock of money, it has to borrow the money needed to fill the gap of the windfall loss. The reason is that the revenue to the I sector is less than the cost of the I sector by the amount of the windfall loss. However it can borrow that much from the lenders *since the int. Le. is still equal to the sum of the int. I. (=I(i)−x) and the windfull loss (=x) just after the shift.*
Thus the act. LT. stays just after the shift.

See *Fig. 8.* The total employment reduces as employment in the I sector falls. The I sector reduces employment in order to

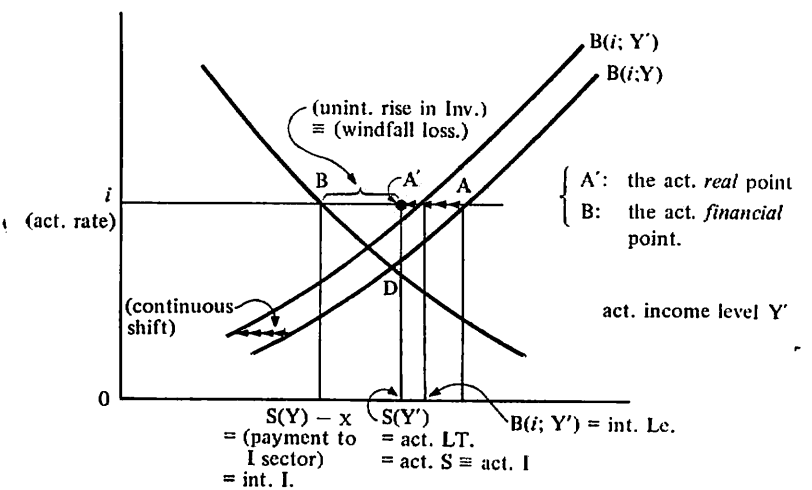

Fig. 8 (The situation a little after the shift)

reduce the unint. rise in Inv. As the unint. rise in Inv. falls, the windfall loss falls, and so the act. LT. falls. As the income falls the act. S. falls and so the int. Le. falls, because the lending curve shifts continuously as the act. S. changes. However *the speed of reduction of the int. Le. is smaller than that of the act. LT., and so there is no fear of an excess of the act. LT. over the int. Le.* The act. rate does not change until the inventory adjustment is completed.

Eventually the windfall loss becomes zero, when the act. I. becomes equal to the int. I. This situation is depicted in *Fig. 9*. The act. LT. and the act. rate are at the levels of the point B. There is a notional excess supply of loan, and the situation belongs to the case 1 of *Fig. 2*. The consequence of this situation is similar to that explained in the case of the shift I(i) to I(i)+x.

(3) *The Shift of m^s to m^s+x* See *Fig. 10*. The lending schedule

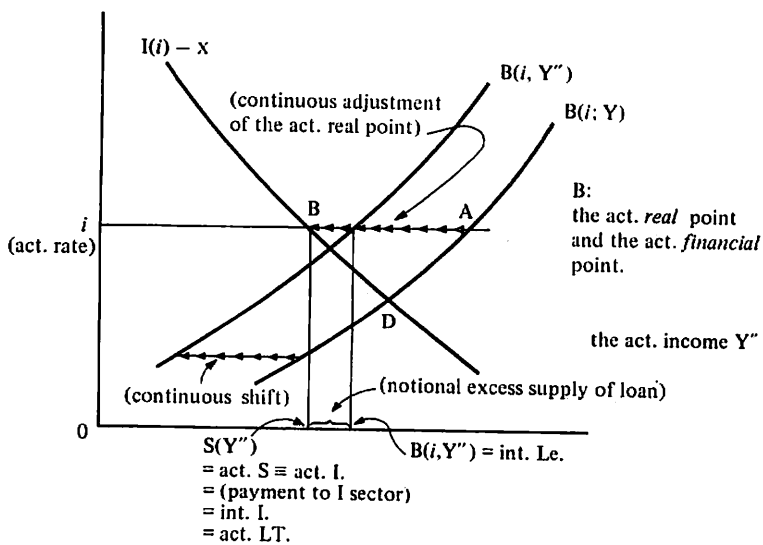

Fig. 9 (The situation after the first stage of inventory adjustment is completed)

shifts to the right, but the act. LT. does not rise by the full amount x, because the firms won't borrow more than the level of the point A as long as the act. rate is i. The situation is in the case 1 in Fig. 2. *It is not the borrowers but the lenders that make the act. rate fall to i', because the lenders are unsatisfied at the point A, whereas the borrowers are satified there since the point A is on the borrowers' schedule.*

