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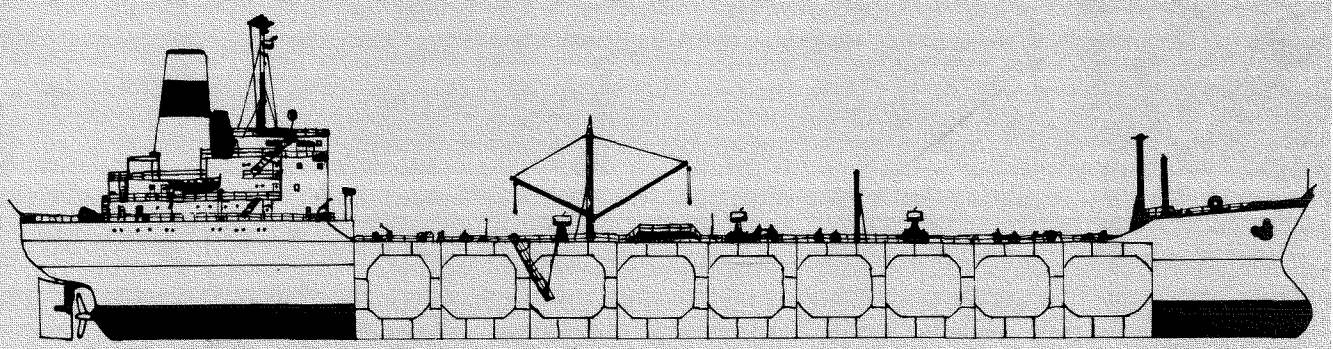

RESPONSES TO INTERNATIONAL INFLATION

SUMMER 1980

The Federal Reserve Bank of San Francisco's **Economic Review** is published quarterly by the Bank's Research and Public Information Department under the supervision of Michael W. Keran, Senior Vice President. The publication is edited by William Burke, with the assistance of Karen Rusk (editorial) and William Rosenthal (graphics). Opinions expressed in the **Economic Review** do not necessarily reflect the views of the management of the Federal Reserve Bank of San Francisco, nor of the Board of Governors of the Federal Reserve System.

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Responses to International Inflation

Editorial committee for this issue:
Randall Pozdena, Rose McElhattan, John Scadding

Responses to International Inflation

The international economy, like the domestic economy, has learned to cope during the past decade or more with an environment of high risk and high inflation. Economists thus have increasingly focused their attention on the responses of various national economies to a difficult and fast-changing international environment. This issue of the *Economic Review* analyzes three such patterns of response. Can a regime of floating exchange rates provide more monetary independence than was possible under the fixed-rate regime characteristic of a less inflationary age? How does a nation (specifically, Japan) overcome a major burst of inflation, and at what cost to the nation's growth? Can the "financial deepening" process succeed in an era of repressed finance, where the authorities hold nominal interest rates rigid even in the face of general price inflation?

Adrian W. Throop addresses the first question, examining the claim that flexible exchange rates permit a greater independence of monetary policies by weakening linkages between national interest rates. Under the former Bretton Woods system of fixed exchange rates, foreign interest rates moved sympathetically with U.S. interest rates, and this interest-rate dependence made it difficult for foreign countries to pursue independent monetary policies. The system finally collapsed during the raging inflation of the early 1970's, mainly because nations were no longer willing to accept such a lack of monetary independence.

The world's financial authorities thus replaced Bretton Woods in 1973 with a flexible exchange-rate system. Theoretically, with perfectly "clean floating" — that is, without any central-bank intervention in the exchange market — foreign interest rates would be completely insulated from U.S. rates. But as Throop notes, central banks in practice have intervened in foreign-exchange markets about as frequently under the new system as under the old. Has "managed floating" then decoupled interest rates? "This depends not on the amount of intervention per se, but rather on the relative amount of intervention in response to interest-rate variations under the two different systems."

For four major countries — Germany, Switzerland, France and Belgium — Throop concludes that managed floating generally has severed short-run linkages between U.S. and foreign interest rates. This has occurred apparently because of reduced exchange-market intervention in response to interest-rate variations, rather than larger offsetting domestic monetary operations. Canada and the United Kingdom were atypical, however. In both countries, linkages to U.S. interest rates did not change significantly between the two exchange-rate regimes, because of unique Canadian and British policies.

Charles Pigott, in a second article, analyzes the causes of the rise and fall of Japanese inflation during the 1970's, and attempts to gauge the costs the nation incurred in its successful effort to reduce inflation. Consumer-price inflation decelerated from 25 percent in 1974 to only 3 percent in 1978, and the inflation rate remained below 5 percent in 1979. Japan's real-growth performance was somewhat less enviable, however. Between 1965 and 1972, Japan's real GNP grew at a 10 1/2-percent annual rate — but since 1975, real growth has averaged less than 6 percent.

Japan's experience confirms that the key to containing inflation is controlling money growth,

in Pigott's view. "Without the 1971-72 acceleration in money growth, Japan's inflation in 1973 and 1974 would have been much lower than it actually was. Moreover, the relatively low inflation of the late 1970's was not the result of a fortuitous exchange-rate appreciation or government fiscal 'discipline', but rather of a consistent policy of containing money growth." But substantial increases in the domestic price level sometimes have resulted from other factors, such as the oil-price hike of 1974. In addition, Japan's monetary authorities have demonstrated that high budget deficits and foreign-exchange market interventions need not inevitably destroy monetary control.

Japan's experience is perhaps most interesting for what it reveals about the costs of reducing inflation, Pigott adds. His evidence suggests that Japan's attempts to reduce inflation through lower money growth substantially aggravated the 1974 recession. However, the evidence also suggests that the continuation of slow money growth was not primarily responsible for the sluggishness of the recovery. Instead, real growth may have lagged because the inflation and the ensuing recession undermined investor confidence.

Hang-Sheng Cheng, in a third paper, presents an overview of the financial-deepening process in eleven Pacific Basin countries during the inflationary period of the past two decades. For any nation, "financial deepening" represents an increase in the extent of financing of production and investment through specialized, organized markets. In developing countries, the process is identified with increases in the activity of financial intermediaries — such as commercial banks, savings institutions, and insurance companies — because of the general unimportance of capital markets. In developed economies, capital markets play a larger role than in developing economies, but financial intermediation still predominates in the savings-investment process.

To measure and compare financial deepening, Cheng provides a cross-section view of the degree of financial intermediation in each country in 1978, plus a comparison of the eleven countries' financial-growth process over the entire 1960-78 period. Financial-intermediation ratios in 1978 were significantly higher than average in Japan, Singapore and Taiwan, and significantly lower than average in Australia, New Zealand and the United States. In terms of growth over time, Malaysia, Singapore and Taiwan achieved nearly uninterrupted growth between 1960 and 1978. Most other countries also experienced at least some growth — except Australia and New Zealand, which sustained net declines in their degree of financial intermediation.

Cheng argues that the real deposit-interest rate played a critical role in setting the pace of each nation's financial growth. Positive real deposit rates maintained over a number of years invariably led to financial deepening, while negative real deposit rates (even over brief periods) could result in sharp financial disintermediation against an otherwise strongly upward trend. "Because of the importance of financial deepening for economic growth," he concludes, "economic policy should be aimed at reducing inflation, which by definition lowers the real deposit rate." He adds that where inflation cannot be brought down quickly, interest rates should be allowed to adjust with sufficient flexibility to permit a positive real rate of return to savings.

Managed Floating and the Independence of Interest Rates

Adrian W. Throop*

The major industrial powers abandoned the Bretton Woods system of fixed exchange rates in March 1973. From a foreign point of view, the Bretton Woods system had a major disadvantage: foreign interest rates moved sympathetically with U.S. interest rates. Studies have indicated that a 100-basis point (one percentage point) change in U.S. short-term interest rates caused short-term rates in industrialized countries abroad to change by about 40 basis points, on average, during that period of fixed exchange rates.

This interest-rate dependence reflected a lack of monetary-policy independence. For example, when U.S. interest rates fell as a result of monetary expansion, investors had an incentive to purchase foreign securities. Such purchases generated a demand for foreign currency and an outflow of dollars — which foreign central banks were obliged to purchase to maintain a fixed exchange rate. The accumulating dollars boosted foreign reserves and, hence, their money supplies. This tended to push down foreign interest rates in sympathy with U.S. rates.

As this example indicates, such interest-rate dependence made it difficult for countries to pursue independent monetary courses. The Bretton Woods system collapsed mainly because nations were no longer willing to accept a lack of monetary independence.

The world's financial authorities replaced Bretton Woods in 1973 with a flexible exchange-rate system, mainly because they believed that this approach would permit a greater independence of monetary policies. Theoretically, with perfectly "clean" floating — that is, without any intervention by central banks in the exchange market — foreign interest rates would be completely insulated from U.S. rates. In practice, however, central banks have intervened in foreign-exchange markets about as frequently under the new system as under the Bretton Woods system. But has "managed floating" decoupled interest rates? This depends not on the amount of intervention *per se*, but rather on the relative amount of intervention in response to interest-rate variations under the two different systems.

This article examines the impact of managed floating on the relationship between U.S. money-market conditions and short-term interest rates in Belgium, Germany, Switzerland, France, Canada, and the United Kingdom. Our conclusion is that managed floating generally has severed short-run linkages between U.S. and foreign interest rates. The reason apparently has been reduced exchange-market intervention in response to variations in interest rates, rather than larger offsetting domestic-monetary operations. Canada and the United Kingdom are exceptions to this general pattern, however, because of policies peculiar to those two countries.

*Senior Economist, Federal Reserve Bank of San Francisco. Deborah Anderson and Steven Kamin provided research assistance for this article.

I. Interest Rates, Risk, and the Exchange Rate Regime

National interest rates can be linked in the short run through the impact of international capital flows on national money supplies. The tightness of this linkage depends upon the substitutability of the financial assets of different countries, which in turn is importantly influenced by the exchange-rate regime. In a completely fixed exchange-rate regime, and with perfect substitutability of financial assets, national interest rates would be perfectly linked.

This case provides a useful point of departure for our analysis.[1] Consider the impact of a decline in U.S. interest rates on foreign interest rates. First, lower interest rates in the U.S. would encourage investors to buy foreign, rather than American, securities. As investors try to obtain the necessary foreign currency to effect these purchases, the dollar value of foreign currencies would tend to increase. However, central-bank intervention to maintain fixed exchange rates, through purchases of dollars and sales of foreign currency, would expand foreign money supplies until foreign interest rates fell to equality with U.S. rates.[2] Thus a change in the U.S. interest rate (i_{us}) precipitates an equivalent change in the foreign interest rate (i_f), or

$$\Delta i_{us} = \Delta i_f. \qquad (1)$$

Of course assets are not perfectly substitutable in practice. But the higher the degree of substitutability, the stronger may be the linkage of interest rates between countries. The financial assets of different countries are imperfect substitutes because of (a) economic and political risk, and (b) exchange-rate risk. To understand the processes which link national interest rates in practice, it is necessary to examine the influence of these factors.

Economic and political risk

Purely economic factors, such as the probability of default, influence the riskiness of financial assets. However, for short-term securities, economic risk is quantitatively less important than political risk.[3] Political risk arises because of official restrictions on the flow of capital, either current or prospective. Prospects of such governmental restrictions make securities issued in different political jurisdictions imperfect substitutes in the eyes of international investors. Due to the imperfect substitutability of the securities, an interest-rate "differential" arises between U.S. and foreign securities, even in the absence of any risk of a change in the exchange rate.

The magnitude of this differential depends upon a number of factors. Obviously the differential would change with any change in investors' perceptions of comparative economic or political risk across countries. More importantly, however, this interest-rate differential would vary with any change in the relative supplies of various countries' securities. If, for example, investors are asked to hold relatively more foreign securities, the foreign interest rate would have to rise relative to the U.S. interest rate, leading to a new differential. The change is necessary to make investors content with the shift in the composition of their security portfolios.

Exchange-rate risk

U.S. and foreign interest rates also may differ because of exchange-rate risk. This type of risk enters the picture because an American investor must (1) obtain foreign currency to purchase a foreign security and then (2) convert the foreign funds obtained at that security's maturity back to dollars. If there is a risk that the exchange rate will change during the maturity period, then the American investor is not assured of a fixed dollar return on his investment. The investor can "cover" himself against this eventuality, however, by contracting to redeem his foreign currency at the currently quoted dollar price of foreign exchange in the forward market (F), while purchasing the needed foreign funds at the spot dollar price of the foreign currency (S).[4]

Market forces will work to equalize returns "covered" for the risk of exchange-rate changes, except for any differential due to

economic and political risk. It can be shown that, in equilibrium

$$i_{us} = i_f + fp + d, \qquad (2)$$

where $fp = ((F-S)/S)(1/\text{contract period})$ is the "forward premium" at an annual rate on a foreign-exchange contract, and d is the differential due to economic and political risk. Since d explains the differential between the U.S. interest rate and the "covered" return on the foreign security, it is called the "covered interest differential."[5]

Thus, in a world where exchange-rate risk exists in addition to economic and political risk, changes in the U.S. interest rate are distributed over three factors: the foreign interest rate, the forward premium, and the covered interest differential. That is,

$$\Delta i_{us} = \Delta i_f + \Delta fp + \Delta d.$$

The questions raised in this paper concern how changes in U.S. interest rates have been distributed over these factors. The first is whether managed floating has led to a decoupling of U.S. and foreign interest rates. That is, does a change in i_{us} now primarily lead to changes in fp and d rather than i_f? Under perfectly "clean" floating, we would expect the money-supply channel that links interest rates to be completely severed.[6] However, this question remains open, in view of the large amount of official intervention in exchange markets in the post-Bretton Woods system.

Secondly, how is foreign central-bank behavior responsible for decoupling interest rates, assuming this has actually occurred? Interest rates could be decoupled either because foreign central banks have decreased their exchange-market intervention in response to U.S. interest-rate changes or because they have increased "sterilization" actions designed to remove foreign influences from their money supply. Thus, it would be useful to devise an empirical means of distinguishing between these two approaches. The distribution of the effect of a change in i_{us} between changes in fp and d will provide us with the necessary clue.

II. Foreign Impact of Changes in the U.S. Interest Rate

As we have just seen, changes in the U.S. interest rate must affect either the foreign interest rate, the forward premium, or the covered interest differential. The most significant factors determining the outcome are (1) the extent of official intervention in the exchange market and (2) the degree of sterilization of reserve-flow effects on the foreign monetary base. Before considering some examples, we should examine what each of these factors involves.

A foreign central bank's official intervention in exchange markets — that is, its "support of the exchange rate" — involves spot-market purchases or sales of currency. For example, if the dollar price of a foreign currency tends to rise above the level desired, the foreign central bank could sell its currency and buy dollars. Such actions would tend to drive its currency's spot dollar price back down. Just as importantly, however, such intervention causes the foreign central bank's dollar holdings to rise. Since these dollars represent a form of reserves, the foreign economy's monetary base expands, thereby expanding its money supply and depressing its interest rate. It is also important to note that the foreign central bank generally holds these additional dollar reserves in interest-bearing form. Typically, the central bank uses these dollars to purchase U.S. securities, thereby exchanging non-interest-bearing reserves for interest-bearing reserves. Thus intervention increases the demand for U.S. securities while also increasing the foreign money supply.

If the foreign central bank wishes to avoid having its domestic monetary policy affected by its intervention activity, it can "sterilize" the effects of that activity by contracting the domestic component of reserves by exactly as much as the intervention has increased the foreign component of reserves. The central bank accomplishes this by selling foreign securities in its own domestic market — what we would call open-market operations. This sops up the undesired liquidity and "sterilizes" the effect of the intervention. This action, however, tends to increase the supply of foreign securities in world markets.[7]

With this background in mind, the impact of

changes in the U.S. interest rate can be explored under alternative scenarios of foreign central-bank behavior. The relevant cases are: (1) no official intervention; (2) support of the exchange rate with sterilization; (3) support of the exchange rate without sterilization. These cases are best analyzed through the use of the modern theory of forward exchange.[8] We limit ourselves here to a heuristic analysis. The appendix demonstrates the conclusion rigorously for the interested reader.

Case 1: No official intervention

Consider the impact of a decline in the U.S. interest rate when there is no attempt by the foreign central bank to intervene in support of its currency. First, without intervention, there is no reason for foreign central-bank reserves to change. Thus, the foreign money supply and the foreign interest rate remain unaffected. Second, without intervention there is no change in the supplies of U.S. and foreign securities available to private investors — and no reason for a change in investors' perception of political and economic risk. Therefore, the covered interest differential will not change either.

It follows, then, that the decline in the U.S. interest rate must only affect the forward premium on the foreign currency. U.S. investors, eager to buy foreign securities, must buy foreign currency in the spot market and sell it in the forward market. This bids up the spot exchange rate and bids down the forward rate on the foreign currency, thereby depressing the forward premium. The forward premium will fall until covered returns are once more equal.

In Case 1, then, the entire reduction in the U.S. interest rate is absorbed by a decline in the forward premium.

Case 2: Exchange-rate support with sterilization

In this case, the decline in the U.S. interest rate puts upward pressure on spot foreign currency as U.S. investors buy foreign currency as before. But the support operation keeps the exchange rate from rising. Moreover, the sterilization action insulates the foreign money supply and the foreign interest rate from the impact. However, as noted above, the support operation typically causes the foreign central bank to acquire U.S. securities, while sterilization results in an official sale of foreign securities — making U.S. securities scarce relative to foreign securities in private markets. Even without a change in investors' risk perceptions, this will cause a reduction in the covered interest differential, which allows the change in relative supplies of securities to be absorbed. In addition, as U.S. investors sell foreign currency in the forward market to cover their investments in foreign securities, the price of forward exchange is driven down, and the forward premium declines despite the support of the spot rate.

Thus, in Case 2, the reduction in the U.S. interest rate is absorbed by both a decline in the forward premium and a decline in the covered interest differential.

