Formulas for the Current Account Balance

By Leigh Harkness

Abstract

This paper uses dynamic models to explain the current account balance in a range of situations. It starts with simple economies with fixed exchange rates and progresses to more complex economies with floating exchange rate systems.

It models the hypothesis that floating exchange rates can bring about external balance. Also, it analyses whether the capital account determines the current account. It finds that money constrains expenditure and that the creation of additional money using bank credit in certain circumstances can generate current account deficits.

It then tests whether that hypothesis can explain how countries like Japan can generate current account surpluses and finds that the theory is consistent with that outcome.

Background

Up until 1974, the Kingdom of Tonga did not have a bank. Even so, the country issued its own currency. When foreign currency entered the country, the government would exchange that money for domestic currency and add the foreign money to the country's foreign reserves. When people spent money on imports, the government converted their domestic currency back to foreign currency to pay for the imports. In that way the country always had sufficient foreign reserves to pay for its imports.

When Tonga established a bank, it started lending money. That lending created additional money that did not contribute to foreign reserves. Yet, when that money was spent on imports, it still needed to be converted into foreign currency. Therefore, increased bank lending depleted the country's foreign reserves.

To ensure that there were adequate foreign reserves to meet requirements, the government advised the bank to regulate its lending according to the level of foreign reserves. If there were plenty of foreign reserves, it could lend without restraint. But if foreign reserves were low, it was required to slow down or stop lending. The International Monetary Fund later commended the government on the success of that policy.

Given the experience of that small South Pacific Island country, I investigated whether the relationship between bank credit and the current account deficit could be identified in larger economies such as Australia, New Zealand, the Philippines and the United States of America. The relationships I found are presented in Figures 1 to 4 below.

