THE KEYNESIAN AND CLASSICAL DETERMINATION OF THE EXCHANGE RATE

by

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May 1982

N°82/07

Directeur de la Publication:

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Associate Dean: Research and Development

INSEAD

Imprimé par L'INSEAD, Fontainebleau
France

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DETERMINATION OF THE EXCHANGE RATE *

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MAY 1982

* This note represents parts of a research work supported by the Deutsche Forschungsgemeinschaft and elaborated within its special program on "Inflation and Employment in Open Economies". The author would like to thank the unknown referee for his helpful comments.

INTRODUCTION

The exchange rate is a macroeconomic variable whose determinants depend on the choice of the underlying macroeconomic model. Two criteria can be used for the selection of the appropriate macroeconomic model.

1. By recognizing that the existing macroeconomic models for open economies are still rather simple in comparison to those of a closed economy, one could choose between two extreme cases: the Keynesian assumption of a given price level and the classical assumption of a given employment level. Even though there are intermediate cases between a fixed-price model and a fixed-quantity model, for didactical reasons we shall expose the extreme ones in order to show that they are surprisingly similar with respect to the determinants of the real exchange rate.

2. One-country models are used for small open economies where foreign variables are considered as given and two-country models are constructed when domestic and foreign macroeconomic variables are interdependent. We know from the literature that floating exchange rates isolate the countries from each other only when there is no capital mobility (and by ignoring the Laursen-Metzler effect). Consequently, there must be the highest degree of an international transmission of disturbances in the case of perfect capital mobility. The second aim of the article is to show such an international transmission mechanism of a disturbance, in the traditional terms of an expansionary monetary policy in the home country, under the assumption of perfect capital mobility. Again, it is astonishing that the Keynesian and classical framework are similar with respect to this transmission mechanism: in the Keynesian model the foreign country will realize a decrease of its real national income and in the classical model the foreign country will obtain a fall in its general price level.

In what follows we shall present firstly the Keynesian two-country model for the determination of the real exchange rate and afterwards the classical two-country model; the latter has to differentiate between the nominal and real exchange rate.

Keynesian Approach

The Keynesian two-country model (under flexible exchange rates and perfect capital mobility) has been developed mainly by Mundell (1968) and popularized on a more comprehensive level, for instance, by Dornbusch/ Krugman (1976, pp. 542-548) and Dornbusch (1980, pp. 199-202). Its caracteristic is the mobility of capital which renders possible a disequilibrium in the current account, for example, a surplus in the home country and a corresponding deficit in the foreign country, creating an income expansion in the first country and an income contraction in the second one. This international interdependence of income determination is valid a fortiori under perfect capital mobility (in the sense of a perfect substitutability of domestic and foreign financial assets).

The traditional two-country model of the Mundellian type can be written as:

domestic goods market

$$S(y) - I(r) - T(y,y^*,e) = 0$$
$$S_y>0,\ I_r<0,\ T_y<0,\ T_{y^*}>0,\ T_e>0 \qquad (1)$$

foreign goods market

$$S^*(y^*) - I^*(r) + T(y,y^*,e) = 0$$
$$S^*_y>0,\ I^*_r<0 \qquad (2)$$

domestic money market

$$L(y,r) = M$$
$$L_y>0,\ L_r<0 \qquad (3)$$

foreign money market

$$L(y^*,r) = M^*$$
$$L^*_{y^*}>0,\ L^*_r<0 \qquad (4)$$

where S denotes saving, I investment, T the current account surplus, L the demand for money, M the supply of money, y the output, r the interest rate and e the exchange rate - defined as the domestic currency price of foreign exchange, all variables being expressed in real terms. The asterisk stands for the foreign country.

The solution of the above equation system can be conceived analytically in terms of two successive stages even though they are realized simultaneously. (i) The world market for goods [(1)+(2)] and the

world market for money [(3)+(4)] determine the world interest rate and world income. (ii) The distribution of world income is given by the equilibrium condition in the national money markets. In the case that the equilibrium values for r, y and y* imply still a disequilibrium in the national goods markets (for instance an excess supply of goods in the home country which must be equal to an excess demand for goods in the foreign country because of the equilibrium on the world market for goods), a change in the exchange rate will take place which equilibrates the national goods markets. In our example, a depreciation of the home currency arises which increases total demand in the home country and correspondingly, lowers total demand in the foreign country. In this sense, the money market determines national income and the goods market the exchange rate.

In fig. 1, the equilibrium condition of the domestic money market is described by the LM schedule and the equilibrium condition of the domestic goods market by the IS schedule. Given the world interest rate (r_0), the money market fixes the equilibrium value for domestic output (y_0). Assume that there is an excess supply in the goods market such that the exchange rate is at the level U (correspondingly, the foreign country possesses an excess demand for goods). Consequently, the exchange rate will rise until point A by which part of world demand is switched from the foreign country to the home country in order to equilibrate the national goods markets. The positive slope of the IS schedule reflects the assumption that the Marshall-Lerner condition holds, i.e that $T_e > 0$.

