Title	The Mundell-Fleming model revisited : a microeconomics
Sub Title	
Author	大山, 道廣(Ohyama, Michihiro)
Publisher	Keio Economic Society, Keio University
Publication year	2007
Jtitle	Keio economic studies Vol.44, No.1 (2007.) ,p.1- 18
JaLC DOI	
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Notes	
Genre	Journal Article
URL	https://koara.lib.keio.ac.jp/xoonips/modules/xoonips/detail.php?koara_id=AA00260492-20070001-0001

KEIO ECONOMIC STUDIES **44**(1), 1–18 (2007)

THE MUNDELL-FLEMING MODEL REVISITED: A MICROECONOMICS

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First version received July 2006; final version accepted October 2007

Abstract: This paper presents a simple microeconomic foundation for the Mundell-Fleming model, which posits a small country's economy facing a given rate of interest under the flexible exchange rates. We derive the Keynesian aggregate consumption function and the liquidity preference function from the optimizng behavior of the representative consumer, and use them to reformulate the Mundell-Fleming Model, shedding light on some issues of open-economy macroeconomics hitherto ignored or glossed over. For instance, we shall reconsider the celebrated Mundell proposition on the inefficacy of fiscal policy under the flexible exchange rates and show that it is generally untenable in the present model. We shall also investigate the dynamics of the balance of payments adjustment, largely neglected in the conventional literature on the Mundell-Fleming model. (JEL E10 E21 E24)

Keywords: The Mundell-Fleming Modell: Consumption; Liquidity preference; Optimizing Behavior; Balance of Payments Dynamics

JFL Classification Number: E12, E21, E63, F31, F32, F41

1. INTRODUCTION

An open macroeconomic model developed by Mundell (1961) and Fleming (1962), commonly referred to as the Mundell-Fleming Model, has been used extensively to discuss monetary and fiscal policy issues and still occupies a central place in any undergraduate textbook on international macroeconomics. One of the most startling and influential propositions derived from the model is that with perfect capital mobility fiscal policy is powerless but monetary policy is effective in controlling aggregate demand under flexible exchange rates. The model was reinterpreted and dynamized by Dornbusch (1976) to demonstrate that a similar conclusion holds for an economy where the price level is adjusted over time to eliminate product market disequilibria.

Being an open-economy version of the IS-LM model, however, the Mundell-Fleming model has been criticized for its lack of microeconomic foundations. For instance, Branson and Buiter (1982) claimed that the unjustified exclusion of the exchange rate

Acknowledgements. Iam indebted to a referee of this journal for helpful remarks.
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from money-market equilibrium condition and the arbitrary omission of asset market dynamics are the crucial features of the Mundell-Fleming-Dornbusch models responsible for their strong conclusions. Obstfeld and Rogoff (1998) also argued that the important deficiency of these models include their inability to deal with current account dynamics and welfare issues.

This paper attempts to provide a simple microeconomic foundation for the Mundell-Fleming model on the basis of the reformulation of the IS-LM model developed in Ohyama (2002), with a view to overcoming some of its deficiencies mentioned above. In section 2, we formulate a small country's economy facing a given rate of interest and trading its national product for the foreign product in the international capital and commodity markets. In so doing, we assume the existence of the representative consumer and adopt the Robertsonian framework of period analysis with a payment lag. In section 3, we derive the Keynesian aggregate consumption function and the liquidity preference function of the country and formulate IS and LM equations for the present model, which determine the equilibrium home output (national income in terms of the home product) and the equilibrium terms of trade (or real exchange rate) under flexible exchange rates as in the Mundell-Fleming Model. Section 4 develops some comparative statics of the present model. We shall reconsider the Mundell proposition on the inefficacy of fiscal policy under the flexible exchange rates and show that it is generally untenable in the present model. There will arise, however, the possibility of extreme fiscal policy paradox that an increase in the government expenditure may decrease the national income as a result of the accompanying exchange appreciation when the country is a debtor in the international capital market. In Section 5, we investigate the dynamics of the balance of payments adjustment. It will be shown that the stationary state of the economy characterized by the balance of payments equilibrium is potentially stable. The dynamic analysis of monetary expansion also reveals the possibility of exchange-rate overshooting that an increase in the supply of home money gives rise to an immediate sharp depreciation of the home currency inducing subsequent gradual appreciation throughout the process of balance of payment adjustment.

2. DEMAND FUNCTIONS FOR COMMODITIES AND REAL BALANCES

We model a small open economy adopting the basic structure of the extended two-period closed economy developed in Ohyama (2004). There are two countries, home and foreign. They produce and consume distinct national products and engage in free trade in perfectly competitive markets. The home residents trades bonds in competitive international capital markets. For simplicity, the foreigners are assumed to have no interest in holding the home currency or the bonds denominated in the home currency with the consequence that the home residents engage in capital transactions only among themselves. The home and foreign bonds are perfect substitutes in the eyes of home residents so that the home bonds bear the same real rate of interest as the foreign bonds. The home country is small in the sense that it takes as given the rate of interest prevailing in the rest of the world.The central bank of the home country is able to intervene in the

foreign exchange market by buying or selling the foreign bonds at the beginning of each period.

There are many identical consumers in the home country. Every period, they are paid their income in money with one-period Robertsonian lag. In other words, they receive wages and dividends out of the firms' sales in the previous period. They plan how much to spend in the current period and how much to store for future consumption without distinguishing consumption expenditures in different future periods. The representative consumer's utility function is supposed to be of the form:

$$u_t = \ln C_t + (\beta - \gamma) \ln R_{t+1} + \gamma \ln L_t\,, \quad \beta > \gamma, \gamma \geq 0\,, \tag{1}$$

where C_t is her real consumption in period t, and R_{t+1} is her real aggregate consumption in period $t+1$ and in all future periods after that. We interpret R_{t+1} as the real purchasing power she plans to hold in period $t+1$ for future consumption. In the presence of uncertainty about the fulfillment of loan contract, the consumer may wish to preserve part of the real purchasing power in the form of real cash balances. L_t represents the real cash balances and parameter γ indicates the consumer's evaluation of the default risk. In the present model money serves not only as a means of payment but also as a store of value. The real consumption, C_t, is composed of the consumption of the home good, C_{Ht} and that of the foreign good, C_{Ft}, as follows:

