THE J-CURVE EFFECT AND U. S. BALANCE OF PAYMENTS

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I. Introduction

Ten years have passed since the general floating exchange rate system was adopted among major industrial countries. Before 1973, many economists in academic world had recommended the floating rate system as the best international payment mechanism. In the closing years of the Bretton-Woods system, its insisted advantages had seemed brilliant and promising. The main reason of such a reputation was that floating or flexible exchange rates would free countries from the balance of payments problem. With flexible exchange rates, overall balance of payments would always be in balance, so that authorities were supposed to get an additional policy tool that can be assigned to domestic policy targets instead of external one. Freed from balance of payments problem, authorities were expected to obtain larger degree of policy freedom.

But now, we all recognize that we are, as before, not freed from balance of payments problem. Our current balance disequilibrium tends to become larger than that of before 1973. Besides, exchange rate movements in the seventies have far exceeded the expectations of many economists. In short, the adjustment of balance of payments, especially on current account, has not been yet achieved successfully under the contemporary flexible exchange rate system.

Why is balance on current account not adjusted smoothly and sufficiently, in spite of large movements of exchange rates? One of the reasons is related to the phenomenon calld 'J-curve' effect. J-curve effect is usually referred to an adverse reaction of balance on current account to an exchange rate change in the short run. The balance on current account, or more precisely, the trade balance is defined as

export value minus import value. When the exchange rate depreciates, that is, when the domestic currency price of the foreign currency rises, its influence on the trade balance is twofold. One effect is to raise the foreign goods price relative to the domestic goods price. This increases the unit value of imports compared with that of exports, so that the trade balance tends to deteriorate. The other effect is on the quantities of trade. The rising relative price of imports over exports tends to reduce the quantity of imports and to raise that of exports. As a consequence, the trade balance tends to improve. If the former effect is smaller than the latter, the exchange rate depreciation will improve the trade or current balance, and vice versa. The necessary condition for the improvement of the trade balance is that the sum of the price elasticities of imports and exports is larger than one (Marshall-Lerner condition). This condition is satisfied usually, at least in the long run. However, this is not certain in the short run. The J-curve effect is related to this point. If the short run price elasticities are small, an exchange rate depreciation will deteriorate rather than improve the trade balance as an immediate response, and only after a substantial period the improving effect will appear. Thus, the typical adjustment pattern of the trade balance to an exchange rate depreciation looks like a *J*.

This J-curve argument has some implications in theory and policy. For example, suppose a country's current balance falls into deficit. This deficit will pull its exchange rate down (depreciation), and according to the J-curve effect its current balance will aggravate still more in the short run. Thus, the exchange rate will depreciate still more. This chain of cause and effect means that flexible exchange rates tend to adjust excessively or to overshoot the equilibrium rate. Large exchange rate movements in the 1970's may thus be explained by this J-curve effect. The vicious and virtuous circle argument can also be explained in the same way. Under the general floating rate system of 1970's, it was often said that strong currencies such as German Mark, Swiss Franc, and Japanese Yen got stronger and stronger, and on the other hand, that week currencies such as Sterling Pound and Italian Lire got weeker and weeker because of the exchange rate flexibility. If imported inflation is easily converted