However after the act. rate falls, the firms increase the borrowing. Thus the act. L.T. and the act. rate come to the levels depicted by the point B. This movement of the actual point from A to B is assumed to be done in a moment or discretely. The act. I. does not change just after the shift, and there arises the unint. fall in Inv. The I sector begins to raise employment and the act. S. rises from the level A' towards the level of B. Correspondingly the int. Le. rises. These rises are gradual or continuous, and continue until

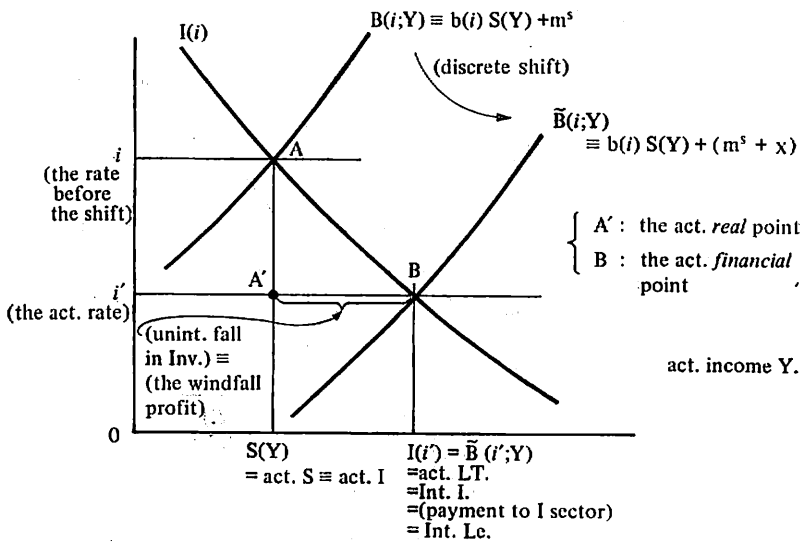

Fig. 10 (The situation just after the shift)

the act. S. reaches the level of the point B, when the situation is like *Fig. 11.* In the meantime the act. rate has not changed from i' by the assumption of the priority of inventory adjustment to interest adjustment. The situation is in the case 1 in *Fig. 2.* The similar effects happen thereafter, and the sequence is convergent.

(4) *The Shift of m^s to m^s-x.* The lending schedule shifts to the left by the amount x. See *Fig. 12.* In this case the effect is drastically different from those in the cases dealt with above: the financial contraction affects the economy in a very unstable way compared with the other cases of exogenous change. One of the reasons for it is that *the shift of the lending schedule to the left is an effective strengthening of a constraint upon the effective demand.*

The shift of the schedule is revealed at first by the fall in the act. LT. from the level of the point A down to that of the point B.

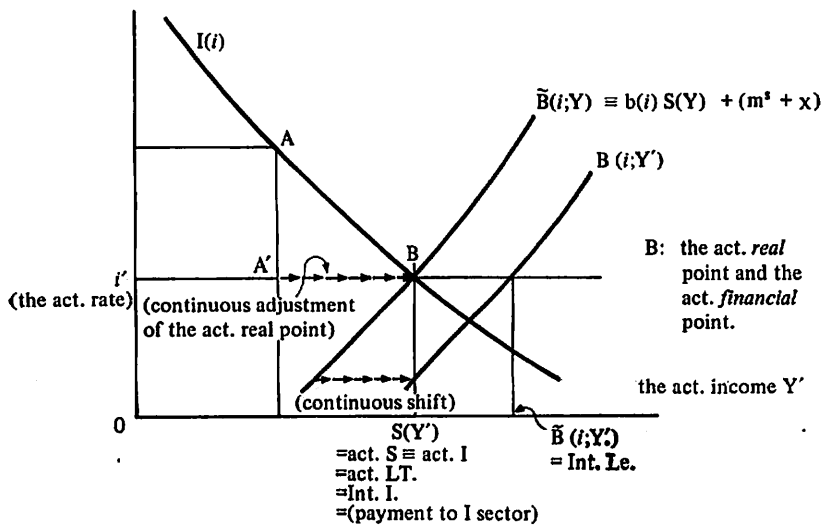

Fig. 11 (The situation after the completion of the first stage of inventory adjustment)

