



Trade Imbalance and IS-LM Analysis

メタデータ	言語: eng 出版者: 公開日: 2009-08-25 キーワード (Ja): キーワード (En): 作成者: Miyamoto, Katsuhiko メールアドレス: 所属:
URL	https://doi.org/10.24729/00009776

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The trade conflict between the U.S.A. and Japan is becoming an important economic problem for the both countries. The U.S.A. becomes a trade deficit country. On the other hand, Japan becomes an excess export country. In this paper, we will develop the balance of trade in the framework of IS-LM analysis and will consider the status in quo of the both economies. Then we will give some economic policies in order to improve the existing state of the both economies.

§ 1 Closed Economy

(1) Product Market

The equilibrium condition of product market in a closed economy is,

$$I(r) + G = S(Y - T(Y)) + T(Y). \quad \text{--- (1)}$$

The left-hand side of this equation presents total output not going to consumer expenditure, and the right-hand gives total income of consumers that is not spent. I is private investment, G is government expenditure, S is total saving, T is tax payments, r is interest rate and Y is national income. $Y - T$ is disposable income. The investment is a decrease function of interest rate,

$$I' = \frac{dI}{dr} < 0. \quad \text{--- (2)}$$

The saving is an increase function of disposable income,

$$0 < S' = \frac{dS}{d(Y - T)} < 1. \quad \text{--- (3)}$$

The tax revenue is an increase function of national income,

$$0 < T' = \frac{dT}{dY} < 1. \quad \text{--- (4)}$$

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(1) I am very thankful to Professor H. Niwa for his comments.

The slope of the *IS* curve in a closed economy is,

$$\left. \frac{\partial r}{\partial Y} \right|_{IS} = \frac{S'(1 - T') + T'}{I'} < 0. \quad \text{--- (5)}$$

An increase of government expenditure gives the *IS* curve a shift upward.

$$\left. \frac{\partial Y}{\partial G} \right|_{IS} = \frac{1}{S'(1 - T') + T'} > 0. \quad \text{--- (6)}$$

(2) Money Market

The equilibrium condition of monetary market in a closed economy is,

$$H = L(Y, r). \quad \text{--- (7)}$$

The left-hand of this equation (*H*) presents money supply and the right-hand (*L*) gives money demand. The money demand function has following characters.

$$L_Y = \frac{\partial L}{\partial Y} > 0,$$

$$L_r = \frac{\partial L}{\partial r} < 0. \quad \text{--- (8)}$$

The slope of the *LM* curve in a closed economy is,

$$\left. \frac{\partial r}{\partial Y} \right|_{LM} = -\frac{L_Y}{L_r} > 0. \quad \text{--- (9)}$$

An increase of money supply gives the *LM* curve a shift downward.

$$\left. \frac{\partial r}{\partial H} \right|_{LM} = \frac{1}{L_Y} > 0. \quad \text{--- (10)}$$

§ 2 Open Economy

(1) Product Market

In this section, we will consider the relationship between the foreign sector and the domestic economy. The international balance of payments is divided into two major accounts. They are the current account and the

capital accounts. For the sake of simplicity, we assume that the current account is the trade balance.

The equilibrium condition of product market in an open economy is,

$$I(r) + G + X(Y, q) = S(Y - T(Y)) + T(Y) + \frac{1}{q}M(Y, q). \quad \text{--- (11)}$$

$X - \frac{1}{q}M$ is the net exports term. X is total value of export in terms of the domestic monetary unit, and M is total value of import in terms of the foreign monetary unit. q is the exchange rate. The export function has following characters.

$$X_Y = \frac{\partial X}{\partial Y} < 0, \quad X_q = \frac{\partial X}{\partial q} < 0. \quad \text{--- (12)}$$

The import function has following characters.

$$M_Y = \frac{\partial M}{\partial Y} > 0, \quad M_q = \frac{\partial M}{\partial q} > 0. \quad \text{--- (13)}$$

In the U.S.A., the excess demand of domestic product market is adjusted with the excess import. On the other hand, in Japan the excess supply of domestic product market is covered by the excess export of goods and services.