$$C_t = C_{Ht}^{\alpha} C_{Ft}^{1-\alpha}\,, \qquad 0 < \alpha < 1\,. \tag{2}$$

Let p_{Hs} and p_{Fs} denote the price of the home good and that of the foreign good in the unit of the home currency in period s ($s = t, t-1$), T_t the tax payment (fixed in terms of the home national product) in period t, X_{t-1} the non-interest real income (or wages and dividends) in period $t-1$, A_{t-1} the home currency value of bonds purchased in period $t-1$, i_{t-1} the nominal rate of interest in period $t-1$, e_t the exchange rate of the foreign currency for the home currency in period t. The representative consumer's consumption of the home and foreign goods in perod t is constrained by

$$\begin{aligned} p_{Ht}C_{Ht} + p_{Ft}C_{Ft} \leq\ & p_{Ht-1}X_{t-1} - p_{Ht}T_t + (1 + i_{t-1})A_{t-1} \\ & + p_{t-1}L_{t-1} - A_t - p_tL_t + \Delta M_t - e_t \Delta F_t\,, \end{aligned} \tag{3}$$

where ΔM_t is the central bank's supply of new money, and ΔF_t stands for the central bank's purchase of bonds denominated in the foreign currency in period t. For instance, $\Delta M_t = \Delta F_t > 0$ means the central bank's purchase of bonds denominated in the foreign currency in period t. We assume that the net value of the home bonds held by the representative consumer is zero. It is basically a simplifying assumption implied by the aforementioned underlying assumption of the model that the foreigners have no interest in holding the home currency or the bonds denominated in the home currency. Thus the home currency denominated bonds issued by the home residents must be held by the fellow home residents, rendering the home net holding of the home currency denominated bonds null. Furthermore, we assume either that the government budget is balanced each period or that the Ricardian equivalence holds and the government bonds is not valued as part of wealth. The home currency value of bonds, A_t, then reduces to

the value of foreign bonds denominated in the foreign currency:

$$A_s = e_s A_{Fs} \quad (s = t-1, t)\,, \tag{4}$$

where A_{Fs} denotes the value of foreign bonds in unit of foreign currencies. As mentioned above, the home and foreign bonds are assumed to be perfect substitutes for each other so that the home interest rate, i_t, becomes equal to the foreign interest rate, i_t^*. This presupposes that the consumer entertains static expectations with respect to the exchange rate.[1] With this assumption, the real purchasing power she plans to reserve for future consumption can be expressed as

$$p_{t+1}^e R_{t+1} = p_{Ht} X_t + (1 + i_t^*) A_t + p_t L_t + p_{Ht+1}^e Z_{t+1}\,, \tag{5}$$

where p_t denote the price level in period t and Z_{t+1} is the discounted real value of expected flows of the consumer's non-interest income in period $t+1$. Superscript e to a variable in period $t+1$ indicates its value expected to prevail in period $t+1$. For instance, p_{t+1}^e is the expected price level in period $t+1$. Assuming that the interest payment from bonds is made in the home currency, the home money supply in period t, M_t is written,

$$M_t = p_{Ht-1} X_{t-1} + i_{t-1} A_{t-1} + p_{t-1} L_{t-1} + \Delta M_t\,. \tag{6}$$

The first term on the right side is the non-interest income arising from the productive activities in period $t-1$ to be paid to the household in period t, the second term is the interest payment, the third term is the nominal value of cash balances carried over from period $t-1$, and the fourth term is the central bank's injection of new money in period t. The initial holdings of the foreign bonds immediately after the central bank's intervention at the beginning of period t, is defined as

$$F_t = A_{Ft-1} - \Delta F_t\,. \tag{7}$$

Combining (3) and (5) and taking notice of (6) and (7), we obtain the integrated budget constraint:

$$\begin{aligned} p_{Ht} C_{Ht} + p_{Ft} C_{Ft} + \frac{p_{t+1} R_{t+1}}{1 + i_t^*} + \frac{i_t^* p_t L_t}{1 + i_t^*} \\ \leq \frac{p_{Ht} X_t}{1 + i_t^*} - p_{Ht} T_t + \frac{p_{Ht+1} Z_{t+1}}{1 + i_t^*} + V_t\,, \end{aligned} \tag{8}$$

where $V_t (= M_t + e_t F_t)$ is the consumer's financial wealth at the beginning of period t. The first-order conditions for utility maximization yield demand functions for the home and foreign goods in period t:

[1] To be more precise, uncovered interest rate parity is assumed to hold, or

$$1 + i_t = (1 + i_t^*) \frac{e_{t+1}^e}{e_t}\,,$$

where e_{t+1}^e is the exchange rate expected to prevail in period $t+1$. Static expectations with respect to exchange rate, i. e., $e_{t+1}^e = e_t$, ensures $i_t = i_t^*$.

$$C_{Ht} = \frac{\alpha}{1+\beta}\left(\frac{X_t + (1+\pi_t)Z_{t+1}}{1+i_t^*} - T_t + \frac{V_t}{p_{Ht}}\right), \tag{9}$$

$$C_{Ft} = \frac{1-\alpha}{(1+\beta)q_t}\left(\frac{X_t + (1+\pi_t)Z_{t+1}}{1+i_t^*} - T_t + \frac{V_t}{p_{Ht}}\right), \tag{10}$$

where $q_t (= p_{Ft}/p_{Ht})$ is the relative price of the foreign good, or the inverse of the home country's terms of trade and $\pi_t (= (p_{t+1}^e - p_t)/p_t)$ is the expected rate of inflation from priod t to period $t+1$. The aggregate consumption expenditure in terms of the home good is proportional to the total wealth measured in units of the home good:

$$C_{Ht} + q_t C_{Ft} = \frac{1}{1+\beta}\left(\frac{X_t + (1+\pi_t)Z_{t+1}}{1+i_t^*} - T_t + \frac{V_t}{p_{Ht}}\right). \tag{11}$$