Case 3: Exchange-rate support with no sterilization

In this case, the effects of a decline in the U.S. interest rate are spread over all three factors. The forward premium changes for the same reasons as in Case 2. The covered differential also changes in the same fashion because, once again, the foreign central bank's support operations typically result in an increase in demand for U.S. securities, thereby affecting the balance of supplies available to private portfolios. But now the lack of sterilization causes the foreign money supply to be

Table 1

		Impact of Δi_{us}
Case 1:	No official intervention	$\Delta i_{us} = \Delta fp$
Case 2:	Exchange rate supported with complete sterilization abroad	$\Delta i_{us} = \Delta fp + \Delta d$
Case 3:	Exchange rate supported without sterilization abroad	$\Delta i_{us} = \Delta fp + \Delta d + \Delta i_f$

affected by the support operation. This causes the foreign interest rate to fall in sympathy with the U.S. rate.

Case 3, then, is the only one in which the foreign interest rate is affected.

Implications for empirical analysis

The above cases are summarized in Table 1. We see that there are two ways in which interest rates could have become decoupled after Bretton Woods. Decoupling could occur either because official intervention ceased to be associated with changes in the U.S. interest rate (Case 1) or because intervention was accompanied by complete sterilization (Case 2). If lack of intervention were the sole cause of the decoupling (Case 1), changes in the forward premium should absorb all of the impact of changes in U.S. interest rates. In contrast, if complete sterilization were the sole cause (Case 2), the impact should be felt in both the forward premium and the covered interest differential.[9]

III. Measured Impact of Managed Floating on Linkages Between Interest Rates

In this section, we examine empirically the impact of managed floating on the interest-rate linkages for six industrialized countries. Our methodology tests for the direct linkage of interest rates, allowing for two other factors that may impinge upon foreign interest rates.[10]

The first such factor is the cyclical variation in the demand for money, and hence interest rates, that occurs over the business cycle. To measure this influence, we use as a proxy the percentage deviation of industrial production from its trend.[11] Other things equal, when the cyclical component of industrial production is relatively high, the demand for money, and hence the real interest rate, also tends to be high. A second factor to consider is the inflation-expectations premium in interest rates. A major part of the movement in foreign interest rates can be attributed to variations in the inflation premium.[12] Unless we allow for such variations, measured changes in monetary effects on interest rates might be spurious and simply due to common inflationary trends.

The following equations relate U.S. interest rates to comparable foreign interest rates:[13]

$$i_f = a_0 + a_1 D + a_2 i_{us} + a_3 D i_{us} + a_4 Q + \sum_{i=0}^{8} a_{5+i} \dot{C}P_{t-i} + e_1 \qquad (3)$$

$$fp = b_0 + b_1 D + b_2 i_{us} + b_3 D i_{us} + b_4 Q + \sum_{i=0}^{8} b_{5+i} \dot{C}P_{t-i} + e_2 \qquad (4)$$

where

i_f = foreign interest rate,
fp = forward premium on the foreign currency,
i_{us} = U.S. interest rate,
D = dummy variable having a value of one for the Bretton Woods system and zero for the period of managed floating,
Q = percentage deviation of industrial production from trend,
$\dot{C}P$ = rate of change of the consumer-price index,
e = error term.

In equation (3), the foreign interest rate (i_f) depends on domestic and foreign components of the foreign monetary base, as well as the foreign demand for money. The exchange rate regime influences the components of the foreign monetary base, and therefore the foreign money supply. Variations in the foreign demand for money (relative to supply) are explained by cyclical variations in output (Q) and inflationary expectations ($\dot{C}P$). Expected inflation is measured by a (nine quarter) fourth-degree polynomial distributed lag on current and past quarterly changes in the consumer-price index. The sum of the coefficients on this distributed lag is expected to be positive, but not necessarily equal to one, as would be true in the long run in the absence of tax effects.

Equation (3) is used to test if managed floating has decoupled interest rates. A dummy variable (D) having a value of one during the

fixed-exchange-rate period and zero otherwise is included, both as a multiplicative term on the U.S. interest rate and as a shift parameter for the constant term.[14] If a_2 is not significantly different from zero, we may conclude that i_{us} and i_f have generally not moved together during the floating-rate period. The coefficient on a_3, on the other hand, registers the additional impact attributable to the fixed-exchange-rate regime, so that we would expect a_3 to be positive if i_{us} and i_f were more closely linked during that period.

Equation (4), which accounts for the impact of these same variables on the forward premium, provides evidence on the reason for a decoupling of U.S. and foreign interest rates under managed floating — assuming this has actually occurred. If the major factor is a lack of market intervention in response to U.S. interest-rate changes, the forward premium would change by as much as the U.S. interest rate, making the value of b_2 close to one. On the other hand, if interest-rate linkages were severed by complete sterilization, changes in the U.S. interest rate would affect both the forward premium and the covered interest dif-

Table 2
Impact of U.S. Interest Rate on Foreign Interest Rates and Forward Premiums on Foreign Currencies

$$i_f = a_0 + a_1 D + a_2 i_{US} + a_3 D i_{US} + a_4 Q + \sum_{i=0}^{8} a_{5+i}\, \dot{C}P_{t-i} \qquad fp = b_0 + b_1 D + b_2 i_{US} + b_3 D i_{US} + b_4 Q + \sum_{i=0}^{8} b_{5+i}\, \dot{C}P_{t-i}$$

Country	Dependent Variable	Estimated Coefficients of Independent Variables								
		a_0 or b_0	a_1 or b_1	a_2 or b_2	a_3 or b_3	a_4 or b_4	$\sum_{i=0}^{8} a_{5+i}$ or $\sum_{i=0}^{8} b_{5+i}$	S.E.	Rho	D.W.
Belgium	i_f	5.32	−1.92	.255	.178	.211	.348	.978	.657	1.56***
		(1.64)*	(−.662)	(1.15)	(.545)	(2.27)**	(1.63)*		(6.22)***	
	fp	−6.84	4.76	.973	−.550	−.271	−.488	1.452	——	1.82***
		(−1.77)*	(1.67)*	(3.32)***	(−1.80)**	(−2.84)***	(−2.72)***			
Germany	i_f	−.973	−6.71	.181	.508	.192	.935	9.14	.982	1.12**
		(−.150)	(−1.60)*	(.960)	(1.57)*	(2.16)**	(1.53)*		(36.8)***	
	fp	3.23	−2.49	.748	−.0734	−.211	−1.58	1.470	.548	1.74***
		(1.05)	(−.760)	(2.86)***	(−.157)	(−1.67)*	(−3.44)***		(4.67)***	
Switzerland	i_f	1.79	−1.77	−.0385	.456	.0801	.465	.533	.560	1.78***
		(1.40)*	(−1.26)	(−.324)	(2.66)***	(2.02)**	(6.64)***		(4.82)***	
	fp	−1.10	4.50	1.01	−.924	−.141	−.712	1.112	.610	1.82***
		(−.405)	(1.49)*	(4.03)***	(−2.51)***	(−1.72)**	(−4.47)***		(5.50)***	
France	i_f	12.5	−7.61	−.196	.843	.0678	−.192	.716	.886	1.55***
		(4.44)***	(−2.85)***	(−1.27)	(3.10)***	(2.17)**	(−.820)		(13.1)***	
	fp	−12.0	8.81	1.21	−.863	−.0578	.158	.884*	.815	1.34***
		(−3.68)***	(2.82)***	(6.43)***	(−2.58)***	(−14.5)*	(.588)		(9.66)***	
Canada	i_f	.894	−.314	.652	.0833	.0297	.390	.588	.712	1.54***
		(.865)	(−.160)	(6.05)***	(.326)	(.427)	(3.02)***		(7.24)***	
	fp	−1.26	.368	.480	−.188	−.00152	−.346	.770	.549	1.82***
		(−1.15)	(.178)	(3.45)***	(−.655)	(−.0178)	(−2.51)***		(4.69)***	
United Kingdom	i_f	9.72	−3.49	.195	.0501	−.0741	−.0509	1.265	.884	2.14***
		(2.07)**	(−.736)	(.670)	(.108)	(−.492)	(−.251)		(13.5)***	
	fp	−10.7	8.42	.730	−.713	.183	.166	2.013	.742	2.08***
		(−1.51)*	(1.19)	(1.53)*	(−.970	(.726)	(.574)		(7.92)***	

t-statistics are in parentheses.
*** indicates a coefficient that is significantly different from zero at the one-percent level on the basis of a single-tailed test.
** indicates significance at the 5-percent level; and * signifies a 10-percent level of significance.
With respect to the Durbin-Watson statistic (D.W.), the absence of significant positive serial correlation in the residuals is denoted by *** at the 5-percent level and ** at the 2.5-percent level.

ferential, resulting in a value of b_2 significantly below one.[15]

The coefficients on the "control" variables, b_4 and b_5 in equation (4), are expected to be nearly equal in absolute value to a_4 and a_5 in equation (3), but opposite in sign. Changes in the foreign demand for money—as measured by the Q and $\dot{C}P$ variables—would affect the foreign interest rate, and this in turn would produce opposite changes in the forward premium. The U.S. interest rate would not be affected by such variations, because the U.S. dollar was a reserve currency throughout the periods of both fixed and floating exchange rates.

Belgium, Germany, Switzerland, and France

Estimates of these equations for a sample of six industrialized countries, using ordinary least squares and a first-degree Cochrane-Orcutt adjustment for serial correlation, are shown in Table 2. The a_2 coefficient is not significantly different from zero for Belgium, Germany, Switzerland and France — which suggests that under managed floating there was no transmission of U.S. interest rates to those countries' interest rates through direct monetary effects. Also, the b_2 coefficient is not significantly different from one, indicating that with managed floating a change in the U.S. interest rate resulted in nearly an equal movement in the forward premium on the foreign currency.

On average in these four countries, a 100-basis-point change in the U.S. interest rate is estimated to have produced a 99-basis-point change in the forward premium on the foreign currency, but only a 5-basis-point change in the foreign interest rate, and also hardly any change in the (implied) covered interest differential. This result corresponds most closely to Case 1, in which there is no official intervention in the foreign-exchange market in response to incipient capital flows induced by differences in interest rates.

The overall magnitude of central-bank intervention has been about as large for these four countries under managed floating as under the Bretton Woods regime (Table 3).[16] But whether managed floating has brought about a lesser degree of foreign interest-rate dependence on U.S. rates does not depend on the amount of intervention per se. Rather, it depends on the relative amount of intervention under the two regimes, in response to variations in U.S. interest rates and associated incipient capital flows. Because the forward premium is seen to have changed, on average, by just about the full amount of the change in the U.S. interest rate (with hardly any change in the implied covered interest-rate differential), we infer that official intervention has ceased to be associated with interest-sensitive movements of capital.

Interest-rate independence might also occur if foreign central banks intervened to support the exchange rate but fully sterilized the impact on foreign money supplies (Case 2). However, in that case the impact of the change in the U.S. interest rate would be split between a change in the forward premium and a change in the covered differential between interest rates. Under managed floating, the forward pre-

Table 3
Average of Absolute Values of Quarterly Percent Changes in Official Reserves*

	Bretton Woods	Managed Floating
Belgium	2.50	4.05
Germany	8.35	3.62
Switzerland	3.32	5.00
France	5.17	6.83
Canada	4.39	6.37
United Kingdom	4.40	12.97

*Reserves are denominated in SDR's as tabulated in *International Financial Statistics*. Since world reserves have been growing over time, this in itself would result in an observed "use" of reserves. To correct for this trend effect, percentage changes in world reserves were subtracted from corresponding country figures. The formula used to measure the average absolute percentage change in quarterly values of reserves is:

$$\left(\sum_{i=1}^{T} \left| \frac{R^c_t - R^c_{t-1}}{R^c_{t-1}} - \frac{R^w_t - R^w_{t-1}}{R^w_t} \right| / T\right) \times 100$$

The periods of fixed and managed floating correspond to those used in estimating the interest-rate and forward-premium equations, as described in footnote 14. For a discussion of this and various alternative measures of intervention, see Suss (1976).

mium is estimated to have responded by approximately the full amount of a change in the U.S. interest rate. Thus a lack of exchange-market intervention in response to interest rate variations, rather than sterilization, apparently accounted for most of the interest-rate insulation for those countries under the floating-rate regime.[17]

In contrast, their insulation from the U.S. interest rate was far less complete in the period of fixed exchange rates. The estimated value of a_3, the coefficient on the multiplicative dummy variable in the interest-rate equation, is positive in all cases, and significantly so in all cases but one. Thus, the U.S. interest rate significantly affected interest rates in these countries during the Bretton Woods years. The estimated value of b_3, the coefficient on the multiplicative dummy in the equations explaining the forward premium, is negative for all these countries, and significantly so in all but one case. Thus, the impact of U.S. interest rates on the forward premium of these countries' currencies was significantly less during the fixed exchange-rate period, as would be expected in the case of stronger intervention in response to interest-induced capital flows.

The four countries' results for the fixed-rate period correspond most closely to Case 3. Our estimated responses of foreign interest rates to the U.S. interest rate, equal to the sums of the a_2 and a_3 coefficients, are consistent with those obtained by Herring and Marston (1977). On average, we find that a 100-basis-point change in the U.S. rate produced a 55-basis-point change in the foreign interest rate. In Case 3, the difference between the changes in U.S. and foreign interest rates is split between changes in the forward premium and the covered interest differential. We find the average estimated response of the forward premium for the fixed-rate period, equal to the sum of the b_2 and b_3 coefficients, to be 38 basis points. The implied change in the covered interest differential, obtained by subtracting the sum of the above two values from one, is significantly smaller at 7 basis points.

The variables influencing the demand for money have highly significant effects on foreign interest rates for these four countries, which suggests the need to consider those variables when testing for the effect of managed floating on the short-run interdependence of interest rates. In all four cases, the cyclical component of output has significantly positive effects on the foreign interest rate and significantly negative impacts on the forward premium. Similarly, except for France, the measure of expected inflation significantly and equally affects the foreign interest rate and the forward premium, but with opposite signs. The sum of the coefficients on past inflation is generally less than one, as would be anticipated in the short-run when output and employment are variable.

Canada and the United Kingdom

Canada is an exception to this general pattern of money-market insulation from U.S. interest rates under the managed-float regime. The estimated a_2 coefficient indicates that a change of 100 basis points in the U.S. short-term interest rate affected the Canadian short rate by about 65 basis points even during managed floating. The insignificance of the a_3 coefficient indicates further that the impact of U.S. on Canadian interest rates was not very different under a fixed exchange-rate system. Similarly, the impact on the forward premium is estimated to have been about the same under fixed and floating exchange rates.

Although the Canadian dollar was ostensibly freed to float on the foreign-exchange market in May 1970, the Bank of Canada continued to make the U.S.-Canadian dollar exchange rate an important policy target, and it viewed domestic monetary and fiscal policies as primary instruments for achieving the desired exchange rate.[18] However, the target range for the Canadian dollar turned out to be a relatively static one, which did not allow for any significant movement in the exchange rate.[19] After floating in 1970, the Canadian dollar appreciated immediately against the U.S. dollar by about 10 percent, and then remained in that range throughout most of the decade. To maintain this exchange rate, Canadian authorities keyed nominal interest rates quite

closely to U.S. interest rates, continuing the traditional interest differential in favor of Canada.

Another unique case is the United Kingdom, where interest rates apparently were fully insulated from U.S. interest rates during both the fixed-rate and floating-rate regimes. The estimated value of the a_2 coefficient, measuring the impact of the U.S. interest rate on the U.K. rate during the managed float, is not significantly different from zero; and neither is the value of the a_3 coefficient that registers the difference made by the fixed-exchange-rate regime.[20]

The absence of any observable transmission may be explained by the existence in the United Kingdom, as in the United States, of a highly developed short-term market for credit, which allows the authorities easily to sterilize the impact of reserve flows on the money supply and interest rates. Indeed, sterilization occurs almost automatically as a consequence of the normal operation of the British Government's Exchange Equalization Account. When this Account purchases foreign exchange to support the exchange rate, it obtains the necessary sterling by issuing Treasury bills to the public, thereby preventing a new injection of bank reserves and deposits into the monetary system. Similarly, when it sells foreign exchange it uses the sterling proceeds to purchase a like amount of Treasury bills from the market, thereby preventing a contraction of bank reserves and a tightening of credit-market conditions.[21]

IV. Summary and Conclusions

Advocates of a system of flexible exchange rates, such as the managed floating adopted in 1973, claim that it permits a greater independence of monetary policies by weakening linkages between national interest rates. Variations in U.S. interest rates affect international capital flows, which in turn put pressure on exchange rates. When exchange rates are supported by central-bank intervention, as under the Bretton Woods system, foreign money supplies are affected. Such changes in foreign money supplies, unless they can be sterilized by offsetting central-bank action, in turn impact on foreign interest rates.

Quantitatively, central-bank intervention in exchange markets has been about as large under managed floating as under the Bretton Woods system. Whether managed floating has actually weakened interest-rate linkages therefore depends upon whether intervention now offsets the effects on exchange rates induced by interest-rate differentials to a lesser extent. It also depends on the extent of utilization of sterilization policies. This study has analyzed the question by comparing the linkages between U.S. and foreign interest rates in six industrialized countries under the two exchange-rate regimes.

Canada and the United Kingdom were atypical. In both countries, linkages to U.S. interest rates did not change significantly during the two exchange-rate regimes, although for different reasons. In Canada, interest rates continued to be pegged to U.S. interest rates after the shift to managed floating, simply as a matter of policy. In contrast, the Bank of England was both willing and able to prevent any linkage between U.S. and U.K. interest rates by sterilization operations under both exchange-rate regimes.

The more typical pattern was exhibited by Belgium, Germany, Switzerland, and France. For all four of these countries, U.S. interest rates exerted a strong impact on foreign interest rates under the Bretton Woods system of fixed exchange rates. A 100-basis-point (one percentage point) change in the U.S. short-term interest rate, on average, produced a 55-basis-point change in the comparable foreign interest rate. The results for this period, thus, conform most closely to Case 3 of our theoretical analysis, in which the exchange rate is supported by central-bank intervention with little or no sterilization. Case 3 is the only one in which the foreign interest rate is affected. In it the difference between the changes in

U.S. and foreign interest rates is split between a change in the forward premium on the foreign currency and a change in the covered interest differential.