The economy at first comes to a situation like the case 3 in *Fig.* 2. The act. rate does not rise to the level of the point D, because the shift of the lending schedule is not known to the firms beforehand and the firms know the shift only after the shift is revealed in the form of the reduction of the act. LT. There arises a windfall loss in the I sector because the payment to the I sector has fallen as the act. LT. has fallen, and the cost of production of the I goods stays at least for the moment of the windfall loss. However since the firms are assumed to have no stock of money, *the I sector cannot cope with this windfall loss, because the lenders won't lend more than the level of the point B. Therefore the I sector cannot help but reduce employment as fast as possible by the amount of the windfall loss,* but then the demand for C goods contracts in the multiplier sequence, and the total employment falls by the income

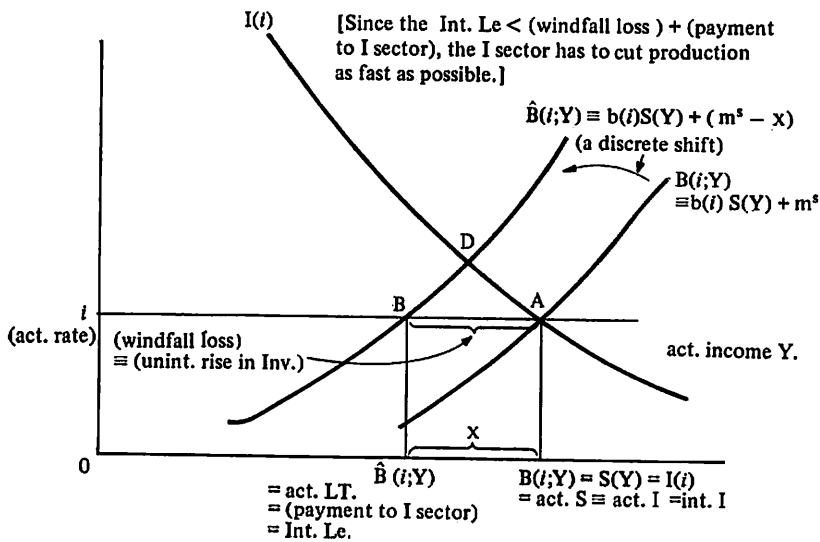

Fig. 12 (The graph for explanation as to what will happen *in the first transitional stage* just after the shift)

multiplier times the fall in employment in the I sector. The fall in the total employment in this first stage of adjustment is completely different from the rise in the total employment in the case of the shift of m^s to m^s+x in the following respects: (1) the speed of change of the total employment is very fast in this case, because the windfall loss is not backed up financially, (2) the act. rate changes only after the act. LT. begins to fall, and therefore the fall in the act. LT. is the full amount of x, whereas in the previous case (of the upward shift of m^s) the rise in the act. LT. in the first stage is less than x.

However the act. LT. falls even more than that. In fact as the act. S. reduces towards the level of the point B, the int. Le. falls from the level of the same point B and so even when the act. LT. reaches the point B the act. LT. is greater than the int. Le., which is a contradiction or at least an unusual situation. The reason is that the act. LT. is usually equal to, or less than the int. Le. Therefore the act. LT. has to fall more apart below the level of the point B. Then the windfall loss arises again and employment in the I sector is reduced again very fast, because the int. Le. is less than the act. LT. which in turn is less than the act. S. Thus the lending schedule continues to shift to the left of the point B, until the following equations hold:

$$b(i).S(Y')+(m^s-x)=(\text{the act. LT.})$$

which means that the int. Le. (the left-hand side of the equation) is equal to the act. LT, and

$$(\text{the act. LT.})=S(Y').$$

These equations hold at the point C in *Fig. 13*.

Before the shift it held that

$$b(i).S(Y)+m^s=S(Y).$$

Therefore $S(Y)-S(Y')=x/a(i)$, where $a(i)=1-b(i)$.

Thus the following statement holds: *the initial fall in the incremental cash supply (demoted by x) causes in the first stage of adjustment the sudden reduction of the act. S. of the amount x/a(i), where 1/a(i) may be called as the monetary contraction multiplier.*

Since 1>a(i)>0, the multiplier is greater than 1.

