II. Basic Concepts in Open Economy Macroeconomics

In section I, we reviewed some of the basics of closed economy macroeconomics. In this section, we move on to the main theme of this lecture and introduce key concepts in open macroeconomics such as small country and two-country models, stocks vs. flows, the balance of payments and exchange rates.

Small country and two-country models

There is only one "country" in a "small country model", i.e. there is only one system of equations and it describes the domestic economy. The foreign country or "Rest of the World" (ROW) exists, but there is no system of equations that describes the economy of the ROW, and all foreign variables are treated as exogenous. Whatever the domestic economy does has absolutely no effect on the ROW. This is because the domestic economy is too small, in fact miniscule compared to the ROW.

Contrast this with the "two-country model", in which there are two countries of similar size. Each country is "big" enough to affect the endogenous variables of the other. There are two systems of equations, one for each economy. When we want to discuss economic interdependence, as we will do in Section IV, a two-country model is often more suitable. Note that more is not always better when it comes to the number of countries in an economic model. There are models with three or more countries, but they tend to be more complicated due to the increased number of equations and endogenous variables. If the complication is a necessary evil for a meaningful analysis of the topic, then such a model would be appropriate. In general, economists try to use the least complicated model that allows them to answer the questions they are asking. One way in which an economist is judged is how simple his/her model remains, after incorporating all the necessary elements.

The difference between stocks and flows

In order to correctly grasp concepts such as the balance of payments and exchange rates, one needs to understand the difference between stock variables and flow variables. We can define stock variables for each moment in time. In contrast, we can only define flow variables for a given time period, during which the variable is measured. Flow variables are differences or differentials of stock variables. The amount (level) of water in a pool is a stock variable, while the water flowing in and out per minute is a flow variable.

In macroeconomics, examples of stock variables are stocks of financial assets such as the ones that appear in our models below; M, B, F. The stock of capital in a production function is also a stock variable. Examples of flow variables are Y, C, I, G, EX, IM. Note that the stock of foreign assets and foreign debt are stock variables, while the balance of payments is a flow variable.

Balance of Payments

Japan's balance of payments comprises the following items.

Current Account

Goods and services

Trade balance — Export, Import

Services

Transportation — Sea transport (Passenger, Freight), Air transport (Passenger, Freight)

Travel

Other services — Communication, Construction, Insurance, Financial, Computer and information, Royalties and license fee, Other business, Personal, cultural and recreational, Government services, n.i.e.

Income

Compensation of employees

Investment income — Direct investment income, Portfolio investment income, Other investment income

Current transfers

Official sector, Other sectors

Capital and Financial Account

Financial Account

Direct investment

Portfolio investment (Excl. securities lending)

Equity securities (Excl. securities lending)

Debt securities — Bonds and notes (Excl. securities lending), Money market instruments

Financial derivatives

Other investment (Excl. securities lending)

Loans — Long-term — Banks' inter-office account

Short-term (Excl. securities lending) — Banks' inter-office account

Trade credits — Long-term, Short-term

Currency and deposits

Other assets / liabilities

Capital Account

Capital transfer Official sector, Other sector

Acquisition/disposal of non-produced, non-financial assets

Changes in Reserve Assets

Errors and Omissions

Source: International Department, Bank of Japan, http://www.mof.go.jp/1c004.htm

For further details please refer to the Bank of Japan, Balance of Payments Statistics Study Group (2000), "Nyumon Kokusai Shushi --- Tokei no Mikata/Tsukaikata to Jissen Katsuyoho (Introduction to the Balance of Payments --- How to read/use the statistics)".

The purpose of the balance of payments (BoP) is to record all transactions across borders. It uses the same method as double-entry bookkeeping, so the sum of all the items should add up to zero. But there are transactions that are not or cannot be reported for different reasons. So the discrepancy is recorded as "errors and omissions", and the table adds up to zero by including this item.

One way in which the BoP enters the open macroeconomic model is in the form of the Current Account (CA) in the IS equation.

As shown above, the current account is defined as

CA = Goods and services balance + Income Balance + Current Transfers.

At the same time,

Gross National Disposable Income (GNDI) is

(GNDI)

= GDP + Income Balance + Current Transfers.

= GNP + Current Transfers

Gross Domestic Product (GDP) is

GDP = C + I + G + Goods and services balance (GSEX-GSIM)

Gross National Product (GNP) is

GNP = C + I + G + Goods and services balance + Income Balance

where C is aggregate consumption, I is aggregate investment, G is government spending.

Hence, if we let Y denote Gross National Disposable Income (GNDI),

Y = C + I + G + CA.

And we can rewrite GDP and GNP as

GDP = C + I + G + CA - Income Balance - Current Transfers and

GNP = C + I + G + CA - Current Transfers.

Note that Income Balance and Current Transfers are separate from aggregate supply produced domestically. They are also separate from exports or imports of goods and services. They are amounts of money transferred to/from abroad (as remuneration paid to factors of production such as capital and labour, and as transfers).
But Income Balance and Current Transfers are parts of CA, and parts of GNDI, because they are amounts of money (income) available to be used as C, S^P or T (where S^P is aggregate private savings and T is tax payments, as we see below).
Note also that the expression Gross National Income (GNI) is sometimes used in place of Gross National Product (GNP).
As we shall see shortly, the open economy IS equation turns into an equation that shows the relationship between CA and the broadly-termed Capital Account (KA, using the capital letter for Kapital). We use the adjective "broadly-termed" because KA is the sum of all the items in the BoP table excluding CA. The sum of CA and KA is zero. The same IS equation shows that aggregate supply is equal to aggregate demand, and that CA and KA add up to zero. So the fact that "the total sum of BoP is zero" is based on the same logic as "aggregate supply is equal to aggregate demand".

CA=S-I

In order to transform the equation

$$Y = C + I + G + CA$$

into one that shows the relationship between CA and KA, we use the following relationships:

$$Y = C + S^P + T$$
$$T - G \equiv S^G$$
$$S^G + S^P \equiv S$$

The first equation states that income is spent on consumption, savings and the payment of taxes. The superscript P on S stands for "private," signifying private sector savings. The superscript G on S in the second equation stands for "government." This second equation defines government savings as the difference between government expenditure and tax revenues. When this value is negative, the government has a deficit; when positive, a surplus. The third equation defines aggregate savings as the sum of private and government savings.

Substituting these relationships into the IS equation, we get

$$CA = Y - C - I - G = S^P - I - G + T\ .$$

The right hand side of this equation is the sum of the difference between "private sector savings and investment", and the "government budget balance". This is the KA, the broadly-termed capital account. In reality, transactions that are captured under "errors and omissions" are sprinkled all over the BoP table.

Hence, in terms of the definitions used in the BoP table,

current account ＝－（capital account ＋changes in foreign reserves）

confirming that the sum of CA and KA is zero.

KA is often called the "savings and investment balance" or "IS balance", and can be rewritten as S-I. From now on, we will be using the equation

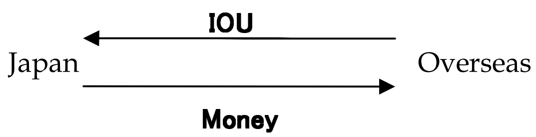
$$CA = S - I$$

again and again.