Under the Bretton Woods system, a 100-basis-point change in the U.S. interest rate produced, on average in these countries, a 38-basis-point change in the forward premium required by the market to provide the forward cover needed by investors. The average change in the covered interest differential needed to induce investors to move their capital internationally was much smaller, at only 7 basis points. These results indicate that: (1) In the absence of exchange-rate risk, securities in different national markets are fairly close but not perfect substitutes for one another, and (2) the elasticity of supply of forward cover to investors was not very high even in the Bretton Woods period, suggesting that the market required a significant risk premium for bearing the risk of change in the exchange rate.[22]

In contrast to the Bretton Woods years, during the period of managed floating a 100-basis-point change in the U.S. short-term interest rate produced a 99-basis-point average change for the four countries in the forward premium on the foreign currency, but no significant change in either the foreign interest rate or the covered interest differential. These results for the period of managed floating correspond to Case 1 of our theoretical analysis, where monetary independence flows from an absence of foreign-exchange market intervention by foreign central banks in response to a change in the U.S. interest rate. Without such exchange-market intervention, there can be no impact on foreign money supplies and foreign interest rates.

In the theoretical Case 2, the exchange rate is supported in response to a change in the U.S. interest rate, but monetary independence flows from sterilization of the impact of international reserve flows on the foreign money supply. In Case 2, both the covered interest differential and the forward premium change in response to a change in the U.S. interest rate, while in Case 1 only the forward premium is affected. The general absence of a significant response of the covered interest differential to the U.S. interest rate in the period of managed floating suggests that sterilization policies were not the main cause of the observed monetary independence under this regime.

APPENDIX
Interest Arbitrage in the Modern Theory of Forward Exchange

The modern theory of forward exchange recognizes that both covered-interest arbitragers and speculators are important forces in determining the response of the foreign interest rate, the forward premium, and the covered interest differential to a change in the U.S. rate of interest. As discussed in footnote 4, uncovered interest arbitrage can be decomposed into covered-interest arbitrage and speculative activity in the forward market, and therefore does not have to be treated separately.

We abstract from growth and therefore focus on short-run equilibrium at a point in time, in which the total stock of private wealth and supplies of U.S. and foreign securities are given. Conditions of portfolio balance determine interest rates and the spot and forward exchange rates. Figures 1 through 3 show the supply and demand for the stock of forward commitments in a foreign currency. The vertical axis measures the price of forward exchange, and the horizontal axis indicates the stock of forward exchange either supplied or demanded at a point in time. The spot price of foreign exchange is initially equal to S in the diagram. To simplify the analysis, we assume initially that the U.S. interest rate and foreign interest rate are equal. We also assume that, given this condition, tastes and portfolio sizes are such that at a forward rate equal to the spot rate, there is initially no supply of or demand for forward exchange by investors hedging against the risk of exchange-rate changes.

Arbitragers, who cover their investments against exchange risk with contracts in the forward market, constitute one side of the market for forward exchange. If the forward price of foreign currency declines, given the current spot rate, covered rates of return on U.S.-dollar-denominated securities exceed those on foreign-currency-denominated securities; and arbitragers demand foreign currency forward to cover additional holdings of dollar-denominated assets. Conversely, if the price of forward exchange rises, assets denominated in foreign currencies now become more attractive; and to achieve portfolio equilibrium arbitragers supply foreign currency forward. Thus, the amount of forward exchange that arbitragers wish to hold is a downward-sloping schedule (AA). It is less than infinitely elastic, because financial assets in different national markets are imperfect substitutes even when covered against exchange-rate risk.

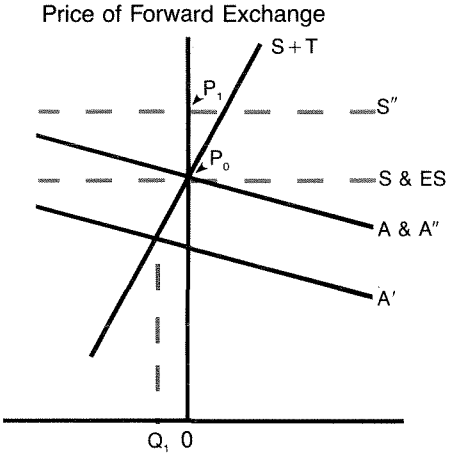
Speculators and traders (i.e., importers and exporters) constitute the other side of the forward market. For simplicity, we initially assume that the value of the future spot rate expected by traders and speculators, ES, is equal to the current spot rate, S. Unlike arbitragers, speculators and traders take positions with respect to exchange-rate risk — speculators outright and traders by not covering commercial commitments. When the forward rate rises above the expected future spot rate, ES, speculators and traders will supply foreign currency forward. Since both are to some extent averse to risk, a higher forward price of foreign currency, and hence a larger risk premium, will be required to draw forth a larger supply. Conversely, when the forward rate falls below the expected future spot rate, speculators and traders demand foreign currency forward. Thus, the amount of forward exchange made available by speculators and traders (S & T) is an increasing function of price.

Case 1: No Official Intervention

Figure 1 shows the effect of a change in the U.S. interest rate with no official intervention in the spot market. Under the conditions specified, the initial equilibrium price of forward exchange is equal to the current spot rate, S. Now suppose the U.S. interest rate falls because of either an increase in supply or a decrease in demand for money in the United States. With the spot price of foreign exchange initially at S, the arbitrage schedule shifts down to A′ by an amount equal to the decline in the U.S. interest rate. This occurs because, with a given demand by arbitragers for forward exchange, the price of forward exchange must fall by an amount equal to the decline in the U.S. interest rate, leaving covered returns on U.S. and foreign-currency-denominated assets as before. At the intersection of the S&T and A′ schedules, arbitragers desire to shift Q_1O assets from the United States to foreign financial markets. But this incipient capital outflow puts upward pressure on the spot price of foreign exchange, which operates to shift the arbitrage schedule back up.

Figure 1

Transmission of U.S. Monetary Policy with No Official Intervention



Supply of Forward Foreign Currency from Arbitragers and Demand by Speculators and Traders

Demand for Forward Foreign Currency by Arbitragers and Supply from Speculators and Traders

For simplicity, we may assume that exchange-rate expectations are perfectly inelastic, so that speculators and traders expect an unchanged spot rate to prevail in the future. In that case, pressure in the spot market pushes the spot exchange rate to S″ until the A′ schedule returns to its old position. The spot rate rises by an amount equal to the decline in the U.S. interest rate. The net result is that, under a fully flexible exchange rate, the discount on forward exchange becomes sufficiently large to offset the difference in interest rates, preventing an actual capital outflow. In terms of the basic equation in the text. Δi_{us} impacts only on Δfp (equals P_0P_1), and not at all on Δd or Δi_f.

More realistically, if the future spot rate is expected to rise, but by less than the change in the current spot rate, the S&T schedule then shifts up as well. However, the new equilibrium involving higher S&T and A schedules would still intersect on the vertical axis and generate the same discount on forward exchange as shown in Figure 1, but simply at higher levels of spot and forward rates. Once again, Δi_{us} does not impact on Δd or Δi_f.[23]

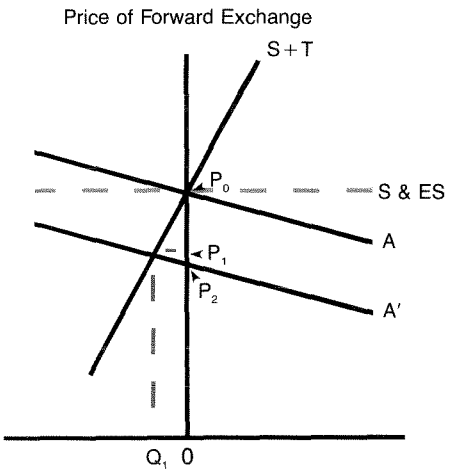
Case 2: Exchange Rate Support With Complete Sterilization

Figure 2 shows the impact on the forward-exchange market of a decline in the U.S. interest rate when the exchange rate is supported, and when the foreign central bank sterilizes the effects of international reserve flows on its monetary base by offsetting operations. The decline in the U.S. interest rate shifts the A schedule down to A′ as before. But now, because of central-bank support operations in the spot market for foreign exchange, the incipient capital outflow, Q_1O, becomes an actuality. The upward pressure on the spot price induces foreign central banks to sell foreign exchange in order to maintain the exchange rate. In addition, when the foreign central bank sterilizes the effects of this operation on the foreign money supply, say, by sales of securities in the foreign money market, it prevents the foreign interest rate from falling.

The net result for the foreign central bank is an exchange of foreign securities for U.S. securities. Q_1O of private capital can flow abroad even in the short run, with the total stock of wealth given, because an equal amount of foreign official capital flows in the opposite direction. The result in the forward exchange market is an allocation of the impact of Δi_{us} on Δfp (equals P_0P_1) and Δd (equals P_1P_2), depending upon the degree of substitutability of financial assets and the degree of exchange-rate certainty. The greater the substitutability of financial assets in the absence of exchange-rate risk, the greater is the elasticity of the A schedule; and the greater the certainty about future exchange rates, the more elastic is the S&T schedule. If the A schedule is elastic relative to the S&T schedule, as drawn, then Δi_{us} mostly affects Δfp, with relatively little impact on Δd. The empirical results in the text suggest that these relative

Figure 2

Transmission of U.S. Monetary Policy with Supported Exchange Rate and Complete Sterilization



Supply of Forward Foreign Currency from Arbitragers and Demand by Speculators and Traders

Demand for Forward Foreign Currency by Arbitragers and Supply from Speculators and Traders

elasticities are indeed a realistic configuration. But in any case, the forward premium changes by less than the change in the U.S. interest rate, which creates a change in the covered interest differential, Δd, inducing investors to substitute foreign assets for U.S. assets.

Case 3: Exchange Rate Support Without Sterilization

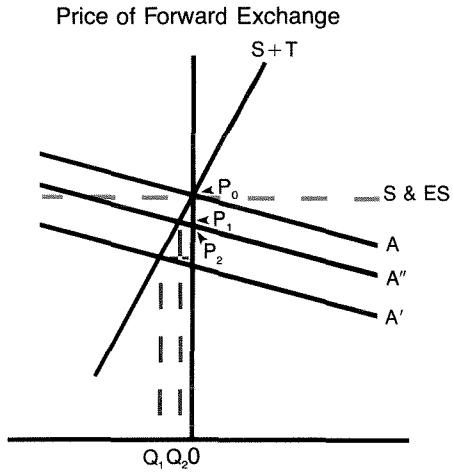
Figure 3 shows the impact of a decline in the U.S. interest rate when the exchange rate is supported, but the foreign central bank does not offset the effects of exchange-market intervention on its own money supply. The decline in the U.S. interest rate once again shifts the A schedule down to A′, resulting in an incipient capital outflow equal to Q_1O. As arbitragers increase their (covered) investment abroad, however, the foreign interest rate declines because of the increase in the foreign money supply. The foreign central bank supports the exchange rate by purchasing an excess supply of dollars in the spot market and investing these dollars in U.S. securities. The arbitragers use the foreign currency that they purchase from the foreign central bank to bid up the price of foreign securities and reduce the yield, until the original holders of the securities are willing to exchange them for the newly created foreign money. But the decrease in the foreign interest rate shifts the arbitrage schedule to A″ and consequently reduces the size of the actual capital outflow to Q_2O.

The outflow of private capital can occur even in the short run, with the total stock of private wealth given, because an equal amount of foreign official capital (the exchange of foreign money for U.S. securities) flows in the opposite direction. The relative impacts on Δfp (P_0P_1) and Δd (P_1P_2) depend upon the relative elasticities of the A and S&T schedules, with the impact on Δfp (P_0P_1) being greater if the A schedule is relatively elastic, as drawn. Empirical results in the text for the Bretton Woods period correspond most closely to this case. They indicate the existence of a relatively inelastic schedule for the net forward commitments of speculators and traders, implying that speculators and traders require a relatively large risk premium in order to bear the risk of exchange-rate changes.[24]

Because national financial assets are not perfect substitutes, even in the absence of exchange-rate risk, the foreign interest rate does not decline by as much as the U.S. interest rate. Thus the arbitrage schedule does not shift all the way from A′ to A, but rather to an intermediate position A″ where a positive covered interest differential, P_1P_2, induces arbitragers to increase their holdings of foreign assets. Because the increase in the covered differential is less than in the case where the monetary effects on the foreign economy are sterilized, the size of the capital outflow, Q_2O, is less also.

Figure 3

Transmission of U.S. Monetary Policy with Supported Exchange Rate But No Sterilization



Supply of Forward Foreign Currency from Arbitragers and Demand by Speculators and Traders

Demand for Forward Foreign Currency by Arbitragers and Supply from Speculators and Traders

FOOTNOTES

1. This is an instance of perfect capital mobility internationally. The pioneering treatment of the effects of perfect capital mobility under different exchange-rate regimes is contained in a series of papers by Mundell (1968). More recently, the assumption of perfect capital mobility has become an important ingredient of the "global monetarist" approach to international adjustment. See Whitman (1975).

2. Since the U.S. dollar is a reserve currency, international capital flows normally have no impact on the U.S. money supply. Dollar reserves purchased by foreign central banks in exchange-rate support operations are returned to circulation when they are invested in U.S. money-market instruments. But in the case of adjustment between two nonreserve-currency countries, reserve flows would reduce the money supply and increase interest rates in the home country (where interest rates had originally fallen) and produce opposite reactions abroad, until interest levels at home and abroad were equalized.

Moreover, it would be impossible for foreign central banks to sterilize the impact of capital flows on their money supplies and interest rates through offsetting policies when financial assets are perfectly substitutable. If foreign central banks decrease the domestic component of their monetary bases by sales of securities in the open market, or by other means, all that would occur is a one-for-one substitution of the international reserve component for the domestic component of the monetary base, as new capital outflows from the United States were stimulated.

3. Aliber (1973) has shown that securities issued in the same political jurisdiction—such as Eurodollar and Euromark deposits in London—show nearly equal returns covered for exchange-rate risk. In contrast, covered returns on securities originating in different countries differ from one another to a larger extent, and also exhibit less covariation.

Results similar to those of Aliber (1973) have been obtained by Frankel and Levich (1975) and Minot (1974). Studies showing less than perfect integration among national capital markets, even on securities covered for exchange-rate risk, include those of Grubel (1966), Stoll (1965), and Stein (1965).

4. The alternative—holding foreign securities without the exchange risk being covered in the forward market—is completely equivalent to holding foreign securities with the exchange risk covered combined with a simultaneous and equal speculative holding of a forward contract. Speculation in the forward market involves the acquisition of contracts to buy (sell) foreign exchange at some future date in the hope that the future spot rate will be higher (lower) than the current forward rate. When the contract becomes due, the speculator sells (buys) foreign currency in the spot market to discharge (obtain) the foreign exchange obtained (necessitated) by his forward contract.

Because of this equivalence, the portfolio equilibrium of American investors can be analyzed completely in terms of holdings of domestic securities, holdings of foreign securities with exchange risk covered in the foreign market, and holdings of speculative positions in the market for forward exchange. A similar analysis also holds for foreign investors. Therefore, the portfolio position for American and foreign investors combined can be analyzed in terms of the net amount of covered interest arbitrage and the net size of the speculative positions undertaken by both.

We can easily demonstrate the equivalence of holding foreign securities without the exchange risk being covered in the forward market to the combination of holding foreign securities with the exchange risk covered and a simultaneous and equal speculative holding of a forward contract. Suppose an American investor has $1 to invest in foreign securities of one year's maturity. Let S_1 be the current price of foreign exchange in the spot market, and S_2 be the price when the foreign security matures. Also let i_f be the foreign interest rate and F equal the current price of foreign exchange in the forward market. If the investor does not cover his exchange risk by a transaction in the forward market, the value of his investment in dollars at maturity equals

$$\frac{1}{S_1}\ (1 + i_f)S_2$$

Alternatively, the American investor can hedge his investment against exchange risk by entering into a forward contract to sell foreign currency to be received at maturity. The value of his investment in dollars at maturity is

$$\frac{1}{S_1}\ (1 + i_f)F$$

If at the same time he speculates in the forward market by buying forward

$$\frac{1}{S_1}\ (1 + i_f)$$

of foreign currency, he will make an additional gain or loss. The gain or loss is equal to the dollar value in the spot market of this amount of foreign currency, which he gets by selling the proceeds from the forward contract, less the dollar cost of buying this amount of foreign currency in the forward market.

The investor's gain or loss on his speculative activity is therefore equal to:

$$\frac{1}{S_1}\ (1 + i_f)S_2 - \frac{1}{S_1}\ (1 + i_f)F$$

The total value in dollars of the covered interest-arbitrage transaction plus the speculative transaction at the maturity of the security is therefore:

$$\frac{1}{S_1}(1+i_f)F + \frac{1}{S_1}(1+i_f)S_2 - \frac{1}{S_1}(1+i_f)F = \frac{1}{S_1}(1+i_f)S_2$$

This return is precisely the same as for the uncovered interest-arbitrage transaction. Thus, uncovered interest arbitrage can be decomposed into covered interest arbitrage and a simultaneous speculative position in the forward market; and there is therefore no need to treat it separately.

5. The total covered return is actually only approximately equal to $i_f + fp$. For example, the yield, at an annual rate,

from covered interest arbitrage on the 90-day securities used in this study is:

$$\left(\frac{1}{S}(1 + i_f/4)F - 1\right) \times 4$$

The forward premium (fp), or percent gain (or loss if a discount) on the spot and forward market transactions, at an annual rate, is:

$$\left(\frac{F - S}{S}\right) \times 4$$

Therefore, by substitution, the yield on covered interest arbitrage reduces to:

$$fp + \frac{F}{S} i_f$$

But this is approximately the same as $fp + i_f$, since $\frac{F}{S}$ normally has a value close to one.