The assumption that a country's aggregate expenditure in terms of the home goods is independent of her terms of trade is called "expenditure condition" and questioned by Laursen and Metzler (1950) as groundless. Even so, it has been repeatedly employed for simplicity in the related literature. Note that this controversial "expenditure condition" is satisfied in the present model. One can also show

$$\alpha^{-\alpha}(1-\alpha)^{\alpha-1} p_{Ht}^{\alpha} p_{Ft}^{1-\alpha} C_t = \frac{1}{1+\beta} p_{Ht}\left(\frac{X_t + (1+\pi_t)Z_{t+1}}{1+i_t^*} - T_t + \frac{V_t}{p_{Ht}}\right), \tag{12}$$

where

$$C_t = \frac{p_{Ht}}{p_t}(C_{Ht} + q_t C_{Ft}). \tag{13}$$

Thus the price level, p_t, in period t taken for granted thus far is now given a rigorous and precise definition:

$$p_t = \alpha^{-\alpha}(1-\alpha)^{\alpha-1} p_{Ht}^{\alpha} p_{Ft}^{1-\alpha}. \tag{14}$$

The demand function for real balances is also derived from the first order conditions for utility maximization as

$$L_t = \frac{(1+i_t^*)\gamma}{(1+\beta)i_t^*}\frac{p_{Ht}}{p_t}\left(\frac{X_t + (1+\pi_t)Z_{t+1}}{1+i_t^*} - T_t + \frac{V_t}{p_{Ht}}\right). \tag{15}$$

Similarly, the real purchasing power the consumer expects to hold for future consumption is written as

$$R_{t+1} = \frac{(1+i_t^*)(\beta-\gamma)}{(1+\beta)(1+\pi_t)}\frac{p_{Ht}}{p_t}\left(\frac{X_t + (1+\pi_t)Z_{t+1}}{1+i_t^*} - T_t + \frac{V_t}{p_{Ht}}\right). \tag{16}$$

Note that the demand function for real cash bsalances, L_t, is related to the aggregate consumption, C_t by

$$L_t = \frac{(1+i*)\gamma}{i*} C_t. \tag{17}$$

Not surprisingly, the demand for real balances exceeds the aggregate expenditure only if the consumer's fear of default risks is sufficiently high, or to be moreprecise, if $\gamma > i*/(1+i*)$. In what follows we shall consider the temporary market equilibrium of

the home country using these relationships derived from the representative consumer's utility maximization.

3. THE MARKET EQUILIBRIUM UNDER CAPITAL MOBILITY

In order to formulate the market equilibrium of the economy, it is convenient to rewrite demand functions for commodities and real cash balances using the concept of personal income rather than non-interest income. The national income in period t, denoted by Y_t, is defined as the sum of the consumer's non-interest and interest incomes:

$$Y_t = X_t + \frac{i_t^* A_t}{p_{Ht}} . \tag{18}$$

From the definition of money supply, (6) and the budget constraint (3), satisfied with equality, we have

$$A_t - e_t F_t = M_t - p_t(C_t + L_t) - p_{Ht} T_t . \tag{19}$$

Substituting these into (13) and (15) and taking account of (9) and (10), we obtain

$$[(1+\beta)(1+i_t^*) - i_t^*]C_t - i_t^* L_t = \frac{p_{Ht}}{p_t} W_t \tag{20}$$

$$-\gamma i_t^* C_t + (1+\beta-\gamma) i_t^* L_t = \gamma \frac{p_{Ht}}{p_t} W_t , \tag{21}$$

where

$$W_t = Y_t - T_t + (1+\pi_t) Z_{t+1} + \frac{V_t}{p_{Ht}} \tag{22}$$

is the home consumer's wealth (net of tax) in period t measured in the home good. We can solve these for real consumption and liquidity functions:

$$C_t = \frac{1}{1+(\beta-\gamma)(1+i_t^*)} \frac{p_{Ht}}{p_t} W_t , \tag{23}$$

$$L_t = \frac{(1+i_t^*)\gamma}{[1+(\beta-\gamma)(1+i_t^*)] i_t^*} \frac{p_{Ht}}{p_t} W_t . \tag{24}$$

We shall refer to (23) as the consumption function and to (24) as the liquidity preference function. The former is a positive function of the national disposable income satisfying the "psychological law" as assumed by Keynes (1936)[2]. It depends negatively on the rate of interest and positively on the real national wealth including the value of current disposable income and expected future non-interest incomes. The latter also satisfies the Keynesian assumption that liquidity preference depends positively on the national income and negatively on the rate of interest. Note that the liquidity preference function depends on the same variables as the consumption function. In the present set-up, it is given by multiplying the consumption function by $(1+1/i^*)\gamma$ in the present model. It vanishes to zero when there is no liquidity preference, or $\gamma = 0$ and exhibits liquidity-trap property when the interest rate gets close to zero. Among other things, the dependence of the liquidity preference function on the current and expected

[2] The marginal propensity to consume is positive but luss than unity.

future disposable incomes is not correctly recognized in the conventional literature of ad hoc macroeconomics. As we shall see later, it affects the effects of fiscal policy in an unconventional manner.

Let us simplify the supply side of the economy by assuming

$$b_t(Y_{Ht} + \delta K_t, K_t)(Y_{Ht} + \delta K_t) \leq N_{Ht}\,, \tag{25}$$

where Y_{Ht} is the the net domestic product, b_t is labor input per unit output, K_t is aggregate capital stock usable in period t, δ is the rate of capital depreciation, and N_{Ht} is the aggregate supply of labor in the home country. Given production technology, labor input per unit output, b, is supposed to be a non-increasing function of aggregate output, $Y_{Ht} + \delta K_t$, and aggregate capital stock, K_t, over the relevant range. The classical system is characterized by the assumption that (25) is satisfied with equality by the flexible adjustment of real wages. We denote by Y_{Ft} the full-employment income, or the value of Y_t corresponding to the net domestic product Y_{Ht} that satisfies (25) with equality. In contrast, the Keynesian system that we consider in this paper focuses on the case that (25) is satisfied with strict inequality on account of wage rigidity and deficient aggregate demand for the national product. Firms are thus assumed to produce as much as there is demand for the product in the market.