We assume that the exchange rate is determined by the following equation,

$$q = \phi[F(r, r_f), X(Y, q) - \frac{1}{q}M(Y, q)]. \quad \text{--- (14)}$$

F is net capital inflow (capital inflow – capital outflow). $X - \frac{1}{q}M$ is net export. r_f is the foreign interest rate. The net capital inflow function has following characters,

$$F_r = \frac{\partial F}{\partial r} > 0, \quad F_{r_f} = \frac{\partial F}{\partial r_f} < 0. \quad \text{--- (15)}$$

The exchange rate increases with an increase of net capital inflow and with an increase of net export.

$$\phi_1 > 0, \quad \phi_2 > 0. \quad \text{--- (16)}$$

The exchange rate elasticity of exports and imports are μ and ϵ .

$$\begin{aligned}\mu &= \frac{q}{X} X_q < 0, \\ \epsilon &= \frac{q}{M} M_q > 0.\end{aligned}\quad \text{--- (17)}$$

δ is the ratio of imports and exports.

$$\delta = \frac{1}{q} \frac{M}{X} > 0.\quad \text{--- (18)}$$

The effect of national income to the exchange rate is,

$$\frac{\partial q}{\partial Y} = \frac{\phi_2 (X_Y - \frac{1}{q} M_Y)}{1 - \phi_2 \frac{M}{q^2} (\mu \frac{1}{\delta} - \epsilon + 1)}.\quad \text{--- (19)}$$

The effect of the interest rate to the exchange rate is,

$$\frac{\partial q}{\partial r} = \frac{\phi_1 Fr}{1 - \phi_2 \frac{M}{q^2} (\mu \frac{1}{\delta} - \epsilon + 1)}.\quad \text{--- (20)}$$

“Marshall-Lerner condition” is as follows,

$$\epsilon - \mu > 1,\quad \text{--- (21)}$$

and in the case of imbalance of trade, the modified Marshall-Lerner condition is,

$$\epsilon - \frac{1}{\delta} \mu > 1.\quad \text{--- (22)}$$

Under the modified Marshall-Lerner condition, the effect of national income to the exchange rate is negative,

$$\frac{\partial q}{\partial Y} < 0.\quad \text{--- (23)}$$

Under the same condition, the effect of the interest rate to the exchange rate is positive,

$$\frac{\partial q}{\partial r} > 0.\quad \text{--- (24)}$$

When the imbalance of domestic product market is adjusted with the foreign sector, we call the *IS* curve the IS_0 curve, and the slope of the IS_0 curve is,

$$\left. \frac{\partial r}{\partial Y} \right|_{IS_0} = \frac{X_Y + X_q q_Y - S'(1 - T') - T' - \frac{1}{q}(M_Y + M_q q_Y) + \frac{M}{q^2} q_Y}{-I' + \frac{1}{q^2} M_q r(\epsilon - 1 - \frac{1}{\delta} \mu)} \quad \text{--- (25)}$$

We assume that the direct effects of national income to exports and imports is bigger than the indirect effects.

$$\begin{aligned} X_Y + X_q q_Y &< 0, \\ M_Y + M_q q_Y &> 0. \end{aligned} \quad \text{--- (26)}$$

Under these conditions, the slope of the IS_0 curve in an open economy is negative,

$$\left. \frac{\partial r}{\partial Y} \right|_{IS_0} < 0. \quad \text{--- (27)}$$

The government investment multiplier is positive,

$$\left. \frac{\partial Y}{\partial G} \right|_{IS_0} = \frac{-1}{X_Y + X_q q_Y - S'(1 - T') - T' - \frac{1}{q}(M_Y + M_q q_Y) + \frac{M}{q^2} q_Y} > 0. \quad \text{--- (28)}$$

(2) Money Market

In an open economy, we will consider the domestic money market and capital inflow-outflow in a foreign sector. The equilibrium condition of money market in an open economy is,

$$H + F(r, r_f) = L(Y, r). \quad \text{--- (29)}$$

In the U.S.A., the net capital inflow is positive and on the other hand, in Japan, that is negative. When the imbalance of domestic money market is adjusted with the foreign sector, we call the *LM* curve the LM_0 curve in an open economy. The slope of the LM_0 curve is positive,

$$\left. \frac{\partial r}{\partial Y} \right|_{LM_0} = \frac{L_Y}{F_r - L_r} > 0. \quad \text{--- (30)}$$

An increase of money supply gives the LM_0 curve a shift downward.

$$\left. \frac{\partial Y}{\partial H} \right|_{LM_0} = \frac{1}{L_Y} > 0. \quad \text{--- (31)}$$

An increase of the foreign interest rate decreases national income.

$$\left. \frac{\partial Y}{\partial r_f} \right|_{LM_0} = \frac{Fr_f}{L_Y} < 0. \quad \text{--- (32)}$$