Surplus and deficit of capital accounts

Before discussing this equation in detail, we would like to make sure we know how to tell if KA (and its components as defined in the BoP table) is in a surplus or a deficit. KA is in surplus when the country borrowed from abroad more than it lent abroad, during that time period. KA is in deficit when the country lent abroad more than it borrowed from abroad, during that time period. For example, the CA was in surplus and KA was in deficit for Japan for 2004, and Japan lent more than borrowed from abroad during 2004.

It might be a bit counter-intuitive to call it a surplus (deficit) when one borrows more (less) than one lends. But this is how the record on international borrowing and lending are kept. One can sometimes get confused about this, and it may be helpful to think of the capital account as keeping track of trade in IOUs. Importing contributes to deficits, exporting contributes to surpluses. For example, if Japan lends money overseas, Japan receives IOUs from abroad.



Conversely, if Japan borrows money from overseas, an IOU is exported.

If the total number of IOUs imported exceeds the number of IOUs exported, the capital account will be in deficit. If the total number of IOUs exported exceeds the number of IOUs imported, the capital account will be in surplus.

Another way to look at it is to say that an outflow of money will contribute to a deficit, be it of the CA or the KA. And an inflow of money will contribute to a surplus, be it of the CA or the KA.

The Current Account --- myths and facts

We have seen that (i) the balance of payments (BoP) enters the open economy macroeconomic model through the IS equation, and that (ii) the Current Account (CA) is the mirror image of the broad Capital Account (KA) as defined above (or the Savings and Investment gap: $S - I = S^P - I - G + T$).

These two fundamental characteristics of the BoP are in fact crucial in correctly understanding the open macro-economy. Yet, or maybe because of that, they have given rise to two commonly held myths.

One of these is that "a CA deficit is a bad thing, while a CA surplus is a good thing". A variation of this myth is that "a CA deficit increases unemployment". The other, closely related fallacy is that "a CA deficit can be reduced if we only take measures to increase exports and decrease imports". Below, we debunk these myths. Doing so involves explaining the following facts:

1. A CA deficit reflects the fact that the country has borrowed from abroad more than it has lent abroad during that period, which can be good or bad. And a CA surplus reflects the fact that the country has lent abroad more than it has borrowed from abroad during that period, which can also be good or bad.
2. In general there is no one-to-one relationship between changes or levels of aggregate unemployment and changes or levels of the CA, or of any other set of two variables that appear in the IS equation.
3. In general the CA and the S-I are simultaneously determined, just as aggregate supply and aggregate demand are simultaneously determined. In order to control the value of the CA, all variables involved, not just exports and imports, must move in the desired direction, by the desired amount, simultaneously.

CA imbalance is neither good nor bad

We start with the first fact. The crucial relationship has already been derived above using the IS equation, and the relationship is reproduced here:

$$CA\left(Y, Y^*, eP^*/P\right) = S(Y) - I(r) - (G - T) \qquad (1)$$

where we have used S(Y) in place of S^P and specified also what I and CA are functions of.

There are two ways to explain the equality between CA and S-I; from left to right and from right to left. Every time goods and services are bought and sold, payment is made. And every time capital flows form one place to another, the recipient uses that amount to purchase goods and services.

As a concrete example, take the case of the USA where the value of this equation is negative, i.e. the country has a CA deficit and net borrowing (net capital inflow). Reading equation (1) from left to right, we can tell the following story: "because the CA is in deficit, imports are higher than exports; the USA is paying more to foreigners than the USA is receiving from foreigners, and the foreigners are richer by that amount and invest that money in the USA, resulting in a net capital inflow". Or we can read the equation from right to left and say for instance: "because private and public saving is low and investment is high in the USA, there is a scarcity of funds, returns on investment are high, and the world invests in the USA and with this net borrowing the USA can maintain its high level of spending".

Both of these explanations are correct, because both sides of this equation are simultaneously determined (as explained below). Those who argue that a CA deficit is necessarily bad tend to adopt the first interpretation. But a CA deficit reflecting net borrowing from abroad is not a bad thing if the net borrowing can continue without incident. If foreigners continue to be happy lending money to the USA, then there will be no capital flight from the USA, no financial crises of the kind experienced by countries in Latin America and East Asia. And as we explain below, it is not correct to attribute higher aggregate unemployment to CA deficits. So a CA deficit, or net capital inflow, is neither always good nor always bad. It can be good if the net borrowing continues smoothly and the domestic economy prospers as a result of higher spending. It can be bad if it results in capital flight and financial and economic crises.

By the same token, a CA surplus, or net capital outflow, can be good or bad. Let's go back to the two ways to explain the equality shown in equation (1) and take Japan as an example this time. Reading the equation from left to right, others might envy Japan for "having a CA surplus, being paid from abroad more than Japan pays abroad, and as a result being rich enough to invest that extra money abroad". But what if return on that investment abroad turned out not be so high, or even negative over time? What if the borrower defaulted, or the exchange rate of the yen turned out (at time of maturity) to be unfavourable? In such a case, Japan will have invested its earnings from abroad unwisely, and lost money. Alternatively, we could read the equation from right to left: "because Japan has private saving that is high enough to more than cover the domestic demand for funds, even after funding the huge budget deficit, it lends money all over the world, and as a result, foreigners have money to spend, which they spend on buying Japanese products, resulting in Japan's CA surplus". Is this necessarily good, or could it be bad? The answer depends on how the Japanese economy is faring. If Japan has money to lend abroad because the domestic economy is in a serious recession, this will not be good. But if it is prospering and still having excess savings to lend to foreigners, then this will be good (at least from Japan's standpoint).