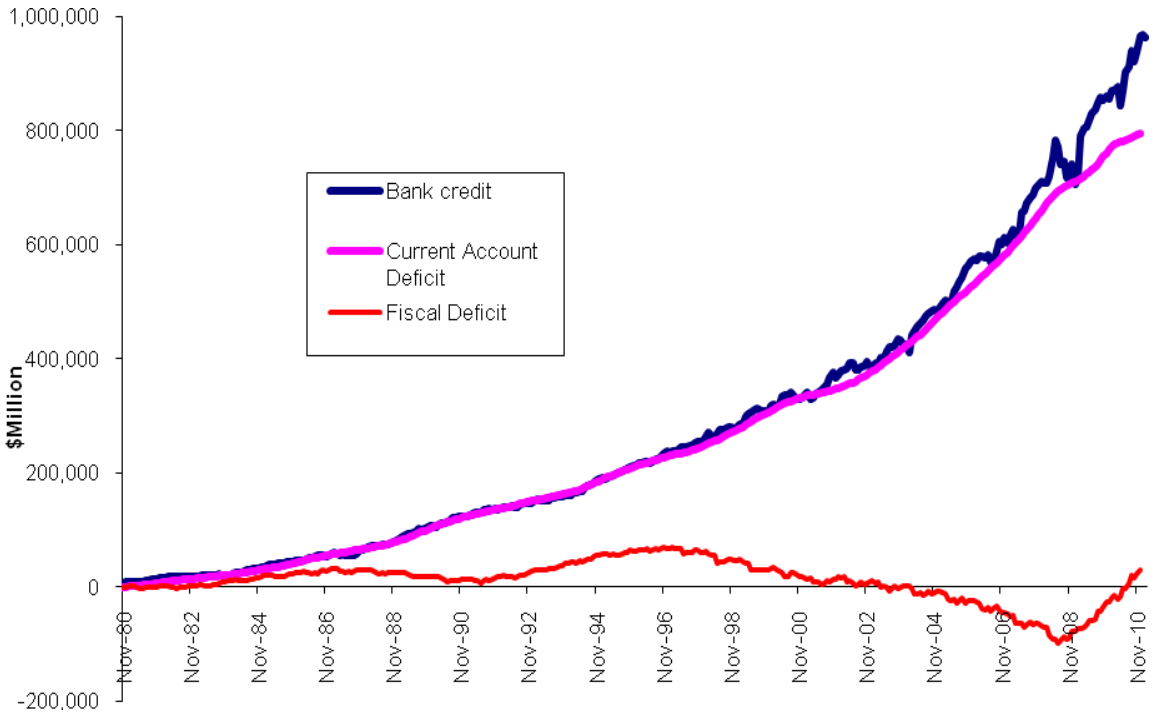

Figure 1. Australia: Bank credit, fiscal deficit and current account deficit

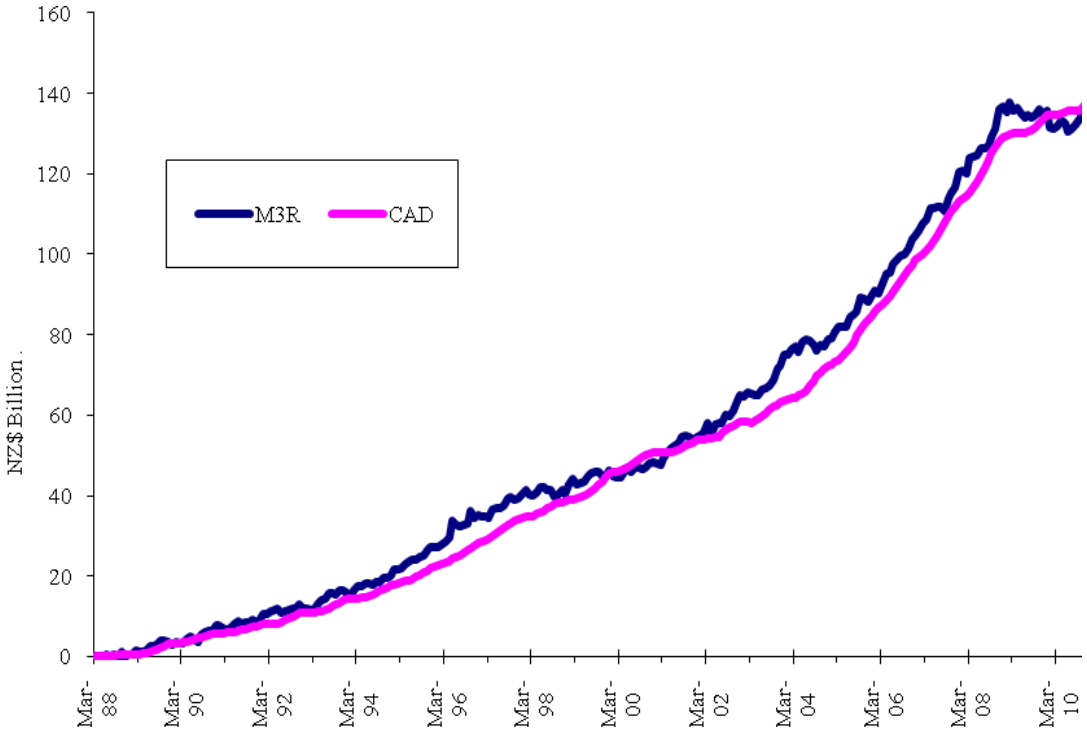

Figure 2. New Zealand: Bank Credit (M3R) and current account deficit

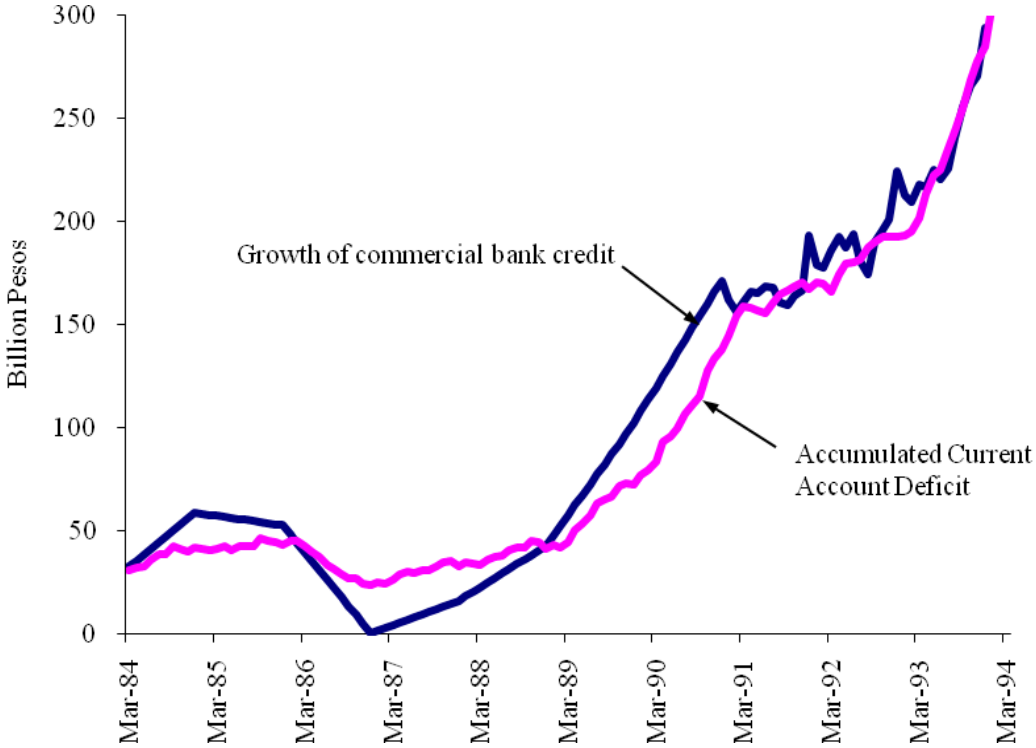

Figure 3. Philippines: Bank credit and current account deficit

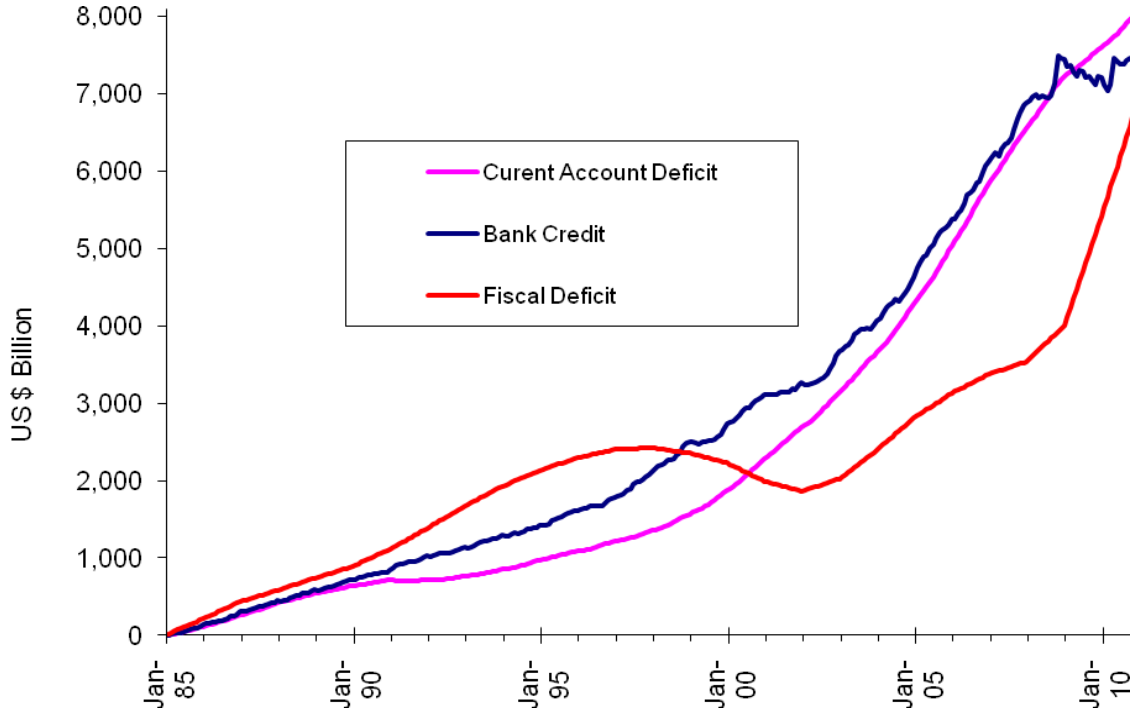

Figure 4. USA: Bank credit, fiscal deficit and current account deficit

Introduction

This paper seeks to explain why the current account deficit has been approximately equal to the growth of bank credit and currency as evident in Figures 1 to 4. It starts with simple examples used to consider basic principles and works towards more complex models.

There is economic literature linking monetary growth to the current account deficit. These include Polak (1957) and Frenkel and Johnson (1976).

However, the relationships considered here are much stronger than experienced in the past. The wide use of floating exchange rates has quarantined money from foreign exchange from entering the economy, allowing the relationship between bank credit and the current account balance to be more clearly identified and studied.

The basic hypothesis of this paper is that if the only source of money were from income (including foreign income), then a country could not buy more than it produced; it would generally have a surplus or balanced current account. Current account deficits are caused when additional money is created which finances national expenditure in excess of national income.

To consider this hypothesis, this paper considers three sources of additional money:

- additional money that arises from national savings when foreign income (e.g., from exports) is greater than expenditure on foreign goods and services (e.g., on imports);
- additional money from the growth of bank lending; and
- additional money from net foreign capital inflow.

Also considered are three means of reducing the quantity of money:

- reducing money when expenditure on foreign goods and services (imports) is greater than foreign income (exports);
- reducing money when loans are repaid to banks; and
- reducing money when there is a net international capital outflow.

The effects of these sources of money are modelled and presented arithmetically and diagrammatically for countries with fixed exchange rates (Figures 5-11) and those with floating exchange rates (Figures 12-17).

Economic theory

There is not a widely accepted theory for the cause of a current account deficit. Neo-classical literature, such as Obstfeld and Rogoff (1996), attributes the current account balance to an inter-temporal preference. That is, people and businesses may prefer to invest or consume now and are prepared to build up foreign debt which they will repay in the future.

That theory is rather assertoric and is not useful in explaining the relationship evident in the data. The relationship between the growth of bank credit and the current account deficit is not generally acknowledged, let alone explained.

This paper applies dynamic models to explain these outcomes. Before considering the formulas, I wish to clarify what I mean by the "quantity of money".

The Quantity of Money

Regardless of whether it is supplied or demanded, there is a certain quantity of money in the economy, and that is the money that this paper considers. It consists of bank deposits (excluding saving bank deposits), other negotiable bank instruments (including bills of exchange) and currency (notes and coins). This paper is not concerned about whether the money was supplied or demanded. It is the money that exists that is considered in this paper.

Money from foreign reserves

To start developing a formula for the current account deficit, let us assume that an economy has a fixed exchange rate, and that it's only source of money is from the growth of foreign reserves. These foreign reserves accrue when the money earned from exports and other foreign receipts is greater than the money spent on imports and other payments to foreign entities[1]. That is:

$$R_t = R_{t-1} + X_{t-1} - M_{t-1} \qquad (1)$$

Where:

R_t is the level of foreign reserves at time "t";

R_{t-1} is the previous level of foreign reserves or the foreign reserves at time "t-1";

X_{t-1} are exports in time "t-1"; and

M_{t-1} are imports in time "t-1"

[1] To simply the discussion, exports and imports are assumed to include traded goods and services and other current international transactions.

The foreign reserves are assets of the banking system. Money is on the liabilities side of the banks' balance sheets. When banks buy foreign currency from exporters, they give the exporter domestic currency in exchange for the foreign currency. Both domestic currency and bank deposits are liabilities of the banking system.

As far as people in the economy are concerned, they earn money either from selling products to the domestic market or by selling products overseas as exports. Therefore, the quantity of money in the economy that they have to spend can be given by:

$$L_t = N_{t-1} + X_{t-1} \qquad (2)$$

Where:

L_t is the quantity of money in the economy at time "t" available to be spent;

N_{t-1} is income from the sale of products to the domestic economy in time "t-1".

To simplify the model, we assume that "t" is the time taken to earn the amount of money L_t. In that way, we can treat L_t not only as a stock of money but as the flow of money earned from domestic sales and from exports. Therefore, we can say that:

$$Y_t = N_t + X_t \qquad (3)$$

Where:

Y_t is the income earned in time "t".

We will assume that people spend their income or money on either domestic products or imports. That is:

$$L_t = N_t + M_t \qquad (4)$$

The quantity of money and income will continue to grow while exports are greater than imports.

Let us assume that spending on imports is a proportion of total spending such that:

$$M_t = mL_t \qquad (5)$$

Where:

"m" is the proportion of total available money spent on imports, or the marginal propensity to import.

By substituting equation (2) ($L_t = N_{t-1} + X_{t-1}$) into equation (5) and the result into equation (4), we can conclude that:

$$L_t = N_t + m(N_{t-1} + X_{t-1}) \qquad (6)$$

Figure 5 below diagrammatically represents the dynamics of this formula. It assumes that exports are \$5 B and the value of "m", the marginal propensity to import, is 0.25, or 25%. In the first period, there is no money to spend so nothing is spent on imports or domestic products. In the second period, there is only the \$5 B earned from exports, in the previous period, to spend. Of this, \$1.25 B is spent on imports and \$3.75 B on domestic products. In the third period, there is \$8.75 B (5+3.75) to spend.

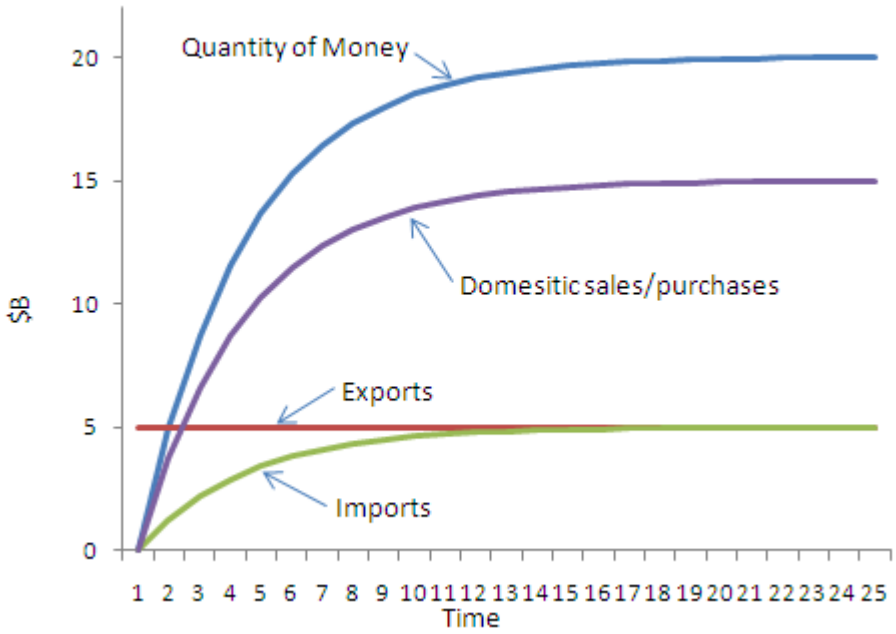

Figure 5: Foreign source of money

The quantity of money grows more slowly as it approaches \$20 B. When the quantity of money reaches \$20 B, imports would be \$5 B and equal to exports. At that point, the quantity of money cannot increase any further. It is said to be at equilibrium. This equilibrium quantity of money can be defined as:

$$L^* = X/m \qquad (7)$$

Where:

L^* is the equilibrium quantity of money.