The net domestic product, Y_{Ht}, is related to the national income, Y_t, defined here by

$$Y_t = Y_{Ht} + \frac{i_t^* e_t F_t}{p_{Ht}}\,. \tag{26}$$

The national income is obtained by adding the interest receipt from the holding of foreign bonds to the net domestic national product. For simplicity, let us assume that net investment is zero and that the government expenditure is direted solely to the home good. The equilibrium condition of the home good market can then be written,

$$Y_{Ht} = \frac{p_t C_t}{p_{Ht}} + G_t + \frac{B_{Tt}}{p_{Ht}} \tag{27}$$

where G_t is the government expenditure in terms of the home good and B_{Tt} is the home country's balance of trade measured in units of the home currency. Signifying the foreign variables by asterisks, we express the balance of trade as follows:

$$B_{Tt} = p_{Ht} C_{Ht}^* - e_t p_{Ft}^* C_{Ft}\,, \tag{28}$$

In view of (26), we can rewrite (27) as

$$Y_t = \frac{p_t C_t}{p_{Ht}} + G_t + \frac{B_{Tt}}{p_{Ht}} + \frac{i_t^* e_t F_t}{p_{Ht}}\,. \tag{29}$$

From (9), (10) and (11), we get

$$q_t C_{Ft} = \frac{1-\alpha}{1 + (\beta - \gamma)(1 + i_t^*)}\left(Y_t - T_t + (1 + \pi_t) Z_{t+1} + \frac{V_t}{p_{Ht}}\right), \tag{30}$$

where $q_t (= p_{Ft}/p_{Ht} = e p_{Ft}^*/p_{Ht})$ is the relative price of the foreign good as defined earlier. By analogy,

$$C_{Ht}^* = \frac{\alpha^*}{1 + (\beta^* - \gamma^*)(1 + i_t^*)} q_t W_t^* \tag{31}$$

where W_t^* is the foreign real wealth in terms of the foreign good and α^* is the share of the home good in the foreign consumption expenditure. By the assumption that the home country is small, α^* is a small fraction and W_t^* may be treated as a variable exogenously given to the home country. For simplicity, we asuume that the government budget is balanced, i. e., $G_t = T_t$ and $\beta - \gamma = \beta^* - \gamma^*$. Substituting (22), (23), (28), (30) and (31) into (29) and rearranging terms, we get the IS equation of the present model:

$$(1 - \alpha + (\beta - \gamma)(1 + i_t^*))Y_t - \left(\alpha^* W_t^* + (\alpha + [1 + (\beta - \gamma)(1 + i_t^*)]i_t^*) \frac{F_t}{p_{Ft}^*}\right) q_t$$
$$= (1 - \alpha + (\beta - \gamma)(1 + i_t^*))G_t + \alpha\left((1 + \pi_t)Z_{t+1} + \frac{M_t}{p_{Ht}}\right). \tag{32}$$

The demand for the home money is balanced with its supply when

$$C_{Ht} + C_{Ht}^* + G_t + \frac{B_{Tt}}{p_{Ht}} + \frac{i_t^* e_t F_t^N}{p_{Ht}} + \frac{p_t}{p_{Ht}} L_t = \frac{M_t}{p_{Ht}}. \tag{33}$$

The left side represents the aggregate demand for the home money, and the right side the supply of home money. The first four terms on the left side stand for the transactions demand for money, the fourth term for the foreign payment of interest to the home residents and the fifth term for the speculative demand for money. Recalling (19) and subtracting B_t from both sides, we have

$$M_t - p_{Ht}\left(C_{Ht} + C_{Ht}^* + G_t + \frac{B_t}{p_{Ht}}\right) - p_t L_t$$
$$= A_t - e_t F_t - B_t. \tag{34}$$

where B_t is the current account surplus of the home country, i.e.,

$$B_t = B_{Tt} + e_t i_t^* F_t. \tag{35}$$

The left side of (35) is the excess supply of money and the right side is the excess demand for foreign bonds. Note that the current account surplus generates current supply of foreign bonds. Thus, when the demand for money is matched by the supply of money, the market for bonds is also equilibrated. Using (29), we can rewrite (33) as

$$Y_t + \frac{p_t L_t}{p_{Ht}} = \frac{M_t}{p_{Ht}}. \tag{36}$$

Substituting (24) into (36), we get the LM equation:

$$\frac{(i_t^* + (1 + i_t^*)[i_t^* \beta + (1 - i_t^*)\gamma]}{(1 + i_t^*)\gamma} Y_t + \frac{F_t}{p_F} q_t$$
$$= \frac{i_t^* + (1 + i_t^*)[\beta i_t^* - (1 + i_t^*)\gamma]}{(1 + i_t^*)\gamma} \frac{M_t}{p_{Ht}} - ((1 + \pi_t)Z_{t+1} - G_t). \tag{37}$$

Given p_{Ht}, p_{Ft}, π_t, i_t^*, M_t, H_t, G_t, Z_{t+1}, F_t and the parameters of the consumer's utility function, (32) and (37) constitute a linear simultaneous equation system in the

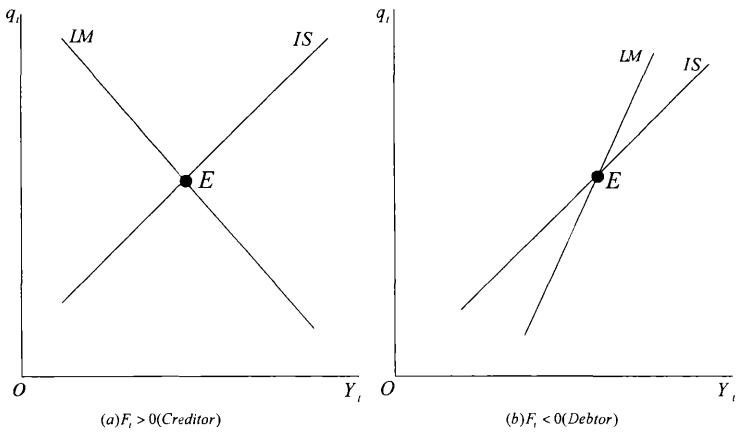


Figure 1. Possible Equilibria

endogenous variables of the model, i.e., q_t and Y_t. It is easy to solve the present IS-LM equations for the equilibrium values of Y_t and q_t. In stead of presenting the cumbersome solution here, let us explain it in terms of diagrammatic illustration. Figure 1 illustrates the determination of these endogenous variables. The IS curve shows the locus of q_t and Y_t that satisfy (32), or the equilibrium condition of the market for the home good. It is upward sloping on the assumption that the home country is not an extremely heavy debtor, i.e.,

$$\alpha^* W_t^* + (\alpha + [1 + (\beta - \gamma)(1 + i_t^*)]i_t^*)\frac{F_t}{p_{Ft}^*} > 0\,. \tag{38}$$