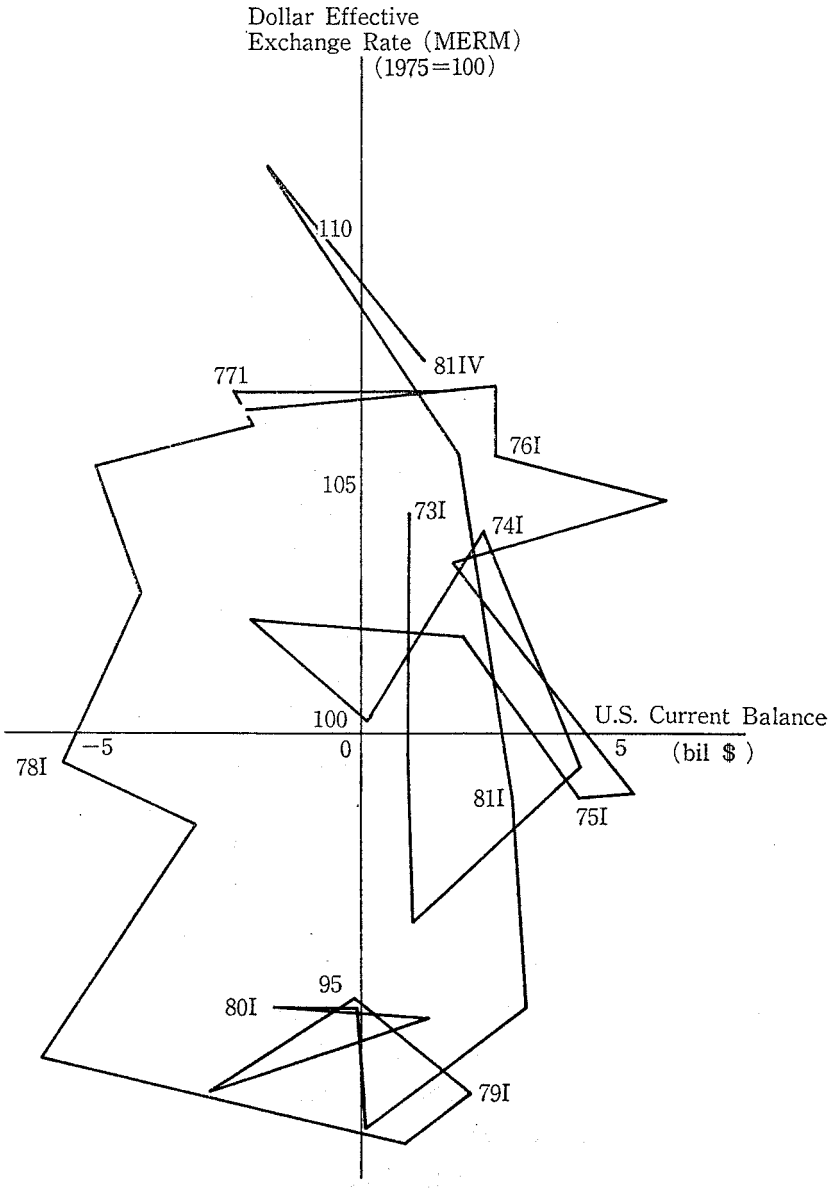


Figure 1.

into domestic inflation through wage and cost of living connection, the vicious spiral between domestic inflation and exchange rate depreciation is also easily formed. Thus, the vicious circle effect imposes a heavy burden on the policy management of week currency countries.

Figure 1 shows the actual relation between dollar effective exchange rate (MERM) and U. S. balance on current account. Where can we

find out the J-curve effect? U. S. current balance deteriorated mostly from the third quarter of 1976 through the third quarter of 1978 in spite of the depreciation of U. S. Dollar. Such a continuous depreciation with an increasing current balance deficit was difficult to understand for many people. Thus J-curve argument explained above was introduced. Therefore, we can define a J-curve as a continuous exchange rate depreciation accompanied with the current balance deterioration or a continuous appreciation with the current balance improvement. Such a definition has an advantage that it is not necessary to confirm the true cause of the J-curve effect.

Usually the interpretation of a J-curve is related to the smallness of the short run price elasticities of exports and imports. That is, the adjustment of trade flows against an exchange rate change is accompanied with a substantial lag. Many trade contracts take a ratherr long time to conclude, and there is also a lag between the contract and the transfer of the ownership, that is, the timing of balance of payments recording. Thus, if the dollar depreciates today, the U. S. trade volume is not affected immediately after the depreciation, as traders' trade behaviors have been already decided, say, 3 months before. This is the reason of the short run inelasticity of trade volume and the reason why a dificit of current balance may often accompany an exchange rate depreciation. In this explanation, the stress is on the technical conditions. We recognize the importance of such technical matters. However such an explanation often exaggerates the fixity of technical conditions, I think. Economic agents such as firms and households determine their behavior rationally in economic sense. They always try to lessen and remove the difference between their expectation and its realized fact. Traders are to expect their trade conditions in advance and try to supass competitors in the accuracy of their expectations. If not, they will be wiped out from the market. According to this arguement, traders' adjustment lag to an exchange rate change must be rather short. Therefore, the two years (from the 2nd quarter of 1976 through the 3rd quarter of 1978) J-curve effect of the U. S. is too long to be interpreted as above.

There is another possibility of the J-curve interpretation. In the above argument, an exchange rate change exerts an influence on the

current balance. However, the current balance also exerts an influence on the exchange rate. This direction of influence is not stressed in the J-curve arguments. But in this paper, I wish to discuss the importance of this influence on the J-curve effect.

In section II, an outline of the simple theory of exchange rate determination, that is, the basic idea of the the J-curve interpretation will be explained. Using this idea, a simple theory of J-courve effect will be presented in section III. In section IV, empirical evidences will be examined.

II. Exchange Rate Determination

Theories of exchange rate determination have changed completely during these ten years. Now, most theoretical models are built not on the 'flow approach' but on the so-called 'asset market approach'. This transfiguration of theory is closely connected with our understanding of the relation between exchange rates and balances on current account. This is the reason of taking up the problem of exchange rate determination in this section.