Moreover the initial fall in the incremental cash supply (denoted by x) causes in the first stage of adjustment the sudden reduction of employment and income of the amount x/(s.a(i)), where 1/(s.a(i)) may be called as the monetary contraction multiplier of income, which is always greater than the income multiplier 1/s.

The second stage of adjustment is similar to the adjustment described in the case of the shift of I(i) to I(i)+x, because at the

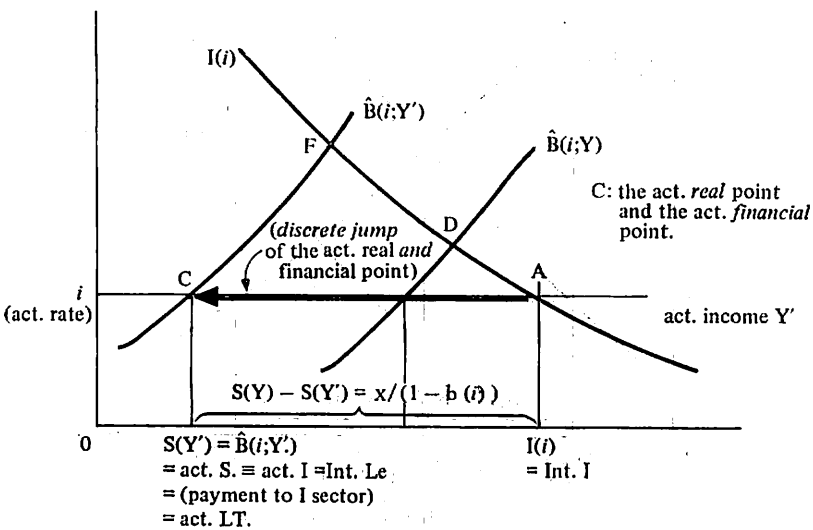

Fig. 13 (The graph for explanation as to what will happen *in the first transitional stage* just after the shift)

point C the int. I. and the act. I. are equal. The economy has just jumped from the point A to this point C, and the transition has been a very rapid contraction of employment and the act. LT. Theoretically this process is a litrerally sudden jump or discrete change, and this is a logically necessary consequence of the theoretical assumptions set forth above.

From the point C, the act. LT. jumps up, as the act. rate does so, and the act. I. follows it. The economy comes to the phase of upward recovery. As long as I(i) does not shift the recovery continues, whereas the act. rate first rises and then turns to fall. The final position of the economy just after the shift is depicted in *Fig. 14*. The consequent adjustment is similar to that in the case of the shift of I(i) to I(i)+x.

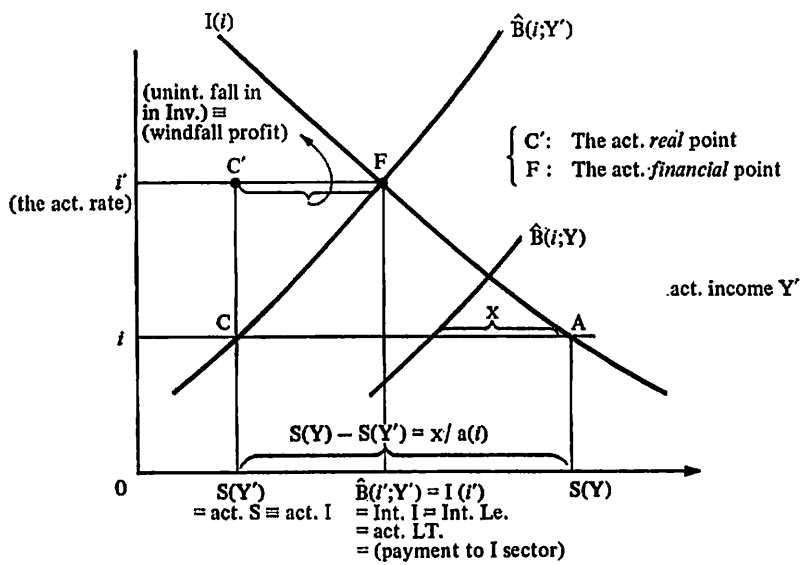

Fig. 14 (The graph to show *in summary all* of what will happen *just after* the shift)

(5) *Other Cases of Shift(s)* There can be infinite cases of combinations of shifts of the schedules, and each of these cases has a unique path on which the economy carried out of equilibrium by the shift(s) converges to the new equilibrium that the schedules after the shift(s) determine. The behavioral assumptions set forth above will be sufficient to specify uniquely the way in which the economy behaves in any of these cases of shift(s) including those of the consumption schedule, C(Y).