On the other hand,the LM curve is the locus of q_t and Y_t that satisfy (37), or the equilibrium condition of the money market. The LM curve is downward falling when the home country is a creditor, but it is upward rising when she is a debtor. The reason is as follows. An appreciation of the home currency decreases or increases the home consumer's net external wealth thereby decreasing or increasing the speculative demand for money depending on whether the home country is a creditor or a debtor. Given the supply of money, the national income must increase inducing an offsetting increase in the transactions demand for money when the home country is a creditor and it must decrease when the country is a debtor.

In order to avoid irrelevant taxonomies in what follows, we confine ourselves to the case where the equilibrium is stable under a plausible adjustment process of the home output and the exchange rate.[3] If the home country is a creditor, IS curve is positively sloped, and the LM curve is negatively sloped. In this case, the equilibrium can be shown to be stable under the adjustment process. If the home country is a debtor, both

[3] To be precice, we assume that the home output incereases in the presence of excess demand for the home good and the home exchange rate depreciates in the presence of excess supply of the home money. This adjustment process is locally stable only if the determinant of the Jacobian matrix of the equation system, (32) and (37), is positive.

the LM and IS curves are positively sloped. The stability of equilibrium then requires that that the LM curve be steeper than the IS curve. Figure 1 (a) depicts the case where the home country is a creditor, Figure 1(b) the case where the home country is a debtor. Clearly, the economically meaningful euilibrium exists if and only if the value of national income that equilibrates the money market is larger than the value of national income that clears the market for the home good when q_t is zero.The precise condition for the existence of a stable equilibrium runs as follows:

$$(1-\Delta)\frac{M_t}{p_{Ht}} > G_t + \Delta(1+pi_t)Z_{t+1} \tag{39}$$

where

$$\Delta = \frac{(1+i_t^*)\gamma}{[1+(\beta-\gamma)(1+i_t^*)]i_t^*} + \frac{\alpha}{1-\alpha+(\beta-\gamma)(1+i_t^*)}. \tag{40}$$

PROPOSITION 1. *A stable IS-LM equilibrium exists with positive q_t and Y_t under condition* (39).

Two remarks are in order. First, Δ must be positive if condition (39) is to be satisfied. This in turn implies that there is a positive lower bound for the rate of interest, i_t^*. [4] Second, Proposition 1 also reveals the necessity of approppriate monetary policy for the existence of the $IS-LM$ equilibrium. The right side of condition (39) shows elements of demand for the home money when its relative price is infinitely high, or $q_t = 0$. It requires that money supply must be greater than the "minimum" demand for the home money given by the right side of (39).[5] Thus money is fundamentally important in the present model. Suppose that γ is positive and the foreign rate of interest, i_t^* approaches rero. An infinitely large amount of home money would then be needed to ensure the existence of the equilibrium with any positive value of q_t.

4. COMPARATIVE STATICS

In this section we reconsider the comparative statics of the Mundell-Fleming model in light of the present open-economy IS-LM model with a microeconomic foundation. The most celebrated result of the Mundell-Fleming analysis is the proposition that with perfect capital mobility and a freely floating exchange rate, fiscal policy becomes powerless as a tool to control the national income (the Mundell proposition). The model implies that the home country's fiscal expansion appreciates the home currency exactly to offset its positive effect on the national income. It has been criticized, however, on the ground that its microeconomic foundation is unclear as it is an open-economy version of the ad hoc IS -LM model. Let us first consider how the Mundell proposition may carry over to the present model. It is often argued that the propositon is valid if the

[4] Recall the old english saying quoted by Keynes(1936) in connection with liquidity preferences that"Jon Bull can stand many things, but he cannot stand a 2 per scent."

[5] Note that the demand for the home money is a decreasing function of q_t.

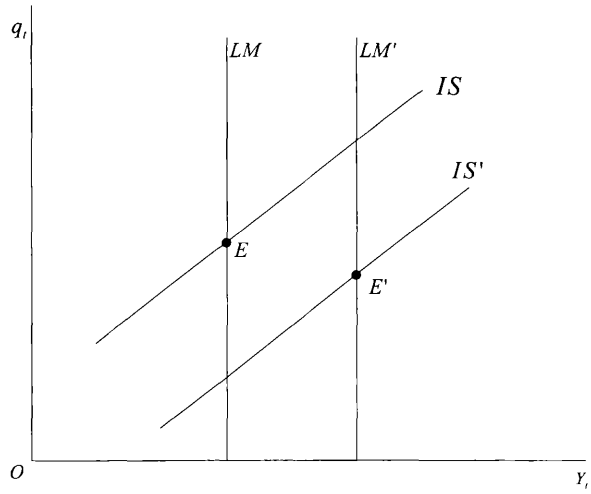


Figure 2. The Effect of Fiscal Expansion when $F_t = 0$

home coutry's net claim on the rest of the world is zero.[6] Under the present setup, this argument is not generally tenable. Let $F_t = 0$ but $\gamma > 0$ in (32) and (37) to obtain

$$(1 - \alpha + (\beta - \gamma)(1 + i_t^*))Y_t - (\alpha^* W_t^*)q_t$$
$$= (1 - \alpha + (\beta - \gamma)(1 + i_t^*))G_t + \alpha\left((1 + \pi_t)Z_{t+1} + \frac{M_t}{p_{Ht}}\right), \tag{41}$$

$$\frac{(i_t^* + (1 + i_t^*)[i_t^*\beta + (1 - i_t^*)\gamma]}{(1 + i_t^*)\gamma} Y_t$$
$$= \frac{i_t^* + (1 + i_t^*)[\beta i_t^* - (1 + i_t^*)\gamma]}{(1 + i_t^*)\gamma} \frac{M_t}{p_{Ht}} - ((1 + \pi_t)Z_{t+1} - G_t). \tag{42}$$