According to the modern theory, exchange rates are determined in financial asset markets through portfolio adjustments of economic agents such as firms, banks, and individuals. Especially the stress is on balances of foreign assets, for an exchange rate is a relative price of foreign assets and domestic assets. Generally, people diversify their portfolios according to the expected rate of return and the risk of each asset in which they are considering to invest their wealth. By diversifying their portfolios, people can attain the most desirable combination of the expected rate of return and the risk of their total wealth. Thus, foreign currency denominated assets are included in their portfolios.

Suppose people want to hold a certain proportion of their wealth in foreign currency denominated assets (foreign assets). If we assume that foreigners do not hold domestic currency denominated assests (domestic assets), the exchange rate is determined by demands for and supplies of foreign assets in this country. Suppose that the financial asset market is in equilibrium initially and then an exogenous shock

is introduced, which shifts people's demand for foreign assets to increase. Now, there is an excess demand for foreign assets. But, as we have no way to get additional foreign assets in exchange for domestic assets because foreigners do not hold any domestic assets, the domestic currency price of foreign assets (the exchange rate) must be raised to clear the excess demand. As domestic people value their wealth in terms of domestie currency, this exchange rate change (depreciation) will increase the value of their foreign assets. This increase in the supply of foreign assets reduces and ultimately clear the excess demand, and the market eqilibrium will be realized again. This is the simplest form of the contemporary exchange rate theory.

The demand for foreign assets is determined by expected rates of return, risks, total wealth, and so on. What then determines the supply of foreign assets? This is the balance on current account of the country. A balance on current account surplus means a net addition to the foreign assets of this country. That is, a country's net balance of foreign assets is the accumulated value of past current balance surpluses. Thus, a current balance surplus today means an increasing foreign asset supply, which is simultaneously lowering the price of foreign currency (appreciation of domestic currency). Therefore, a country's current balance surplus determines the *rate of change* (appreciation) in the exchange rate.

In the traditional flow theory, the exchange rate is determined so as to equilibrate the overall balance of payments. As long as the capital flow is determined by other factors, this means that the exchange rate is determined so as to equalize the current balance surplus to the capital balance deficit. Therefore, the current balance determines the *level* of the exchange rate. This is the essential difference between the asset market approach and the flow approach.

One of the most important implications of the asset market approach is that the exchange rate adjustmet is accompanied with a lag. If an exogenous shock brings down the equlibrium exchange rate, the actual exchange rate will not depreciate immediately. As a consequence of the overvalued exchange rate, the current balance falls into deficit, with which the exchange rate begins to depreciate. The exchange rate does not reach the new equilibrium level until the necessary decrease

in the country's foreign assets is realized through a lasting current balance deficit. Thus, the exchange rate adjustment is a time consuming process.

This point has an important relation to the J-curve effect. Suppose a country's business condition begins to fall into recession. Stagnant economic activity leads the current balance into surplus, which in turn brings about the exchange rate appreciation. In the early stage of the recession, the current balance surplus will be expanding in spite of exchange rate appreciation because of falling economic activity. Thus, in the early stage, the exchange rate appreciation will be accompanied with the expanding current balance surplus. This is just the J-curve effect defined above. Or, when a country begins to make her way to the recovery, her balance on current account will display an expanding deficit (or a shinking surplus) with a simultaneously depreciating exchange rate. This interpretation of the J-curve effect stresses the direction of influence from balance on current account to exchange rate. The U. S. J-curve during 1976 through 1978 is explained only in this way, I think.

A more formal analysis of the J-curve effect will be presented in the next section.

III. Business Cycle and J-Curve Effect

In this section we will present a formal model of J-curve effect. The model ignores the technical factor that performs a crucial role in the usual J-curve interpretation. That is, we ignore the time lag between an economic decision and its execution. This is not because we ignore the actual importance of the time lag but because we want to display that the J-curve effect can be explained without such a technical factor.

We assume again that domestic residents diversify their financial wealth between domestic and foreign assets, but that foreigners do not hold domestic assets. Thus, we can neglect foreigners' behavior in exchange rate determination. (Domestic) people wish to diversify their wealth W among domestic money M, domestic bond S, and foreign bond S* according to the ratio a: b: c,

$$\begin{cases} M=aW \\ S=bW \\ ES^*=cW, \end{cases}$$

where E is the exchange rate (domestic currency price of foreign currency) and $a+b+c=1$. (a, b, and c depend on the expected rates of return and the risks of various assets generally.) From these equations, we get

$$(1) \qquad ES^* = \frac{c}{a}M.$$

That is, the demand for foreign assets is determined by expected rates of return, risks, and domestic money supply.