6. As has been emphasized by Mundell (1968), even under a perfectly clean float it is theoretically possible for interest rates to be linked through money-demand effects, rather than money-supply effects, if capital continues to be highly mobile internationally. For example, with a decline in U.S. interest rates, capital tends to flow abroad and produce an appreciation in the dollar values of foreign currencies. This appreciation eventually reduces foreign net exports (and strengthens U.S. net exports), contributing to a decline in aggregate demand and interest rates abroad (and to opposite effects in the United States). In the extreme case of perfect capital mobility, where capital flows are infinitely sensitive to differences in nominal interest rates (despite the presence of exchange-rate risk), these movements would continue until interest rates in the United States and abroad were equalized.

However, Mundell's mechanism for the linking of nominal interest rates under floating exchange rates is not likely to be important in practice. First, in the short-run the trade balance tends to respond perversely to changes in the exchange rate. (For a summary of the evidence on this point, see Goldstein and Young (1979).) This "J curve" effect tends to drive interest rates apart initially, rather than together, leading to further capital flows and exchange-rate movements until investors begin to take into account an expected future reversal of exchange-rate movements. Therefore, the response of foreign interest rates to U.S. rates is not unidirectional. Secondly, over a longer period differing inflation rates between the United States and foreign countries produce differential inflation premiums in interest rates, as well as exchange-rate movements that tend to maintain approximate purchasing-power parity between currencies. Thus, expected changes in exchange rates—corresponding to inflation differentials—tend to offset differences in nominal interest rates attributable to inflation premiums, severing any systematic response of capital flows to differences between nominal interest rates. The mechanism that is supposed to drive nominal interest rates together is therefore effectively destroyed. In other words, Mundell's argument has more applicability to real rates of interest than to nominal ones. The question of whether national real rates of interest continue to be closely related under managed floating of exchange rates lies outside the scope of this study. However, for some partial evidence on this question, see Howard (1979).

7. A useful analysis of sterilization policies and their tendency to short-circuit the transmission mechanism is found in Herring and Marson (1977, Ch. 2). Empirical work in the same volume, however, shows that sterilization was not complete under Bretton Woods, leading to some interdependence between U.S. and foreign interest rates. For more recent work on sterilization policies, see Hickman and Schleicher (1978) and Laney (1980).

8. Expositions of the modern theory of forward exchange include Argy and Hodjera (1973), especially section III; Grubel (1966); and Stoll (1965).

9. The shift to managed floating could also affect the distribution of effects between Δfp and Δd under conditions of exchange-rate support. But this effect is probably not large. The split between Δfp and Δd when the exchange rate is supported depends upon the substitutability between U.S. and foreign securities relative to the elasticity of the supply of forward cover from speculators. The willingness of speculators to supply forward cover to interest arbitragers depends importantly upon the degree of uncertainty about exchange rates. Even under the Bretton Woods system, there was a substantial amount of exchange-rate risk. The spot rate was allowed to fluctuate by $\pm$ 1 percent around the official parity, and official parities were sometimes changed. Indeed, a recent study by Farber, Roll, and Solnick (1977) concludes that exchange rates were neither more nor less certain in the Bretton Woods period. Although exchange-rate changes have occurred with greater frequency under the managed float, such changes were larger and more unpredictable under Bretton Woods. Thus, the elasticity of the speculator supply of forward cover may have been made neither more nor less elastic by the shift to managed floating.

Governmental controls over capital movements have been the most important factor affecting substitutability between domestic and foreign securities. Such controls have been used under managed floating to help stabilize the exchange rate and under the Bretton Woods system to affect reserves. It is not clear that either the incidence or threat of capital controls has generally been any less under managed floating than before. Moreover, in neither case were capital controls highly effective. So substitutability between domestic and foreign securities may not have been importantly affected by the exchange rate-regime either.

10. Previous empirical work on this question generally has not allowed for the influence of such other factors. For example, Logue, Salant, and Sweeney (1976) use factor analysis to measure the degree of covariation in interest rates among industrialized countries during the fixed exchange-rate period. They find that a single factor explains a fairly high proportion of the covariation in interest rates across countries. However, factor analysis sheds no light on the causes of this common variation. It could be due to events that have impinged more or less simultaneously on all financial markets, such as common business-cycle and inflation trends; or it may be the result of the transmission of interest-rate changes from one country to another through money-supply channels.

White and Woodbury (1980) extend this type of analysis to the floating-rate period, and find a significant reduction

in the covariation of interest rates associated with the shift to managed floating. (The main body of their paper compares the covariation in **covered** interest rates between the two periods, finding little change. But in footnote 10, the analysis is applied to **uncovered** yields on a set of financial assets in a manner similar to that used by Logue, Salant, and Sweeney (1976). The result is a significant reduction in the covariation of interest rates in the period of managed floating). Since inflation differentials have widened and become more variable during the period of managed floating, and since nominal interest rates incorporate inflationary premiums, such a result is not unexpected. But this result does not necessarily imply a reduction in the degree of short-run interdependence of interest rates operating directly through money-supply effects. It could be caused merely by more variable inflation differentials, a weaker degree of synchronization of national business cycles, or a combination of the two.

11. The trend level of industrial production was calculated recursively by multiplying last quarter's trend level by the actual rate of growth over the previous 20 quarters. Thus, the trend in period t of industrial production is:

$$\bar{P}_t = \bar{P}_{t-1}(1+R_t) \text{ where } R_t = \sqrt[20]{P_t/P_{t-20}} - 1, \text{ and } \bar{P}_t = P_t$$

for the first observation. The source of the quarterly data on industrial production was the IMF's **International Financial Statistics.**

12. Recent work in this area suggests that, in the post-World War II period, inflationary expectations generally have adjusted relatively rapidly to inflation actually experienced. In the United States, for example, inflation expected by money-market participants appears to be mainly a function of actual inflation over the previous eight quarters. A similar formulation is used here to account for the variation in expected inflation, and hence inflation premiums, in foreign interest rates. A representative study for the United States is Yohe and Karnosky (1969). The consumer-price index was used as the measure of inflation, and the source of quarterly changes in this index was the IMF's **International Financial Statistics.**

13. The interest rates used are 3-month representative money-market rates for all countries except Switzerland, where the bank time-deposit rate is used instead. Quarterly averages were calculated from end-of-month data. The data source is Morgan Guaranty Trust's **World Financial Markets.** The 3-month forward premium was calculated on an annual-rate basis as a quarterly average from end-of-month data on spot and forward rates, as compiled by the International Monetary Fund. The data were obtained from the Chase Econometrics data bank covering various issues of the IMF's **International Financial Statistics.**

14. For all countries in the sample except Canada, the fixed exchange-rate period is 1966-I through 1971-I, and the period covering the managed float is 1973-III through 1978-IV. Canada floated earlier, and its respective periods are 1966-I through 1970-I and 1970-III through 1978-IV.

We experimented with additional dummy variables to account for variations in the forward premium and foreign interest rates caused by expectations of devaluation or revaluation during the fixed-rate period. Only in the case of the U.K. did such a speculative dummy variable register a significant effect, and then only for the quarter of the 1967 devaluation. Rather than entering a dummy variable to help explain behavior for this one quarter, that observation was simply dropped from the U.K. sample.

15. It might be objected that with an infinite elasticity of interest arbitrage with respect to the covered interest differential, Δd would equal zero; and Δfp, and therefore b_2, would equal one in this case also. But to anticipate the empirical results, the evidence for the Bretton Woods period indicates that Δd is smaller than Δfp when exchange rates are supported, but that it is still large enough to distinguish between the two hypotheses. If it could be assumed that the Bretton Woods period constituted a pure combination of Cases 2 and 3, then the evidence from the period would suggest that if interest rates had been completely decoupled under managed floating solely because of complete sterilization (Case 2), Δfp, and hence b_2, would equal only .84 on average. But, since the Bretton Woods period contains an admixture of Case 1, due to floating of the exchange rate between intervention points, this estimate of .84 is really only an upper bound; and we would expect the observed value of b_2 to be lower than that if there were complete sterilization.

16. Since exchange-rate variability has indeed increased very significantly under managed floating, this may at first seem surprising. But shocks to the system, particularly those associated with the oil crisis, may well have been larger in the period of managed floating. In addition, the view that there is necessarily a trade-off between exchange-rate changes and reserve changes rests on assumptions that 1) speculative behavior in the foreign-exchange market is independent of the exchange-rate regime, and 2) the exchange market is stable in the short- to medium-run. Neither assumption is necessarily tenable. For stability to occur, the excess demand for foreign exchange must fall (rise) as the exchange rate rises (falls). But "J curve" effects on the current account assure that this will not be true in the short run unless speculation is stabilizing within the relevant range. With a locally unstable market, movements in the exchange rate increase the size of any gap between the demand and supply for foreign currency, increasing the use of reserves for authorities who intervene in order to resist such exchange-rate fluctuations. For a detailed treatment of these points, see Williamson (1976).

17. Thus, a 100 basis-point change in the U.S. interest rate, on average, actually produced a 99 basis-point change in the forward premium on the foreign currency under managed floating, compared to the less than 84 basis-point change that likely would have resulted from the Case 2 model of complete sterilization (see footnote 15). These point estimates strongly suggest that the insulation of these foreign interest rates under managed floating was mainly due to an absence of exchange-market intervention in response to changes in the U.S. interest rate. However, the standard errors of the estimated coefficients are not low enough to allow one to reject with a high degree of certainty the alternative hypothesis of complete sterilization.

18. The Annual Report of the Bank of Canada (1970, p. 9) clearly states this orientation:

> The exchange rate is a very important price in a country that trades with the outside world on the scale that Canada does. . . . It is not therefore possible to ignore it, even when it floats. Public financial management must continue to be concerned that the exchange rate is broadly suitable to the development of Canada's international trade, and compatible with the desired structure of our balance of payments, in particular the size of the balance on current account. It is therefore still necessary to seek a mix of fiscal and monetary policy which encourages levels of interest rates in Canada that are consistent with the exchange rate staying within a suitable range.

19. For more extended treatments of this point, see Pesandro and Smith (1973) and Courchene (1976). Toward the end of 1975, the Bank of Canada announced an apparently radical change in monetary policy. Instead of interest rates, the focus of policy henceforth would be the behavior of a monetary aggregate; and policy would be geared to a gradual lowering of the inflation rate. But in practice, interest rates were chosen as the policy instrument for controlling money, and on certain occasions were explicitly used to defend the exchange rate. The econometric results presented here suggest that actual policy remained much the same, despite the change in rhetoric. See also Howitt and Laidler (1980).

20. In contrast, the estimated coefficient on the multiplicative dummy variable, b_3, though not significantly different from zero, is about equal in magnitude but opposite in sign to the estimated response, b_2, of the forward premium to the U.S. interest rate in the period of managed floating. This suggests a smaller impact on the forward premium under fixed exchange rates. However, the reason in this case is different than it is for the other four countries. The explanation apparently is the heavy intervention in the forward exchange market undertaken by the Bank of England early in the fixed exchange-rate period, rather than an increased response of the U.K. interest rate to the U.S. interest rate. The fact that the forward rate was supported by the Bank of England over only a portion of our fixed exchange-rate period (up until the 1967 devaluation) likely accounts for the lack of statistical significance in the observed shift in the impact of the U.S. interest rate on the forward premium. Chalmers (1971) provides a collection of papers detailing this period of forward-exchange intervention by the Bank of England.

21. Hodgman (1974, p. 173) describes the operation of the Exchange Equalization account.

22. Another recent attempt at measuring risk premiums in the forward exchange market is Stockman (1978). His findings suggest that significant risk premiums exist for those taking open positions, but that they are probably not constant. This result is consistent with both the modern theory of forward exchange outlined in the appendix and our empirical results. See also Froewiss (1977).

23. The above analysis assumes that the decline in the U.S. interest rate is a change in the "real" rate, and is unaccompanied by a change in inflationary expectations that might affect the expected future spot rate, ES. But since a major part of the movement in U.S. interest rates during the period examined can be attributed to variations in inflationary premiums, we should consider the case of a decline in the nominal U.S. interest rate that is due to lower inflationary expectations. However, the distribution of this impact of Δi_{us} on Δfp, Δd, and Δi_f when there is no official spot-market intervention turns out to be the same as when the change in the U.S. interest rate is due to a change in the real rate.

If the U.S. interest rate declines because of lower inflationary expectations, in a situation (such as managed floating) where there are no official parities for the spot rate, speculators and traders might expect the future spot rate to fall according to the well known principle of purchasing-power parity. In Figure 1, the initial downward shift in the A schedule would be accompanied by an equal downward shift in the S+T schedule (due to the change in the expected spot rate, ES). The new equilibrium would occur at the same quantity as initially (at 0); and Δfp would be equal to Δi_{us}, leaving no impact on Δd or Δi_f — as is also true in the case of a "real" rate decline.

However, two differences can be cited. When the U.S. interest rate declines purely because of lower inflationary expectations, the decline in the forward premium is produced solely by a decline in the forward rate, with the spot rate given. Whereas when that decline is a "real" change, the reduction in the forward premium tends to be produced by an increase in the spot rate. Secondly, when the decline in the U.S. interest rate is only nominal, arbitragers have no incentive to move their capital abroad. But with a "real" decline in the U.S. interest rate, there is an incipient capital outflow, which then turns the forward premium against arbitragers. Nevertheless, no matter which kind of change occurs in the U.S. interest rate, an equal change in the forward premium indicates a lack of official intervention in the spot market.

24. If the decline in the U.S. interest rate were due to lower inflationary expectations, the S+T schedule might shift downward as described in footnote 23, to reflect a decline in the expected future spot rate based on purchasing-power parity. Then the relative impacts on Δfp and Δd would no longer be determined soley by the relative elasticities of the A and S+T schedules.. However, this probably did not occur to any significant extent in the Bretton Woods period.

To be sure, changes in the U.S. interest rate were partly only nominal, and not "real". But it is unlikely that changes in the inflation premium in U.S. interest rates were significantly associated with concurrent changes in expected future spot rates under the Bretton Woods system. For in that system, anticipations of speculators and traders were conditioned more by the likelihood of imminent changes in official parities, which in turn depended on such things as the size of international reserve holdings and political factors, than by current changes in purchasing-power parity. Consequently, the relative impacts on Δfp and Δd estimated for the Bretton Woods period would appear to be indicative of the actual relative elasticities of the A and S+T schedules.

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Wringing Out Inflation: Japan's Experience

Charles Pigott*

Over the last five years, Japan has succeeded in reducing her inflation rate to a degree that, from an American perspective, can only seem enviable. In 1974, Japanese consumer prices rose by nearly 25 percent. By 1978, CPI inflation had declined to 3 percent, and, despite sharp oil price increases, remained below 5 percent for 1979 as a whole. Japan's success in reducing inflation is all the more remarkable in view of its experience with two factors widely blamed for U.S. inflation: oil price increases and government budget deficits. Japan is substantially more dependent upon foreign oil than is the U.S., and so should have suffered more inflation from OPEC price increases. Moreover, Japan's budget deficit as a fraction of its GNP has been nearly twice the U.S. ratio since 1976.

Japan's real growth and unemployment performance over the last five years has been far less enviable than her inflation experience. Between 1965 and 1972, Japan's real GNP grew at a 10½-percent annual rate. After 1975, real growth averaged less than 6 percent, and in no year has it substantially exceeded that figure. Japan's unemployment rate—always remarkably low compared to other industrial countries—rose to nearly twice the 1965–72 average in the second half of the 1970's.

This paper reviews Japan's experience in reducing inflation, and examines several issues raised by it that are potentially applicable to other countries. Section I considers the factors accounting for the rise and fall of Japanese inflation over the 1973–78 period. We found that the 1973–74 surge in import prices, and in particular the 1974 oil price hike, was a major but not the most important factor behind the upsurge in inflation. Instead, variations in Japan's money growth were the single most important factor in the 1973–74 rise in inflation, and in its subsequent abatement over the next four years.

Japan's experience is perhaps most interesting for what it reveals about the costs of reducing inflation. According to a common view, lowering inflation necessarily entails a very substantial and prolonged cost in terms of reduced real growth and higher unemployment. Japan's performance would at first seem to confirm that this cost is indeed very high and protracted, judging from both the severity of the 1974 recession and the exceptionally sluggish recovery that followed. The evidence cited in Section II suggests that Japan's attempts to reduce inflation through reduced money growth substantially aggravated the 1974 recession. However, it also suggests that the continuation of slow money growth may not have been primarily responsible for the sluggishness of the recovery. Instead, real growth may have lagged largely because of the undermining of investor confidence by the previous inflation and the ensuing recession. If this is so, the cost of reducing Japan's inflation, while high, was not as great as simple comparisons of its actual and pre-1973 performances might suggest.

Taken as a whole, Japan's experience thus suggests two lessons relevant for the U.S. and other industrial countries. First, lowering money growth can bring inflation down within several years' time. Second, other factors besides reduced money growth may produce periods of reduced real GNP growth, such as Japan experienced after 1973; the cost, that is, of reducing inflation in Japan was high, but not

*Economist, Federal Reserve Bank of San Francisco. David Parsley provided research assistance for this article.

so high as might appear at first. Other aspects of Japan's experience noted below—such as her ability to reduce money growth in the face of very large government budget deficits—may also have wider significance. Further analysis of Japan's experience thus may define additional lessons of use to other industrial economies.

I. Rise and Fall of Inflation

Economists generally agree that variations in average long-run inflation are nearly always caused by changes in domestic money growth. There are disagreements, however, about the impact of money growth on medium-term fluctuations in inflation, over periods of several years or so. According to one view, other factors—such as government budget deficits or imported-goods price changes—cannot have more than a small and temporary effect upon the level of domestic prices *unless* they are 'accommodated' by changes in the domestic money stock. According to an alternative view, such 'non-monetary' factors can independently and significantly affect inflation for a considerable time—although, because they tend to be sporadic and reversible, their influence diminishes with the lengthening of the time horizon. The first view implies that a policy of steady money growth will alleviate all but relatively small fluctuations in inflation; the second suggests that substantial variability in inflation may remain even after money growth is stabilized.