The quantity of money at a time "t" is defined also as the income from domestic sales and foreign sources in time "t". If the quantity of money is in equilibrium, then income is also stable and at equilibrium. In other words, the economy grows only while it is in disequilibrium. When the economy is at equilibrium, it stops growing.

Note that the current account has been in surplus or balanced throughout this example. If the only source of money is from the growth of foreign reserves generated by exports, the current account will be in surplus, or balanced.

In this example, all additional money is created through national savings (spending less on imports than earned from exports). Also, the growth in the quantity of money in any period is equal to the current account balance.

For the nation to accumulate national savings, it was not necessary for any individual to defer spending. National savings occurred because the nation deferred spending on imports and spent that money on domestic products instead.

Money from bank credit

Money can also be created through the growth of bank credit. The growth in bank credit is equal to new loans less loan repayments. If we assume that bank credit is the only source of new money and there is no international trade, then we can say that the quantity of money in the economy can be given by:

$$L_t = N_{t-1} + C_{rt} - A_t \qquad (8)$$

Where:

C_{rt} is the amount of new bank lending in time "t";

A_t is the loan repayment in time "t".

As all money is created by bank credit, all money is equivalent to the amount of outstanding loans. We will assume that loan repayments in each period are a proportion of outstanding debt, such that:

$$A_t = aL_{t-1} \qquad (9)$$

Where:

a is the proportion of outstanding debt repaid in a period. It is the inverse of the average term of outstanding loans.

Substituting equation (9) into equation (8) we can conclude that:

$$L_t = N_t = N_{t-1} + C_{rt} - aL_{t-1} \qquad (10)$$

This formula defines the quantity of money at time "t" as equal to the money earned from selling products in the domestic economy, plus new bank loans less loan repayments. This domestic source of money is represented in Figure 6. In this example, loans are assumed to be \$5 B per period (C_{rt} = \$5 B) and loan repayments in each period are 25% of the outstanding balance at the end of the previous period (a= 0.25).

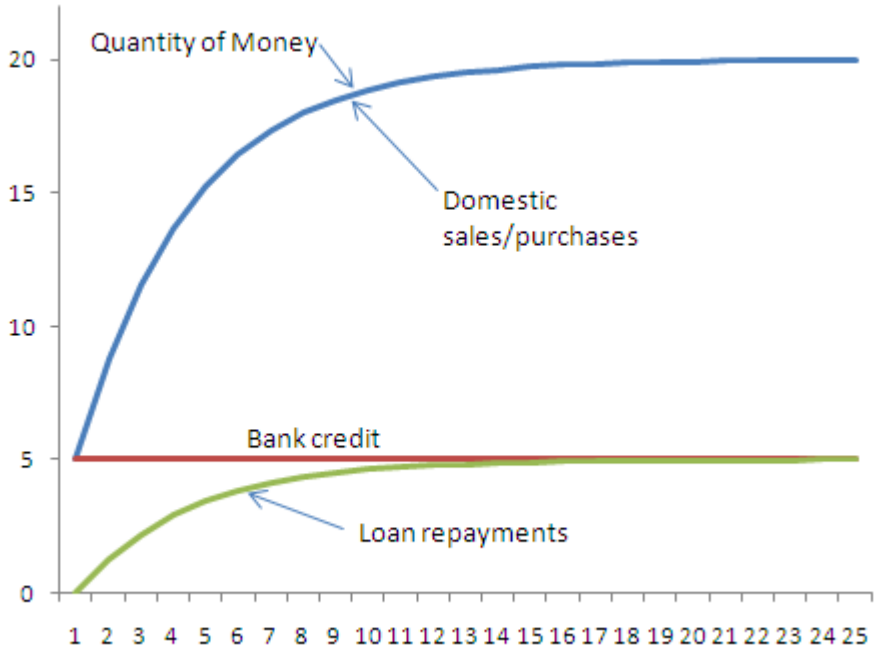

Figure 6: Domestic source of money

In this example, the equilibrium quantity of money is $20 B. That is, total lending will be stable when loan repayments equal new lending. That occurs when the quantity of bank debt, or money, is $20 B. The equilibrium quantity of money from domestic sources (bank credit) is given by the following equation:

$$L^* = C_r/a \qquad (11)$$

This model is a purely theoretical one of an economy with money. It does not consider the effect of international trade. Hence, there is no current account balance. Even so, the equilibrium quantity of money from domestic sources is a useful concept in understanding the cause of the current account balance.

Money from foreign and domestic sources

In a country with both foreign and domestic sources of money the total quantity of money is the sum of both sources. That is:

$$L_t = L_{ft} + L_{ct} \qquad (12)$$

Where:

L_{ft} is the quantity of money from foreign sources and from equation (2) [$L_t = N_{t-1} + X_{t-1}$] may be written as:

$$L_{ft} = N_{t-1} + X_{t-1} \qquad (13)$$

L_{ct} is the quantity of money from domestic sources and from equation (10) may be written as:

$$L_{ct} = N_{t-1} + C_{rt} - aL_{ct-1} \qquad (14)$$

The following equation combines the two sources of money given by equations (13) and (14). We can retain a single variable (N_{t-1}) for the domestic production for the domestic economy in period t-1:

$$L_t = N_{t-1} + C_{rt} - aL_{ct-1} + X_{t-1} \qquad (15)$$

This is the equation for the money available to be spent. It is spent on domestic products and imports as in equation (4) [$L_t = N_t + M_t$].

As in equation (6) [$L_t = N_t + m(N_{t-1} + X_{t-1})$] we apply the marginal propensity to import "m" to the money created from all sources. The loan repayments factor, "a", relates only to domestic debt: the domestic source of money.

This model is presented in Figure 7. Exports are assumed to be $5 B and the marginal propensity to import "m" is 25% of the money spent. Bank credit "C_{rt}" is assumed to be $5 B, also, and the rate of loan repayments "a" is 25% of domestic loans outstanding with the banks.

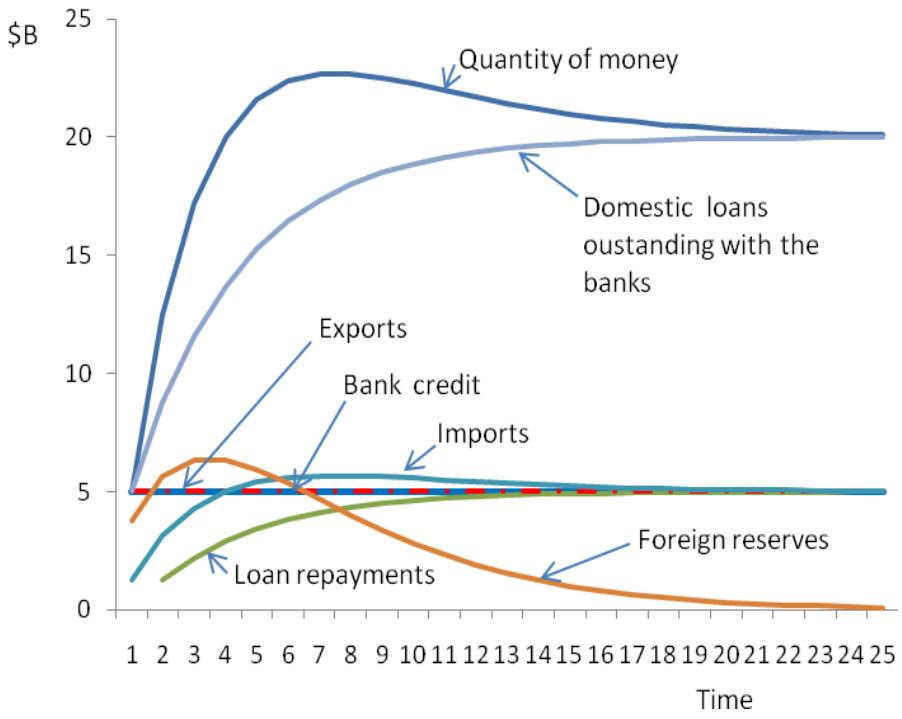

Figure 7: Interaction of Foreign and Domestic sources of money

Although the two sources of money are combined in this model, the equilibrium quantity of money remains at $20 B. The current account balance can be traced by following the difference between imports and exports and the slope of the foreign reserves curve.

Initially, the current account is in surplus with exports exceeding imports. After period 4 there are current account deficits with imports exceeding exports. From period 8, imports start to decline and approach the level of exports. In equilibrium, imports equal exports, the current account is balanced and foreign reserves are zero.

The zero balance in the level of foreign reserves in this special example is a key to understanding the cause of the current account deficit. We saw in Figure 5 that the equilibrium level of money from foreign sources was $20 B and this created foreign reserves of an equivalent amount. That money was created because the economy saved. It sold more than it purchased because it exported more than it imported. If we use our initial analogy of the airline, these reserves are the spare seats. They represent a foreign obligation to provide products (seats) to the domestic economy.