(3) Balance of Trade

The equilibrium condition of trade sector is,

$$X(Y, q(Y, r)) = \frac{1}{q(Y, r)} M(Y, q(Y, r)). \quad \text{--- (33)}$$

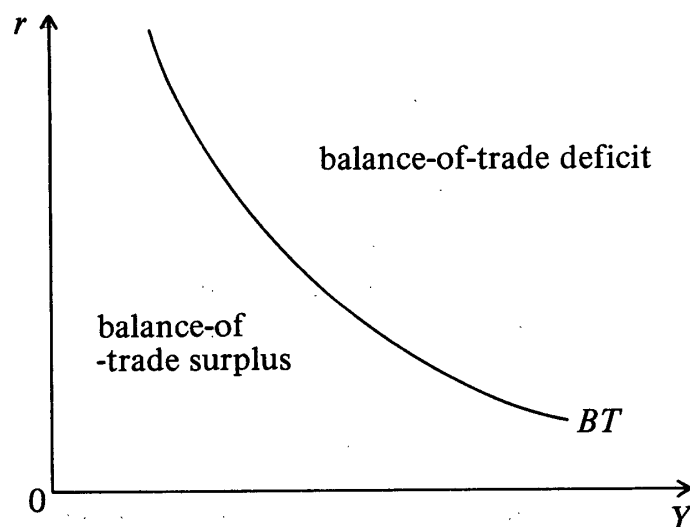
We call this equation the *BT* curve (balance-of-trade curve). The slope of the *BT* curve is as follows,

$$\left. \frac{\partial r}{\partial Y} \right|_{BT} = \frac{X_Y \cdot q - M_Y + q_Y \left\{ \mu X - \frac{M}{q} (\epsilon - 1) \right\}}{q_r \left\{ \frac{M}{q} (\epsilon - 1) - \mu X \right\}}. \quad \text{--- (34)}$$

Under the conditions of trade balance ($X = \frac{1}{q}M$) and “Marshall-Lerner condition ($\epsilon - \mu > 1$)”, the slope of the *BT* curve is negative.

$$\left. \frac{\partial r}{\partial Y} \right|_{BT} < 0. \quad \text{--- (35)}$$

The field above the *BT* curve will yield a balance-of-trade deficit. Conversely, the field below the *BT* curve will yield a balance-of-trade surplus.

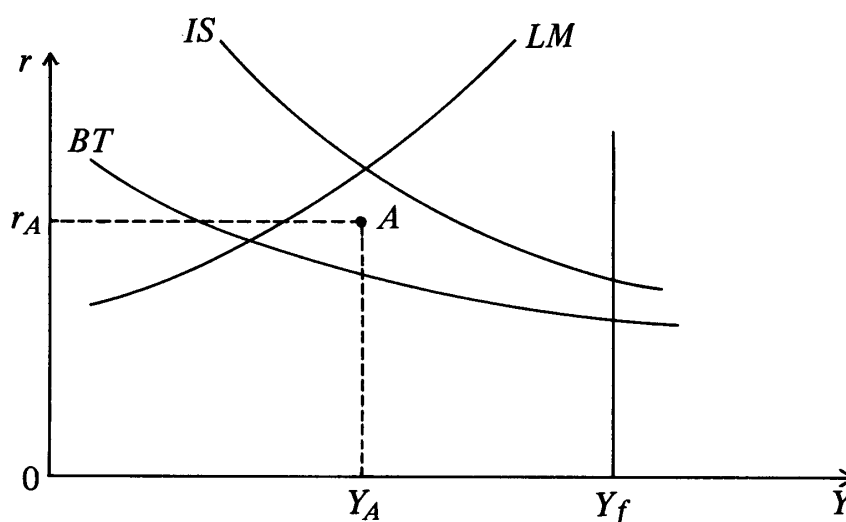


(Figure 1)

§ 3 American Economy

In this section, we will consider the status in quo of American economy and will give some economic policies.

Now the U.S.A. has a balance-of-trade deficit and net capital inflow. That is, the U.S.A. is in an excess demand of domestic product market and in an excess demand of domestic money market. The existing state of American economy is in the below field of the *IS* and the *LM* curves and in the above field of the *BT* curve.