In this special case, the LM curve becomes vertical as depicted in Figure 2. An increase in the government expenditure shifts the IS rightward by the amount of the increase (the balanced budget effect) and the LM curve rightward by less than the increase. Note that the LM curve shifts rightward because the tax increase associated with the fiscal expansion reduces the consumer's wealth and therefore the speculative demand for money. (See liquidity preference function (24)). To be more precise, the tax increase directly reduces the disposable income in the next period and expected disposable incomes in the future periods as well if it is conceived as permanent. This point has been completely ignored in the conventional literature on the Mundell- Fleming Model.[7] Figure

[6] For instance, see Buiter and Branson (1983).

[7] Buiter and Branson (1983) carefully reformulated the Mundel-Fleming model although in an ad hoc way considering the dependence of demand for money on the financial wealth, but failed to recognize the possibilty that speculative demand for money also depends on the human wealth, i.e., the present value of expected non-interest income flows. Whether this possibility is actually negligible is of course another question. If γ is very small, the shift of the LM curve consequent upon a change in the government expenditure may be negligible.

2 demonstrates that a fiscal expansion appreciates the home currency and increases the national income even in the case where $F_t = 0$.

Next, suppose that $\gamma = 0$. In the present model, this is the case where the representative consumer has no liquidity preference. The LM equation, (37), then reduces to the simple quantity equation.

$$Y_t = \frac{M_t}{p_{Ht}}, \tag{43}$$

since the demand for money stems only from transactions motives. Here again, the LM curve becomes vertical. An increase in government expenditure, G_t, shifts the IS curve rightward but does not affect the LM curve. Therefore, it brings about a decline in q_t, or an appreciation of the home currency without affecting the national income, Y_t.

PROPOSITION 2. *The fiscal policy becomes powerless as a means to control national income in the special case where there is no liquidity preference, or* $\gamma = 0$.

Recall that fiscal policy is impotent in afffecting national incocome even in a closed economy when LM curve is vertical and independent of the government expenditure, i.e., in the so-called Monetarist special case.[8] In light of the present model, the fundamental assumption of the Monetarist case is the absence of liquidity preference. The inefficacy of fiscal policy as an instrument of stabilization policy arises from the absence of liquidity preference but not from the assumption that the country faces a given world rate of interest under flexible exchange rate regime.

Thus we may conclude that the Mundell proposition is generally untenable in the present model as long as the consumer has liquidity preference. The effect of fiscal policy on national income, however, differs depending on whether the home country is a creditor or a dector.

PROPOSITION 3. *Suppose that the consumer has a positive liquidity preference, or* $\gamma > 0$. *An increase in the home country's government expenditure increases the national income more than the amount of the budget increase when she is a creditor (i.e., if* $F_t \geqq 0$*), but it may decrease the national income when she is a debtor (i. e.,* $F_t < 0$*). On the other hand, it appreciates the home currency regardless of whether the country is a creditor or a debtor.*

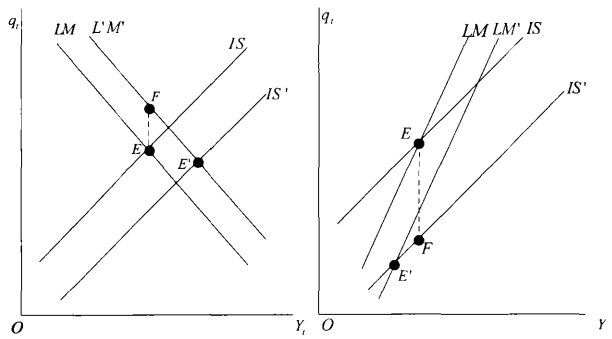
Figure 3 illustrates this proposition. The balanced budget fiscal expansion assumed here shifts the IS curve rightward by the amount of the budget increase and at the same time shifts the LM curve rightward by less than the amount. Consider point F, where the money market clears on the new LM curve at the initial level of national income. If $F_t > 0$, the home currency depreciates at this point. This may be regarded as an instantaneous effect of fiscal expansion on the exchange rate. There exists a positive excess demand for the home good at point F due to the fiscal expansion and the instantaneous exchange rate depreciation. Starting from point F, the home income must increase and the home currency must appreciate along the new LM curve, to achieve

[8] See Tobin (1974) and also Ohyama (2004).

the IS equilibrium as well at point E'. This is the new $IS - LM$ equilibrium, showing the ultimate effects of fiscal expansion on the exchange rate and national income. The value of the home currency is higher than before at the new $IS - LM$ equilibrium and the balanced budget multiplier becomes less than unity because of the exchange rate appreciation, as shown in Figure 3(a). If $F_t < 0$, however, the home currency appreciates at point F, where the LM equilibrium obtains at the initial level of national income. Figure 3(b) depicts the case where there is a positive exess demand for the home good at point F. Suppose that one goes down the new LM curve from point F reducing the national income and appreciating the home currency. Since the LM curve is steeper than the IS curve, the excess demand for the home good will diminish along the way to achieve the IS equilibrium at point E'. The home currency must appreciates, but the nationalincome decreases at the new $IS - LM$ equilibrium compared with the initial equilibrium. The shift of the LM curve consequent upon fiscal expansion arises from our formulation of liquidity preference function (24), which depends on the consumers' net external wealth as well as on the government expenditure. As noted above, this nature of liquidity preference function has been overlooked in the conventional ad hoc models of open macoeconomies.

Let us turn to the effects of monetary policy. A purchasing operation of the foregn bond means that $\Delta M_t = -\Delta F_t > 0$. It may be interptred as an intervention in the foreign exchange market. In fact, it is indistinguishable from an equivalent purchasing operation of the home bonds in the present model where the home and foreign bonds are perfect substitutes. They shift the LM curve rightward but leave the IS curve unaffected. By the help of Figure 4, we obtain.