Denoting $e=\log(E)$ and $s^*=\log(S^*)$, and taking care of the relation that the increase in the supply of foreign assets $\dot{ES}^*$ is equal to the balance on current account surplus B, we obtain

$$\dot{s}^* = \frac{\dot{S}^*}{S^*} = \frac{ES^*}{\frac{c}{a}M} = kB,$$

where $B=\dot{ES}^*$, and $k=\frac{a}{cM}$.

The balance on current account B depends on income Y and exchange rate e:

$$B=B(Y, e),$$

where $B_y<0$, and $B_e>0$. Expanding this around the long run equilibrium values Y_0 and e_0, we have

$$\begin{aligned} B &= B_y(Y-Y_0)+B_e(e-e_0) \\ &= B_y y + B_e e - Q, \end{aligned}$$

where $y=Y-Y_0$, and $Q=B_e e_0$. From (1), we have

$$e+s^*=C_0,$$

where $C_0=\log(\frac{c}{a}M)$. Substituting this relation into the equation of B and making use of $\dot{s}^*=kB$ yields

$$\dot{s}^*+C_1 s^* = -C_2 y + C_3,$$

where

$$C_1=kB_e,$$

$$C_2=kB_y,$$

and

$$C_3=k(B_e C_0 - Q).$$

Making use of the relation $e+s^*=C_0$, this equation is rewritten as

(2) $$\dot{e}+C_1e=C_2y+(C_0C_1-C_3),$$

This is the differential equation of exchange rate e. If we use the relation $\dot{s}^*=kB$, another differential equation is obtained:

(3) $$\dot{B}+C_1B=-\frac{C_2}{k}\dot{y}.$$

This equation determines the time path of the current balance B.

Now, we can consider the current balance movements along the cyclical movements of economic activity. Suppose that the cyclical movements of income Y is of such a typical pattern as

$$y=A\sin(vt).$$

Then equation (2) becomes

$$\dot{e}+C_1e=C_2A\ \sin(vt)+(C_0C_1-C_3),$$

which has the general solution:

$$e=C\exp(-C_1t)+\frac{C_2}{C_1}A\sin\ (vt+\frac{\pi}{2})+C_0-\frac{C_3}{C_1}.$$

Or, equation (3) becomes

$$\dot{B}+C_1B=-\frac{C_2}{k}A\ \sin\ (vt+\frac{\pi}{2}),$$

which has the general solution:

$$B=C'\exp(-C_1t)-\frac{C_2}{kC_1}A\ \cos(vt+\frac{\pi}{2}).$$

Therefore, the locus of the point (B, e) approaches a stable limit cycle

$$k^2B^2+(e-C_0+\frac{C_3}{C_1})^2=(\frac{C_2}{C_1}A)^2.$$

as time passes (see Figure 2).

If the pattern of the business cyele is so typical as expressed by a sine curve, and if the adjustment path is on the limit cycle, the exchange rate appreciation is accompanied with expanding current balance surplus when the economy is on the arc AB in Figure 3, and the exchange rate depreciation is accompanied with expanding current balance deficit when the economy is on the arc CD in Figure 3. That is, AB and CD are the J-curve situations.

Since the size of the limit cycle is determined by

$$r=\frac{C_2}{C_1}A=\frac{B_y}{B_e}A,$$

the circle is larger, that is, it seems that an exchange rate change affects the current balance more slowly, and as a consequence the exchange rate change that is necessary for the adjustment becomes larger;

(i) the larger the income elasticity of the balance on current account (the marginal propensity to import) is,

(ii) the smaller the exchange rate elasticity of the balance on current account is, and

(iii) the larger the size of the fluctuation of economic activity is.

Secondly, the time necessary for a move from A to B (or from C to D) depends on the value v. Therefore, the adverse situation of the J-curve lasts longer, the more slowly the business cycle proceeds.

It is not necessary that the business cycle is so typical as assumed above. Since the relation between the exchange rate and the current balance is written as

$$\dot{e} = -kB,$$

the exchange rate is appreciating when the current balance is in surplus, and depreciating in deficit. Unless the equilibrium exchange rate value is rising or falling infinitely, economic fluctuations are sure to draw circular loci. Accordingly, the J-curve phase must necessarily appear during economic fluctuations.

As we can see in Figure 1, the dollar effective exchange rate and the U. S. current balance are showing circular movements on the whole. (Be careful that the axis of ordinates is reversed in Figure 1). This fact is compatible with our J-curve theory.