The money created by bank credit does not come from saving. It comes from lending. As was explained above, the money people earn from selling goods and services enables them to buy the equivalent of what they have produced. If additional money is created, it enables the economy to buy more than it has produced. In our analogy of the airline, bank credit is equivalent to issuing additional tickets.

Balancing the current account requires the balancing of the foreign and domestic sources of money. That does not mean that we need equal quantities of money from the two sources. In the Figure 7 example, the net quantity of money created from foreign reserves was zero and there was $20 B created from bank credit. The element that must be balanced is the equilibrium level of money from foreign reserves relative to the equilibrium level of money from domestic sources. From equations (7) [$L^* = X/m$] and (11) [$L^* = C_r/a$], this can be put as:

$$CAB = X/m - C_r/a \qquad (16)$$

Where:

"CAB" means the current account balance and relates to the long term balance.

In the Figure 7 example, the equilibrium quantity of money from foreign trade was $20 B and the equilibrium quantity of money from domestic sources was also $20 B. As a result the current account was balanced with no foreign reserves and no foreign debt at equilibrium.

Current account deficit and money

If we assume that the equilibrium quantity of money from domestic credit is greater than the equilibrium quantity of money from foreign sources the outcome will be a net current account deficit in the long term. In Figure 8, we have assumed that the rate of loan repayment has been reduced from 25% per period to 12.5%. This is equivalent to increasing the average term of bank loans from 4 periods to 8 periods.

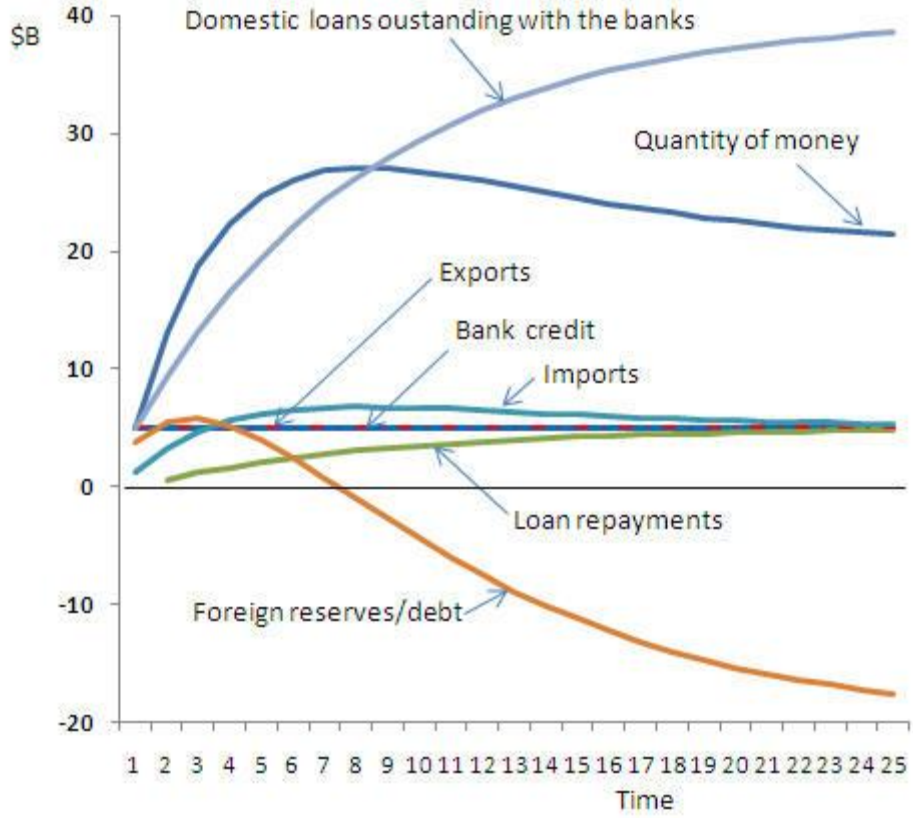

Figure 8: Current account deficit

In the Figure 8 example, the economy has a current account surplus for the first 3 periods after which the current account balance turns to a deficit. When the economy reaches equilibrium, the current account is balanced but there is an accumulated foreign debt of $20 B.

Applying the formula for the current account balance, the equilibrium quantity of money from foreign sources would have been $20 B (5/0.25). The equilibrium quantity of money from domestic sources would have been $40 B (5/0.125). While the current account has stabilized, at the end of the time series the current account balance is a deficit of $20 B.

One of the features of this economy is that the growth of bank credit is greater than the income of the economy. Also, it is evident that the amount by which the growth of bank loans exceeds the quantity of money is equal to the level of foreign debt.

Current account surplus and money

In the following example, we now assume that the equilibrium quantity of money from bank credit is less than the equilibrium quantity of money from foreign sources. To do so, we now assume that the rate of loan repayment is 0.4, equivalent to a term of two and a half periods for the average loan. All the other variables remain as they were. Applying equation (16) [CAB = X/m - C_r/a] we can determine that the equilibrium quantity of money from domestic sources

would be $12.5 B while the equilibrium quantity of money from foreign reserves remains at $20 B. Therefore, the long term current account surplus would be $7.5 B. This is evident in Figure 9 below.

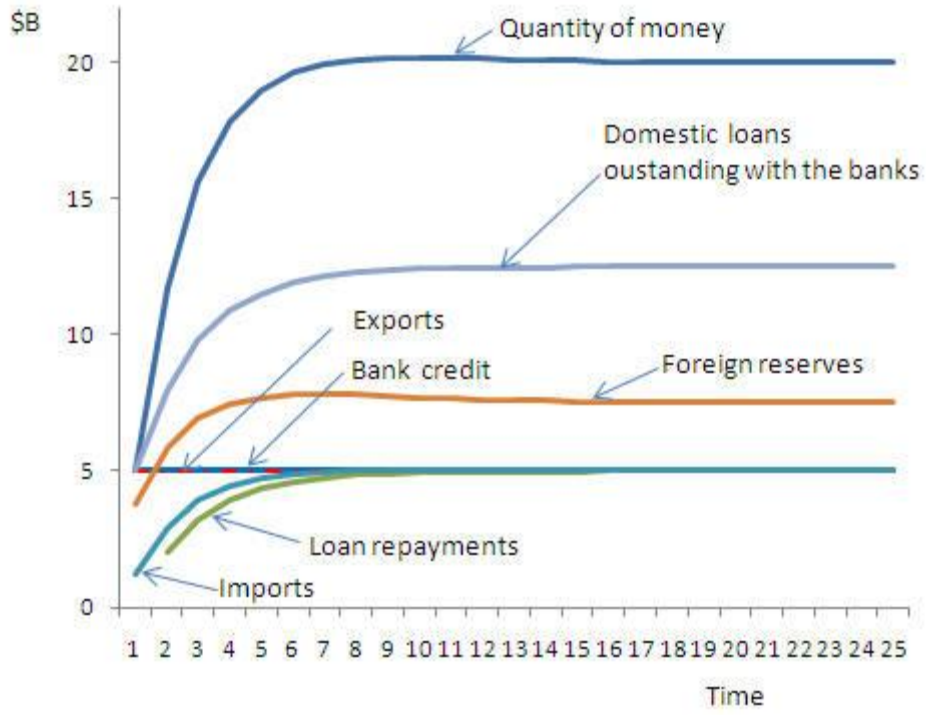

Figure 9: Current account surplus

The example presented in Figure 9 differs from Figure 8 in that the growth of domestic loans outstanding with the banks is now less than the growth in the total quantity of money. Foreign reserves have contributed to the quantity of money.

The rate of repayment of bank loans is particularly significant to the equilibrium level of money from bank credit. The longer the term of the loans, the more likely it is that the equilibrium quantity of money from bank credit is going to be greater than the equilibrium quantity of money from foreign reserves.

This relationship suggests that a country with a current account deficit should aim to reduce the term of bank loans. Commercial or trading bank credit should not be used for long term loans such as home mortgages. Other forms of finance should be used for such loans (e.g., savings bank loans, superannuation funds, etc).

Current account balance and capital flows

International capital flows also have an effect on the quantity of money in an economy with fixed exchange rates. We can include capital inflow in equation (15)[$L_t = N_{t-1} + C_{rt} - aL_{ct-1} + X_{t-1}$] such that:

$$L_t = N_{t-1} + C_{rt} - aL_{ct-1} + X_{t-1} + K_{t-1} \quad (17)$$

Where:

K_{t-1} is the net foreign capital inflow in the previous period.

Foreign capital inflow adds to the quantity of money in much the same way as increased exports considered in equation (7)[$L^* = X/m$]. The equilibrium quantity of money can be put as:

$$L^* = (X + K)/m \quad (18)$$

However, capital flows are not income. They represent an increase in foreign debt, or an increase in foreign equity in the economy. If we were to consider only the balance of payments, that is the level of foreign reserves, they could be defined as:

$$R_t = R_{t-1} + X_{t-1} + K_{t-1} - M_{t-1} \quad (19)$$

Drawing on equation (16) [$CAB = X/m - C_r/a$], the equilibrium level of foreign reserves can be put as:

$$R^* = (X + K)/m - C_r/a \quad (20)$$

While foreign reserves can move to a stable equilibrium, there cannot be a stable equilibrium for the current account balance unless there is a mechanism to turn it off, or reverse it. This is evident in Figure 10 below which uses the same assumptions used in Figure 7 but with the inclusion of foreign capital inflow of $1 B in each period.