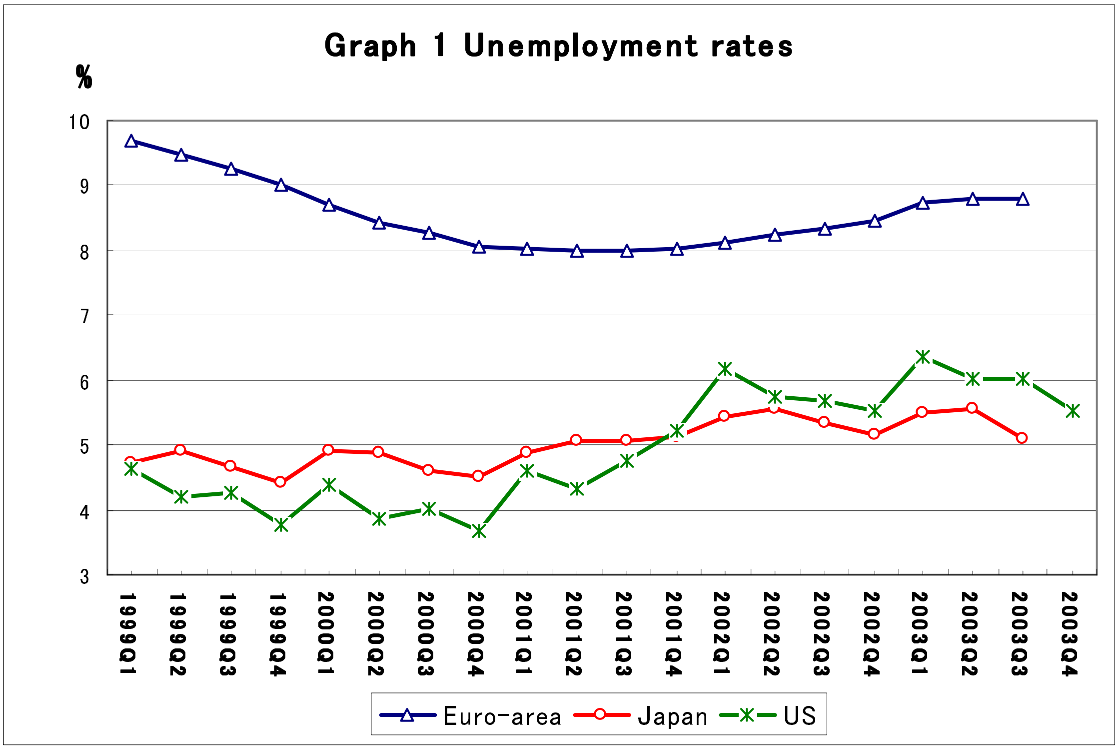
This discussion should alert us of the dangers of focusing too much on the CA. What matters is whether people can put bread, or rice as the case may be, on the table. Rather than the value of the CA, the goal of macroeconomic policy should be stable real income, which requires stability in both employment and prices. This is not just a theoretical possibility. For instance, Japan has experiences with choosing the ratio of CA to GDP as the policy goal. In 1985, Japan embarked upon a policy of monetary relaxation in order to reduce the CA surplus to GDP ratio, as promised to its G7 partners. The so-called "lost decade" of the 1990s and the lingering economic malaise are the price Japan is paying. This is an example of what happens when the wrong endogenous variable is chosen as the policy target.

Too many degrees of freedom

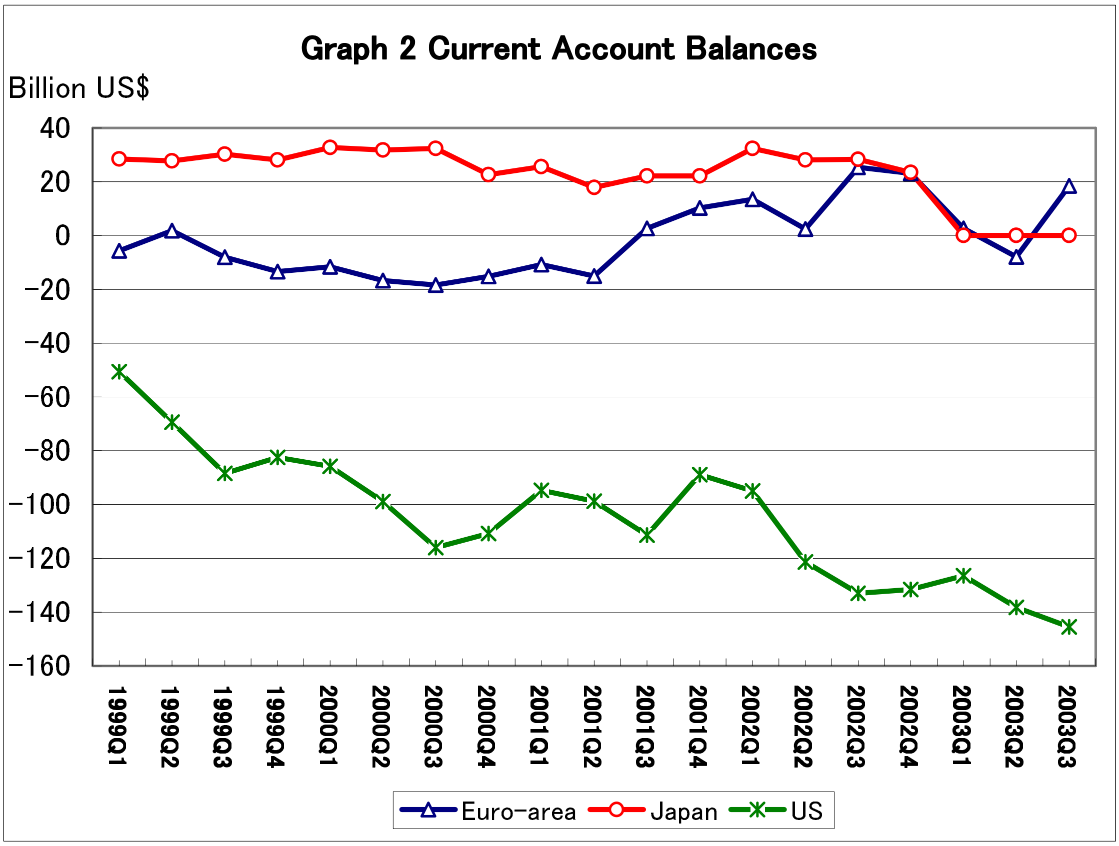
Employment is important, but what exactly is the relationship between unemployment and the CA? We have stated above (as the second fact) that there is no one-to-one relationship between changes or levels of unemployment and the CA.

If we compare for example the quarterly data shown as Graphs 1 and 2, it shouldn't be difficult to agree that there is no one-to-one relationship between aggregate unemployment and the current account. This is true in terms of both changes and levels. A country (or region) that experiences an increase in CA deficit (or a decrease in CA surplus) does not always experience an increase in aggregate unemployment. A country with a high level of unemployment does not necessarily have a CA deficit.

The theoretical reason why this is so is because the IS equation contains more than two endogenous variables, or it has too many degrees of freedom.



Source: IMF International Financial Statistics



Source: IMF International Financial Statistics

The values of endogenous variables are determined at levels where the macro economy is in equilibrium. In this way, endogenous variables are much like unknown variables in a mathematical equation. Think of an equation with more than two unknown variables such as:

$$y = x_1 + x_2 + x_3$$

and compare this with an equation with only two unknown variables:

$$y = x_1$$

Clearly, changes and levels of y and x_1 have one-to-one relationships in the latter equation. That is not the case in the first equation with more than two unknowns (unless we make assumptions in advance, for instance that $x_2 + x_3$ is fixed). There are too many degrees of freedom in the first equation.

Similar to the first equation, the IS equation has too many degrees of freedom. It contains more than two endogenous variables, whether it is written as:

$$CA(Y, Y^*, eP^*/P) = S(Y) - I(r) - (G - T) \qquad (1)$$

or

$$Y = C(Y) + I(r) + G + CA(Y, Y^*, eP^*/P). \qquad (2)$$

Unemployment enters this equation through the aggregate production function

$$Y = F(N, K, A) \qquad (3)$$

where unemployment would be equal to the total number of workers available for employment (a fixed value in the short-run) minus N. Putting together equations (2) and (3), we have

$$F(N, K, A) = C(Y) + I(r) + G + CA(Y, Y^*, eP^*/P) \qquad (4)$$

and it should be clear that changes and levels of aggregate unemployment have no one-to-one relationship with changes and levels of the CA. Movements in other endogenous variables such as C and I, in response to movements in the endogenous variables Y and r, will in general interfere with a one-to-one correspondence between CA and N. This is true regardless of whether CA is in deficit or surplus.