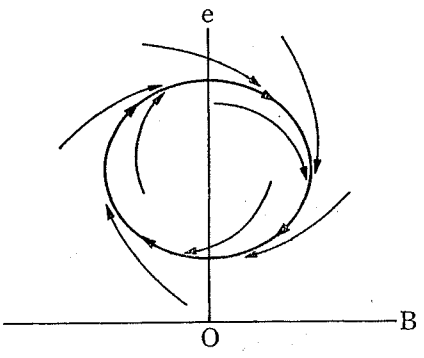


Figure 2

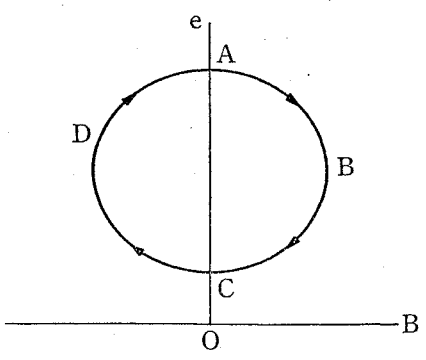


Figure 3

IV. Empirical Evidence

In this section, we will examine the J-curve effect hyptheses by making use of U. S. actual data. First, we will examine the traditional theory of the J-curve, and our theory will be treated next.

The validity of the traditional theory depends on the smallness of the short run export and import elasticities. Thus, the first examination is concerning to the price elasticities of U. S. exports and imports. Table 1 shows the results of estimation of U. S. export functions. We used the relative share of U. S. exports in the total exports of the industrial countries as the dependent variable so as to remove the influence of the shift of the export function. The ratio of U. S. export price index to the export price index of industrial countries was used as the relative export price of U. S. Similarly, table 2 shows the

Table 1.

U. S. export function: relative share of U. S. exports

	explanatory variables								OLS
	Const.	PEXP	lags	IP	D1	D2	R^2 $\bar{R}^2$	DW	(quarterly)
1	-.922	.8512	0	-1.069	-.0224	-.0114	.601	1.126	1973II-
	(-1.21)	(5.153)		(-2.754)	(-.926)	(-.739)	.546		1981III
2	-.039	.658	1	-1.040	-.0207	-.0062	.396	.975	1973II-
	(-.036)	(2.77)		(-2.14)	(-.700)	(-.301)	.313		1981III
3	3.628	-.141	2	-1.400	-.0039	-.0384	.243	.756	1973III-
	(2.34)	(-.420)		(-2.47)	(-.096)	(-1.42)	.134		1981III

t-values are in parentheses

PEXP: logarism of the ratio of US export price index to that of industrial countries

lags: lags of PEXP (quarters)

IP: logarism of the ratio of US industrial production index to that of OECD countries

D1: First Oil Shock Dummy (1 from 1974I)

D2: Second Oil Shock Dummy (1 from 1979II)

results of estimation of U. S. import function. The dependent variable is the relative share of U. S. imports in the total imports of the industrial countries.

Table 2

U. S. import function: relative share of U. S. imports

	explanatory variables								OLS
	Const.	PIMP	lag	IP	D1	D2	R^2 $\bar{R}^2$	DW	(quarterly)
1	2.017	.1857	0	2.654	.0747	-.0791	.612	1.19	1973II-
	(1.94)	(.786)		(5.58)	(1.32)	(-2.23)	.558		1981III
2	1.607	.2819	1	2.625	.0461	-.0909	.638	1.30	1973II-
	(2.19)	(1.68)		(5.83)	(.948)	(-3.30)	.588		1981III
3	1.864	.2225	2	2.530	.0671	-.0828	.640	1.25	1973III-
	(3.38)	(1.76)		(5.55)	(1.50)	(-3.50)	.589		1981III
4	2.206	.1462	3	2.482	.0780	-.0724	.606	1.23	1973IV-
	(4.41)	(1.27)		(5.17)	(1.40)	(-3.17)	.547		1981III

t-values are in parentheses

PIMP: logarism of the ratio of U. S. import price index to that of U. S. WPI

lag: lag of PIMP

From these tables we find that U. S. exports and imports have significant relations with corresponding relative prices. Especially, the coefficients of relative prices are all positive in both equations. As a dollar depreciation tends to be connected with a fall in relative U. S. export price and with a rise in relative U. S. import price, it seems that both price elasticities are small and this is compatible with the traditional theory of the J-curve. However, we must take care that in these estimations the dependent variables are the ratios of U. S. values to those of industrial countries *measured in dollar value.* Thus, it is necessary for the traditional theory to be ascertained that the sum of export and import price elasticities must be greater than at least one. But the sum is hardly greater than one. Therefore, the insistence of the traditional theory is, at least, dubious. This point will be made clearer in the following estimations.

Tables 3 and 4 are the estimations of U. S. current balance and U. S. trade balance functions. The estimations use the same explanatory variables except the U. S. relative price. We use the ratio of the U. S. WPI (wholesale price index) to the export price index of industrial countries as the U. S. relative price. The export price index of industrial countries is the proxy of the world price level.