During the last seven years, prices in Japan (as in other countries) have been buffeted to an unusual degree by external shocks largely unrelated to her domestic money growth. These included the commodity-price increases of 1973–74, as well as the sharp exchange-rate fluctuations (appreciation and then depreciation) of the 1977–79 period. For this reason, it is worthwhile examining the sources of Japanese inflation to find an indication of the extent to which factors other than domestic money growth can affect inflation. As explained below, money was in fact the main factor accounting for the rise and fall of Japanese inflation, but traded goods' prices played a significant role as well.

Waxing & Waning of Inflation

Beginning in 1973, Japan experienced its worst inflation since the early 1950's, with prices rising at double-digit levels in that and the following year. Over that two-year period, the GNP price deflator increased by nearly 40 percent, compared with the 11-percent increase experienced over a typical two-year period during the 1960's. Increases in consumer and wholesale prices were even more dramatic, reflecting sharp increases in the prices of Japanese imports relative to non-traded goods and services.

Then, following Japan's first decline in real GNP in nearly twenty years, inflation abated nearly as fast as it had arisen. By 1975, inflation measured by the GNP deflator was virtually back to the 1960's average, although consumer price inflation remained high by historical standards through 1976. Inflation decelerated further during 1977 and 1978, with wholesale prices actually falling over that period. Thus the lessons drawn from Japan's inflation performance of the 1973–78 period are likely to be very important for other countries: no other major industrial country experienced a sharper surge in inflation during 1973–74, and none was as successful as Japan in reducing inflation thereafter.[1] What then accounted for the rise and fall of Japan's inflation?

Inflation, both in Japan and elsewhere, is often attributed to a variety of factors. The most prominent "candidates" include high government-expenditure levels and budget deficits, wage increases in excess of productivity gains, exchange-rate depreciations and/or import-price increases, *and* money-supply growth. As it happens, the list of factors substantially affecting Japan's inflation can be easily narrowed to the latter two.

Neither the government budget deficit nor accelerating government expenditures can plausibly be blamed for Japan's 1973–74 inflation surge. During the late 1960's, Japan's budget deficits were relatively modest, averaging about one percent of her GNP. The def-

icits then increased in 1972 and 1973 to about 1½ percent of GNP, but were still quite comparable to those in the U.S., where inflation was only about half as great as in Japan. Meanwhile, government expenditures as a fraction of GNP also remained relatively stable during the early 1970's. Indeed, Japan's budget deficit and government expenditures did not rise substantially until after 1975, when inflation was declining. Japan in 1977 and 1978 managed to keep inflation at or below the 1960's average, while incurring a budget deficit whose size (relative to GNP) was easily the largest of any major industrial country. Government fiscal policy, therefore, was probably not a major factor in Japan's inflation over this period.[2]

Likewise, it is very doubtful that 'excessive' wage increases led to the 1973–74 inflation.

Table 1
Basic Data Sheet for Japan[1]

	1962–70 Average	1971	1972	1973	1974	1975	1976	1977	1978	1979
GNP Growth Rate (%)										
Nominal GNP	17.2	8.0	17.6	23.2	18.0	8.4	10.9	11.2	9.8	7.0
Real GNP	11.4	4.3	11.9	6.2	−1.5	3.4	5.0	5.8	6.1	6.0
Inflation Rate (%)										
Consumer	5.8	5.5	4.6	16.5	24.5	8.5	9.4	6.2	3.1	4.9
Wholesale	1.7	−1.0	4.0	24.0	23.3	0.7	6.1	−1.0	−3.2	16.0
GNP Deflator	5.2	3.7	5.7	15.5	18.3	5.0	5.9	5.4	3.7	1.0
Wage Rate	12.1	13.9	16.5	19.5	26.1	13.4	11.3	9.3	5.3	6.0
Money Supply Growth (%)										
M−1[5]	17.1	29.9	25.0	17.1	11.8	11.1	12.5	8.2	13.4	3.0
M−2[5]	17.4	24.4	24.8	16.8	11.5	14.4	13.6	11.1	13.1	8.4
Change in Exchange Rate (%)										
Dollar Exchange Rate	0	13.6	4.2	7.8	−7.0	−1.4	4.2	22.0	23.3	−18.9
Trade-Weighted Rate[4]	na	na	11.8	7.6	−6.4	−3.2	3.6	10.6	24.2	−6.7
Real Exchange Rate[6]	na	−3.7	6.6	10.8	2.3	−12.0	3.8	3.4	11.6	−11.6
Government Deficit/GNP (%)	1.3	0.2	1.6	1.6	1.3	4.4	2.0	6.1	6.5	5.3
Foreign Exchange Reserves ($ billion)	1.8	13.8	16.5	10.2	11.3	10.6	13.9	20.1	28.9	1
Change in Unit Labor Costs (%)	1.7	10.7	2.6	6.0	41.0	9.1	−4.2	4.1	−4.9	−3.0[2]
Unemployment Rate (%)	1.3	1.2	1.4	1.3	1.4	1.9	2.0	2.0	2.2	2.1
Average Output Gap[3] (%)	−1.2	−3.0	−5.8	0.1	−8.4	−24.5	−19.2	−19.9	−18.6	−15.4

[1]All growth rates are computed fourth-quarter-over-fourth-quarter unless otherwise indicated.
[2]Figure refers to 1979.3/1978.3.
[3]The output gap is defined as the percentage difference between actual and potential industrial output. Data are taken directly from Artus (1978) for 1960–77, and then estimated using his potential-output figures and industrial-production series from *International Financial Statistics* for 1978–79.
[4]The trade-weighted exchange rate is an *average* of the value of the dollar against foreign currencies taken from *International Financial Statistics;* the 'real' exchange rate is a trade-weighted average of the dollar-denominated wholesale prices of Japan relative to those of her competitors (Source: IFS).
[5]Figures are year-end over year-end; for 1979, considerable distortion exists due to year-end window dressing or some other factor. The *average* M-1 level in December 1979 was about 9 percent higher than the average of December 1978.
[6]The 'real' exchange rate is a trade-weighted average of the dollar-denominated wholesale prices of Japan relative to those of her competitors (Source: IFS). The figures in the table are percentage changes in yearly averages. For 1977, 1978, and 1979, the fourth-quarter over fourth-quarter percentage changes are 8.1%, 9.6%, and −22.0% respectively.

During the 1960's, Japanese wages typically increased at more than twice the general inflation rate. This pattern reflected rapid advances in productivity, as the increase in unit labor costs was very modest. Unit labor costs accelerated in 1971 in line with that year's cyclical downturn, but then decelerated again in 1972. Thus the 1973–74 surge in prices was not *preceded* by wage increases large enough to account for the ensuing inflation. And the sharp 1973–74 increases in wage rates are, for reasons cited below, most plausibly regarded as symptoms of inflationary pressures generated by other factors.

In fact, only money growth and sharp import-price increases were large enough to have led to an acceleration in inflation of the magnitude observed. And, aside from money growth, only the yen's sharp 1977–78 appreciation could have contributed substantially to the ebbing of inflation after 1974. The question now is, what was the relative importance of each of these in Japan's inflation?

Was Inflation Imported?

The obvious interdependence among national economies revealed by the events of the 1970's has led to increased concern that a country may 'import' price increases from abroad to the detriment of its anti-inflationary policies at home. Much of this concern originates in the 1973–74 period, when a sharp run-up in world commodity prices was associated with an inflation surge in *all* industrial countries, not simply in Japan. These extraordinary commodity price rises accounted for perhaps as much as half of the acceleration in U.S. inflation in that period.[3] Since Japan is even more dependent than the U.S. upon international trade, it is reasonable to ask if her 1973–74 inflation was largely imported.

Certainly, the increase in prices of Japan's traded goods was spectacular. During that two-year period, the average price of Japan's imports of goods and services rose by 87 percent, while her export prices increased by roughly 45 percent. Exchange-rate movements had very little influence on these increases, and indeed the average foreign currency value of the yen did not change appreciably over the period as a whole. Instead, the general rise in Japan's traded-goods prices can be traced to conditions prevailing in world markets—conditions which were largely external to Japan's economy.

Probably the most important of these was a general acceleration in money growth in the industrial countries, which led to a sharp rise in world aggregate demand. In addition, supply shortages, low inventory levels, and other 'special' factors led to severe rises in prices of key raw materials, the most spectacular of which was the early-1974 four-fold increase in the price of oil.[4] These increases accounted for a nearly 30-percent decline in Japan's terms-of-trade (the price of her exports relative to her imports), and represented a substantial loss of real income to her citizens.

There was, however, another potential cause of the price upsurge—the 1971–72 acceleration in money growth. Over that two-year period as a whole, M-1 rose by 62 percent and M-2 by 55 percent. (M-1 includes currency plus commercial-bank demand deposits, and M-2 includes the same plus time deposits.) These increases were at least half again as large as the average increases of the 1960's. Most of the acceleration stemmed from Japan's massive purchases of dollars, undertaken in an effort to stabilize the foreign-exchange value of the yen, which accompanied the December 1971 devaluation of the dollar. These purchases swelled domestic bank reserves, allowing the subsequent sharp increase in bank deposits. Despite this, the increase in money growth cannot meaningfully be termed 'imported.' After 1971, Japan was subject to no international obligation to maintain the pre-1971 foreign-exchange value of the yen. Moreover, this rise in money growth in response to dollar purchases can be traced largely to a deliberate policy choice of the authorities; six years later, equally massive purchases of dollars did *not* lead to any significant acceleration in money growth.[5]

Despite the unusually rapid growth in money during 1971 and 1972, Japan's prices did not begin to accelerate until 1973. This delay in money's impact is not unusual; be-

cause of contracts and other impediments to commodity-price changes, the effects of money-growth variations usually take at least a year to become manifest, and often considerably longer. In addition, the impact upon inflation could have been even further delayed because the surge in money growth was unusually severe *and* prolonged.[6]

Which factor, then, money growth or increases in traded-goods prices, was mainly responsible for Japan's 1973–74 inflation? A recent study by Spitaeller (1978) suggests that the extra inflation was attributable principally to the increase in import prices. He found that Japan's wholesale-price index tended to rise by nearly 30 percent of any increase in import prices. This would suggest roughly a 30-percent rise in 1973–74, resulting from the doubling of import prices—or almost two-thirds of the actual increase in wholesale price inflation over that period. However, this and similar findings reveal primarily the association between import- and domestic-price increases over the estimation period, and thus reflect in part the monetary policies followed by the authorities. For this reason, such estimates can provide a very misleading indication of the independent contribution of traded-goods prices to domestic inflation—that is, of their impact with a *given* path of domestic money.[7]

In fact, a simple calculation—which effectively treats the terms-of-trade deterioration as a tax—shows that traded goods' price hikes *at most* could have had only a quite modest impact on the price level in the *long-run*. This approach involves calculating the extra amount Japan's residents paid to foreigners, versus the additional amount received, as a result of the 1973–74 increases in traded-goods prices. Specifically, Japan's imports in 1972 amounted to 10 percent of her GNP, so that the 88-percent increase in import prices over the following two years required an additional payment for the *same* volume equal to 8.8 percent of annual GNP; likewise, the increase in export prices transferred additional income to Japan equal to 4.5 percent of annual GNP (10 percent of the 45-percent increase). The total effect upon income available to residents was the difference between the additional payments and receipts, or about 4 percent of GNP. This provides a rough estimate of the reduction in Japan's purchasing power that resulted from the external price increases.

Assuming proportionality between real money demand and real income (as was generally the case prior to 1973), Japan experienced about a 4-percent reduction in the demand for money. This reduction, given the level of the money stock, would have required a 4-percent increase in Japan's price level to bring real money demand and supply into balance.[8] An ultimate price effect of this magnitude is clearly significant, but it plainly is very modest compared to the actual acceleration in inflation observed during 1973 and 1974. In contrast, since an increase in money tends to lead eventually to a proportionate rise in domestic prices, the 1971–72 money growth had a much larger ultimate impact upon prices.

Normally, however, the long-run impact of external price increases, which may take several years to be completed, will be smaller than the short-run effects. A rise in import prices raises the domestic price level directly and fairly immediately. The resulting fall in real money balances (given an unchanged path for the nominal money stock) *later* depresses the prices of other domestic goods, although this process can be quite protracted. Hence the impact of external price increases upon the 1973–74 inflation could have been substantially greater than the above calculation would suggest. For this reason, it may be useful to compare the price effects of two alternative money-growth scenarios—one assuming the historical growth rate, and the other assuming the actual 1971–72 growth path of the money stock. (In each case, we assume that the external price increases of 1973–74 had not occurred.) The difference implied by these two hypothetical scenarios provides a crude but nonetheless revealing indication of the extent to which the 1971–72 acceleration in money growth contributed to the 1973–74 inflation.

To begin, assume that both real income and the M-2 money stock had grown at their historical averages during the 1971–72 period—

that is, 38 percent for M-2 and about 24 percent for real GNP (and thus real money demand). This growth of nominal money relative to real money demand would, in turn, have resulted ultimately in an 11-percent increase in the GNP deflator (Table 2). On the other hand, M-2 actually grew by 55 percent, which would suggest a 25-percent increase in the deflator given the same growth in real GNP. In either case, virtually all of the price increase resulting from the 1971–72 money growth probably would have occurred in 1973–74 because, as indicated earlier, virtually no effect of the earlier money expansion was in fact evident until 1973. (For the same reason, the 1973–74 money and output growth is ignored for this calculation.) Thus, this reasoning suggests, inflation during 1973–74 would have been nearly 14 percentage points higher than the historical rate as a result of the 1971–72 acceleration in money growth alone. This accounts for more than half of the actual 1973–74 acceleration in the deflator. And this estimate may be conservative, because when M-1 is used for the calculation, two-thirds of the additional inflation appears attributable to money.

It would also be misleading to attribute all the remaining inflation not accounted for by this calculation to the 1973–74 external price increases. The reason is that real output, and thus real money demand, grew by six percentage points less than the historical average over the 1971–72 period. This reduction in real money demand could have added a further six percentage points to the deflator over the 1973–74 period.[9]

On balance, then, the 1971–72 acceleration in money growth probably accounted for more than half the surge in Japan's GNP deflator over the subsequent two years, and possibly for as much as two-thirds. This would certainly be true if we include the effect of 1971's slower real growth, which may itself have resulted from the 1969–70 mild reduction in money growth. Japan, that is, would have had double-digit inflation in 1973–74 even without the increase in external prices. However, variations in money growth probably had considerably less impact on consumer and wholesale prices than they did on the deflator, because traded-goods prices have substantially more weight in those two indices than in the deflator.[10]

Our analysis thus shows that the 1973–74 increase in traded-goods prices accounted for less than half, and quite possibly no more than one-third, of Japan's inflation increase. This conclusion is fairly consistent with the experience of other industrial countries. For example, a study for the Joint Economic Committee of the U.S. Congress (1975) estimated that import-price increases raised U.S. consumer prices about 5 percent annually between the

Table 2
Contribution of Money Growth to 1973–1974 Inflation[1]

	M-1		M-2
Total Money Growth, 1971–1972 (%)	62		55
Less: Secular Real Output Growth during 1971–1972 (%)		24	
Equals:[3] Predicted rise in GNP Deflator, 1973–1974 (%)	31		25
Less: Secular Inflation implied by historical average Money Growth (%)		11[4]	
Equals: Additional Inflation due to higher 1971–1972 Money Growth (%)	20		14
Plus: Additional Inflation from lower Real Output Growth in 1971[2]	6		6
Equals: Additional Inflation from accelerated Money *and* lower Real Output Growth, 1971–1972 (%)	26		20

MEMO: Actual total rise in GNP deflator in 1973–74: 37 percent (26 percent above the secular rate).

[1]Based on the assumption that price increases resulting from the growth of nominal money relative to demand (excess money) in 1971–72 occurred in 1973–74, whereas the impact of excess money growth in 1973–74 was evident *after* 1974.

[2]Real output growth over 1971–72 totaled 18 percent, and thus real money demand at the end of 1972 was roughly six percent below the level implied by the historical trend.

[3]Figures are not precisely equal to the arithmetic difference between money and real output growth because of compounding.

[4]This is the figure implied by the historical pattern for M-2 and inflation; for M-1, the implied secular inflation rate is 10 percent.

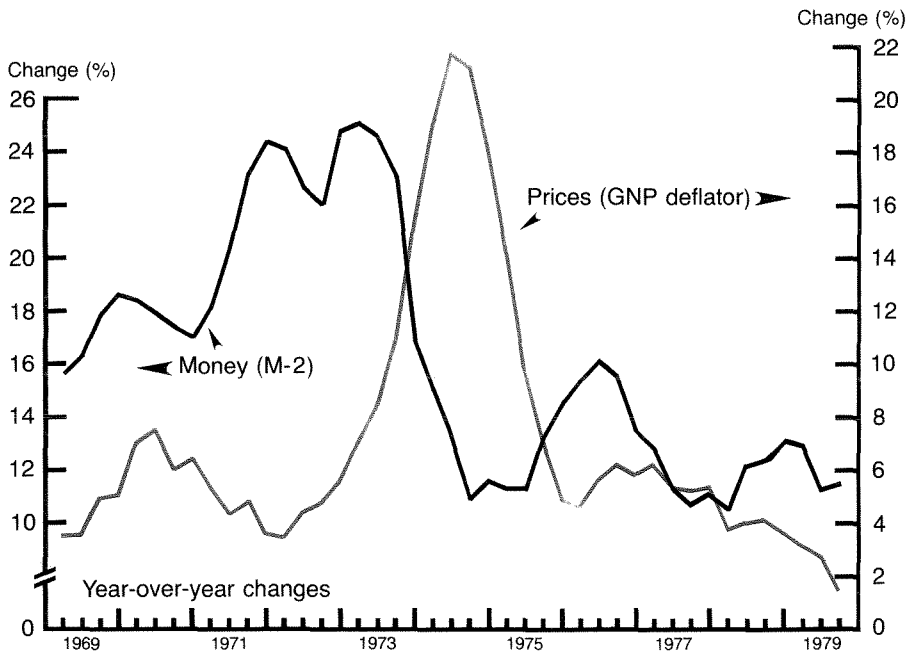
end of 1972 and mid-1974— about one-quarter of the actual increase. The effect upon Japan's CPI might be expected to be substantially greater—Japan's ratio of imports to GNP was about 40 percent higher than the U.S. ratio in 1972, and her relative dependence upon oil imports was even greater. However, the estimate given earlier does not seem substantially out-of-line with that suggested by America's experience.[11] It is also worth noting that no other major industrial country (except Italy) experienced nearly as sharp an increase in money growth during this period, and none experienced nearly as sharp an acceleration in inflation.[12]

Waning of Inflation, 1973–78

The fall in Japanese inflation from 1975 to 1978 was nearly as spectacular as the previous increase. The CPI began to decelerate steadily during the last half of 1974, and by 1975 inflation was back to single-digit levels. By 1975, both the GNP deflator and wage rates were increasing at or even below the average pace of the 1960's, although comparable deceleration was not evident in the CPI until 1977.[13] Inflation fell still further in 1978, to well below the historical rate. In no other major industrial country, except possibly Germany, was the reduction in inflation so substantial and steady.