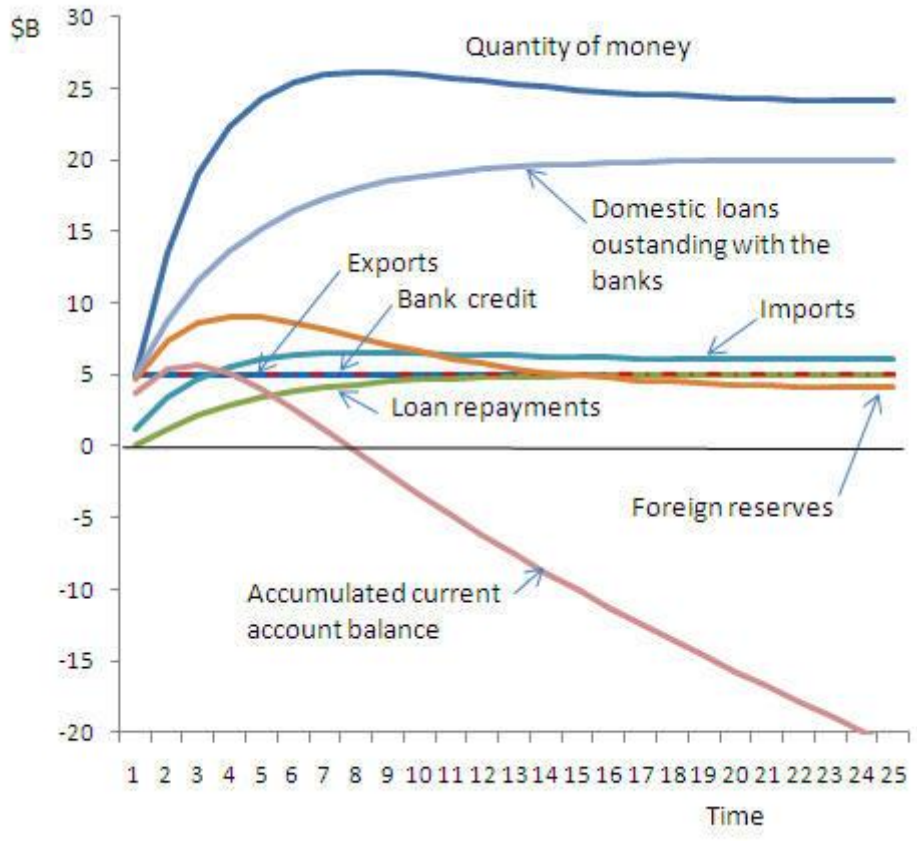

Figure 10: Net capital inflow and the current account balance

Relative to the example in Figure 7, the capital inflow has increased the equilibrium quantity of money by $4 B to $24 B. Also, the equilibrium level of foreign reserves has increased from zero to $4 B, consistent with equation (20). However, the economy experiences a perpetual current account deficit. So the current account balance formula (16) [$CAB = X/m - C_r/a$] can be modified by subtracting the accumulated capital inflow such that:

$$CAB = X/m - C_r/a - sK \qquad (21)$$

Where:

sK is the sum of foreign capital inflows over the relevant period.

Essentially, the equation is saying that the current account balance is equal to national savings less the growth in bank credit, less international borrowing.

The same approach can be applied to assess the impact on an economy of net capital outflow. In Figure 11, the value of capital (K) (which was +1 in Figure 10) is changed to -1, representing a net capital outflow. This lowers the equilibrium quantity of money from $20 B to $16 B, consistent with equation (18).

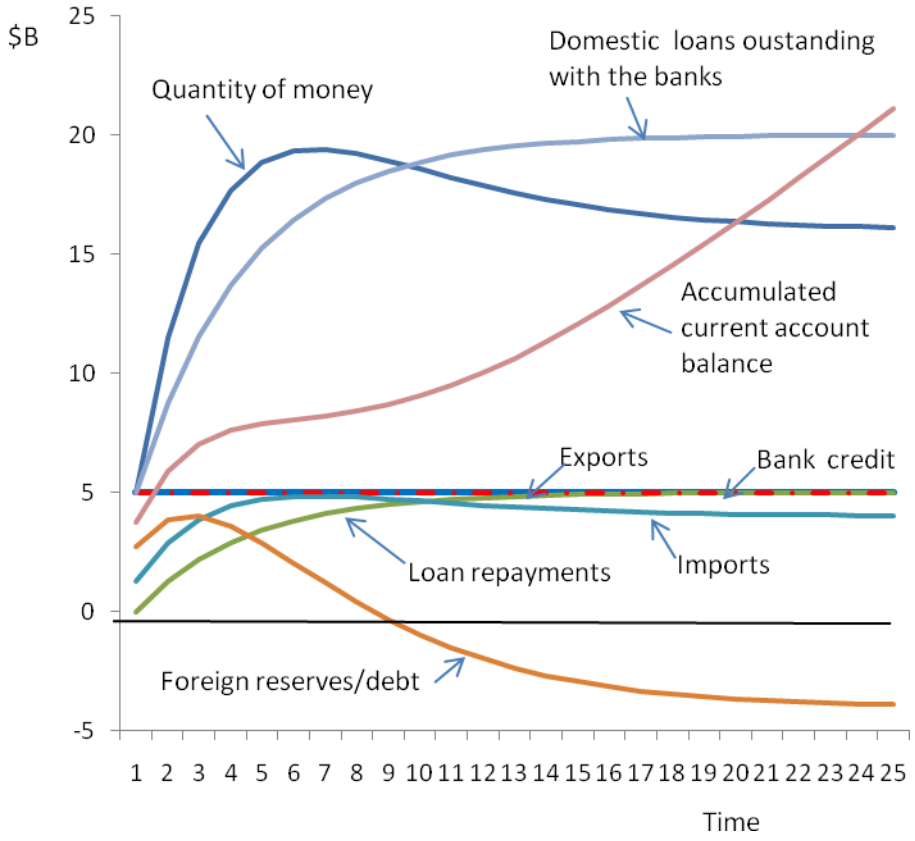

Figure 11: Net capital outflow and the current account balance

Consistent with equation (20) [$R^* = (X + K)/m - C_r/a$], official foreign reserves have fallen below zero to stabilize at a foreign debt of $4 B. Following the decline in the quantity of money available to spend, the equilibrium level of imports has fallen from $5 B to $4 B. The economy experiences current account surpluses which stabilize at $1 B per period. The accumulated current account surplus continues to rise while the capital outflow continues.

The current account balance with floating exchange rates

The analysis above reveals the significance of financial deregulation on countries with fixed exchange rates. That is, increasing total bank lending lowers any current account surplus, raises any current account deficits, and could turn an economy with a current account surplus into one with a current account deficit.

It also suggests that devaluing a currency would help to reduce a current account deficit if it reduces the value of "m": the marginal propensity to import.

Many countries have moved to the floating exchange rate system expecting that the exchange rate would adjust to balance the current account. However, the floating the exchange rate system has not eliminated the current account deficit.

Rather, the relationship between the current account and bank credit has become even more evident. This can be observed in the relationship between bank credit and the accumulated current account deficit for Australia, New Zealand, the Philippines and the USA[2].

The following analysis initially considers some of the popular theories about the floating exchange rate system. It then proposes an explanation of the relationship between the current account and the growth of bank credit that is consistent with the statistics. Finally, it presents a variation to the floating exchange rate system that provides opportunities to balance the current account while maintaining market determined exchange rates[3].

Floating exchange rate achieves external balance hypothesis

Some proponents of the floating exchange rate system believe that the exchange rate should adjust to bring about a balance between the foreign receipts and payments. To assess that hypothesis, let us assume that the exchange rate does adjust to balance imports and exports. To start with, we will assume that there are no capital inflows. We will assume the same economy represented in Figure 7 above, but with a floating exchange rate system.

In that case, exports would be given by:

$$X_t = X/e_t \qquad (22)$$

Where:

e_t is the exchange rate at time "t"; and

X is the value of exports in terms of foreign currency, which is assumed to be constant.

This means that if the exchange rate appreciates, the value of exports will fall in terms of domestic currency. If the currency depreciates, the value of exports will rise in terms of domestic currency.

Assume that imports are given by:

$$M_t = e_t m L_t \qquad (23)$$

That is, the higher the exchange rate, the greater the imports.

Without capital flows, under the floating exchange rate system, imports would equal exports. That is:

$$M_t = X_t \qquad (24)$$

Substituting equations (22)[$X_t = X/e_t$] and (23) into equation (24) means that:

[2] See Figures 3, 4, 5 and 6 in the submission.
[3] This is the system proposed in the submission.

$$e_t mL_t = X/e_t \qquad (25)$$

Which can be rewritten:

$$e_t^2 = X/mL_t$$

$$e_t = \sqrt{(X/mL_t)} \qquad (26)$$

Substituting equations (22) into equation (15) [$L_t = N_{t-1} + C_{rt} - aL_{ct-1} + X_{t-1}$] provides the equation for the quantity of money available to be spent in the economy in time "t".

$$L_t = N_{t-1} + C_{rt} - aL_{ct-1} + X/e_{t-1} \qquad (27)$$

This money is spent on domestic products and imports. As in earlier models, imports increase with the quantity of money. But this time the exchange rate depreciates over time to adjust exports up and imports down so that they remain equal. The outcome is modelled and presented in Figure 12 using the exchange rate presented in equation (26).