Table 3

U. S. current balance function

	explanatory variables									OLS
	Const.	PUS	lag	IP	D1	D2	TT	R^2 $\bar{R}^2$	DW	(quarterly)
1	-26.38	7.099	0	-81.06	-1.607	1.908	-.076	.342	1.22	1973II-
	(-.527)	(.669)		(-2.25)	(-.659)	(.889)	(-.606)	.224		1981III
2	50.29	-9.112	1	-77.43	-2.395	1.847	-.108	.344	1.18	1973II-
	(.855)	(-.736)		(-2.16)	(-.949)	(.860)	(-.866)	.227		1981III
3	129.5	-25.62	2	-81.36	-4.270	.9425	-.1300	.392	1.32	1973III-
	(1.72)	(-1.62)		(-2.29)	(-1.50)	(.426)	(-1.06)	.279		1981III
4	212.1	-42.32	3	-67.65	-6.87	.543	-.214	.473	1.53	1973IV-
	(2.60)	(-2.49)		(-2.00)	(-2.12)	(.259)	(-1.73)	.371		1981III
4′	218.1	-43.66	3	-71.83	-7.223		-.1931	.471	1.52	1973IV-
	(2.84)	(-2.75)		(-2.47)	(-2.50)		(-2.11)	.393		1981III
5	167.2	-33.86	4	-62.09		1.488	-.2452	.406	1.45	1974I-
	(2.14)	(-2.08)		(-1.76)		(.714)	(-1.78)	.314		1981III

t-values are in parentheses.

PUS: logarism of the ratio of the US WPI to the export price index of industial countries

TT: trend terms

The most remarkable thing we can establish from these tables is that the coefficients of the U. S. relative price PUS are all negative but in the first equations without lag of PUS. Besides, the equations that have the highest explanation power are both with 3 quarters lag of PUS. Thus, if the U. S. dollar depreciates, its improving effect on

Table 4

U. S. trade balance function

OLS

	explanatory variables									
	Const.	PUS	lag	IP	D1	D2	TT	R^2 $\bar{R}^2$	DW	(quaretrly)
1	-40.60	10.71	0	-82.43	-1.071	1.422	-.2646	.672	.754	1973II-
	(-.896)	(1.12)		(-2.53)	(-.485)	(.733)	(-2.34)	.614		1981III
2	25.53	-3.30	1	-78.35	-1.627	1.481	-.2936	.659	.698	1973II-
	(.470)	(-.288)		(-2.36)	(-.697)	(.746)	(-2.54)	.598		1981III
3	125.0	-24.11	2	-81.49	-3.683	.5469	-.3235	.682	.725	1973III-
	(1.82)	(-1.67)		(-2.51)	(-1.41)	(.270)	(-2.87)	.623		1981III
4	187.6	-36.90	3	-70.33	-4.802	.2225	-.3911	.694	.942	1973IV-
	(2.45)	(-2.31)		(-2.22)	(-1.58)	(.113)	(-3.36)	.636		1981III
4′	190.0	-37.45	3	-72.04	-4.945		-.3825	.694	.942	1973IV-
	(2.64)	(-2.51)		(-2.63)	(-1.82)		(-4.45)	.649		1981III
5	157.0	-31.08	4	-64.87		1.016	-.4248	.660	.846	1974I-
	(2.17)	(-2.05)		(-1.98)		(.524)	(-3.33)	.607		1981III

t-values are in parentheses.

the U. S. current balance or trade balance will appear only within one year. Especially, the adverse effect of an exchange rate change (a J-curve effect) lasts hardly over one or, at most, two quarters. Besidse, such a short adverse effect is not even significant according to our first equations. Therefore, we conclude that the traditional or usual explanation of the J-curve effect has only an unexpectedly poor explanation power.