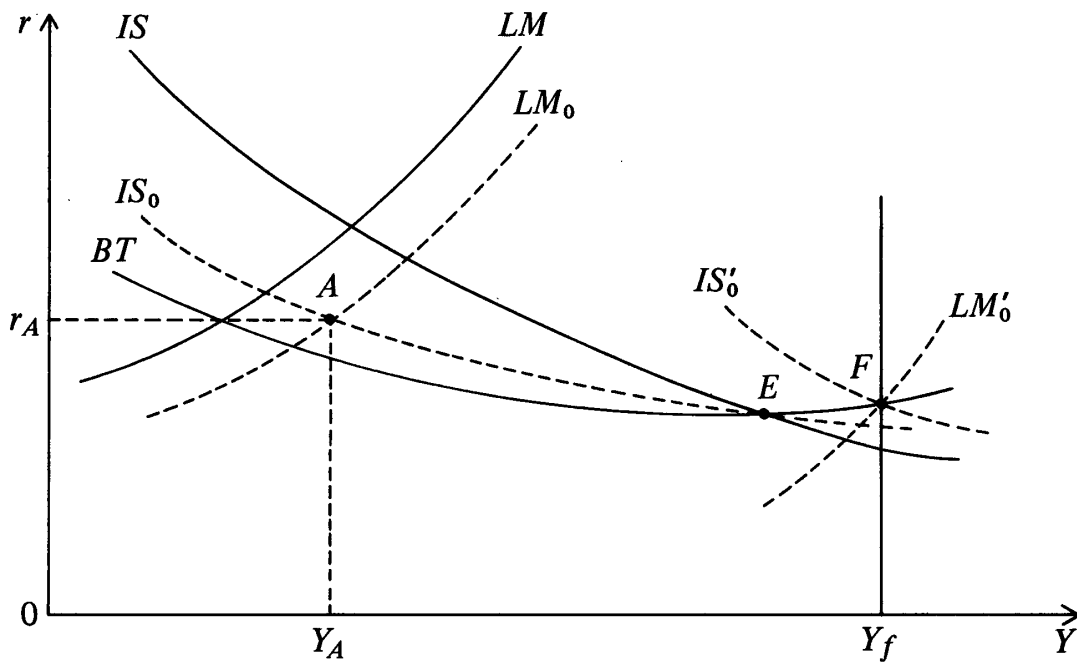
(Figure 2)

It is shown by point A in figure 2. Y_f in figure 2 is full employment national income.

We will consider the two following cases.

(Case 1)

In this case, the *IS* and *BT* curves have an intersection on the right field of the *LM* curve.

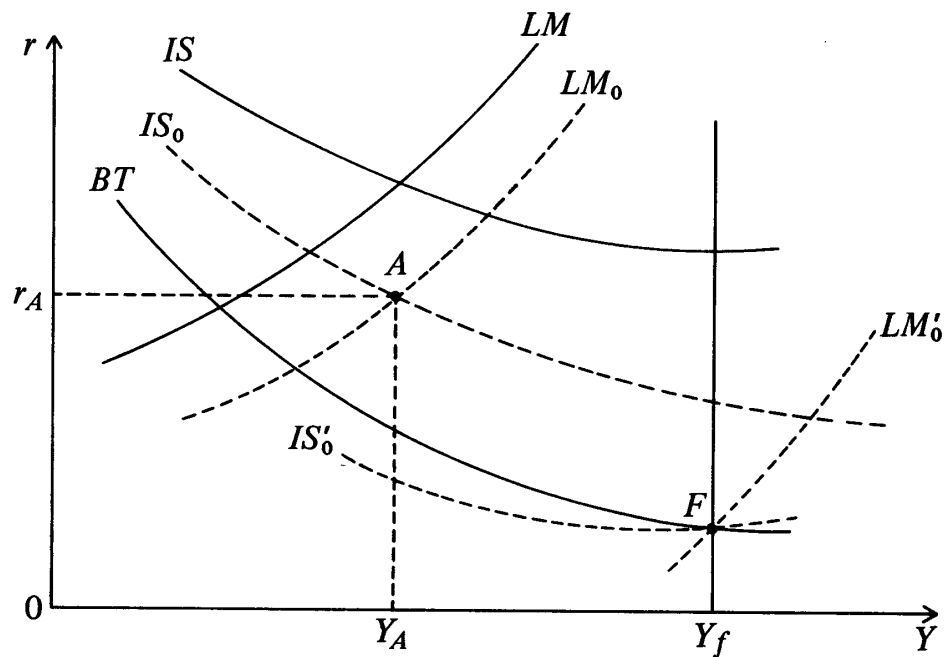


(Figure 3)

The IS_0 curve passes through the intersection of the IS and the BT curves. At point F , domestic product market and foreign trade are in an equilibrium. When the U.S.A. government takes the point F as the most desirable point, the desirable national income is the full employment national income. We will take the fiscal policy to shift the IS_0 curve to IS'_0 curve and will take the monetary policy to shift the LM_0 curve to LM'_0 curve in order to reach the full employment national income. At point F , the U.S.A. is in a balance of foreign trade.