In the upper right-hand panel of fig. 1, the IRP-line describes the interest-rate parity

$$r = r^* + \theta \frac{\bar{e}-e}{e} \qquad 0 < \theta \leqslant 1 \qquad (5)$$

where the last term in the above expression illustrates the expected change in the exchange rate. $\bar{e}$ is the exchange rate which is expected to reign in the long-run. The slope of the IRP-line is equal to $\theta\bar{e}/e^2$. At point A, the domestic interest rate corresponds to the foreign interest rate (r_0 = r*) such that $e_0 = \bar{e}_0$. We have included the interest-rate parity in order to show also the immediate effect of an expansionary monetary policy on the exchange rate and the movements of the latter towards its long-run equilibrium value.

An expansionary monetary policy in the home country shifts the LM schedule to the position LM_1. The effect on the exchange rate is described firstly for a one-country model of the type of the small-country hypothesis and later for a two-country world.

One-country model. At the assumed unchanged interest rate r_o, the disequilibrium in the money market will be eliminated by the rise of national income to y_2 creating an excess supply of goods (absorption rises less than income). The latter will be reduced to zero by the depreciation towards $\bar{e}_2$ according to the IS line. Assuming that individuals fix the newly expected exchange rate of the long-run at the level $\bar{e}_2$ after the monetary expansion has taken place, the IRP-line shifts to the position IRP ($\bar{e}_2$). This rise in output and in the exchange rate is relevant for the long-run.

In the very short-run, there is an interest rate autonomy pushing down the domestic interest rate to r_1. As it is usually done, we assume that financial assets markets adjust quicker to any disequilibrium than goods markets such that there is an immediate movement from A to B in the upper leftward panel of fig. 1. In order to equalize the expected return between domestic and foreign financial assets, there must be an important depreciation (e_1) above the long-run one ($\bar{e}_2$) in order to create an expected rate of appreciation which has to be equal to the interest rate differential (see point B in the upper rightward panel).

The subsequent movement of the domestic interest rate and the exchange rate follows the path from B to C. While there is always a temporary equilibrium in the financial sector, in the real sector exists an excess demand for goods because of the lower interest rate (r_1) and the higher exchange rate (e_1) pushing up national income until y_2. The first capital movements take place at the moment when the depreciation improves the current account because capital flows must be conceived as accomodating any current account imbalance.

Two-country model. If one takes into account a two-country model, the domestic monetary expansion has an effect on the world interest rate by lowering it, for instance, to r_1. Consequently, the adjustment path of the exchange rate and of national income will not be BC but BD (fig. 2). In the long-run, part of the initial excess supply in the domestic money market will be absorbed by a higher demand for money such that the rise in

domestic income will be less in order to equilibrate the national market; see the LM_1 (r_1) schedule and the lower equilibrium income y_1. On the other hand, the excess supply in the national market for goods will be smaller since the lower interest rate rises total demand; see the IS (r_1) schedule. Consequently, the depreciation necessary to equilibrate the national markets for goods will be of a lower size $(\bar{e}_1)$ than in the one-country model (e_2).(1)

As it is well-known from the Mundell model, the international transmission of the domestic monetary disturbance towards the foreign country consists of the reduction of its income. Even though, at the very beginning, an excess demand exists in the foreign market for goods (because of the lower interest rate and because of a higher demand for imports in the home country before the depreciation of its currency), the higher money demand in the foreign country as a consequence of the fallen interest rate cannot be satisfied such that the money demand must be reduced via a lower national income. The excess demand for goods which still exists in the foreign country can only be eliminated by an appreciation of its currency.

Classical Approach

We have restated the Keynesian model of the Mundell type because it can be shown that, in principle, the classical model comes to the same conclusion with respect to the determination of the real exchange rate by the national goods markets and with respect to the repercussion of an expansionary open-market operation in the domestic country on the foreign economy, now in terms of a reduced foreign price level instead of a lower foreign real income. The transmission mechanism is that of a lower world interest rate which pushes up the foreign demand for real cash balances involving a fall in the foreign price level for a given foreign money supply.

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(1) Because the long-run exchange rate will be lower (e_1) than the one of fig. 1 (e_2), the IRP-line shifts less to the right than in the upper right panel of fig. 1 such that the immediate depreciation (e_1 in fig. 1) will be lower. Consequently, the adjustment path towards D may begin at point B' in fig. 2 instead of point B.