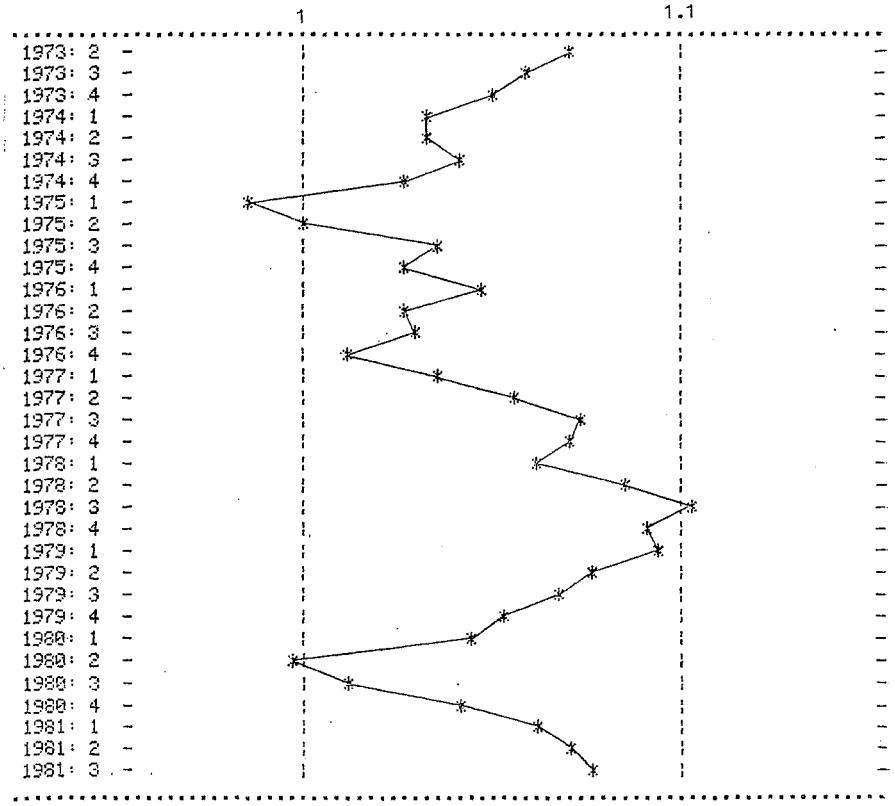
The actual J-curve effects we find in the Figure 1 are well explained by the asynchronous business cycles among countries (especially the asynchronism between the United States and other countries) rather than the trade contract-execution lag of the traditional theory. After the first oil shock and the following world-wide depression, the American economy recovered quickly and enjoyed a long prosperity. On the other hand, the recession lingered and the recovery was slow in European countries and Japan. Accordingly Americans began to buy

more goods from other countries than other countries' people buy from the U. S., the result of which was the U. S. current balance deficits.

Figure 4 shows the relative business activity of the United States to other countries by using the ratio of the U. S. industrial production index to other OECD countries' averaged one. As a result of the first oil price shock and reductions of food supplies, both the United States and other industrial countries fell into a depression that proved to be the deepest in the postwar period. The recovery from the recession started in 1975 in both areas. The U. S. recovery and growth went well under way, but in other countries a slack appeared in 1977. Consequently, the U. S. current balance turned from surplus to deep-seated deficit, which was the main cause of the dollar depreciation until late 1978.

Figure 4

The ratio of US industrial production index to that of other OECD countries



The relative activity of the U. S. economy turned its course to fall in 1979 because of other countries' recovery, although the U. S. economy was not yet in recession. However, the U. S. current balance did not improved notably. The reason is the second oil price shock. As the U. S. import of petroleum was already voluminous, its percentage in total U. S. imports increased from 22.4% in 1978 to 26.4% in 1979 and 29.9% in 1980. Thus, the unusual response of the U. S. current balance in that period was due to a structual change of the U. S. economy brought about by the second oil shock.

The current balance improved in late 1980 and through 1981 in spite of the recovery of the U. S. economy. That was another unusual response. But here, we only point out the fact that the improved current balance raised the dollar exchange rate, which agrees with our theory except that the speed of the appreciatione seems too rapid. The rapid appreciation of dollar in this period was partly due to the high U. S. interest rates and the expectation of dollar appreciation. This is another implication of the asset market approach to the exchange rate.

As we can see in table 3 and table 4, the coefficient of the U. S. industrial production index is positive in every estimation equation of U. S. current or trade balance. If the effect of exchange rate change on the current balance appears stronger, the current balance change would in turn move the economic activity similarly and the correlation between the current balance and the economic activity or the coefficient of IP in the estimation equations would become positive. In the contrary, if the effect of the current balance on the exchange rate appears stronger, the coefficient of IP in the equations would become negative. Thus, the results in the tables indicate that the empirical evidence is in favor of the insistence that the latter connection is actually stronger than the former. Therefore, the actual relation between the exchange rate and the current balance must be from the current balance to the exchange rate, which causes the poor explanation power of the traditional theory of the J-curve effect.

Lastly, we will examine the relation between the dollar exchange rate and the U. S. current balance empirically. As shown in the section III, the exchange rate e and the current balance B is connected by

the equation:

$$\dot{e} = -kB,$$

or by its integrated form:

$$e = -k\sum B.$$

In reality, the value of k is not necessarily constant but dependent on such variables as the expected rates of return on various assets, the expected rate of the exchange rate appreciation (depreciation), etc. However, the supply of foreign assets $\sum$ B is the most important variable to explain the exchange rate, I think, so that the dollar exchange rate will be explained by this variable fairly well.