As the previous discussion suggests, Japan's money growth was the key to her success in lowering inflation. Money growth began to fall sharply in 1973 (Chart 1), and continued to decelerate in 1974. Thus the delay between the deceleration of money and the decline in inflation (roughly two years) was consistent with the lag observed during the previous upsurge. This again demonstrates that money growth takes a considerable time to affect domestic prices. After 1974, both M-1 and M-2 grew at average rates of 12–13 percent annually, nearly one-third less than during the 1960's. While the abatement of import price increases after

Chart 1
Growth Rates of Japanese Money and Prices



mid-1974 almost surely speeded the initial decline in inflation, the later continuation of that trend may plausibly be attributed to the reduction in money growth.

The other factor often credited with helping to reduce Japan's inflation in 1977 and 1978—the nearly 40-percent appreciation in the average foreign-currency value of the yen—was itself probably a *result* rather than a cause of Japan's lowered money growth. The yen's appreciation far outstripped the contemporaneous gap between Japanese and foreign inflation, so much so that Japan's wholesale-price level, in *dollar* terms, rose almost 20 percent more than her trading partners' average price level during this period. This increase in the real value of the yen led many observers to conclude that Japan's 1976–78 current-account surpluses were causing the currency appreciation, and depressing Japan's inflation rate in the process. However, as Keran (1979) has argued, most of Japan's surplus was the result of her incomplete recovery from the 1974 recession. Normally, business cycle variations in trade balances do not have such substantial effects upon exchange rates.[14]

Also, as Keran has shown, the yen's 1977–78 appreciation may plausibly be attributed to the differential growth of Japan's money supply relative to other nations. In 1973, money growth slowed in Japan, but so did that of most other industrial countries. By late 1976, however, Japan's money (adjusted for demand) was growing substantially more slowly than abroad—especially in comparison with the U.S. acceleration—and the yen's appreciation followed soon after. The yen's ability to far out-strip contemporary inflation trends can be explained by the tendency of exchange rates to respond more quickly than prices to money changes, because exchange-rate adjustments (unlike price adjustments) are not constrained by contracts and other institutional impediments. Thus there is a 'monetary' explanation of the rise in the real, as well as the nominal, value of the yen.[15]

Deficits, Intervention, and Money Slowdown

Japan's reduction in money growth was particularly remarkable in view of two factors that have often considerably complicated money-supply control—government budget deficits and foreign-exchange market intervention. No other major industrial country ran budget deficits as large in relation to GNP as Japan did during this period; none engaged in heavier foreign-exchange market intervention. Yet these factors, which are often asserted to make money-supply control virtually impossible, did not prevent money growth from remaining relatively low during this period.

The sharp expansion of Japan's budget deficit, beginning in 1975, resulted primarily from an expansion of public-works expenditures aimed largely at stimulating the private economy. In effect, the Japanese authorities decided to maintain money growth at a level thought to be compatible with reducing inflation, while using fiscal policy to stimulate the economy. By 1978, this endeavor had brought the government budget deficit to over six percent of GNP—well above the rate in any other major industrial nation. Indeed, in that year, government borrowings amounted to nearly one-third of total expenditures. According to a widely held view, substantial deficits make it nearly impossible for the authorities to avoid excessive money expansion. In this view, containment of money growth in the face of expanding deficits tends to "squeeze out" smaller borrowers in politically powerful sectors, such as agriculture and housing. However, Japan's experience demonstrates clearly that there is no inexorable link between expanding budget deficits and money growth.

Similarly, Japan showed during 1977 and 1978 that heavy foreign-exchange market intervention can be sterilized—that it need not necessarily lead to an acceleration in money growth. In that period, Japan's foreign-exchange reserves more than doubled, from less than $14 billion to nearly $29 billion. (That increase was nearly as great as the 1971–72 rise.) These purchases of dollars resulted from the authorities' efforts to slow the sharp ap-

preciation of the yen. But during 1977 and 1978—and in sharp contrast to 1971–72—Japan's authorities largely offset the increase in bank reserves resulting from their foreign-exchange intervention by reducing Bank of Japan lending to the banking sector. As a result, average money growth was no higher during 1977–78 than during the previous two years.[16]

II. Cost of Reducing Japan's Inflation

Japan's success in reducing inflation was accompanied by a reduction in real growth and a rise in unemployment. The 1974–75 recession was easily Japan's most severe of the post-war era, with real GNP falling for the first time in over twenty years. Moreover, the subsequent recovery was exceptionally sluggish by Japanese standards, so much so that unemployment and underutilized capacity still remain historically high.

According to a widely held view, Japan's reduced real growth over the 1974–79 period was the natural consequence of her policies to reduce inflation. In this view, a substantial lowering of inflation necessarily entails reduced real growth and increased unemployment for several, possibly many, years.[17] This interpretation of Japan's experience is not likely to be encouraging to U.S. policymakers, because it suggests that *only* by tolerating high inflation was it possible to substantially reduce unemployment here after 1974—and that bringing inflation back down is a very painful and protracted task.

An alternative view of Japan's experience, however, implies that its sluggish growth *after* the recession was more the consequence of the 1973–74 surge in inflation and oil-price increase, than of subsequent anti-inflationary policies. This view attributes the continued sluggishness primarily to the depressing effect on spending, particularly private investment, of the uncertainty engendered by the previous inflation and "oil-shock." This suggests that real growth would have remained slow after 1974 even if the government had not continued to restrain money growth.

Severe Downturn, Anemic Recovery

As with the inflation surge, Japan's worst post-war recession began before the oil crisis of late 1973. Real growth slowed markedly in the second and third quarters of 1973, following the deceleration of money growth by roughly one-quarter. Indeed, had real growth recovered after the fourth quarter, Japan would have recorded a "growth recession" comparable in both magnitude and timing with those experienced earlier. It seems clear that the oil embargo and subsequent oil-price hikes were mainly responsible for transforming a fairly ordinary downturn into the debacle of 1974.[18] Output declined nearly 2½ percent between the fourth quarter of 1973 and the recession trough in the first quarter of 1975—an impressive decline for a nation whose average annual real growth had previously exceeded 10 percent.

The sluggish recovery following the recession trough was as troubling as the downturn itself, and rather less understandable (Chart 2). Real output growth rebounded sharply in the last three quarters of 1975, but unlike previous recoveries, it remained *below* the secular average. The recovery then effectively petered out, with growth falling back somewhat in 1976 and settling at slightly below a six-percent annual rate over the next two years. By the end of 1978, Japan's unemployment rate was actually higher than at the recession trough. Also, the gap between actual and potential industrial output, while narrowing, remained near 15 percent. Even this narrowing cannot have comforted the authorities, as it reflected mainly a decline in capacity growth resulting from the depressed state of investment.[19]

Historically, Japan's real growth has been led by her private-investment sector, and this sector played an equally prominent role in the sluggish recovery after the 1973–75 recession. In fact, private investment was largely moribund after the recession, with no real signs of recovery evident until 1978. Indeed, private non-residential investment did not attain the

real level of 1973 until the end of 1978, while residential investment in the latter year remained below the 1973 peak. It is hard to resist the conclusion that private investment substantially retarded the recovery in Japan[20]—and perhaps in other industrial nations.

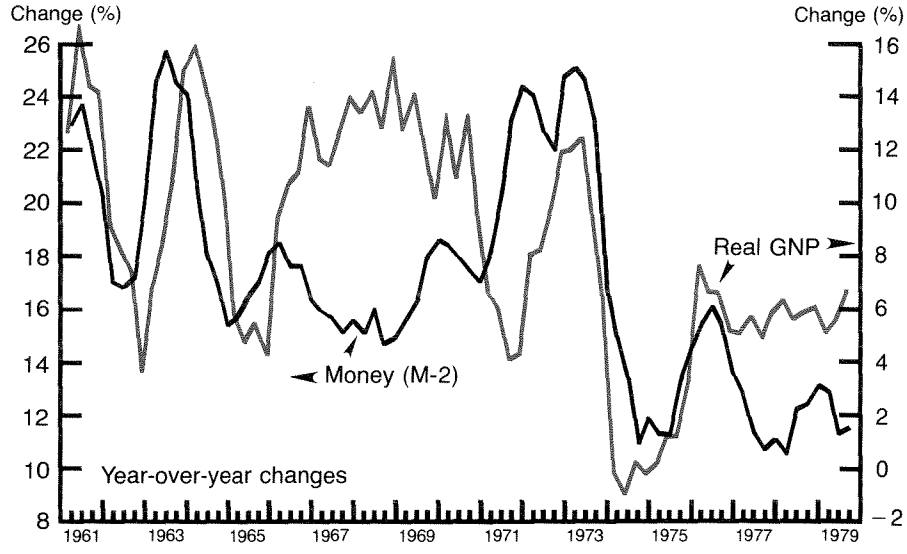
The unusually severe recession, combined with the increase in oil costs, depressed corporate profits to an unprecedented degree, discouraging investment expenditures that in any case were made less pressing by the extraordinarily high levels of excess capacity. Perhaps even more important were the uncertainties about the future engendered by the previous inflation and oil-price increases, events which seemed to many to mark a "watershed" in Japan's economic "miracle." The violent fluctuations of money growth and inflation in the 1971–75 period were a marked departure from the 1950's and 1960's, when variations in inflation were fairly modest and fluctuations in money growth were comparably predictable and understandable. Consequently, substantial uncertainty about future government policies and inflation probably could have been expected to prevail for some time.

The increase in the price of oil also tended to discourage investment. First, because capital goods are generally complementary to energy inputs in the *short-run*, the return to investment in the near-term may have been reduced by the oil-price increase. Moreover, uncertainty about the future price of oil (and security of supply) created doubts about the payoff to investment in particular productive techniques, because of the possibility that they might later be rendered obsolete. In any case, signs of the discouraging investment climate were evident from a high rate of corporate bankruptcies and a high level of pessimism recorded in business surveys.[21] Indeed, the poor investment climate was substantially responsible for the view, then widely held in Japan, that real growth in the medium-term was likely to be well below the pre-1974 average, in fact probably no higher than six percent.[22]

These factors would suggest a longer-than-usual recovery in investment spending after 1974. But can such factors explain the continued sluggishness of private investment nearly *three years* after the recession trough? This raises the question whether Japan's monetary policy substantially delayed the recovery.

Chart 2

Growth Rates of Japanese Money and Real GNP



Monetary Policy Influence

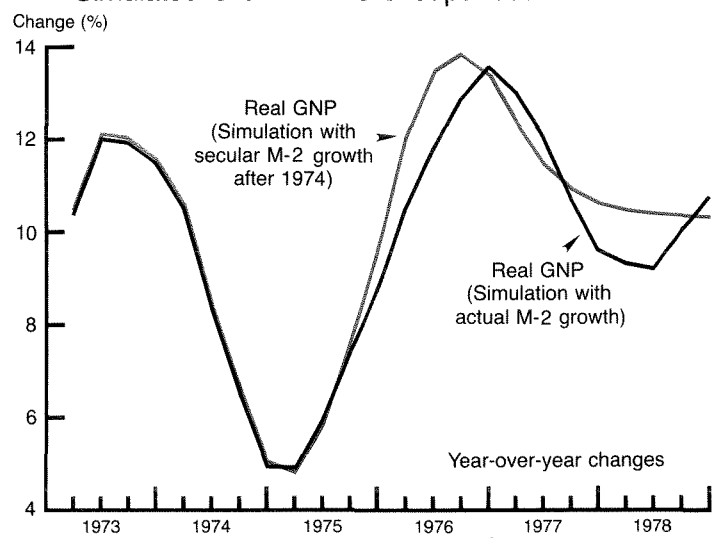
Most economists agree that reducing inflation entails significant costs in terms of lowered real growth, but they disagree about their magnitude and duration. Japan's pre-1973 experience certainly suggests that reduced money growth helped slow inflation, but was also responsible, at least in part, for reduced real growth thereafter. Prior to 1973, policy-induced fluctuations in Japan's money growth were followed fairly regularly by cyclical variations in real output growth; indeed, variations in money growth were probably the most important influence on income fluctuations during this period. Typically, balance-of-payments deficits developed during cyclical upturns leading the authorities to reduce money growth below the secular average. The resulting squeeze on corporate liquidity, manifested by a deceleration in real-money balances (Chart 4) and rising real interest rates, generally led within several quarters to a decline in real growth. Then, once the balance of payments returned to equilibrium, the growth of the money stock (and of real balances) accelerated once again. Real output then recovered, growing for a time at *above* the long-run average, and this reduced the excess capacity developed during the previous slowdown.[23]

This pattern suggests a monetary interpretation of Japan's recession and recovery; specifically, it suggests that the 1973 reduction in money growth caused the recession, while the continuation of slow money growth prevented real GNP from recovering fully thereafter. But as indicated above, other important factors—including the oil embargo and OPEC price increases—also influenced output during this period. In assessing the cost of Japan's anti-inflation efforts, we should ask how much of the reduced real growth in the 1974–78 period was due to slower money growth, rather than to these other factors.

The 1973 slowing of money growth clearly

Chart 3

Simulated Growth Rate of Japanese Real GNP



Notes: The plots are based upon the following regression: $\Delta q(t) = a + \sum_{j=0}^{7} b(j)\Delta m(t-j) + c_1\Delta q(t-1) + c_2\Delta q(t-2)$

where q(t) is the logarithm of real GNP and m( ) is the log of M2. Data are quarterly and seasonally adjusted. In estimating the b( ), a third degree polynomial with 'far' constraint was used, with lags from 0-7 quarters.

a: .025 (1.33) $\sum_{j=0}^{7} b(j)$: −.16 (−.44) Adjusted R^2: .16 Period: 1962.1–1972.4

c_1: −.11 (−.64) c_2: .36 (2.31) Observations: 44

Both simulations depicted are dynamic *after* 1972. The black line gives the predicted effect on real income growth of actual M2 growth over the period 1971–1978; the colored line simulates the impact of a return to the average rate of M2 growth prevailing before 1971, starting in 1975. For comparability with the previous charts, the quarterly growth rates predicted in the simulations were converted to year-over-year changes for the plots.

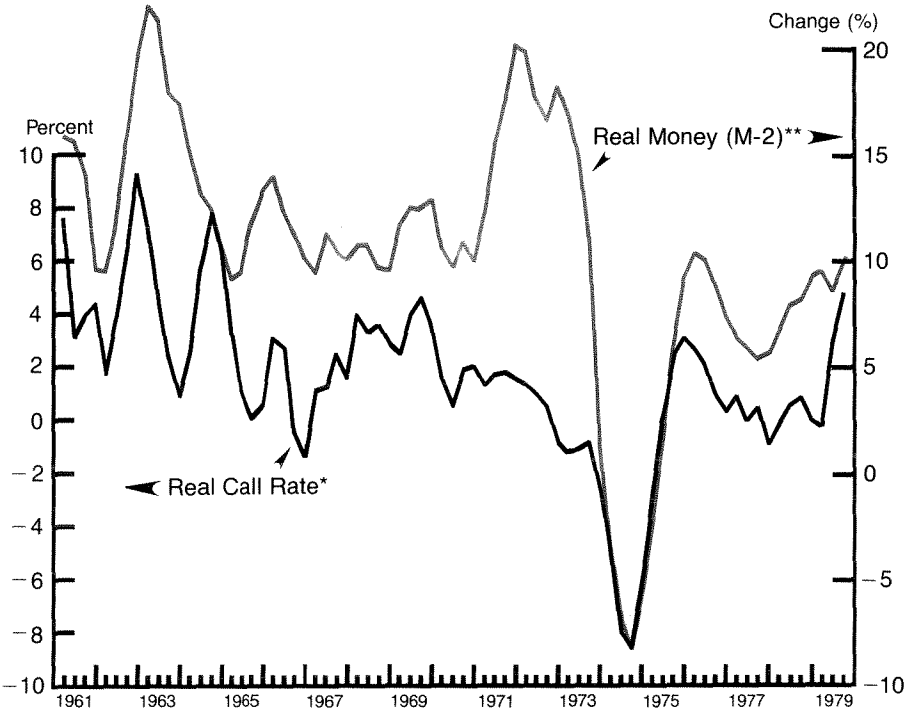
was at least partly responsible for the subsequent recession. Money growth began decelerating, both in real and nominal terms, early in 1973, while output growth slowed shortly afterward. By the third quarter of 1973—even before the oil embargo—a fairly typical Japanese "growth recession" was already evident. In its early stages, this recession resembled the 1965 recession, which was preceded by an almost comparable slowing of money growth. This similarity can be seen from the relation between money and real-output growth over the 1962–72 period, as summarized in the notes to Chart 3.[24] Dynamic simulation of this relation after 1972 (i.e., with simulated values substituted for the lagged values of real GNP growth) suggests that the reduction in money growth would itself have resulted in a deceleration of output growth quite comparable to the 1965 decline. The greater severity of the 1974 recession is an indication of the substantial effect of the oil shock in depressing real output. In other words, both money growth and oil contributed to the unprecedented slowdown of 1974–75.