The quantity-theoretical model, similar in its simplicity to the Keynesian two-country model of the equations (1)-(4), regards real national incomes as given and dichotomizes the economy into the real and monetary sector. The equation system of the real sector can be written as:

domestic goods market $S(r,w) - I(r) - T(\lambda) = 0$ where $w = a+m$ (6)
$S_r>0,\ S_w<0,\ I_r<0,\ T_\lambda>0$

foreign goods market $S(r,w^*) - I^*(r) + T(\lambda) = 0$
$S^*_r>0,\ S^*_{w^*}<0,\ I^*_r<0$ (7)

domestic market for real cash balances $L(r) = m$ $L_r < 0$ (8)

foreign market for real cash balances $L^*(r) = m^*$ $L^*_r < 0$ (9)

w represents the real value of non-human wealth which is supposed to be composed by equities (a) and (outside) money holdings (m where m = M/P). Real cash balances have been introduced in the saving behaviour along the wealth-saving relationship of Metzler (1951). According to the Patinkin (1965) tradition, their introduction guarantees the determinacy of the general price level. λ denotes the real exchange rate or the terms of trade defined as:

$$\lambda = \frac{e^{p^*}}{p} \qquad (10)$$

i.e as the relation between the foreign prices (P^*) of imported goods expressed in home currency and the domestic currency prices of home goods (P).

The solution of the equilibrium system can be conceived in terms of three analytical stages:

(i) As in the Keynesian case, the interaction of the world market for goods [(6) + (7)] and of the world market for real cash balances [(8) + (9)] determines the world interest rate and the world stock of real cash balances (m plus m^*).

(ii) Under the hypothesis that the national goods markets still remain in disequilibrium, an adequate change in the real exchange rate will provide their equilibrium [equations (6) and (7)] :

$$\underbrace{S(r,w) - I(r) = I^*(r)}_{\text{world market equilibrium}} - \underbrace{S^*(r,w^*) \neq T(\lambda)}_{\text{national markets disequilibrium}}$$

As in the Keynesian framework, an excess supply in the domestic goods market ($S-I > T$) which is necessarily equal to an excess demand in the foreign goods market ($I^* - S^* > T$) will be eliminated by the depreciation of the home currency in real terms, i.e by a rise in λ.

(iii) The model is closed with the monetary sector by the derivation of the price levels for a given domestic and foreign nominal money supply and by the nominal value of the exchange rate according to the relationship between the domestic and foreign price level for a given equilibrium value of the real exchange rate: (2)

$$P = \frac{M}{m} \tag{11}$$

$$P^* = \frac{M^*}{m^*} \tag{12}$$

$$e = \lambda \frac{P}{P^*} \tag{13}$$

In fig. 3, the domestic market for real cash balances is illustrated geometrically by the LM schedule and the domestic goods market by the IS schedule. It is assumed that the equilibrium value of the world interest rate is r_0. At the interest rate r_0, m_0 real cash balances are demanded and they will also be supplied by a movement of the general price level for whatever nominal value of the money supply. The IS schedule has a negative slope (equal to S_w/T_λ) provided that the Marshall-Lerner condition holds ($T_\lambda > 0$). While the domestic money market is equilibrated by the domestic

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(2) In the Keynesian model, the symbol e stood for the real exchange rate. Because the price level is absent (or constant) in the simple versions of a Keynesian model, the nominal exchange rate coincided with the real exchange rate.

price level, any disequilibrium in the domestic goods market is eliminated by a change in the real exchange rate. Thus, for instance, an excess supply of goods at point U involves a depreciation towards point A which increases total demand for the products of the domestic economy. (3)

The initial equilibrium is established at point A. We assume that $P_o = P_o = 1$ such that $\bar{e}_o = \lambda_o$. The interest rate parity of equation (5) holds also for the classical model. It is represented in the upper right panel and its interpretation is identical to that of fig. 1.

As in the Keynesian model, we shall examine the exchange rate effects of an expansionary monetary policy of the domestic country. We consider the impact effect, the intermediate effect and the long-run effect on the exchange rate first within a one-country model and then for a two-country model.

<u>One-country model.</u> Suppose that the expansion of the domestic quantity of money is of the <u>outside</u> money type. The increase in the money supply is assumed to be equal to $m_o m_2$. In the long-run, even in a two-country model, the interest rate would not be affected such that the domestic price level would increase in proportion to the quantity of money.

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(3) Dornbusch's quantity theoretical two-country model (1976) is similar to ours with respect to the saving function. Assuming investment in each country equal to zero, equilibrium in the world goods market and in the national goods markets is realized without any change in the real exchange rate :

$$S(r,w) = S^*(r,w^*) = T$$

This is a possible case to the extent that one uses a one-commodity model for the world economy. Consequently, our model assumes that each country produces a differentiated good such that there is an endogenous relative price between domestic and foreign products.