CA and aggregate unemployment

In general there is no one-to-one relationship between changes and levels of aggregate unemployment and changes and levels of the CA. It is still possible for a particular industry to experience higher unemployment when imports of the product produced in that particular industry increases suddenly. The complaint that CA deficits are causing higher aggregate unemployment comes perhaps from the confusion between loss of jobs in certain industries and aggregate unemployment.

It is also possible to think of an economy in which, for some reason, the other endogenous variables in the IS equation are fixed. Or, changes in the other endogenous variables could happen in ways that exactly offset each other, so that the sum of the variables is fixed. But these are exceptional circumstances. In general, there is no one-to-one relationship between changes or levels of any set of two variables that appear in the IS equation. Essentially the same logic can be used to show why a country with a government budget deficit (surplus) does not always have a current account deficit (surplus).

CA and S-I are simultaneously determined

Just now we raised the possibility that some endogenous variables are fixed, or that their sum is fixed. Some endogenous variables indeed change more slowly than others, and this brings us to the third fact. The third fact we stated above is that in general CA and S-I are simultaneously determined. It arises because there are endogenous variables on both sides of the equation, and in general we assume that all endogenous variables change at the same speed and that their values are simultaneously determined. The statement is qualified by the words "in general" because sometimes it is reasonable to assume that some endogenous variables change more quickly than others. Such an assumption is in fact the key ingredient in the Stock Equilibrium approach to Exchange Rate Determination, as well as the Dornbusch overshooting model discussed later in the course.

If there are reasons to believe that during a certain period in a certain country the CA was adjusting more slowly than S-I (or vice versa), then the two sides of equation (1) are not simultaneously determined. An example might be a government deficit that refuses to go away irrespective of policy measures or phase of economic cycle. Or a private sector that continues to save little and invest much. Both of these would tend to keep aggregate S-I stubbornly negative, no matter what happens on the CA side. In such a case, the right-hand-side of equation (1) decides the value of this whole equation, and the two sides are not simultaneously determined.

On the other hand, there may be periods when it is the CA that adjusts more slowly than S-I, and sets the value of this equation. An example is when the J-curve effect is delaying the response of the CA to changes in relative price. The delay in CA adjustment could be due to other factors such as hysteresis.

Except for these special cases, in general the CA and S-I are simultaneously determined. Back in the years when many countries, Japan included, still had tight capital controls, money did not flow freely across borders. Almost all private sector capital flows were payments for trade in goods and services, and it would have been reasonable to think of the S-I side as passively responding to the CA side. But today, with capital controls removed, demand for and supply of foreign exchange arise for reasons related not just to trade but also to investment. There are currency traders who buy and sell foreign currencies related to activities on the CA side and the S-I (or KA) side. Sometimes the same traders engage in currency trading on both sides of this equation. But whoever engages in them, the currency transactions arising from economic activities on the CA side are certainly not dominating the currency transactions arising from economic activities on the S-I side. Neither is it the other way round.

So unless there is reason for some of the endogenous variables in CA=S-I to change more slowly than others, they all find equilibrium values simultaneously, determining values of both sides of the equation simultaneously. It is not the CA side of this equation that finds its value first, forcing the S-I side to adjust and fit into that fixed value. Neither is it the S-I side that finds its value first, forcing the CA side to adjust and fit into that size. The endogenous variables of the two sides respond to exogenous changes, and their changes influence and interact with each other. Both sides end up at the same level as the final result of all of these changes.

To see this, it might be helpful to think of a water tank with a separating wall in the middle. Initially, the water level on the left-hand-side of this wall is not the same as the water level on the right-hand-side of this wall. But when the wall is taken out of the tank, water on both sides mix and the water level ends up being the same in every part of the tank. In this process, it is not the left-hand-side that determines the final level of water first, forcing the right-hand-side to fit into that level. Neither does the right-hand-side determine the final level first, forcing the left-hand-side to follow. Both sides interact with each other, and the level of the water in what used to be the left-hand-side and what used to be the right-hand-side are "simultaneously determined" to settle at an equal level.

Controlling CA by controlling exports and imports

Because CA and S-I are simultaneously determined, the value of the CA cannot be controlled by controlling only exports and imports. For example, we cannot reduce a CA deficit (or turn it into a surplus) by merely increasing exports and reducing imports. Other endogenous variables, such as S, I and T (if dependent on Y) are changing at the same time, partly in response to measures taken to increase exports and decrease imports, partly in response to other events. Even G may be changing, due to policy decisions taken by a separate policy authority. If the total sum of changes in these other variables lead to a lower level of S-I, then CA is not going to go up as intended by those who wanted to reduce the CA deficit. To make the value of the CA=S-I equation reach a desired value, we need to have all variables on both sides of the equation moving in the direction conducive to such a change. In other words, in order to control the value of the CA, all variables involved, not just exports and imports, must be controlled to move in the desired direction, by the desired amount, simultaneously.

The German Transfer Problem

This issue revolving around the CA=S-I equation takes us back to an old debate, carried out between J.M. Keynes and Bertil Ohlin in 1929 on the pages of the *Economic Journal* (*EJ*). Keynes, in the article "The German Transfer Problem" (*EJ* 39, pp.1-7) argued that the Germans will have to bare a burden in addition to the payment of war reparations. This additional burden was a decline in real external purchasing power. This was to happen because, as Keynes maintained, the German CA had to turn into a surplus in order to pay the reparations, and CA surpluses would not come about unless foreign goods became relatively more expensive than domestic goods. In our context he seems to be presupposing that any new flow of funds on the S-I side cannot come about unless the CA side changed first. Ohlin disagreed and explained why in his article "The German Transfer Problem: a Discussion" (*EJ* 39, pp.172-182). He asserted that German real external purchasing power did not have to go down, because higher taxes to fund the external payment will decrease German imports. And Germany's trading partners, richer after having received the reparations, will increase their imports. This view is not inconsistent with one that the CA adjusts just as quickly as capital flows on the S-I side.

In the event, Germany borrowed from abroad to fund the reparation payment, a possibility not accounted for in either of the logic advanced by Keynes or Ohlin. Through the Dawes Plan (April 1924) and Young Plan (April 1930), funds worth over 25 billion Marks flowed in, mainly from the USA. This was more than the amount of the total reparation payments that flowed out from Germany, which was anyway scaled down to one-eighth of the original (Wayne C. Thompson, Susan L. Thompson, Juliet S. Thompson (1994) "*Historical Dictionary of Germany*", Rowman & Littlefield, pp.502-503 and p.404). Yet the Keynes vs. Ohlin debate remains interesting in the present context, because it shows that the CA=S-I relationship is a tricky one. The best economists in history have taken differing interpretations as to which side, if at all, dominates the whole equation.