The primary controversy about Japan's monetary policy during this period centers about its role during the recovery, instead of during the recession. This concerns the extent to which the traditional relation between money and real-output growth could have been "exploited" by the authorities after 1974. According to one "historical" view, the failure of money growth to return to its historical average after the recession trough restrained the recovery. In this view, had money growth been maintained at a higher rate, real growth would have been higher—although perhaps at some cost in additional inflation.[25]

But according to an alternative interpretation, the post-1974 recovery was not primarily a manifestation of the earlier relation between money and output, so that higher money growth primarily would have contributed to

Chart 4

Japanese Real Interest Rates and Real Money Growth



*Current quarter's call rate deflated by GNP deflator (average of preceding three quarters).
**Year-over-year growth in nominal M-2, deflated by GNP deflator.

inflation without substantially increasing real growth.[26] In this view, various factors discouraging investment led to an autonomous decline in the demand for investment goods corresponding to given levels of current and expected future output, interest rates, and other traditional investment determinants (i.e., the investment *schedule* shifted downward). Thus, investment during this period would have been relatively unresponsive to traditional measures of monetary ease. Because of the importance of investment in Japan's total output, then, a prolonged sluggish recovery was likely even if money growth had been substantially greater.

If this account is correct, then the authorities' 1975–78 reduction in money growth was an appropriate policy response, because of the likelihood that real output growth (and thus real money-demand growth) would remain substantially below the historical average for a considerable period of time. If they had followed the historical trend of money growth, they would simply have kept inflation high; because inflation-created uncertainties can discourage investment, such a policy could have been counterproductive.

This interpretation is not as inconsistent with Japan's past record as might at first appear. During previous cycles, investment and output growth generally recovered only after an adjustment period of several quarters following the easing of money growth; thus, in the case at hand, this period was greatly prolonged by the severity of the recession and by the uncertainties engendered by the previous inflation and oil-price increase. Still, this interpretation does *not* absolve pre-1974 monetary policy of some responsibility for the sluggish recovery; indeed, to the extent that the post-1974 investment weakness was the result of the severity of the downturn, prior monetary policy was partly responsible for that protracted recovery.

It is difficult to determine which of these explanations is most correct, considering that their differences center around the hypothetical consequences of different monetary-growth paths. Conceptually, the issue in dispute is one of cause and effect: the first view asserts that slow money growth impeded the recovery, whereas the second implies that slow money growth was necessary to contain inflation because demand growth was *autonomously* depressed by other factors. Traditional measures of monetary ease or tightness, such as interest rates, provide ambiguous evidence, because they are influenced both by policy and by the actual level of aggregate demand. Nevertheless, the post-1974 recovery apparently differed in several important respects from the pattern observed during previous business cycles. In particular, the interactions between money and output growth implied by the pre-1973 historical record suggest that slow money growth should *not* have depressed real growth for as long as actually was the case. This evidence, at the least, raises doubts about the first interpretation.

The behavior of both interest rates and real balances tended to refute the argument that monetary policy restrained an otherwise robust recovery. At the least, their post-1975 behavior was not characteristic of previous periods of monetary restraint during cyclical upswings. In Japan, the (interbank) call-money rate has traditionally been free to vary with market forces, while the central-bank discount rate and the private-bank loan rate (which is partially tied to the discount rate) have usually been set below market-clearing levels. Typically, as money growth slowed during cyclical upswings, all interest rates increased, although the call-money rate rose relative to the loan rate—and in addition, the growth of real money balances decelerated sharply. Moreover, these trends normally tended to precede the slowing of real growth, especially prior to the 1965 and 1973 slowdowns. In addition, the call-money rate has often risen in real terms, that is relative to the recent inflation trend, during periods of monetary restraint— with the exception of the sharp inflation-related decline of 1973.

The 1974 recession and early recovery also conformed, roughly, to the historical pattern, although the same cannot be said of subsequent developments. The call-money rate, both relative to the loan rate as well as in real

terms, fell sharply during the downturn and then recovered substantially for several quarters following the early-1975 recession trough; this pattern was fairly typical of previous cycles, although more pronounced. But during most of the 1976–78 period, both indicators remained relatively low by historical standards; in fact, their levels were more characteristic of previous downturns than of recoveries. Indeed, Japan's real interest rate was actually lower during most of this period than during 1971–72, when monetary policy was "easy" by any normal standard.

Moreover, real-balance growth recovered sharply from the 1975 recession trough—although never again reaching the level attained in previous recoveries—and then fell back in 1976. However, the 1976 decline *coincided* with a fall-off in real GNP growth; indeed, a sustained decline in nominal M-2 growth was not really evident until the end of 1976. This timing suggests that the decline in the growth of real balances was the *result* of the deceleration in growth of real money demand induced by the fall in output growth. Such a pattern is more consistent with the second interpretation than the first. These patterns together tend to refute the idea that strong investment demand was "choked-off" by credit rationing in response to a stringent monetary policy. However the evidence may also be consistent with the first explanation, because the *prospect* of lower money growth quite possibly discouraged investment demand during this period.

More persuasive, perhaps, is the implication of the pre-1973 historical record, which suggests that slow money growth should *not* have depressed real growth after 1974 for nearly as long as it actually did. The apparent reason is the lack of a *permanent* 'trade-off' between money and real output growth—in Japan as well as elsewhere. That is, despite the influence of money-growth fluctuations on cyclical variations in real output, permanent increases or decreases in money growth tend to affect only inflation, and not real growth, in the *long run*. This conclusion is supported by the regression summarized in Chart 3 as well as other statistical evidence reported elsewhere.[27] Consequently, even permanent changes in money growth cannot cause output growth to deviate from the secular average indefinitely. The question then is, how much and for how long did the post-1973 reduction in money growth depress Japan's real growth?

The evidence (Chart 3) suggests that reduced money growth had a substantial but relatively short-lived impact on real output growth. As the solid line indicates, even with relatively slow money growth, real-output growth should have returned to the secular rate by mid-1976 if the historical relation had continued to prevail. With this simulation also, the fall-off in money growth beginning in late 1976 would have led to a sharp but fairly short decline in output growth—*but* output growth would have remained above the level actually recorded over these years. Finally, raising money growth beginning in 1975 back to its historical rate would have speeded the recovery somewhat, but not by a great deal (compare the dotted and broken lines of the chart).[28]

The evidence, although far from conclusive, on the whole raises considerable doubts about contentions that Japan's sluggish recovery was due mainly to slow money growth. We should not rule out the possibility that a sufficient expansion in money growth would have raised growth if the authorities had been prepared to accept a renewal of double-digit inflation. But the behavior of real balances and interest rates during the recovery suggests that monetary policy was not at all "tight" by historical standards. And the historical relation between output and money growth suggests that the recovery should have been substantially more robust than it was—and that the effects of reduced money growth should not have been nearly as long-lasting as the first explanation suggests they were. At the least, the evidence marks the post-1974 recovery as peculiar in several respects, and suggests a basis for the fear that a significant increase in money growth would mainly have raised the inflation rate.[29]

III. Summary and Conclusions

Over the last ten years, inflation and recession have been the dominant economic problems of the major industrial economies. Their policy responses to these difficulties have often been quite similar, yet also different in important respects. But the uniqueness of each country's experience makes it difficult for policy makers to draw clear lessons from their own nation's record alone—always there is the question of "what if." Yet in principle, the paths taken by other industrial countries can provide a clue to "what might have been."

The present article has surveyed Japan's experience with inflation and recession over the 1973–78 period. We have attempted to determine the main causes of the rise and fall of Japanese inflation and to gauge, in a rough fashion, the costs it incurred in its successful effort to reduce inflation. This effort has yielded some tentative conclusions, and it has also raised some interesting questions.

Japan's experience confirms that the key to containing inflation is controlling money growth. Without the 1971–72 acceleration in money growth, Japan's inflation in 1973 and 1974 would have been much lower than it actually was. The relatively low inflation of the late 1970's was not the result of a fortuitous exchange-rate appreciation or government fiscal "discipline," but rather of a consistent policy of containing money growth. At the same time, Japan's record shows that substantial increases in the domestic price level sometimes reflect more than domestic money growth. Japan probably imported a significant amount of inflation in 1973 and 1974. In addition, Japan's monetary authorities have demonstrated graphically that high budget deficits and foreign-exchange market interventions need not inevitably destroy monetary control.

Japan's experience also confirms that inflation reduction can be both protracted and painful. Inflation fell back to the historical average only after two years in which money growth fell considerably below the pre-1973 rate. The reduction in inflation was associated with very heavy costs in terms of lowered real growth, excess capacity, and unemployment. A very substantial portion of these costs can almost certainly be attributed to anti-inflation measures. Also, monetary policy was probably primarily responsible for the fact that the downturn was more severe in Japan than in other major industrial countries. And the 1973–74 monetary restraint probably helped retard the recovery by aggravating the recession. It is much less clear, however, that monetary policy thereafter could have raised output growth substantially above that which actually occurred. At the least, such a policy entailed substantial risks of rekindling inflation.

Finally, there remain intriguing unanswered questions about Japan's experience. Why, for example, were Japanese authorities able to restrain money growth over the 1976–78 period? Were they simply willing to bear the political and social costs which frequently force monetary accommodation in the face of large deficits, or were these costs simply not important to Japan? And while it can be argued that the post-1974 reduction in money growth was not primarily responsible for the sluggish recovery, the question remains as to what factors precisely were responsible. As further research sheds light on these questions, policy makers in other industrial nations are likely to draw additional lessons from Japan's experience.

1. Italy's average CPI inflation over 1973–1974 was nearly the same as Japan's; in other major industrial countries, average inflation during this period was between one-half and two-thirds of the Japanese rate. In all major industrial countries except Germany and Japan, inflation rates have remained well above the 1960's average since 1976. Germany's performance is somewhat unusual, however, because average money growth since 1976 has actually been above the average of 1964–72. One reason may be an increase in international demand for the DM resulting (say) from decreased demand for the dollar. If so, Germany is perhaps the only major industrial nation to have benefited from a true "virtuous circle" induced by currency appreciation.

2. The growth of Japanese government nominal expenditure averaged about 12 percent during the 1960's, compared to 15 percent over 1971–72 and 14 percent over 1971–74 (figures are taken from **International Financial Statistics).** If the effects of government spending upon the domestic price level for Japan are at all comparable to those of other countries, these increases should have had a negligible impact on Japanese inflation. For example, William Dewald and Maurice Marchon (1979) found (long-run) elasticities of total nominal GNP with respect to government expenditures ranging from .05 for Germany and .28 for France (see Table 3). These suggest that only extraordinary accelerations in government spending have a substantial impact upon domestic inflation; in contrast, the elasticities of nominal income with respect to money are generally much higher than those for government spending.

3. Cagan (1980, p. 4) briefly reviews other results for the U.S. He notes that regression studies generally suggest a larger impact of import prices on domestic inflation than do direct computations of the effect upon domestic costs of external price hikes; as argued below, this is not surprising since regression results tend to reflect the monetary policy pursued in response. Cagan's own estimates suggest that about 40 percent of the increase in the prices of U.S. manufactures during this period (or about 16 percentage points) can be attributed to external price increases. His estimate is somewhat higher than would be suggested by Berner et al (1975), who calculated that about 25 percent of the increase in the personal-consumption deflator between mid-1973 and mid-1974 was due to external price hikes. The difference can be traced to the fact that Cagan also allowed for the impact of increases in export prices, whereas Berner et al did not—and to the fact that the latter estimates refer to consumer prices, which are less heavily weighted with traded goods than are wholesale prices of manufactures (see Cagan, p. 8).

4. Richard Cooper and Robert Lawrence (1975) discuss various factors in the 1973–75 commodity price fluctuations; see also "Aspects of World Inflation," OECD **Economic Outlook,** July 1974, pp. 25–37. Supply factors, as well as a surge in aggregate demand, seem to have influenced the surge in basic commodity prices. Michael Keran and Michael Riordan, "Stabilization Policy in a World Context," Fall 1976 issue of this **Review,** attributed these increases largely to a synchronized expansion of money supplies in major industrial countries. This view is not necessarily inconsistent with the fact that relative prices changed greatly in 1973–74, because certain basic commodity prices are often considerably more sensitive to variations in world aggregate demand than are traded goods in general. However, the OECD study also shows that the actual increase in metals and food relative prices, relative to the increased world (real) demand, was still much sharper than during previous cycles (see p. 28).

5. Precisely why the money supply was allowed to expand so sharply in 1971–72 is not entirely clear. It has been suggested that the authorities were worried about the allegedly deflationary effects of the yen's revaluation. Moreover, growth had already slowed in 1971, and traditionally money growth had been allowed to accelerate during recoveries. But the magnitude and duration of the money-growth expansion of 1971–72 were substantially greater than the norms characteristic of the 1950's and 1960's.

6. The only comparable prior surge was that of 1962–63, when M-2 increased at an annual rate of 22 percent, compared to 25 percent in 1971–72. I have argued (see Charles Pigott, "Expectations, Money, and the Forecasting of Inflation" in the Spring 1980 issue of this **Review**) that pricing decisions are likely to be based upon individuals' **forecasts** of money, and that prices will tend to respond more to money changes that are perceived as persistent than to those viewed as transient. Prior to 1971, decelerations of Japan's money growth normally followed accelerations in a fairly regular and comprehensible pattern. Hence the 1971–72 money changes may at first have been regarded as largely transient, delaying the price response.

7. Bijan Aghevli and Carlos Rodriguez (1979) find that about 18 percent of an increase in (commodity) import prices is reflected in the GNP deflator. Since the unit value of imports rose by nearly 100 percent over 1973–74, this suggests a total increase in the deflator of 18 percentage points as a result; this again is about two-thirds the actual rise above historical rates in this index. However, as is argued in Pigott, Rutledge, and Willett (1980), such regression estimates tend to reflect the extent to which external price increases are accommodated by money expansion. This contention is supported by the results of Dewald and Marchon (1979), whose findings suggest that the impact of import prices on the domestic price level is substantially lower for Canada than for Germany and the U.K.—despite the similarity of all three countries' ratios of imports to GNP. Indeed, most regression studies find that domestic prices rise **more** in the long-run than in the short-run in response to a rise in import prices. Because increases in import prices tend, with a given money stock, to lower real balances, the opposite pattern is more likely in the absence of monetary accommodation.

8. This calculation—which is intended to provide an **upper bound** on the ultimate effect—is based upon a procedure very similar to that used by the World Bank in computing "income attributable to changes in terms-of-trade," and which is included in the Bank's definition of "gross domestic income"; see, for example, their **World Tables 1976**, p.7. This income element has been used to explain fluctuations in consumption for LDC's, as well as

for other purposes. Its theoretical basis lies in the Slutsky-Hicks notion of compensated demand. In particular, in a two-good economy in which tastes are identical and homothetic, this calculation approximates the amount of income required to keep an individual's welfare (i.e. the level of his indifference curve) constant when the price of the good he sells (net) falls relative to that which he "imports."

Almost surely, however, the estimate in the text is somewhat larger than the true final effect. Implicit in the calculation is the assumption that the demand for money depends upon permanent real wealth or real income, which declines as the terms-of-trade fall. However, money is to a large extent desired for transactions purposes, and it is much less clear that a change in the terms-of-trade will lower transactions demand, or indeed even change it at all. In fact, Pierce and Enzler (1974), in assessing the effects of the oil price shock on the U.S. economy, relate money demand to a transactions index equal to GNP **plus** imports; the increase in the price of imported oil actually **raises** the transactions demand for money under this formulation, and hence ultimately leads to a **fall** in the domestic price level.

9. It should be emphasized that this calculation assumes that money, nominal income, and the price level vary roughly proportionately in the long-run. Although money and nominal income grew at virtually the same rate over 1962–70, a mild fall in velocity at a roughly 1-percent annual rate was observed for the 1960's as a whole. Allowing for such a trend would not substantially affect the estimate of the inflation due to the 1973–74 external price increase, provided the trend were the same under either money path.

In regression relations between Japanese inflation and money growth for the pre-1971 period, the adjusted R-square is generally found to be quite low, and the long-run impact of money on the price level is well below unity. I have argued—see Pigott (1980)—that this may reflect the tendency of money-growth accelerations to be offset by subsequent decelerations, so that money changes above or below the secular average may have been viewed as transient. It might then be expected that prices would not respond fully to actual money changes. This may also explain why the sharp acceleration in money growth over 1962–63 did **not** lead to nearly as sharp an increase in inflation. Indeed, average M-2 growth over these years was 22 percent, compared to 25 percent in 1971–72. However, inflation did not substantially change over 1964–65, in sharp contrast to the surge in the second episode. Keran (1970) points out that during the earlier period, the government had a well-established policy of tightening monetary policy soon after balance-of-payments deficits developed. It is quite possible, then, that even the money expansion of 1962–63 was expected to be reversed later, so that prices did not respond. By 1973, however, this pattern had disappeared, because Japanese international reserves had been substantially augmented, while the fixed exchange-rate system had broken down. Individuals may then have come to believe that the 1971–72 money expansion would **not** be subsequently offset, or at least not as much as in the past; hence prices may have responded more than in the previous period.

10. This indeed is why the increases were greater for the CPI and WPI than for the deflator. In addition, the WPI, because it includes goods at different stages of processing, tends to "double-count" price increases of raw materials. The distortion in the WPI arising from this can be quite substantial, as William Nordhaus and John Shoven have shown ("Inflation 1973: The Year of Infamy," **Challenge,** May/June 1974, pp. 14–22).

11. Consider another "back-of-the-envelope" calculation. Suppose that half of **total** U.S. inflation recorded over 1973–74 was attributable to external price increases; this is at the upper bound of estimates in the literature, and implies that substantially more than half the additional increase in the U.S. CPI was due to commodity-price hikes. In any case, this implies that the U.S. CPI was raised by 9.5 percentage points as a result. Since the ratio of imports (and exports) to GNP is about 40 percent higher for Japan than for the U.S., it is reasonable to suppose that Japan imported somewhat more inflation. Suppose that commodity price hikes increased the Japanese CPI by 15 percentage points (nearly 60 percent more than for the U.S.). Since the actual increase in Japan's CPI—45 percent—was more than 30 percentage points greater than during a "typical" two-year interval during the 1960's, this suggests that at most half of Japan's CPI acceleration could have been due to external price increases. The fraction for the deflator, which is less heavily weighted with imported goods, was almost surely smaller; indeed, the deflator rose by nearly 8 percentage points less than the CPI during this period.