Another possibility is that of the existence in both countries of (homogeneous) tradable goods and non-tradable goods. An excess supply of goods in the home country (equal to an excess demand for goods in the foreign country because of the equilibrium in the world goods market) does not need to cover exclusively the category of tradable goods - homogeneous or differentiated ones - such that a change in the relative price of tradable and non-tradable goods has to take place in both countries. Under this aspect, λ would represent the relative price between tradable goods (T) and non-tradable goods (N) in the two countries respectively

$[\lambda = (P_N^*/P_T^*) / (P_N/P_T)]$.

Consequently, the change in the long-run exchange rate ($\bar{e}$) will be indicated fully by the purchasing power parity. Suppose that this long-run exchange rate is $\bar{e}_2$, which should also be equal to the expected long-run exchange rate such that the IRP line shifts to the position IRP ($\bar{e}_2$).

The impact effect of the monetary expansion on the domestic interest rate (r_1) and on the exchange rate (e_1) is indicated by point B. Since the financial sector of the economy is assumed to react first to any disequilibrium, there is a fall in the interest rate creating an interest-rate differential which has to be equal to an anticipated rate of appreciation which is brought about by the depreciation towards e_1. To the extent that at the very beginning the domestic price level has still not moved, this depreciation is identical to a depreciation of the real exchange rate (λ_1). At point B in the lower left panel, there is an excess demand for goods because of the lower interest rate and of the higher real exchange rate, both factors pushing up the domestic price level until P_2. The adjustment path towards the long-run equilibrium position is that of BA in the lefthand panels and that of BC in the righthand panels.

We shall now assume an expansion of the domestic quantity of money of the <u>inside</u> type in terms of open-market operations: one part of equities (a) held by the private sector is exchanged against the newly created money. The initial composition of wealth (w) is modified without changing total wealth such that the IS schedule of fig. 3 shifts to the position IS_1 (r_o) by the amount of the additional money $m_o m_2$. This shift takes place under the assumption of a one-country model where the "small country" is not able to influence the world interest rate r_o.

Due to the fact that the long-run equilibrium in the money market must be again at point A in the lefthand panels, the long-run nominal exchange rate will rise also again towards e_2 and the long-run real exchange rate will remain at λ_o which will be demonstrated shortly afterwards.
The impact effect, on the domestic interest rate and on the exchange rate is indicated again by point B. After the impact effect, the domestic price level begins to rise inducing the same adjustment path from B to A in the left hand panels and from B to C in the righthand panels.

Two-country model. If the increase of the money supply takes place in terms of outside money, a two-country model does not add any new information. Since, for the long-run, the interest rate remains unchanged, the adjustment process of the nominal and real exchange rate remains that of the one-country model.

However, in the case of inside money (open-market operations), for the long-run there will be a decline of the world interest rate (even if the domestic country is a small one). The fall in the interest rate rises as well the domestic demand for real cash balances as the foreign demand for real cash balances. Consequently, the increase in the domestic price level is lower than in the one-country model whereas there is also a fall in the foreign price level in order to satisfy the foreign excess demand for real cash balances. In the long run, the nominal exchange rate depreciates by the rise in the domestic price level and by the fall in the foreign price level. Furthermore, if the interest elasticity of the foreign demand for money is higher than the one of the home country, the depreciation of the nominal exchange rate will exceed the rate of increase of the domestic money supply.

As far as the evolution of the real exchange rate is concerned, we shall come to the same conclusion as in the case of the one-country model. Due to the assumption that asset markets react quicker to a disequilibrium than the goods market, the impact effect on the exchange rate is that on the real exchange rate according to the interest-rate parity where the depreciation of the home currency overshoots the long-run exchange rate. From the one-country model we know that a subsequent appreciation will take place accompanied by a rising domestic price level and a rising domestic interest rate. Taking into account a two-country model, after the impact effect has taken place, the foreign interest rate begins to decline which produces a lower interest-rate differential and, by this, a lower expected rate of appreciation of the home currency. This lower expected rate is induced by a subsequent bigger (or quicker) appreciation than the one which is derived in a one-country model.

During the adjustment process towards the long-run equilibrium, the real exchange rate exceeds its long-run value creating a series of current account surpluses in the domestic country. The acquisition of additional foreign assets serves to compensate the loss in wealth due to the rise in

the domestic price level. Similarly, in the foreign country, the increase in wealth as a consequence of the fall in the foreign price level gives rise to a corresponding cumulative foreign current account deficit. When the initial wealth level has been attained in both countries, there will not be any more an excess demand in the foreign goods market and the real exchange rate has to fall to its original level.