The Komiya-Suda Conclusion

There is another relevant, if less known, debate. This took place in Japan in the early 1980s. Two economists, Ryutaro Komiya and Mieko Suda, advanced an argument which came to be known as the "Komiya-Suda conclusion" (Ryutaro Komiya and Mieko Suda, "*Gendai Kokusai Kinyuu Ron, Riron-hen*", Nihon Keizai Shimbun Publishing, 1983.) Their argument was that short-term capital does not flow in response to (changes in) interest rate differentials. The exchange rate does change in response to interest rate differentials, but given the interest rate parity condition (explained later), such exchange rate responses could take place WITHOUT additional flows of capital. Therefore, short-term capital controls were the wrong way to stop exchange rate changes. This conclusion was received with somewhat of a shock by the Japanese policy authorities who, during 1981-82, were trying to stop the US dollar from strengthening against the Japanese Yen by controlling short-term capital outflow into the US dollar. The conclusion also generated heated debate amongst Japanese economists, partly because it was wrongly interpreted as suggesting that capital flows should not be specified as a function of interest rate differentials, and partly because the model used by the authors (the "Tsiang-Sohmen model") was a partial equilibrium model that was not the easiest to understand.

In the box, we provide some background to their paper and the Japanese government's policies which they criticised.

Twenty years later, it is clear that all we need is the CA=S-I equation to understand this reasoning, and it is still correct to think of capital flows as a function of interest rate differentials. All we have to do is to recognise the difference in the speed with which the CA side and the S-I side respond to some events. The type of demand for and supply of foreign exchange on the CA side, arising from exports and imports, respond only slowly to changes in interest rate differentials. In contrast, the type of demand for and supply of foreign exchange that appear on the S-I side react immediately to changes in interest rate differentials. So when the S-I side tries to conduct foreign exchange transactions in response to interest rate changes, there are no transactions in the other direction from the CA side, at least not in the short-run. For this reason, the transactions cannot take place, and only the exchange rate changes. This can be understood visually, by drawing a diagram of demand and supply curves on the P-Q plane, with one of the curves standing upright. With a vertical supply curve (demand curve), when the downward-sloping demand curve (upward-sloping supply curve) shifts, there is no change in the quantity exchanged, only a change in price.

BOX: Background to the Komiya-Suda Paper

The yen/dollar rate:

Feb 1973	The Smithsonian System ($1=¥308±2.5%) breaks down, yen floats
Sept 1973	intervention at ¥265
Oct 1973	First oil shock $2.8/barrel to $11/barrel
	Intervention at ¥300
1974	Japan's CA improves
1975	Japan's CA balances
1976-78	yen begins to rise against US dollar
1976	Criticism against Japan for "weakening" the yen
1977	Autumn: first wave of yen hike, ¥240
1978	March: second wave of yen hike, ¥220
	After second oil shock, yen weakens towards 1979
April 1980	Yen strengthens again
Dec 1980	Revision of Foreign Exchange Law: ¥200
	1981-82 Regan becomes president, Iran-Iraq war, high interest rates,
	US dollar strengthens but US will not intervene in forex market
1983-84:	¥220-260
Feb 1985	US dollar begins to weaken
Sept 1985	Plaza Accord, yen hike speeds up, ¥240goes to ¥160 before Dec
1986	Japan and Europe goes into recession due to ex rate strength
Feb 1987	Louvre agreement, "maintain ¥155", but dollar keeps falling to ¥120
1990	Spring: ¥160, but back to ¥120 → ¥135 → ¥120 → ¥110

Japanese government's capital control policies to stop dollar hike in 1981-82

1. March 1982: Suspension of sales of dollar denominated "zero-coupon bonds"
2. April 1982: Control on issuance of yen denominated lending overseas and sales of yen denominated bonds overseas changed from "control on overall amount" to "individual control of financial institutions and securities houses"

   Five large life insurance companies asked by MOF to suppress net increase in foreign bond holdings to within 5% of net increase in assets for April and within 10% of net increase in assets for May to September

Source: Komiya and Suda (1983)

Aggregate Demand-Supply, Stability and Growth

So far we have discussed the simultaneous determination of CA and S-I. Equally important is the simultaneous determination of aggregate demand and aggregate supply, which follows from the same logic. After all, aggregate demand and aggregate supply belong to the same equation as the CA and S-I, the IS equation. Equation (1) and equation (4) are two different ways of writing the same relationship. And there are endogenous variables on both sides of the equation.

In everyday language, aggregate demand and aggregate supply are simultaneously determined because a macro economy is a system that feeds on itself. The remuneration paid to the labour and capital employed to produce goods turn into payment for consumption, investment and imports. And the payment made for consumption, investment and imports become profits for producers who hire and pay the labour and capital.

This almost deceivingly simple fact is very important for macroeconomic stability. Because of this, an economy can easily fall into a downward or upward spiral. For example, if an exogenous event leads to a sudden decline in overall consumption, prices could stop rising or even begin to fall, producers may reduce production in response, leading to decline in earnings. If this leads to further drop in consumption, it sets in motion a vicious cycle in which prices, production and consumption continue to fall. The economy will stay in this cycle until some exogenous event causes one of the variables to stop or change in the other direction. This exogenous event may be deliberate policy, or it may be some natural occurrence. It is just as likely for an exogenous event to trigger a cycle in which consumption, production and earnings continue to rise, which may not be virtuous if inflation is involved. In any event, the proneness of a macro economy to go into a cycle does suggest the room for economic policy, if it is conducted properly and is successful in stopping the cycle.

The simultaneous determination of aggregate supply and demand is just as important in terms of promoting economic growth. In trying to promote economic growth, if we ignore the supply side and take measures to boost only demand, the result will most likely be inflation. If on the other hand we focus entirely on the supply side and forget about the demand side, the result could be deflation. An economy grows without price fluctuations when both aggregate demand and aggregate supply grow at the same pace. People have described the post-war success of the Japanese economy as the "Japanese miracle". But given that all variables in equation (4) moved simultaneously in the right direction, there was nothing miraculous about Japan's growth. What was miraculous was that the variables moved that way, by chance, by policy, or by effort. Of all the movements they could have made, all variables made movements whose combined effect resulted in the growth achieved.

Most economists are aware of the importance of both the supply and demand sides, although emphasis has been put on one side or the other. A simplified dichotomy puts the Classicals against the Keynesians. The Classical economists had the tendency to focus on the supply side of the economy, a tendency summarised in what is known today as Say's Law; "supply creates its own demand". The "Supply-side economists" of the 1980s deserved their sobriquet by reviving this focus. In contrast, J.M. Keynes and his followers changed economic policy forever with their "principle of effective demand" and other theories that emphasised the demand side of the aggregate economy.

Implications for policy

In Section I we confirmed that in order for results of economic analyses to be useful, the model itself as well as the assumptions on partial derivatives must correctly reflect the economy in question. Here in Section II we saw that in general all endogenous variables are simultaneously determined and that a particular value of CA may not be desirable as a policy goal. Even under circumstances in which CA balance is a desirable policy goal, this goal, or other goals such as economic growth, is unlikely to be achieved by changing only one or part of the set of relevant variables.

This means that we need to be vigilant. We cannot just keep using the same model and assumptions just because they led to useful conclusions in the past. The economy may have changed in the meantime. Variables and markets that were not as important in the past may have become much more important. Partial derivatives, such as the marginal propensity to consume or to import, may have gone up or down. Endogenous variables that tended to be slow to respond may be responding more quickly today.