(Case 2)

In this case, the IS and BT curves have no intersection on the right field of the LM curve.



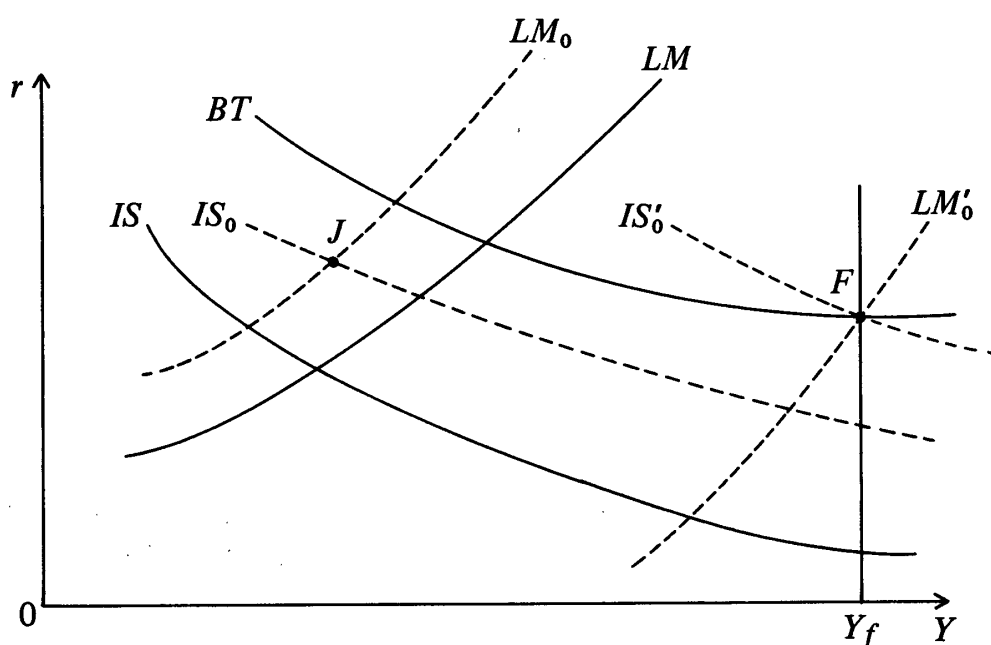
(Figure 4)

When the U.S.A. government takes the point F as the most desirable point in figure 4, we will take the fiscal policy to shift the IS_0 curve to IS'_0 curve and will take the monetary policy to shift the LM_0 curve to LM'_0 curve. At point F , foreign trade is in an equilibrium and national income is full employment national income.

In case 1, we will have to increase the government expenditure to reach the desirable point, on the other hand, in case 2, we will have to decrease the government expenditure. But in both cases, we will have to increase money supply to get the full employment national income. Therefore, the both imbalances of foreign trade and domestic product market in the U.S.A. fairly depend on the U.S.A. monetary policies. The U.S.A. government and FRB have restrained money supply. In order to improve the imbalances of the U.S.A. economy, we suggest that the U.S.A. will have to increase money supply.

§ 4 Japanese Economy

We will consider the status quo of Japanese economy in our framework. Now Japan has a balance-of-trade surplus and net capital outflow. Japan is in an excess supply of domestic product market and in an excess supply of domestic money market. The existing state of Japanese economy is shown by the point J in figure 5 which is in the above field of the IS and the LM curves and in the below field of the BT curve.



(Figure 5)

When the Japanese government takes the point F as the most desirable point, the desirable national income is the full employment national income. At point F , foreign trade is in an equilibrium. We will take the fiscal policy to shift the IS_0 curve to IS'_0 curve, that is, we will have to increase government expenditure. We will take the monetary policy to shift the LM_0 curve to LM'_0 curve, that is, we will have to increase money supply. Therefore, the Japanese government will have to take policy-mix of fiscal and monetary policies in order to reach the desirable equilibrium.

When the IS and BT curves have an intersection on the right field of the LM curve, we will get the same analyses, too.

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