Fig. 4 describes the behaviour of the real exchange rate for the home economy. Point B describes the impact effect. In the long-run, the decline in the world interest rate, for instance towards r_1, rises the domestic demand for real cash balances to the amount of m_1 shifting the $LM(r_0)$ schedule to the position LM_1 (r_1). The long-run equilibrium point is D such that the adjustment process is that of the path BD. Due to the lower interest rate, the IS line will shift to the left (not illustrated in fig. 4). The wealth loss m_1m_2 will be compensated by a corresponding acquisition of foreign assets.

The quantity-theoretical model of the Metzler type, modified for the international economy, has an analytical advantage with respect to the Keynesian model because of its explicit consideration of the wealth constraint which gives rise to additional exchange-rate dynamics discovered during the last half of the 1970's; see e.g. Kouri (1976). The improvement in the current account of the domestic country as a consequence of a temporary rise in the real exchange rate implies a corresponding increase in the creditor position towards the foreign country. The wealth loss of m_1m_2 will be matched over time by a wealth gain due to the improvement of the domestic current account provided that savers maintain their wealth target. (4)(5). This latter aspect would imply that the IS schedule (which has shifted already to the left because of the lower interest rate) continues to shift gradually towards point D. (6).

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(4) It should be noted that in the case of outside money operations there is a transitory increase in wealth in terms of a higher amount of foreign assets as a consequence of the depreciation of the home currency during the short-run. However, in the medium-run, there will also be a temporary appreciation in order to eliminate the excess wealth.

CONCLUDING REMARKS

Under perfect capital mobility, the interaction of the world markets for goods and money determines the interest rate as well within a Keynesian frame-work as in a quantity-theoretical one. The difference between both models consists of the role of the national money markets. For the Keynesian approach which assumes, in its simple version, the general price level as given, they fix national incomes, and for the quantity theory operating under the hypothesis of full employment, they determine the national price levels. Both approaches, when they are transposed into the context of the international economy have one essential feature in common: the national goods markets indicate the equilibrium value of the real exchange rate; in addition, in the classical model, after knowing the real exchange rate, the nominal exchange rate results from the relationship of the national price levels.

The present note stated also the effect of an expansionary monetary policy on the real exchange rate and on real income in the Keynesian framework and on the real and nominal exchange rate and the price level in the classical framework, both within a one-country and two-country model.

As far as the long-run effects are concerned, there is a fall in the world interest rate, a rise in domestic income, a fall in foreign income and an increase of the (real identical to the nominal) exchange rate within the Keynesian model. The latter increase is necessary in order to

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(5) It should be noted that we have neglected, in the construction of the IS schedules, the interest-rate effect on wealth (a lower interest rate increases the value of equities) and, by this, on saving. Another shortcoming is the absence of a real-exchange rate induced wealth effect on saving. Because equities (a) are composed of domestic equities (a_1) and foreign equities (a_2), the latter have to be evaluated by the real exchange rate (λa_2). The two types of wealth effects are treated in Claassen (1982).

(6) However, the country will experience a slight appreciation of the real exchange rate because it receives now more interest payments from abroad. Implicitly we assume that, at the beginning, the home country is a net creditor. Consequently, the trade balance deficit must be larger, which is brought about by an appreciation.

eliminate the excess supply in the domestic goods market and the corresponding excess demand in the foreign goods market. For the classical approach, one has to differentiate between outside and inside money operations because only the latter ones affect the interest rate. An expansionary monetary policy of the outside money type produces a corres- ponding increase in the domestic price level and, by this, a rise in the nominal exchange rate leaving all real variables unchanged. When the monetary expansion is conducted with inside money, there is a fall in the world interest rate and the equilibrium value of domestic and foreign real cash balance increases involving a relatively lower rise in the domestic price level and a decrease in the foreign price level. The nominal ex- change rate adjusts in relation to the new national price levels. The real exchange rate, at least in the long-run, remains unchanged because an excess supply in the domestic goods market and the corresponding excess demand in the foreign goods market will be eliminated, at the initial real exchange rate, when the former wealth level has been reconstituted by a cumulative current account surplus in the home-country and by a corres- ponding cumulative current account deficit in the foreign country.

To the extent that one leaves the world of a Keynesian fixed-price model and of a classical fixed-quantity model and that one regards a situation of a flexible quantity <u>and</u> price model, the long-run effects of an expansionary monetary policy must be a mixture of both extreme cases: a rise in the domestic price and output levels, a fall in the foreign price and output levels and an increase in the nominal and real exchange rate. However, this model has still to be constructed.