If the economy changes in response to the policy itself, it would not be possible to predict exactly how the economy will be after the policy has taken place ("Lucas' critique"). But this does not take away the usefulness of economic analyses, because they can tell us what would happen under certain assumptions. Economists need to be clear about the assumptions, and how the assumptions may be affecting their conclusions. They also need to keep updating their models and assumptions, as more knowledge and experience are accumulated. This they have indeed been doing, a good example being the theory of exchange rate determination discussed in Section III. Before we get there, we need to explain what an exchange rate is.

The Exchange Rate

An exchange rate is the relative price of two monies. It shows how much of a currency we must part with, in order to acquire one unit of the other currency. For instance, if the exchange rate is US$1 = ¥105 and €1 = ¥135, we need to pay 105 yen and 135 yen respectively in order to hold one dollar and one euro in our hand. But we should not understand these as indicating the "absolute" price of one US dollar or one euro. It would be equally correct to say that ¥1 = US$1/105 or ¥1 = €1/135, which might look like, but are not, "absolute" prices of one yen. An exchange rate is a relative price that can be quoted as the value of one unit of either currency, reflecting the fact that we always have to part with one currency to get the other.

One might add that in fact, all prices are relative instead of absolute. This is in fact one of the central themes of economics. Milton Friedman, the 1976 Nobel Laureate, famously reminded us that "there is no such thing as free lunch". Resources are limited, and for every economic activity there is a cost (shadow price). There is no such thing as an absolute price. In the stores, the value indicated on a price-tag is the relative price between that product and money, or the relative price between that product and all other ways in which that money could be used.

Like all (relative) prices, the equilibrium value of an exchange rate is determined where demand equals supply. However, there are ways in which exchange rates are different from other prices. Here we list them one by one.

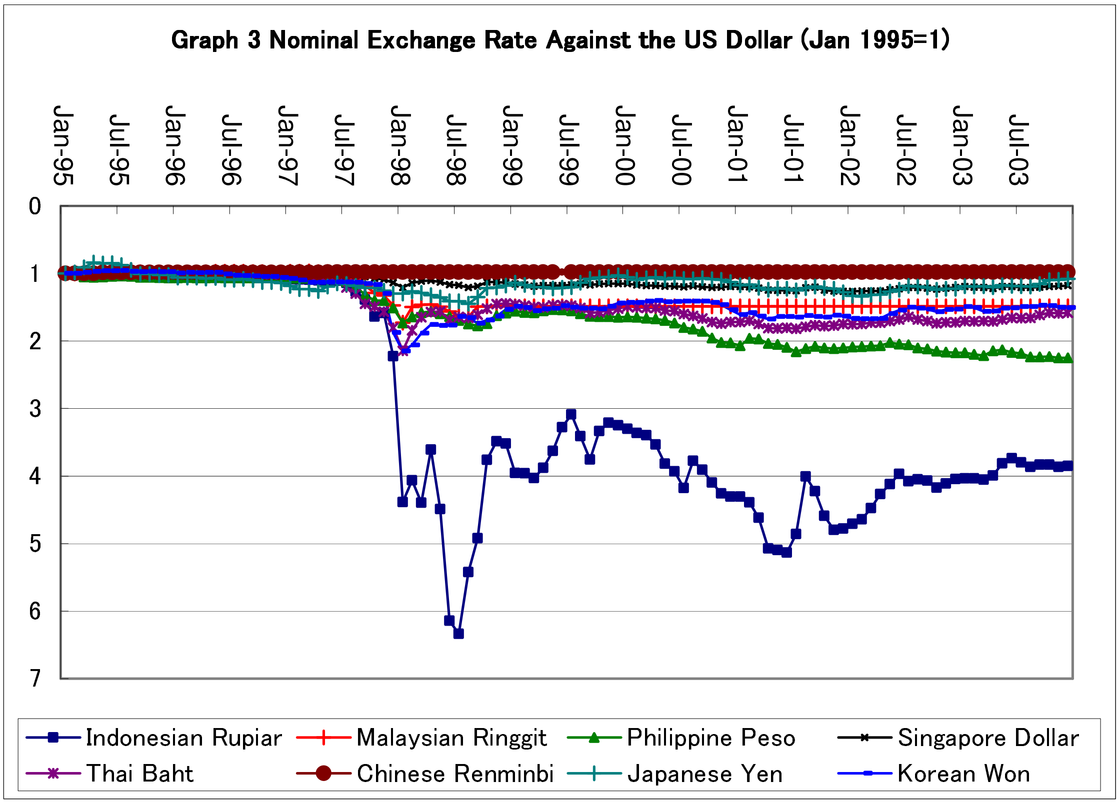
Which demand and supply?

The first peculiarity of exchange rates is that the demand and supply for currencies have many different types. This comes from the peculiarity of money. An exchange rate is the relative price of two monies, and money can be used for many purposes. In macroeconomics we learn that money is used as (i) medium of exchange, (ii) store of value and (iii) unit of account. The third use reflects the international importance of a currency, but affects demand for and supply of a currency only indirectly, through the first and second uses.

The first and second uses, in the present context, correspond roughly to the CA and S-I sides of the IS equation. That is to say, the demand for and supply of a currency as a medium of exchange arises from transactions that appear on the CA side of the equation. And the demand for and supply of a currency as a store of value arises from transactions that appear on the S-I side of the equation. Both types of demand and supply appear in the foreign exchange market. And the equilibrium value of the exchange rate is determined where the overall demand equals overall supply.

So an exchange rate reflects at least two very different reasons to demand and supply the currency. This is not true for many other goods and services. A pen is for writing. A haircut is for looking neater. But a currency is used for many purposes. Even within the broad category of medium of exchange, there are as many uses as there are types of product and service on the market. And within the broad category of store of value, there are as many types as there are ways to hold assets.

Two things happen as a result. One, the exchange rate can be volatile. Because the use of a currency is so varied, the views on how much a currency is worth are also varied. The price of a currency that is unthinkable for one person can be quite reasonable for another. The price of a pen or a haircut can vary, but within a much smaller range. Combined with the fact that buying and selling a currency is instantaneous (the cost of trading a currency is much lower than trading ordinary goods and services), this leads to the possibility of exchange rate volatility. See for example the path taken by some East Asian currencies after the Asian Financial Crisis which started in 1997, shown in Graph 3.



Source: IMF International Financial Statistics 2004

Two, a given level of the exchange rate reflects many different types of demand and supply, on both the CA and S-I sides of the IS equation.

Back in the days when international flow of capital was tightly controlled and the S-I side passively adjusted to the CA side, the exchange rate was considered an ideal tool to bring about a CA balance. A CA balance means that exports are equal to imports. Imports give rise to demand for foreign exchange while exports give rise to supply of foreign exchange (as exporters exchange their foreign exchange revenues into domestic currency). And almost all of the demand and supply in the foreign exchange market were related to the use of currencies as medium of exchange. So a CA balance meant, back then, that demand was equal to supply in the foreign exchange market. Furthermore, the exchange rate was an integral part of the relative price that exporters and importers observed in making their decisions on trade. So it was reasonable to think of using the exchange rate as the relative price which brought about CA equilibrium, which corresponded to equilibrium in the foreign exchange market.