PROPOSITION 4. *An increase in money supply by open market operation in the bond market depreciates the home currency thereby increasing the home national income.*



(a) $F_t > 0$ (b) $F_t < 0$

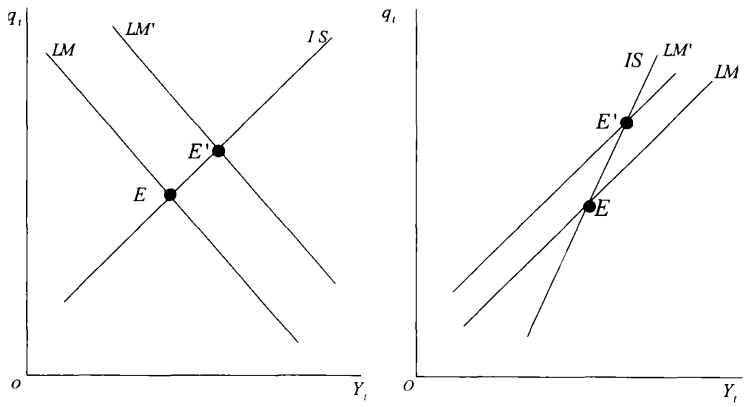
Figure 3. Fiscal Expansion

Figure 4 illustrates the effects of monetary expansion showing that it increases the national income through depreciation of the home currency (by the shift of the equilibrium from E to E'). As long as the equilibrium is stable, monetary expansion moves the equilibrium point upward along the unchanged IS curve regardless of whether the home country is a creditor or a debtor in the world capital market. This result confirms the efficacy of monetary poilicy as an instrument of stabilization policy under the flexible exchange rates.

The present model is designed to incorporate explicitly the consumer's properties such as her thriftiness, her perception of default risks and her expectations of future income flows and inflation. For instance, an increase in the consumer's perception of default risks, indicated by an increase γ, will shift both the IS and the LM curves leftward. The inspection of Figure 5 will reveal.

PROPOSITION 5. *An increase in the home consumer's perception of default risks appreciates the home currency and decreases the home country's national income.*

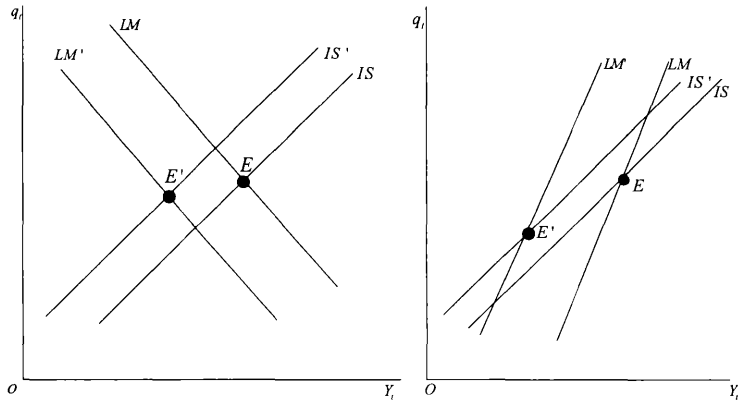
An increase in default risks increases the consumer's speculative demand for the home money thereby causing the LM curve rightward. On the other hand, it reduces consumption demand for the home good thereby causing the IS curve leftward. The rightward shift of LM curve is likely to be greater than the leftward shift of the IS curve.[9] Figure 5(a) depicts the effects of an increase in liquidty preference when the home country is a creditor, and Figure 5(b) those when she is a debtor. In both cases, it entails an appreciaton of the home currency and a deacrease in the home country's national income.



$(a)F_t > 0$ $(b)F_t < 0$

Figure 4. Monetary Expansion

[9] Making use of consumption and liquidty preference functions, (23) and (24), one can derive the exact condition for this to hold.as $1 + (\beta - 2\gamma)(1 + i_t^*) > 0$



$(a)F_t > 0$ $(b)F_t < 0$

Figure 5. An increase in Default Risks

To save space, we omit here the analysis of other disturbances such as changes in the international interest rate, the consumer's thriftiness and her expectations of inflation and future income flows.

5. A DYNAMICS OF EXCHANGE RATES AND BALANCE OF PAYMENTS

In the foregoing analysis, we confined ourselves to the temporary equilibrium in period t assuming that the home country's net external wealth, A_{Ft-1}, is historically given. As long as the country runs a surplus or a deficit in its current account balance, however, its net external wealth increases or decreases over time and its temporary equilibrium changes accordingly. In this section, we study the dynamics of exchange rates and balance of payments.

For simplicity, we assume here that the home consumer has no liquidity preference (i.e., $\gamma = 0$) and that the exogenous variables of the model other than A_{Ft} is kept constant through time (i.e., $i_t^* = i^*$, $p_{Ht} = p_H$, $p_{Ft}^* = p_F^*$, $M_t = M$, $G_t = G$, $Z_{t+1} = Z$, $W_t^* = W^*$, etc.). Furthermore, let there be no intervention in the bond and foreign exchange markets (i. e., $\Delta M_t = \Delta H_t = \Delta F_t = 0$). Under these simplifications, the IS-LM equations, (33) and (38), yield the equilibrium value of the real exchange rate:

$$q_t = \frac{[1 - \alpha + \beta(1 + i^*)](M/p_H - G) - \alpha(Z + V_H/p_H)}{\alpha^* W^* + (\alpha + i^*)[1 + \beta(1 + i^*)]A_{Ft-1}/p_F^*}, \tag{44}$$

where the numerator on the right side is assumed to be positive(condition (40) above). Clearly, q_t declines as A_{Ft-1} increases meaning that the home currency appreciates over time as long as she runs a current account surplus. On the other hand, the home country's net external wealth evolves through time obeying