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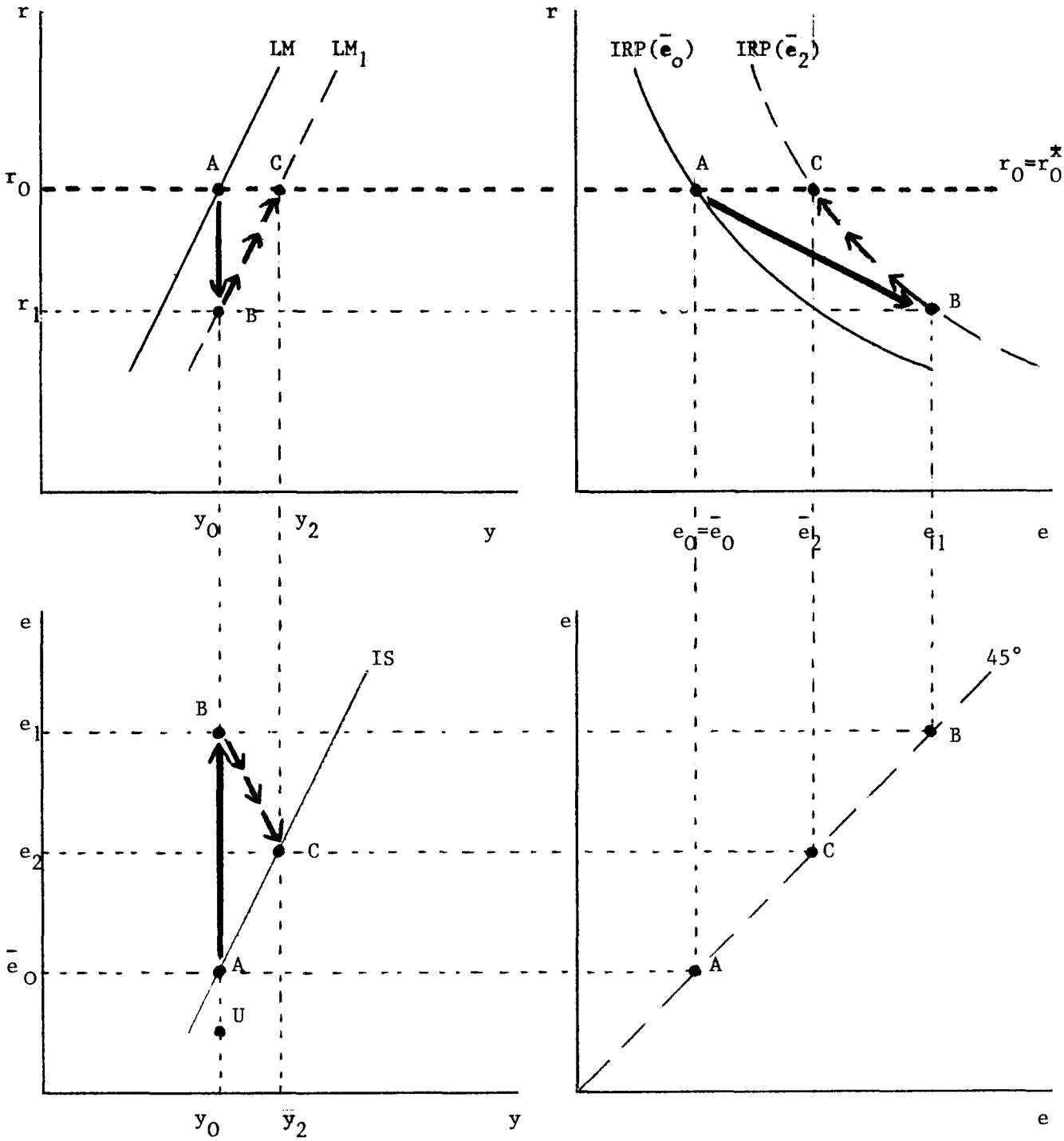
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Fig. 1