But with the removal of capital controls, currency trading on the S-I side became no longer passive but quite active. In such a world, the equilibrium level of the exchange rate is influenced by demand and supply from not just trade but also investment, and cannot be expected to bring about a CA balance.

Ex post, it is possible to empirically test which demand and supply had the dominant influence on the exchange rate during a given period. Recognising the changes in the relative importance of the different demand and supply, economists have developed new theories of exchange rate determination, as we shall see in Section III.

Too few degrees of freedom

The second peculiarity of exchange rates is closely related to the first one (that it reflects many types of demand and supply). This second peculiarity is that it lacks degrees of freedom.

One way in which the exchange rate lacks degrees of freedom is related to its role as a market clearing adjustment variable. The exchange rate cannot be expected to play the role of the adjustment variable that brings about equilibrium on each of the CA and S-I sides. As we have already seen, CA and S-I are equal to each other. But this does not ensure that they are both zero. The exchange rate is influenced by, and influences, events on both the CA and the S-I sides. It often settles at a level that brings about balance in neither CA nor S-I.

Another way in which the exchange rate lacks degrees of freedom is that there are two countries and two currencies, but only one exchange rate. One of the countries may be happy with the current level of the exchange rate, but the other is often not, finding its level either too high or too low. This is why the exchange rate often becomes a source of economic friction. The "beggar-thy-neighbour" policies of competitive devaluation before the Second World War led to serious consequences.

In addition, within an economy there are exporters and importers. There are also economic agents who would like to invest abroad, and who would like to have foreigners to invest in the domestic economy. But there is only one exchange rate, and again the ongoing level will almost never please everyone. One exchange rate cannot keep everybody happy.

The inconsistent triangle

There is another important way in which the exchange rate is related to insufficient degrees of freedom. We can have exchange rate stability or monetary policy autonomy, but not both, once capital controls are removed. Monetary policy autonomy means the ability to conduct monetary policy to stabilise the domestic economy, to assign monetary policy to domestic stabilisation.

More generally, if there are three policy goals; (i) monetary policy autonomy, (ii) stable exchange rates and (iii) free movement of capital, in general all three cannot be attained at the same time. This fact is known as "the inconsistent triangle" (with the three policy goals at each point of the triangle), or "the impossible trilogy". It is actually a restatement of the Mundell-Fleming results under fixed exchange rates, which we discuss in Section IV.

The statement is qualified by "in general" because we can think of cases in which all three policy goals are attained at the same time. In other words, giving up one of the three goals is sufficient but not necessary for attaining the remaining two goals. For instance, the monetary policy stance that is suitable for stabilising the domestic economy might be consistent with the current level of the exchange rate, which happens to be stable even under free movement of capital. In such a case, the triangle collapses into a line or a point. But that is a special case. In general, when capital is free to flow across borders and monetary policy is conducted autonomously, the exchange rate will not remain unchanged.

Exchange rate movements and asymmetry

And here is the reason why. The exchange rate moves when market participants find a reason to sell one currency in exchange for another. And market participants find such a reason when they see differences. A good example of such a difference is a change in monetary policy in only one of the countries. If one country tightens monetary policy by raising the interest rate and the other keeps its interest rate unchanged, that is a difference that can give rise to trading in the foreign exchange market. If the currency of the country which has tightened its monetary policy becomes more attractive to market participants, then they will buy it in exchange for the other currency. As a result, the exchange rate will move.

The differences do not have to actually take place; they could be only in the mind of the market participants. For instance, currencies are sometimes bought and sold in anticipation of a monetary policy change, before it actually happens.

The differences could also be in how the economy responds to a given exogenous change (the partial derivatives discussed earlier). For instance, if a country is more resilient to an oil price hike than the other, that would be another difference that leads to buying and selling of currencies. In macroeconomics, such differences are called "asymmetry".

A Reduced Form for the Exchange Rate

It is fairly easy to show this using a reduced form for the exchange rate, derived from a simple two-country model. Here we will use the model used in Dornbusch, Rudiger (1980) "*Open Economy Macroeconomics*", Basic Books, Chapter 11 (which draws on Dornbusch (1976) "Expectations and Exchange Rate Dynamics", *Journal of Political Economy*, vol. 84, no.6, pp. 1161-76).

The notation is:

h : stock of nominal money supply	e : nominal exchange rate
y : aggregate income	p : price level
r : rate of interest	g : government spending

and variables with an asterisk are those for the foreign country.

The model is simple. There is an IS and an LM equation for each country. There is also the Interest Rate Parity Condition (which we will discuss in more detail below), which shows the investors are indifferent between investing in assets (bonds) denominated in the domestic currency and the foreign currency.

$$y = g + \delta\left(e + p^* - p\right) - \sigma r + f y^*$$

$$h - p = -\lambda r + \varphi y$$

$$y^* = g^* - \delta^*\left(e + p^* - p\right) - \sigma^* r^* + f^* y$$

$$h^* - p^* = -\lambda^* r^* + \varphi^* y^*$$

$$r = r^*$$

Endogenous variables are y, r, y^*, r^* and e, exogenous variables are g, g^*, h, h^*, p and p^*.

The reduced form for the exchange rate is

$$e = \left(p - p^*\right) - \frac{\lambda + \varphi\beta}{\alpha\varphi\left(\lambda^* + \varphi^*\beta^*\right) + \alpha^*\varphi^*\left(\lambda + \varphi\beta\right)}\left(h^* - p^*\right)$$

$$+ \frac{\lambda^* + \varphi^*\beta^*}{\alpha\varphi\left(\lambda^* + \varphi^*\beta^*\right) + \alpha^*\varphi^*\left(\lambda + \varphi\beta\right)}\left(h - p\right)$$

$$- k\frac{f\varphi\left(\lambda^* + \varphi^*\beta^*\right) - \varphi^*\left(\lambda + \varphi\beta\right)}{\alpha\varphi\left(\lambda^* + \varphi^*\beta^*\right) + \alpha^*\varphi^*\left(\lambda + \varphi\beta\right)}g^*$$

$$+ k\frac{f^*\varphi^*\left(\lambda + \varphi\beta\right) - \varphi\left(\lambda^* + \varphi^*\beta^*\right)}{\alpha\varphi\left(\lambda^* + \varphi^*\beta^*\right) + \alpha^*\varphi^*\left(\lambda + \varphi\beta\right)}g$$

where

$$\alpha = \frac{\delta - f\delta^*}{1 - ff^*}, \quad \beta = \frac{\sigma + f\sigma^*}{1 - ff^*}, \quad k = \frac{1}{1 - ff^*},$$

$$\alpha^* = \frac{\delta^* - f^*\delta}{1 - ff^*}, \quad \beta^* = \frac{\sigma^* + f^*\sigma}{1 - ff^*}.$$

All partial derivatives have values between 0 and 1, and $a, \beta, \alpha^*, \beta^*, k$ are positive.