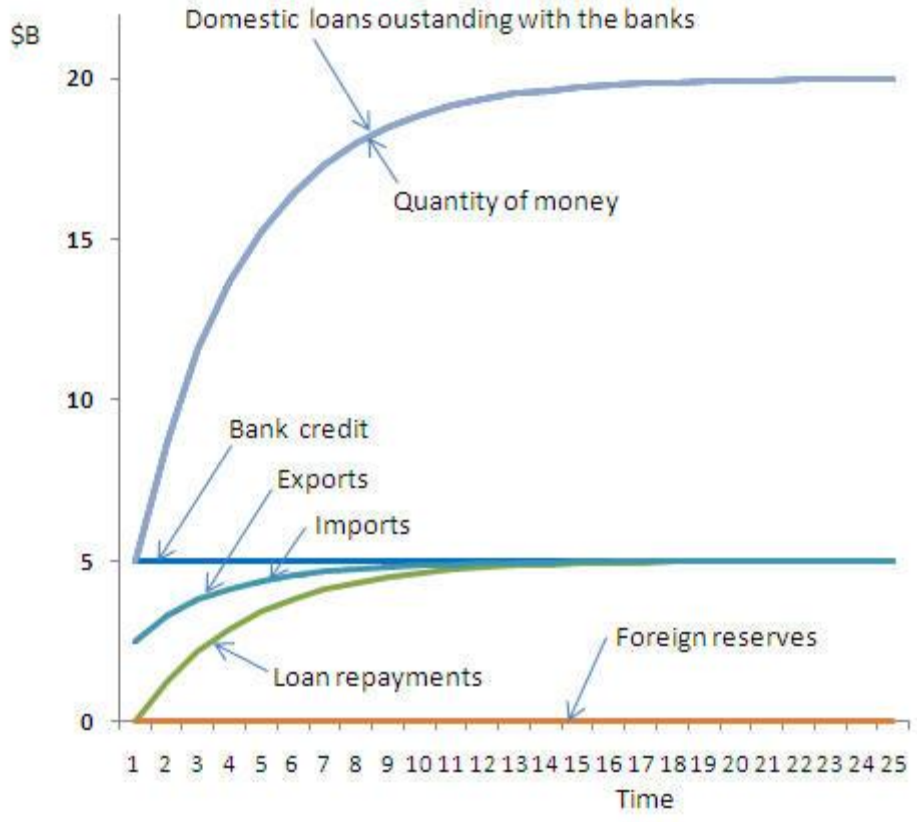

Figure 12: Credit growth with floating exchange rates

In this model, there is always external balance so there is no injection of money from exports or leakage of currency to imports. As in Figure 7, the quantity of money grows to $20 B, following the introduction of bank credit of $5 B per period and repayments equal to 25% of loans outstanding. All money is created

from bank credit so that the quantity of money is equal to the domestic loans outstanding with the banks.

This outcome is similar to the equilibrium outcome in Figure 7. Yet while it is theoretically possible, there is no sustained period of time in the data for Australia, New Zealand, the USA, and the Philippines where there is evidence of such an outcome. Therefore, the exchange rate is not having the effect that is being modelled. The floating exchange rate system is not bringing about external (international) balance in these countries.

Floating exchange rates and the capital inflow hypothesis

The other common explanation for the current account deficit is that it is caused by foreign capital inflows.

Let us continue with the floating exchange rate model used to derive Figure (8) but assume that foreign investors wish to invest $1 B of foreign currency, as was assumed in Figure (6) with fixed exchange rates.

In that case, foreign currency receipts would be made up of exports and foreign capital inflow, given by:

$$X_t + K_t = (X+K)/e_t \qquad (28)$$

Where:

"*X*" is the value of exports in foreign currency terms; and

"*K*" is the value of foreign capital inflow in terms of foreign currency, which is assumed to be constant.

Under the floating exchange rate system imports must equal exports plus foreign capital inflow. That is:

$$M_t = X_t + K_t \qquad (29)$$

Substituting equations (22)[$X_t = X/e_t$] and (28) into equation (29) defines the equilibrium situation of imports equalling exports and foreign capital with the exchange rate adjusting to bring about balance.

$$e_t mL_t = (X+K)/e_t \qquad (30)$$

Solving this equation for "e" determines the exchange rate to achieve this outcome to be:

$$e_t^2 = (X+K)/mL_t$$

$$e_t = \sqrt{((X+K)/mL_t)} \qquad (31)$$

Substituting equation (28) into equation (17)[$L_t = N_{t-1} + C_{rt} - aL_{ct-1} + X_{t-1} + K_{t-1}$] provides the equation for the money available to be spent in the economy.

$$L_t = N_{t-1} + C_{rt} - aL_{ct-1} + X/e_{t-1} + K/e_{t-1} \qquad (32)$$

Again, the money available is spent on domestic products and imports. Using the exchange rate presented in equation (31), the monetary income shown in equation (32), and assuming a capital inflow of $1 B, the modelled outcome is presented in Figure 13.

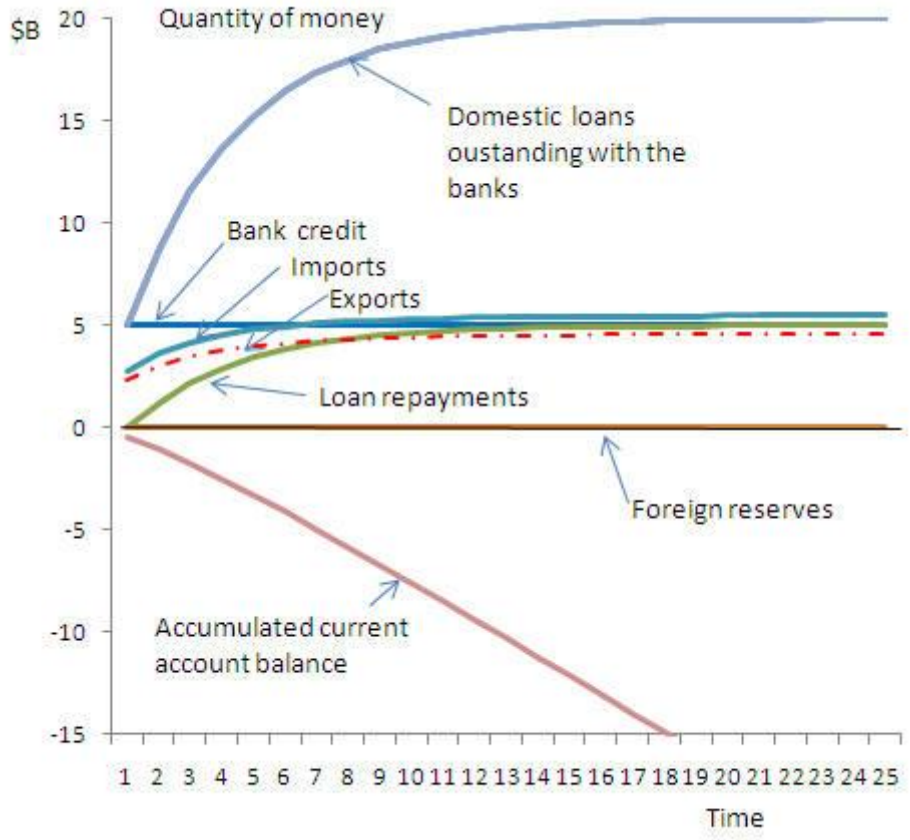

Figure 13: Capital inflow generating current account deficits

The current account deficit is defined here as the amount by which imports exceed exports. It is accumulated each period as the "Accumulated current account deficit" line.

This is equal, also, to the accumulated capital inflow which is an indicator of the level of foreign debt and equity accumulated. It is clearly evident that Figure 13 and the associated theory and model does not reflect nor explain the relationship between the current account deficit and bank credit that is evident in the data for Australia, New Zealand, the USA and the Philippines.

In all four countries, the current account deficit is generally equal to the growth of bank credit. Although the exchange rate has varied in each of these countries over the period shown, those variations have not affected the basic relationship between bank credit and the current account deficit.

The demand and supply constraint hypothesis

The quantity of money available to be spent can be defined in the same way under the floating exchange rate system as under the fixed exchange rate system. That is equation (17) still holds under the floating exchange rate system. That is:

$$L_t = N_{t-1} + C_{rt} - aL_{ct-1} + X_{t-1} - mL_{t-1} + K_{t-1} \qquad (17)$$

The major change under the floating exchange rate system is the requirement that international payments and receipts must be equal. That is:

$$M_t = X_t + K_t \qquad (29)$$

It is evident from the statistics for countries with floating exchange rates (such as Australia, New Zealand, the USA and the Philippines) that the current account deficit is equal to the growth of bank credit (bank loans less loan repayments). That is:

$$M_t - X_t = dC_{rt} \qquad (33)$$

Where:

dC_{rt} is the growth in bank credit in a period and is equal to bank credit in a period less loan repayments (of principal) in that period which is given by:

$$dC_{rt} = C_{rt} - aL_{ct-1} \qquad (34)$$

The reason why the current account deficit should equal the growth in bank credit is not so clearly evident. However, in equation (3) we defined income in a period "t" as:

$$Y_t = N_t + X_t \qquad (3)$$

The only way an economy with a floating exchange rate (without additional money from foreign sources) can spend more than it earns is by creating additional money from bank credit. Therefore, we can say that total money available to be spent is equal to income plus the growth in bank credit:

$$L_t = Y_t + dC_{rt} \qquad (35)$$

If we substitute equation (3) into equation (35) we can say that the money we have to spend is equal to domestic income, exports, plus bank credit:

$$L_t = N_t + X_t + dC_{rt} \qquad (36)$$

We assumed earlier in equation (4) that we spend our money on domestic products and imports:

$$L_t = N_t + M_t \qquad (4)$$

Therefore, substituting equation (36) into equation (4) we can say that:

$$N_t + X_t + dC_{rt} = N_t + M_t \qquad (37)$$

This is the demand and supply constraint hypothesis. The left hand side of the equation represents the demand constraint: the money available to be spent. The right hand side of the equation represents the supply constraint; what can be bought. It can be simplified to:

$$X_t + dC_{rt} = M_t \qquad (38)$$

In equation (38) the left hand side of the equation represents the money that is available to be spent on the foreign exchange market. The right hand side represents what it can be spent on. It can be rewritten as equation (33);

$$M_t - X_t = dC_{rt} \qquad (33)$$

This is the standard Keynesian explanation for the current account deficit in which the growth in credit is the amount by which investment exceeds saving and government expenditure exceeds taxes. The only way that investment can exceed saving, and government expenditure exceed taxes is to add to the domestic money supply. That is, to raise bank credit.