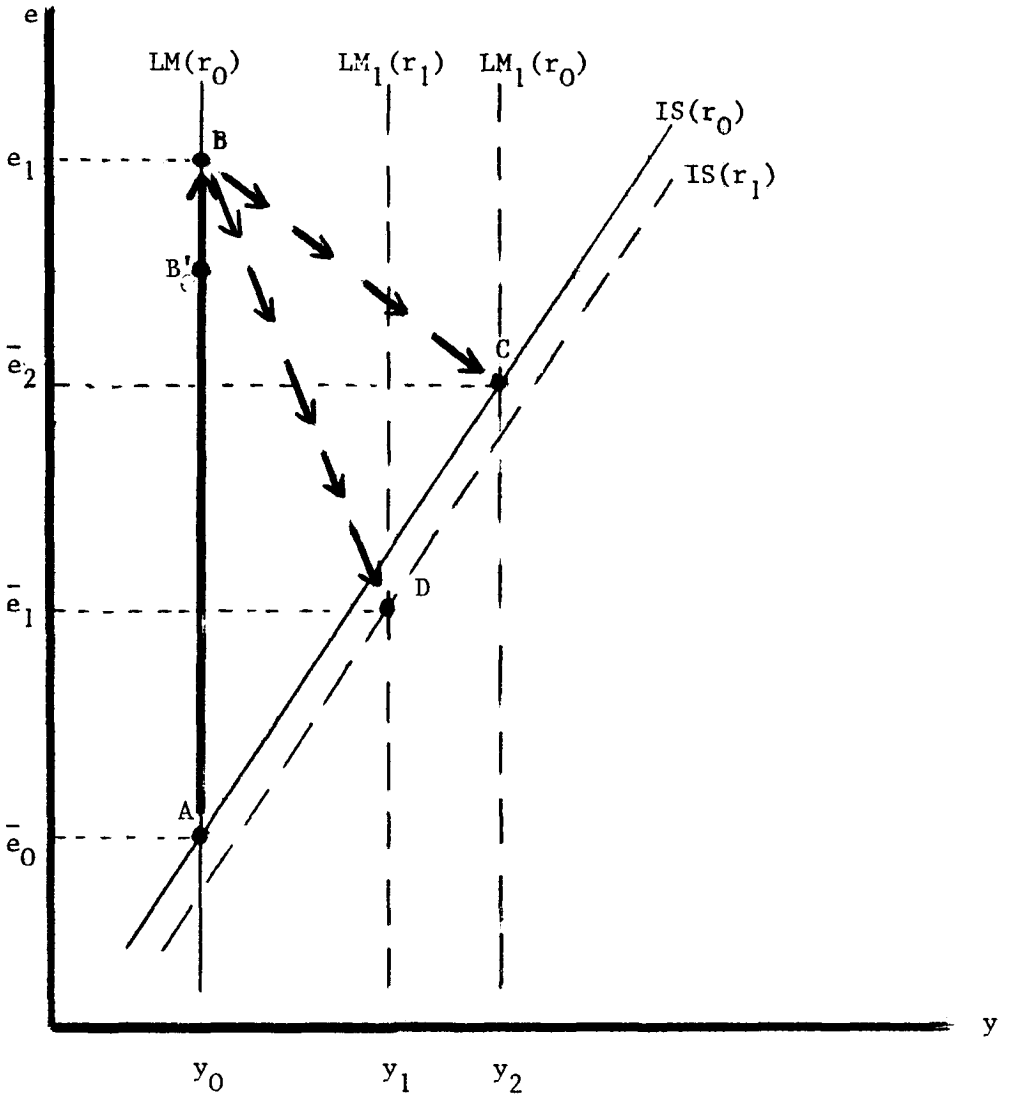

Fig. 2

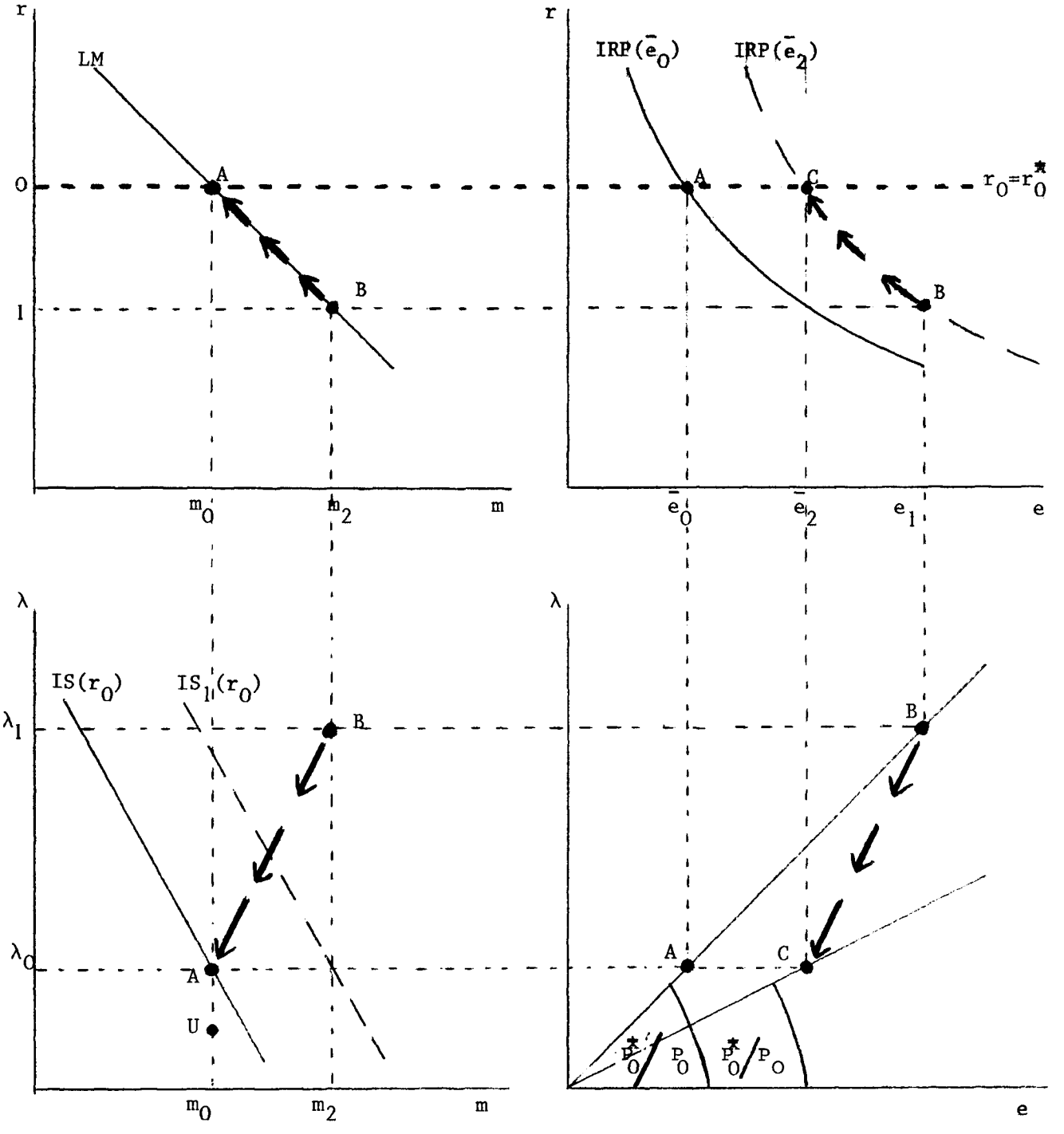
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Fig. 3