$$A_{Ft} = \frac{B_t}{e_t} + A_{Ft-1}. \tag{45}$$

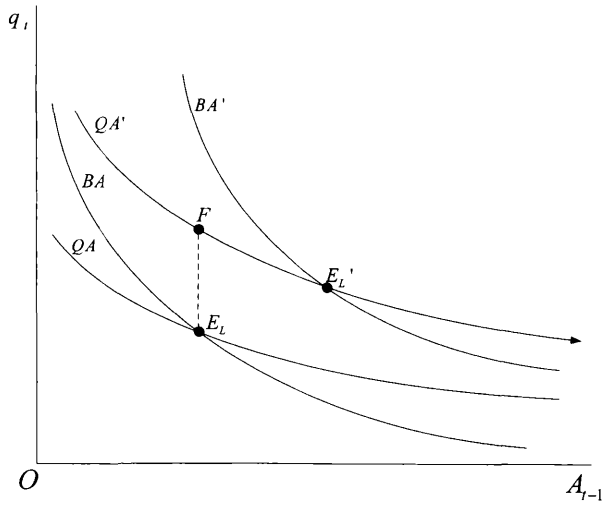


Figure 6. Dynamic Response to Monetary Expansion

This is a non-linear difference equation in A_{Ft}. Note that the stationary state of the equation obtains if and only if $B_t = 0$. The stationary equilibrium is potentially stable if $dA_{Ft}/dA_{Ft-1} < 1$ in its neighborhood. From (45), this condition is equivalent to

$$\frac{dB_t}{dA_{Ft-1}} < 0. \tag{46}$$

Substituting (44) into (35) and taking account of (22), (23) and (29), we obtain

$$\frac{B_t}{p_H} = \frac{1}{1+\beta(1+i^*)}\left(\beta(1+i^*)\left(\frac{M}{p_H} - G\right) - \left(Z + \frac{V_H}{p_H} + \frac{q_t A_{Ft-1}}{p_F{}^*}\right)\right). \tag{47}$$

From (44) and (47), one can readily see $dB_t/dA_{Ft-1} < 0$. Figure 6 illustrates the dynamic stable path of q_t and A_{t-1}. The QA curve depicts the negative dependence of q_t on A_{Ft-1} given by (44). On the other hand, the BA curve shows the combination of q_t and A_{Ft-1} that satisfies (47) with $B_t = 0$. Clearly, it is a rectangular hyperbola defined by

$$\frac{q_t A_{Ft-1}}{p_F} = \beta(1+i^*)\left(\frac{M}{p_H} - G\right) - \left(Z + \frac{V_H}{p_H}\right). \tag{48}$$

The intersection E_L of the QA and BA curve represents the stationary state. Starting from any initial condition, q_t and A_{Ft} travel through time along the QA curve toward E^L, converging to their long run equilibrium values, q^L and $A_F{}^L$.

Combining this observation with Propositions 4 in the preceding section, we can visualize the dynamic response of the terms of trade and the balance of payments to an increase in money supply.

PROPOSITION 6. *Suppose that the long-run equilibrium is stable. An increase in the home money supply leads to a depreciation of the home currency in the shrt run but the resultant surplus in the home country's current account balance works to alleviate the initial depreciation in the course of time in the long run.*

Given A_{t-1}, an increase in money supply shifts the QA curve uniformly upward, say to the QA' curve and the BA curve uniformly downward, say, to the BA' curve. The short-run equilibrium jumps from the initial E_L to F, but the long-run equilibrium moves to the intersection $E_L{}'$ of the QA' curve and the BA' curve. After the initial sharp depreciation, the real exchange rate appreciates through time along the QA' curve to the new long-run equilibrium level as long as the current account runs a surplus. As is shown from Figure 6, an increase in the home supply of money certainly give rise to the overshooting of the exchange rate in the short run. In the present simplified setup, the home national income is determined uniquely by money supply. Thus it jumps to a higher level and will remain at the same level afterward through the process of balance of payment adjustment. We can investigate the dynamic responses of the economy to other disturbances by using similar diagrams.

6. CONCLUDING REMARKS

We developed in this paper a microeconomics of the Mundell-Fleming model, which has been very influential in the discussion of fiscal and monetary policies in open-economy environments and yet looked on with suspicion by some academic economists for the ad hoc nature of its formulation. The present alternative formulation, an open-economy extension of the IS-LM model given by Ohyama (2004), is based on the optimizing behavior of the representative consumer with an extended two-period time horizon in the world where money serves both as a means of payment and a store of value at the same time. It enabled us not only to rationalize the original Mundell-Fleming model but also to add a new dimension to the analysis of open-economy macroeconomic policies by the explicit treatment of liquidity preference and long-run income expectations. For instance, we showed that the introduction of liquidity preference undermines the celebrated Mundell proposition on the inefficacy of fiscal policy under flexible exchange rates even when the country is a net creditor in the international capital market. We also pointed out the paradoxical possibility that an increase in the government expenditure may be detrimental to the short-run business conditions when the home country is a net debtor because of its effect on the exchange rate.

The limitations of the present analysis are more or less obvious. In order to avoid misunderstandings, however, let us mention some of them and consider the possibility of excuse or extension. First, the specification of the representative consumer's utility function may be objectionable. For instance, the consumption and liquidity functions are unitary elastic with respect to scale in the present model, but this property is not robust, being attributable to the log-linearity of the utility function. Second, the assumption of a small country taking the rate of interest in the rest of the world as given is certainly problematical. The original Mundell-Fleming Model was criticized on this

account and it proved to be crucial to the Mundell proposition.[10]This assumption is not so unreal, however, as the assumption of a small country taking the prices of traded commodities in the rest of the world as given. In fact, the home country may not be able to affect the foreign interest rate even in a two-country world if the foreign central bank targets the rate of interest by adjusting its money supply. Moreovere, it should be easy to extend the present model to a two-country model where the rate of interest is endogenously determined if one does not mind slightly more cumbersome computation. Third, we have adhered to the Mundell-Fleming assumption that the domestic price level is fixed at a given level. Although this assumption seems plausible in the short run, it may not be reasonable in the long run in the presence of persistent disequilibrium in the labor market. It could be relaxed by introducing the intertemporal mechanism of price adjustment in response to the discrepancy between the actual and full-employment outputs as in Dornbusch (1976).[11] This complication is, however, beyond the focus of the present paper aimed to illustrate the essential feature of a microeconomics underlying the Mundell-Fleming Model.

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[10] See Mundell(1964).

[11] See Ohyama (2002) for such an attempt in a simpler closed economy version of the present model.