Second, we assumed in section III that foreigners do not hold domestic assets. Needless to say, it is not realistic assumption. When foreigners hold domestic assets, we must treat not only the external assets of our country but the external assets of foreign countries. But if the exchange rate to be treated is the effective exchange rate, it is measured against (the average of) all other currencies so that foreigners' assets are in definition equal to our country's debits. Eventually, only our country's assets $\sum$ B will suffice for our estimation. Thus, we will estimate the U. S. dollar effective exchange rate (MERM) in the following study.

Table 5

The U. S. dollar effective exchange rate (MERM)

OLS

	explanatory variables					
	Const.	$SUSBC_{-1}$	TT	R^2 $\bar{R}^2$	DW	(quarterly)
1	4.532	.003652	.0009117	.370	.274	1973II-
	(128.7)	(4.47)	(1.17)	.333		1982II
2	4.652	.00386	-.00297	.903	1.95	1973II-
	(328.1)	(13.5)	(-7.49)	.895		1979IV
3	4.057	.0156	.00905	.967	2.61	1979I-
	(59.6)	(7.94)	(6.08)	.961		1982II

(The U. S. dollar effective exchange rate is expressed in logarism.
t-values are in parentheses.
$SUSBC_{-1}$: the accumulated U. S. current balance with one quarter lag
TT: trend terms

Table 5 shows the estimations of U. S. dollar effective exchange rate according to our theory of exchange rate determination. Three equations differ in their estimation periods. The coefficient of determination of equation 1 equals 0.37, which is not so high. But the coefficient of the accumulated U. S. current balance $SUSBC_{-1}$ is significantly high. That is, our theory that the exchange rate is connected with the current balance by the equation $e=-k \sum B$ is not rejected. If we estimate the equation in two subperiods 1973III–1979IV and 1979I–1982II according to a conjecture that the exchange market structure changed around 1979, the two equations display very high explanation powers as 0.90 and 0.97 of the coefficients of determination. Of course, the coefficients of the accumulated U. S. current balance are positive and highly significant. In the second period, the U. S. dollar rate was influenced notably by the high U. S. interest rates (not shown in the equation 3). Thus, the assets substitution effect became more important in the second period than in the first one. Why such a change occurred around 1979 is an important theoretical and empirical problem. However, we will consider this problem no more in this paper.

Anyhow, the relevant point here is that the exchange rate is well explained by the current balance and not vice versa. As the essential point of the exchange rate adjustment through a current balance disequilibrium is that it is a time-consuming process, it is only a matter of course that asynchronous business cycles are accompanied with J-curve effects. Thus, the J-curve effect will not disappear even if the technical contract-execution lag problem should be resolved.

V. Concluding Remarks

The J-curve effect was pointed out first at the devaluation of sterling in November 1967. The sterling devaluation was followed by a worsening of the U. K. external deficit and the eventual improvement came only after a delay of more than a year. But a significant reason of this slow adjustment was that the restrictive economic policies were not adopted until late 1968 in the United Kingdom. Thus the adjustment lag in that case should not be attributed only to the short run price effect of the 1967 devaluation.

After the word-wide adoption of flexible exchange rates in 1973 the exchange rates fluctuated from day to day, which made it difficult to identify the balance of payments effect of a exchange rate change on a specific day. Thus, we had to define the J-curve effect actually as a phenomenon of an appreciating exchange rate with an expanding current balance surplus or of a depreciationg exchange rate with an expanding current balance deficit. As such, the J-curve effect happened from 1976IV to 1978III as for the dollar and the U. S. current balance.

Such J-curve effect can be interpreted in two ways. One is an usual explanation by the lag that lies between trade contract and its execution. However, our empirical study shows that the lag is not so long as usually assumed (one year or more). The lag is one or two quarters at most. Negative correlation appears within one year between the U. S. dollar effective exchange rate and the U. S. current balance. Therefore, this interpretation of the actual J-curve effect is, at least, dubious.

Another interpretation is related to the asset market approach to the exchange rate determination. An essential point of this approach is that the exchange rate (not current balance) adjustment is accompanied with time lag. If that is the case, the J-curve effect becomes a very commom phenomenon. From 1976 to 1978, the U. S. economy recovery and growth surpassed other countries' recovery, which produced the large U. S. current balance deficit. As the dollar depreciation due to the U. S. deficit was not sufficient, however, to offset the deficit because of the lag of the exchange rate adjustment, we were compelled to confront to the dollar depreciation and the expansion of the U. S. current balance deficit simultaneously from 1976 through 1978.

Our empirical study was not in contradiction to this view. The U. S. effective exchange rate and the accumulated U. S. current balance surplus are in negative correlation relation according to our estimation. That means that the U. S. current balance determines not the exchange rate level but the rate of change in the exchange rate. Thus, the dollar had to depreciate and the U. S. current balance had to be in deficit until the re-estabishment of the equilibrium of the U. S. current balance.