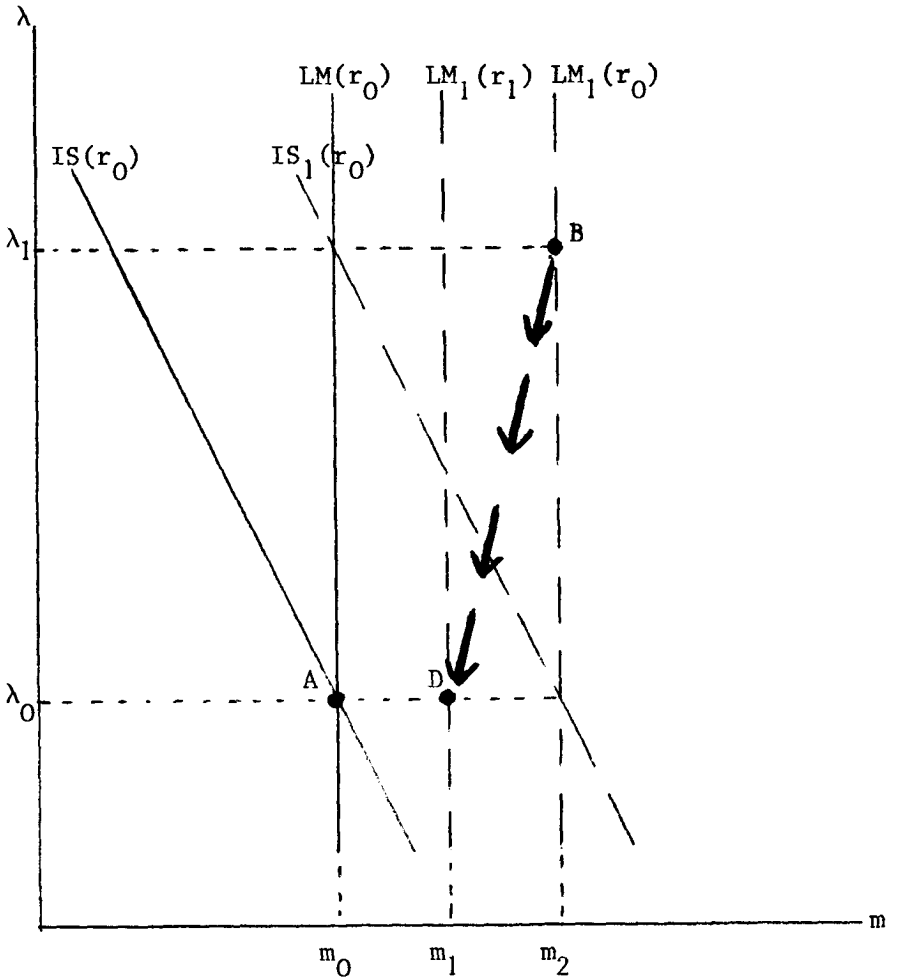

Fig. 4
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