Summary and Conclusion

The essential character of the model set forth above is its loanable funds theoretic nature: the assumption that the rate of interest equilibriates not the stocks of supply of and demand for money but the additional flows of demand and supply of loanable funds. Whether it is an admissible assumption or not is still a controversial matter, but in this paper I dare to take it up in order to highlight the interaction between the real and financial aspects of the flows of transaction in the macroeconomy. The benefit which accrues from this apparently bold assumption does not seem to be superseded by the cost due to the controversialness.

The following is made clear in the analysis above: the leftward shift of the investment curve, or the contraction of the firms' marginal efficiency of investment, does not influence the economy in such an asymmetrical way to the rightward shift as does the leftward shift of the (additional) lending schedule: and when the lending curve shifts to the left with the investment curve constant the total employment and income is affected critically, i.e. pulled down precipitantly by the amount of x multiplied by $1/(a(i).s)$, where a(i) denotes the proportion of the savings, which stays in the

form of cash after additional lending, and s denotes the usual marginal propensity to save, both being less than one half, and usually much less than one third, and x denotes the initial shift of the curve. In the case of the shift of the lending curve to the right, the total employment and income is not affected so unstably as in the case of leftward shift of it. It is certain that even in the case of leftward shift of the lending schedule the *final* position of the short run adjustment is symmetrical to that in the case of rightward shift of it, but it is remarkable that the *immediate* effect is drastically asymmetrical between these two cases. Such asymmetry does not arise in the cases of shift of the investment curve.

It follows from this analytical result that the financial contraction affects the total employment and income more strongly than the contraction of the firms' investment schedule: when the households or banks contract their intended schedule to lend, or when the lending schedule shifts to the left by the amount x, then the total production tends to fall by an amount $1/(a(i).s)$ times as much as the x immediately after the shift: or when the government contracts the addtional supply of cash by the amount x without any notice, the total production tends to fall by $x/(a(i).s)$, immediately after the contraction. However such a sudden fall of the production does not happen in the case of leftward shift of the investment curve by the same amount x: the economy adjusts itself down towards the new equilibrium smoothly and continuously. This is also the case when the lending curve shifts to the right: the adjustment of the economy after the shift is smooth and continuous in that case, too.

These considerations may explain why the economic depressions showed such sudden falls of the aggregates, compared with the smooth rises of them in the recovery phases in the business

cycles.

Such an asymmetrical result is essentially based on the assumption that the firms never hold stock of money. It may follow that dropping this highly restraining assumption will at least partly prevent the asymmetry from happening and thus *'stabilize' or cushion the depressing effect of the contraction of the lending schedule,* though is seems difficult to show *explicitly* that this is the case in the framework of the present model.

Glossary

A: *the act. I.*=the actual investment, p. 19.
the act. LT.=the actual loan transaction, p. 19 to 20.
the act. rate=the actual rate of interest, p. 16.
the act. S.=the actual savings, p. 19.
$a(i)$=1—b (i)=the proportion of the actual savings which the households intend to hold in the form of cash, p. 32.

B: $b(i)$=the proportion of the actual savings which the households intend to lend, p. 6, 10.
$B(i;\ Y)$=b (i).S (Y)+m^s=the total (additional) lending schedule together of the households and the government, p. 14, Fig. 1.

C: $C(Y)$=the consumption function, p. 10.

E: *the effective demand for the I goods*=the payment to the I sector.

I: *the int. I.*=the intended investment, p. 18.
the int. Le.=the intended lending, p. 16.
i=the actual rate of interest, p. 6.

M: m^s=the incremental supply of cash, p. 3 to 7, and 9.

P: *the payment to the I sector*=the effective demand for the I goods, p. 10, 12, 18~20.

S: $S(Y)$=the act. S.=the act. I., p. 19

U: *the unit. fall and rise in Inv.*=the unintended fall and rise in inventory of the investment goods, p. 12 and 20~21.

W: *the windfall profit and loss*=the unit, fall and rise in Inv., resp., p. 12~14.

Y: Y=the actual income, p. 7 and 10.

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