Substitution equations (22)[$X_t = X/e_t$] and (23)[$M_t = e_t mL_t$] into equation (33) means that:

$$e_t mL_t - X/e_t = dC_{rt} \qquad (39)$$

which may be rewritten as:

$$e_t mL_t - dC_{rt} - X/e_t = 0$$

$$e_t^2 mL_t - e_t dC_{rt} - X = 0 \qquad (40)$$

Equation (40) is in the quadratic form "$ax^2 + bx + c = 0$" which can be solved with the standard formula for solving a quadratic equation. Therefore, the exchange rate that solves equation (40) is:

$$e_t = (dC_{rt} +/- \sqrt{(dC_{rt}^2 + 4mLX)})/(2mL_t) \qquad (41)$$

Equation (17)[$L_t = N_{t-1} + C_{rt} - aL_{ct-1} + X_{t-1} - mL_{t-1} + K_{t-1}$] can be restated by substituting equation (34)[$dC_{rt} = C_{rt} - aL_{ct-1}$] for credit growth, equation (22) [$X_t = X/e_t$] for exports and equation (23)[$M_t = e_t mL_t$] for imports, such that:

$$L_t = N_{t-1} + dC_{rt} + X/e_{t-1} - e_{t-1}mL_{t-1} + K_{t-1} \qquad (42)$$

By using equation (41) for the exchange rate, we can ensure that the external balance in terms of foreign currency is maintained. That is:

$$M_t = X_t + K_t \qquad (29)$$

It also ensures that internal balance is maintained in terms of domestic currency. That is:

$$M_t = X_t + dC_{rt} \qquad (38)$$

These relationships are presented in Figure 14.

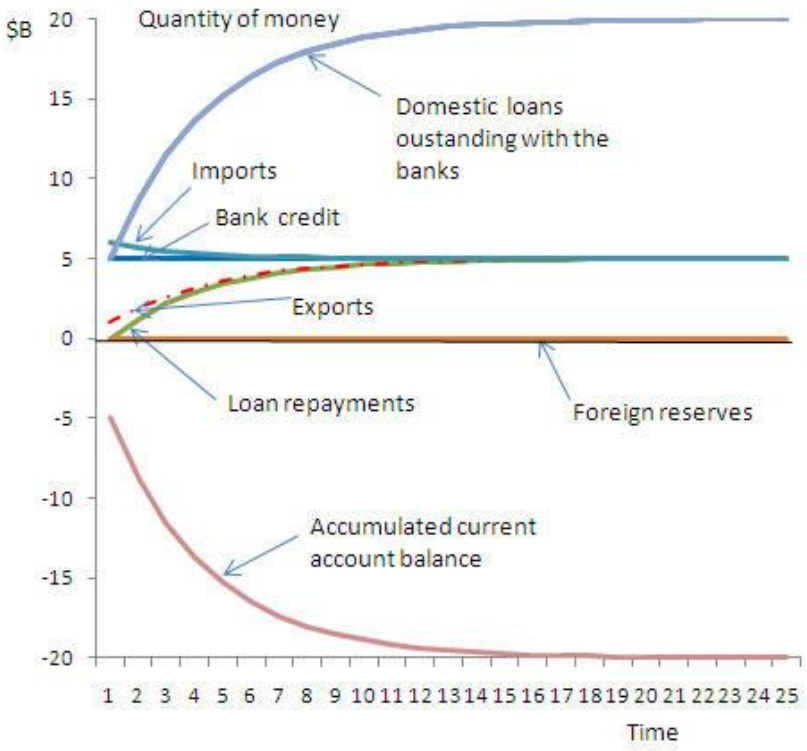

Figure 14: Money supply and current account balance with floating exchange rate system

To compare the quantity of money with the current account balance, Figure 15 plots the same relationships as in Figure 14 but plotting the current account deficit (rather than the current account balance). Also, it shows the foreign capital inflow.

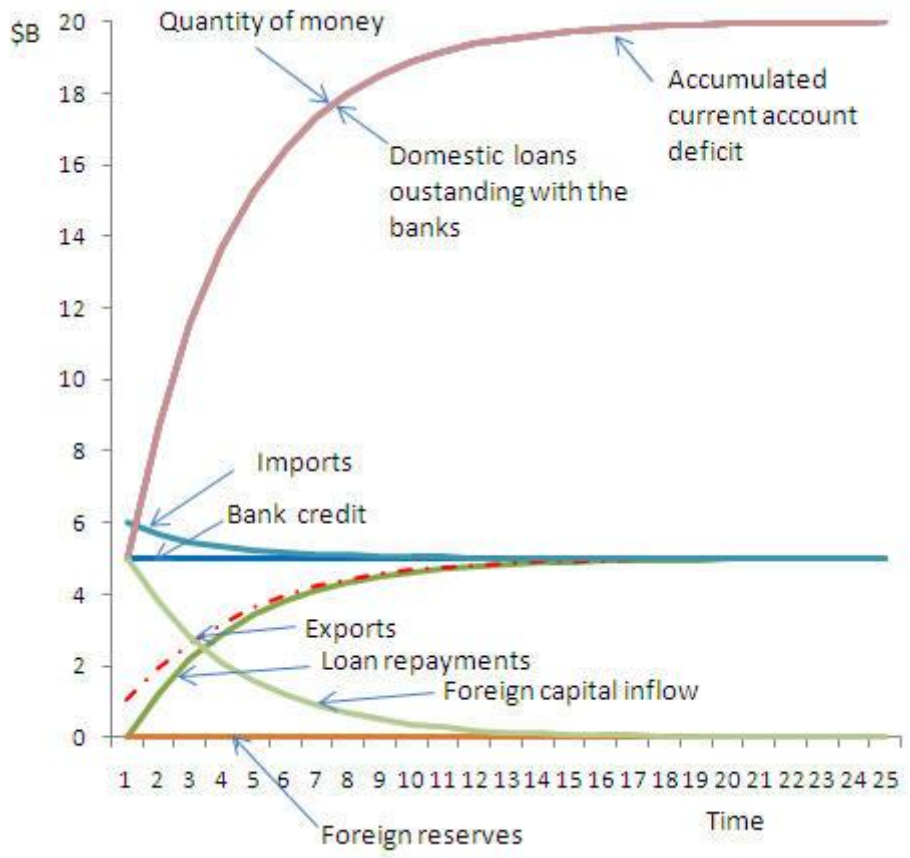

Figure 15: Money supply and current account deficit with floating exchange rate system

Figure 15 shows how the difference between imports and exports is met by foreign capital inflow. Also, foreign capital inflow is equal to the growth of bank credit. However, foreign capital does not normally drive the outcome. It is bank credit that drives the flows in the studied countries.

The demand and supply constraint hypothesis with net private capital outflow

While the supply constraint hypothesis may apply to countries such as the USA and Australia with net capital inflow, the question arises as to whether it explains the outcomes of countries such as Japan that have current account surpluses.

To asses the outcome, we will assume that the economy spends not only on domestic products and imports, but makes fixed foreign investments (private capital outflows). Therefore, we will modify equation (4) such that spending is given by:

$$L_t = N_t + M_t + K_{ot} \qquad (43)$$

Where:

K_{ot} is a fixed amount of capital outflow that is invested in each period "t".

In a similar approach to that used to create equation (37)[$N_t + X_t + dC_{rt} = N_t + M_t$], we substitute equation (36)[$L_t = N_t + X_t + dC_{rt}$] into equation (43) to determine that:

$$N_t + X_t + dC_{rt} = N_t + M_t + K_{ot} \qquad (44)$$

As in equation (37), the left hand side of the equation represents the demand constraint: the money available to be spent. The right hand side of the equation represents the supply constraint: what can be bought, including foreign investments. Equation (44) can be simplified to:

$$X_t + dC_{rt} = M_t + K_{ot} \qquad (45)$$

As in equation (38)[$X_t + dC_{rt} = M_t$] the left hand side of the equation represents the money that is available to be spent on the foreign exchange market. The right hand side represents what it can be spent on. It can be rewritten as:

$$M_t - X_t = dC_{rt} - K_{ot} \qquad (46)$$

In this equation, the capital outflow represents national savings. Therefore, the current account deficit is to the growth of bank credit less national savings.