In order to see the relationship between asymmetry in exogenous variables and changes in the exchange rate, we first assume that both countries respond in exactly the same way to exogenous changes (all pairs of partial derivatives are the same in the two countries). Then we have

$$de = \left(dp - dp^*\right)$$

$$+ \frac{1}{2\alpha\varphi}\left[d\left(h - p\right) - d\left(h^* - p^*\right)\right]$$

$$- k\frac{\left(1 - f\right)}{2\alpha}\left[dg - dg^*\right]$$

which shows us that the exchange rate changes ($de \neq 0$) when there is asymmetry in the changes within the pairs of exogenous variables (when $dp \neq dp^*$ etc.). The exchange

rate will not change just because an exogenous variable changes. Rather, it changes when the pairs of exogenous variables move in an asymmetric manner.
Note that the exchange rate can still remain constant, even when there is asymmetry in the changes in one pair of exogenous variables. This happens when there is asymmetry in the changes in another pair of exogenous variables, and that asymmetry in the second pair happens to exactly offset the asymmetry in the first pair. A foreign exchange market intervention can be interpreted as an effort at creating just such an asymmetry, an asymmetry that exactly offsets the initial asymmetry that was moving the exchange rate in a direction that the authorities found undesirable. (This is the reason why "sterilising" an intervention tends to make it less effective, unless it creates some other asymmetry such as asymmetry in expectations, or money and bonds are close substitutes. A "sterilised" intervention leaves the domestic money supply unchanged via open market operations.)

Next, we assume that all pairs of exogenous variables change symmetrically, but countries respond asymmetrically (all pairs of partial derivatives are different in the two countries). Then we have the following equation:

$$de = \left[\frac{(\lambda^* + \varphi^* \beta^*) - (\lambda + \varphi\beta)}{\alpha\varphi(\lambda^* + \varphi^* \beta^*) + \alpha^* \varphi^* (\lambda + \varphi\beta)} \right] d(h - p)$$

$$+ k \left[\frac{\{ f^* \varphi^* (\lambda + \varphi\beta) - \varphi(\lambda^* + \varphi^* \beta^*) \} - \{ f\varphi(\lambda^* + \varphi^* \beta^*) - \varphi^* (\lambda + \varphi\beta) \}}{\alpha\varphi(\lambda^* + \varphi^* \beta^*) + \alpha^* \varphi^* (\lambda + \varphi\beta)} \right] dg$$

where we used $dp = dp^*, d(h^* - p^*) = d(h - p)$ and $dg^* = dg$.
This equation shows that when pairs of exogenous variables change in a symmetric manner, it is the asymmetry in partial derivatives that move the exchange rate.

Here the only exogenous variables were the nominal price level, real money supply balances and government spending, but many other exogenous variables can be introduced. For instance, by including expectations as exogenous variables, we can show how asymmetry in expectations can cause exchange rate changes. The model used in Canzoneri and Henderson (1988) ("Is Sovereign Policymaking Bad?", *Carnegie-Rochester Conference Series on Public Policy* 28, pp. 93-140) is a good example.

The Interest Rate Parity Condition

The Interest Rate Parity Condition (IRPC) in the model we just used set the domestic interest rate equal to the foreign interest rate. This is a special case of the IRPC, a case when the expectation regarding the change in the exchange rate is static (today's exchange rate is expected to prevail tomorrow, or $E(e)=e$).

More generally, the IRPC is written as

$$r = r^{*} + \Pi$$

where Π is the expected rate of depreciation (increase) of the nominal exchange rate: $\Pi \equiv \frac{E(e)-e}{e}$.

Since the nominal exchange rate e is the amount of domestic currency that must be paid in exchange for one unit of foreign currency, an increase in e signifies a depreciation of the domestic currency. Needless to say a decrease in e is an appreciation of the domestic currency.

The IRPC holds when investors are indifferent between investing in domestic and foreign bonds (or interest bearing assets). Their expected returns are the same. A simple explanation is as follows. If investors invest in domestic bonds, they earn the rate of interest r. So if they start out with ¥1, at the time of maturity, they will have ¥$(1+r)$. If on the other hand they invest in foreign bonds of the same maturity, they earn the rate of interest r^{*}. Say for instance the foreign bonds are euro denominated. One yen today is €$1/e$, and at maturity the amount they receive in euros is €$(1+r^{*})(1/e)$. In yen, it is ¥$E(e)(1+r^{*})(1/e)$, where $E(e)$ is the spot exchange rate expected to prevail at time of maturity. For investors to be indifferent between the two types of investment, it must be true that

$$¥(1+r) = ¥E(e)(1+r^{*})(1/e)$$

If we divide both sides of this equation by $(1+r^{*})$, we have

$$\frac{(1+r)}{(1+r^{*})} = \frac{E(e)}{e}$$

and since r and r^{*} are numbers between zero and one, we can approximate this equation as:

$$\frac{(1+r)(1-r^*)}{(1+r^*)(1-r^*)} = \frac{1+r-r^*-rr^*}{1-r^{*2}} \approx \frac{1+r-r^*}{1} = \frac{E(e)}{e}.$$

By manipulating this equation a little bit, we have the more general form of the IRPC shown above.

This IRPC is sometimes called the "Uncovered IRPC", as the investors have not "covered" the currency transaction at maturity. That is to say, the euro amount at maturity $€(1+r^*)(1/e)$ is translated into yen using the spot exchange rate expected to prevail at time of maturity. The spot exchange rate at time of maturity could be at any level, and the investors are exposed to exchange risk.

Investors might choose to remove the exchange risk by "covering" this transaction. They can do so by selling the euro amount $€(1+r^*)(1/e)$ today, at the forward exchange rate between the euro and the yen. If the maturity of the bonds are x months, then they will use the x month forward exchange rate. When domestic and foreign bonds are indifferent in the eyes of investors as a result of such covered transactions, the resulting IRPC is called the "Covered IRPC".

This x-month forward rate can be very different from the spot rate prevailing in x months. If the spot rate in x months turns out to be at a more depreciated level than the forward rate in x months, the investors in this example actually lose money by covering. But if the spot rate in x months turns out to be at a more appreciated level than the forward rate in x moths, then the investors can thank their decision to cover. Forward contracts are between two parties and must be fulfilled. Alternatively, investors could purchase futures contracts in the market, if the appropriate contracts are available. This opens the possibility for the investor to get out of a contract later, by selling it in the market. In any event, covering does not secure higher returns. It only removes or reduces the uncertainty arising from exchange rate risk.

Perfect capital mobility and substitutability

IRPC in a macroeconomic model indicates that the domestic and foreign interest bearing assets are assumed to be perfect substitutes. This assumption used to be called the "perfect capital mobility" assumption. Today the term "perfect capital substitutability" is used more frequently. The reason seems to be because we have come to realise that "mobility" is not synonymous to "substitutability". "Mobility" means the "ability to move", depicting a state before investors make the transactions that may render the domestic and foreign assets perfectly substitutable. In contrast, "substitutability" describes the state resulting from massive and frequent investment in domestic as well as foreign assets. Even after capital controls are removed and capital becomes "mobile", investors might not choose to move capital in large amounts across borders. Therefore it seems more appropriate to use "substitutability" instead of "mobility" to describe the situation in which the IRPC holds.