Substituting equations (22) [$X_t = X/e_t$] and (23) [$M_t = e_t mL_t$] into equation (46) means that:

$$e_t mL_t - X/e_t = dC_{rt} - K_{ot} \qquad (47)$$

which may be rewritten as:

$$e_t mL_t - (dC_{rt} - K_{ot}) - X/e_t = 0$$

$$e_t^2 mL_t - e_t(dC_{rt} - K_{ot}) - X = 0 \qquad (48)$$

Equation (48) can be solved with the standard formula for solving a quadratic equation. Therefore, the exchange rate that solves equation (39) is:

$$e_t = ((dC_{rt} - K_{ot}) +/- \sqrt{((dC_{rt} - K_{ot})^2 + 4mLX})/(2mL_t) \qquad (49)$$

Figure 16 plots the dynamics of the main components of equation (42)[$L_t = N_{t-1} + dC_{rt} + X/e_{t-1} - e_{t-1}mL_{t-1} + K_{t-1}$] (the demand constraint: the money available to be spent) using equation (49) to determine the exchange rate.

This model is similar to that used for Figures 14 and 15 except that it assumes investment overseas (capital outflow) of $1.2 B in each period.

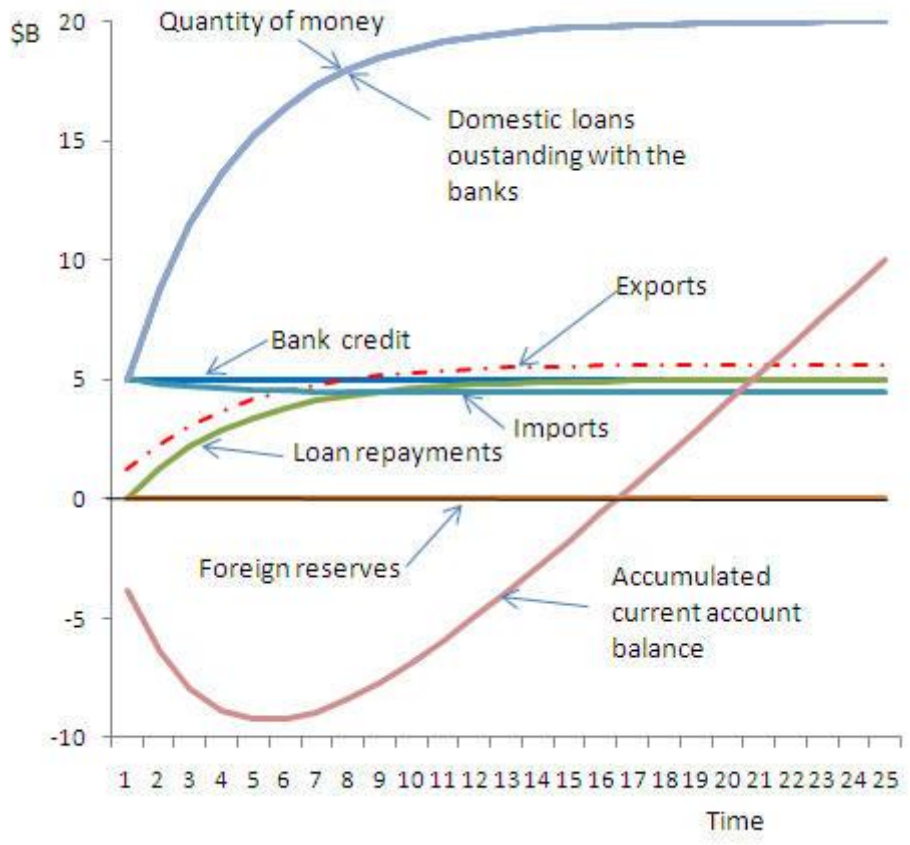

Figure 16: Private capital outflow and current account balance with floating exchange rate system

Initially, the growth in net bank credit is greater than the capital outflow. This causes current account deficits. However, when the loan repayments increase so that the investment overseas exceeds the growth of bank credit, the current account balance is reversed and the economy experiences current account surpluses. This is the experience of countries such as Japan whose net capital outflow is greater than the net growth of bank credit.

The demand and supply constraint hypothesis with net official capital outflow

The Central Bank of the Philippines has intervened in the floating exchange rate system to stabilize the exchange rate of the Peso. In the process its foreign reserves have been growing and the Philippines have been experiencing current account surpluses.

The following model extends the model represented in Figure 16 to explain what is happening in economies that significantly increase their official foreign reserves, such as the Philippines.

In an economy with private capital outflow, the investment reduces the expenditure on other products. However, when the banking system initiates capital outflow, it does not reduce expenditure on other products. That is,

instead of equation (43)[$L_t = N_t + M_t + K_{ot}$] we can return to equation (4). Money can be spent on domestic products or imports:

$$L_t = N_t + M_t \qquad (4)$$

This is the only difference between private capital outflow and official capital outflow (that raised foreign reserves). In the case of private capital outflow, from equation (43)[$L_t = N_t + M_t + K_{ot}$] we can say that expenditure on domestic products can be put as:

$$N_{t-1} = L_{t-1} - M_{t-1} - K_{ot-1} \qquad (50)$$

In the case of official foreign investment, from equation (4) we can say that:

$$N_{t-1} = L_{t-1} - M_{t-1} \qquad (51)$$

This change alters the value of "N_{t-1}" in equation (42)[$L_t = N_{t-1} + dC_{rt} + X/e_{t-1} - e_{t-1}mL_{t-1} + K_{t-1}$].

The foreign exchange market does not distinguish between private and official capital flows. Therefore, it is possible to retain equation (49)[$e_t = ((dC_{rt} - K_{ot}) +/- \sqrt{((dC_{rt} - K_{ot})^2 + 4mLX}))/(2mL_t)$] used to define the exchange rate in the private capital outflow example except that we will replace private capital outflow with official capital flows that raise the foreign reserves of the banking system. That is:

$$e_t = ((dC_{rt} - dR_t) +/- \sqrt{((dC_{rt} - dR_t)^2 + 4mLX}))/(2mL_t) \qquad (52)$$

Where:

dR_t is the growth in the foreign reserves of the banking system in time "t".

Figure 17 plots the effect of this change. In this example, all the variables have the same values as in Figure 16, except that instead of private capital outflow of $1.2 B per period, the foreign reserves are increased $1.2 B in each period.

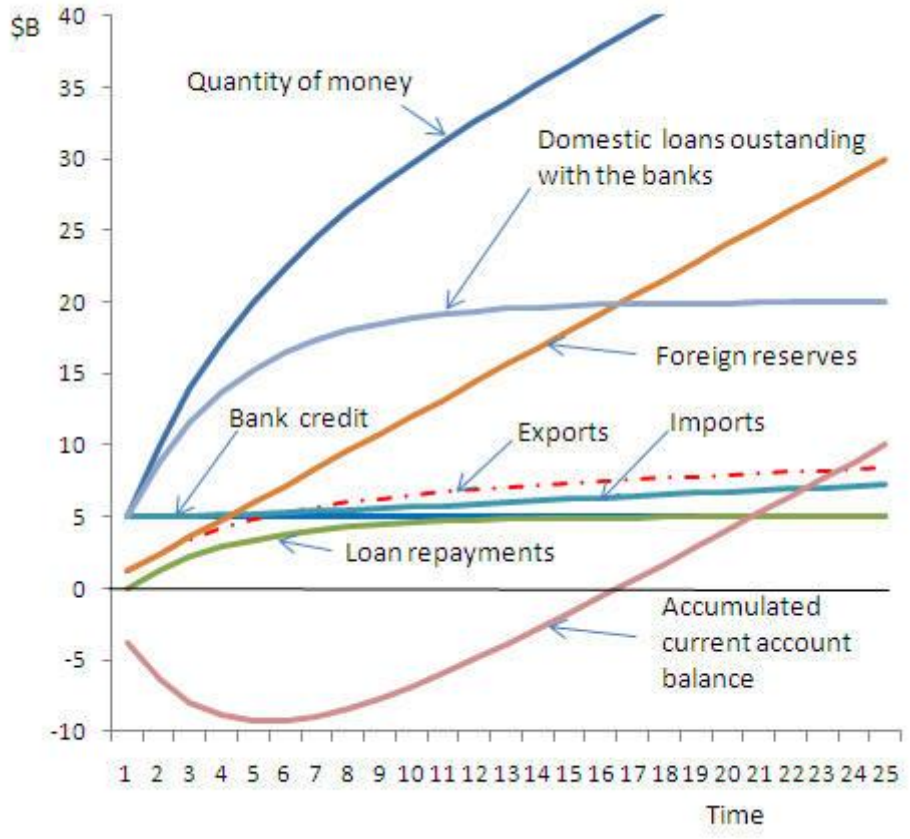

Figure 17: Official capital outflow and current account balance with floating exchange rate system

As in the example with private capital outflow, the country experiences a current account deficit while the growth of bank credit is greater than the growth in foreign reserves. When the growth in foreign reserves is greater than the growth in bank credit, the economy experiences current account surpluses.

The major difference also evident is that the growth in foreign reserves adds to the quantity of money and stimulates the economy.

Given the massive debts accumulated by governments to stimulate their economies during the global financial crisis, the use of official capital outflow (to buy foreign investments or foreign exchange) to stimulate the economy would avoid the debt burden and actually reduce net foreign debt.

Concluding comments

This paper has shown that it is possible to find a unifying theory and a formula explaining the current account balance for countries with both fixed and floating exchange rates. The Demand and Supply Constraint Hypothesis is able to explain both current account deficits and current account surpluses under the floating exchange rate system that have been experienced in Australia, New Zealand, the Philippines and the United States of America. Also, it is able to explain the effect of different types of capital flows.

An understanding of the determinants of the current account balance means that economists now manage the current account. To continue to leave the current account balance as it is, or change it, is a now a conscious decision of economic policy.

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