12. German CPI inflation averaged only 6.75 percent over 1973–74, despite money growth somewhat above the historical average in 1971–72. In fact, in all other major industrial countries except Italy, average annual CPI inflation in 1973–74 was below 12 percent (usually below 10 percent)—less than two-thirds the rate suffered by Japan. Several of these countries are substantially more dependent on trade than Japan is.

13. One possible reason why the CPI rate remained above the historical average was a delay in price increases in government-regulated sectors. The WPI movements were also probably somewhat distorted by the sharp fall in basic commodity prices during late 1974 and 1975. However, neither factor can account satisfactorily for the substantially higher rate of increase of the CPI compared to the GNP deflator during this period.

14. The yen's appreciation in real terms, in fact, exceeded the fall in the real value of the U.S. dollar after the December 1970 devaluation. Between 1970 and 1972, in fact, the dollar value of U.S. wholesale prices fell relative to those of her trading partners by about 12 percent; as noted in the text, the dollar value of Japan's wholesale prices rose relative to abroad by substantially more than 12 percent. However in 1970, the U.S. was clearly in a **chronically** imbalanced position in its current account; moreover, by 1973, the volume of both our exports and imports had responded quite sharply to the previous devaluation. In addition, most estimates of the price elasticities of demand for traded goods suggest that even a secular surplus of the size of Japan's would have required a far smaller change in relative prices than actually occurred over 1977–78. See Keran (1979) for further arguments that the Japanese surplus was largely a business-cycle imbalance. He also shows that the expansion of the surplus in 1978 was due entirely to price changes.

15. See Keran (1979), pp. 228–238 and especially Figure 2.

16. This performance is more impressive than might at first appear. Both Germany and Switzerland substantially overshot money-growth targets in 1978, in large part because of heavy dollar purchases.

17. The most pessimistic views are based upon a fixed relation between excess capacity and changes in inflation. These imply that reducing inflation requires maintaining unemployment well above its natural rate for many years. See, for example, Nigel Duck, Michael Parkin, David Rose, and George Zis, "The Determination of the Rate of Change of Wages and Prices in The Fixed Exchange Rate World Economy, 1956–1971," in Michael Parkin and George Zis (eds.), **Inflation in The World Economy,** 1977, especially pp. 134–136.

18. This conclusion is supported by the study by James Pierce and Jared Enzler (1974) of the effects of the oil-price increase on the U.S. economy. They found that real output was substantially depressed and unemployment raised as a result (see pp. 36–41). The effect on Japan was almost certainly larger, because of its much greater dependence on oil imports.

19. According to the potential-output series computed by Artus (1978), Japan's actual output was below potential by nearly 25 percent at the recession trough in 1975. The output gap for other major industrial countries was only about half as large. His figures also suggest that the gap remained very wide in all major industrial countries except the U.S. through 1978. In Japan, for example, the gap was almost certainly above 15 percent by the end of 1978. These statements are based upon extensions of his series using industrial-production data from **International Financial Statistics** (although the series are not strictly comparable). Artus' figures also show a slowing of potential-output growth to about 5 percent over 1976–78, compared to nearly 12 percent prior to 1973.

20. This statement is based, in part, on the extraordinary fall-off in private investment expenditures over 1974–77. Real private non-residential investment grew nearly 50 percent faster than real output over 1965–73, while it grew more slowly than output during 1974–77. Because this sector accounts for nearly one-fifth of total GNP, its slowing was bound to substantially retard the recovery. The depressed state of investment and reasons for it are extensively discussed in the **Economic Survey of Japan** for fiscal 1975/76 and 1976/77. See especially pages 37–46 of the 1975/76 issue and pp. 84–98 of 1976/77. These present an interesting contrast indicative of the uncertainties about the course of the economy: the earlier issue reflects the beginnings of an investment recovery in 1976; the subsequent issue focuses on why investment remains sluggish, reflecting the stalling of the recovery. These issues also indicate considerable divergence in conditions in various industries and among various-sized firms— a divergence that may have led to additional uncertainty about **relative** prices and demands. Other sectors also influenced the recovery as well, of course. Until 1978, real export growth exceeded that of imports, so the external sector contributed to Japan's growth. In 1978 this pattern was reversed, and indeed real GNP growth that year would have been well above 6 percent had real export and import growth been equal. Inventory investment fell sharply in 1975, after remaining high in 1974—a pattern fairly typical of an unexpectedly severe downturn. Finally, while real private consumption certainly slowed compared to the 1960's, its behavior suggests a fairly passive adjustment to the slower growth of total output. Private and total savings rates actually fell after 1974, although this again is not surprising in view of the sharp downturn.

21. See **Economic Survey of Japan,** fiscal 1976/77, pp. 80–98.

22. There has, in fact, been considerable controversy about the future level of Japan's long-run secular growth rate. Projections of a 6-percent growth rate are to a large extent based upon the relatively sluggish investment of 1976–1978; in view of the continued very high savings rate, this seems unduly pessimistic. There is a consensus that Japan's future growth will be slower than in the pre-1973 period, because of a slowing of productivity increases. How much lower depends crucially upon the contribution to growth of capital and labor vis-a-vis that of technical progress. See M. Nishimizu and Charles Hulten, "The Sources of Japanese Economic Growth; 1955–1971," Research Memo #200 (June 1976) of the Econometric Research Program of Princeton University. On balance, it seems likely that Japan's secular growth rate is above 6 percent. Thus growth during 1975–78 has probably been below the secular average—and certainly has not been substantially above it as occurred during previous recoveries.

23. See Keran (1970) and Pigott (1978) for further discussion of this policy and its effects.

24. The procedure used here departs from my previous analysis of the relation between Japanese money and output—see Pigott (1978)—in that money growth is not decomposed into anticipated and unanticipated components in the regression. In the previous study, I considered mainly the effect of money growth on Japan's industrial production. The findings, in the sense that the long-run impact of an increase in money on Japan's industrial production was virtually zero, are consistent with those reported here. The relation summarized in Chart 3 is in fact, more "traditional." It can be viewed as a reduced form of a system in which money influences nominal income and prices, as well as real income. Although the relation used here allows only current and past money (up to seven quarters) to affect output growth **directly,** the effective lag from money growth to output is potentially much longer because of the inclusion of lagged output growth as regressors. These latter terms can, if large, allow a change in money growth to affect output for a considerably longer time than the lag on money alone would suggest. In fact, however, the coefficients of the lagged dependent variables were relatively small, and this largely accounts for the fact that output growth seems to "rebound" quickly even when money growth is substantially permanently reduced. This finding is also fairly similar to that reported in the earlier study. I experimented with alternative lag lengths for money, but found that allowing for a twelve-quarter lag length (compared to the eight for the regression reported) substantially reduced the adjusted R-square.

25. The U.S. experience appears to confirm this: U.S. inflation accelerated along with money growth after 1976, while U.S. output growth returned to the secular rate.

However, as is discussed later, this pattern is not nearly as clear when the industrial countries as a whole are examined.

26. This view is certainly consistent with the actions of the Japanese authorities, and it seems to have been held by some. As will become clearer below, it was obvious by 1976 that the recovery was already rather different from previous episodes. The **Economic Survey of Japan** issues at the time placed considerable emphasis on **structural** shifts needed in response to higher oil prices and other factors—which further suggests that this was not an ordinary recovery, and hence may not have been as malleable (via monetary expansion) as those in the past.

27. See Pigott (1978). The results there also imply that there is no permanent effect of money growth on real-output growth.

28. A static regression, using the actual values of real GNP growth during 1973–74 (at least) might have been more appropriate here, although space prevents its presentation. However, the pattern is essentially the same, except that income growth falls lower during 1974 than under the dynamic simulation. The difference between the simulations with actual money growth versus the average rate of the 1960's is virtually the same in either case.

29. Again, the record of other industrial countries is suggestive, although far from conclusive. Output gaps in all major European countries apparently remained substantial through 1978 (based upon my extension of Artus' actual output figures and his estimates of potential output). None of these countries, however, succeeded in reducing money growth (or, except in the case of Germany, inflation) back to the pre-1973 average. In France, for example, inflation remained nearly twice as high in 1975–78 as in 1964–72, while her output gap averaged over 10 percent. This evidence may be suspect, however, because real wages apparently rose in excess of productivity after 1973 in many European countries, which may have helped to retard the recovery and keep unemployment high.

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Financial Deepening In Pacific Basin Countries

Hang-Sheng Cheng*

This paper presents an overview of the financial-deepening process in eleven Pacific Basin countries during the past two decades. For any nation, financial deepening represents an increased amount of financing of production and investment through specialized, organized markets. The economic literature has expanded its coverage of this subject in the last twenty-five years,[1] stressing financial deepening as an important factor in determining the course of a nation's economic growth[2] and welfare. This review of Pacific Basin experience should help us see what generalizations (if any) can be made about the factors promoting or retarding the financial-deepening process.

Economists traditionally examine this process within the context of *developing,* rather than developed economies. In developing economies, financial deepening is associated with increases in the activity of financial intermediaries—such as commercial banks, savings institutions, insurance companies and the like—because direct placement or capital markets generally are unimportant. In developed economies, financial intermediation is less predominant as capital markets develop. While this paper maintains the focus on financial intermediation characteristic of developing nations, it also examines the experience of the developed Pacific Basin countries. We include them in the analysis in order to highlight the changing role of financial intermediaries in the development process and also to highlight those processes that are common to both types of economies.

Section I presents a simple conceptual framework for analyzing the role of financial markets in economic growth. Drawing on the existing literature, it distinguishes between various modes of finance in relation to economic growth. In addition, it analyzes the effects on economic growth of "repressed finance"—that is, a policy of rigid nominal interest rates in the face of general price inflation. This section may be skipped by those who are familiar with the economic principles underlying this study.

Section II presents a comparative study of the experiences of eleven Pacific Basin countries—Australia, Indonesia, Japan, Korea, Malaysia, New Zealand, the Philippines, Singapore, Taiwan, Thailand, and the United States. The observation period varies from country to country depending on data availability, but generally covers the 1960–78 period. In this analysis, we use the degree of financial intermediation as a proxy for overall financial development. We present two views of financial deepening—first, a cross-section view of the *degree* of financial intermediation in each country in 1978, and second, a comparison of the eleven countries' financial-growth processes over the entire observation period.

Relative to per capita income, Japan, Singapore, and Taiwan had the highest financial-intermediation ratios of all eleven countries in 1978. This finding does not imply that Japan, Singapore, and Taiwan have achieved a higher degree of financial development than such fully-developed countries as the United States, but merely shows that they have given a greater role to financial intermediaries in their activities.

The study identifies the real deposit-interest rate—i.e., the nominal deposit rate deflated by

*Assistant Vice President and Economist, Federal Reserve Bank of San Francisco. Benny Yu provided research assistance for this paper.

a consumer-price inflation rate—as a critical factor in setting the pace of each nation's financial growth over time. Positive real deposit rates maintained over a number of years invariably lead to financial deepening, and negative real deposit rates even for a year or two tend to result in sharp financial disintermediation against a strongly upward trend. The finding reinforces the view that inflation is directly and indirectly detrimental to economic growth—assuming a positive relationship between financial intermediation and growth. It also suggests that, where inflation cannot be brought quickly under control, interest rates ought to be left flexible enough to cover more than the inflation premium, and thus allow a positive return which would encourage saving through financial intermediaries.

I. Financial Deepening and Economic Growth

Economic growth depends on capital formation; capital formation requires financing. The functioning of a financial system to generate savings and allocate savings among different types of productive activities is obviously relevant to a nation's economic growth. Broadly speaking, a nation can choose among three alternative ways of channeling national savings to investment (Figure 1):[3] (1) self-finance by entities undertaking the investment, (2) external finance through capital markets (direct finance), and (3) external finance through financial intermediation (indirect finance).

Self-finance by entities undertaking the investment may occur in either of two forms—government investment in economic infrastructure (such as roads, harbors, schools, or irrigation facilities) through government-budget appropriations, or capital formation by private or government enterprises through retained earnings. Self-finance is widely used in both developed and less-developed countries. However, in countries with well-developed financial markets and institutions, both government and private enterprises may finance either through their own resources or by borrowing from the market, whereas in countries with under-developed financial markets, investing entities must accumulate savings from within.

This difference is important for two reasons. First, when self-finance is the only available approach, a highly productive investment project may have to be postponed or scrapped because of its size relative to the investing entity's internal financial resources. This limitation applies whenever economies of scale are important, or whenever the adoption of modern technology requires substantial initial investment in human and physical capital.[4]

This difference is also important because an efficiently functioning financial market signals to each investing entity the opportunity cost of self-finance, thus helping to weed out investment projects which promise lower returns than the market cost of capital. For instance, an enterprise in a country with limited financial markets often has little choice but to plow back its earnings regardless of potentialities elsewhere. In contrast, an enterprise in a country with well-developed financial markets has other alternatives—debt retirement, repurchase of its own stock, or investment in securities of other enterprises—and can choose among the various alternatives depending on the risks and the relative returns of the alternative uses of funds. A well-developed financial market helps insure that the funds generated from within each firm are channeled to the most efficient uses from the viewpoint of society. Thus, self-finance itself is not necessarily inefficient finance—but when self-finance is coupled with an absence of market discipline, the result may be arbitrary and wasteful allocation of capital.

The second channel, direct finance, may take the form of the issuance of stocks, bonds, notes, commercial paper, or other types of debentures by investing entities on open, organized capital markets under various degrees of government supervision and regulation. Alternatively, as in many less-developed countries, it may take the form of advances of seeds, fertilizers, food, or money by landlords or

merchants to peasants; or direct personal loans from friends, relatives, and the general public to business firms; or the discounting and trading of business firms' post-dated checks among the public outside regulated markets. The form may vary, but the essence is the same: Direct finance consists of the ultimate borrower issuing a liability against itself, and selling it either directly to the ultimate lender or through dealers and brokers.

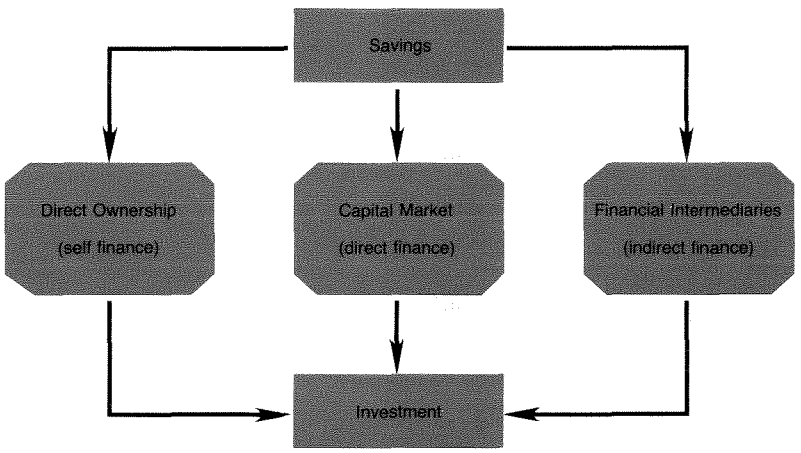
Direct finance is characterized by (a) the separation of saving and investment, and (b) the bearing of the lending risk by the saver. Typically, the saver is not himself a professional lender, and has neither the time nor the expertise for the continued monitoring of the borrower's financial soundness. With direct finance, therefore, the government and well-established large enterprises have a distinct advantage in raising funds from the market; others must pay a higher cost of capital to compensate for the higher risk arising out of lenders' lack of knowledge about borrowers' financial capacity. In this environment, innovation-generating venture capital is especially liable to suffer because of the public's lack of expertise in risk assessment.

Moreover, borrowers typically prefer long-term, and lenders short-term, financing. Without a secondary market of considerable "depth, breadth and resilience," borrowers have to pay higher costs for capital in order to overcome lenders' liquidity preferences. However, a well-developed secondary market presupposes a high degree of financial sophistication, based on generally accepted accounting standards, knowledgeable investment-advisory services, efficient communication networks, and reasonable regulatory authorities to enforce the rules of the game. Generally speaking, such preconditions do not exist in developing nations. Not surprisingly then, developing nations strive mightily—but usually in vain—to develop a domestic capital market, in their eagerness to mobilize national savings for economic growth. In many instances, it is a policy of chasing the will'-o'-the-wisp.

The third channel of investment finance, financial intermediation, is characterized by a flow of funds through financial institutions, which specialize in intermediating between ultimate savers on the one hand and ultimate users of funds on the other. These institutions conduct their business by issuing liabilities against themselves, and directly or indirectly investing the proceeds in the financial instruments of ultimate fund users. In general, the more financially sophisticated a national economy, the wider is the variety of its financial institutions—central banks,[5] commercial

Figure 1

Channels of Savings-Investment Flows



(checking-deposit) banks, investment (merchant, development) banks, savings institutions, insurance companies, mutual funds, pension funds, finance companies, and so on. Also, the more sophisticated the economy, the more varied is the menu of financial instruments offered by these institutions—with diverse maturity, liquidity, riskiness, and auxiliary services (such as insurance, investment counseling, and data processing) tailored to the preferences of ultimate savers.

Financial intermediation enhances economic growth through the promotion of savings and investment. By borrowing short and lending long, financial intermediaries cater to the liquidity preferences of both borrowers and savers. By specializing in the provision of financial services, they reduce the riskiness of each individual loan through their expertise in assessing the creditworthiness of each borrower. By pooling savings and diversifying lending, they diminish the aggregate risk of investment for the nation as a whole. And by realizing economies of scale in financing, they reduce the cost of capital to ultimate borrowers and thereby encourage capital formation.[6]

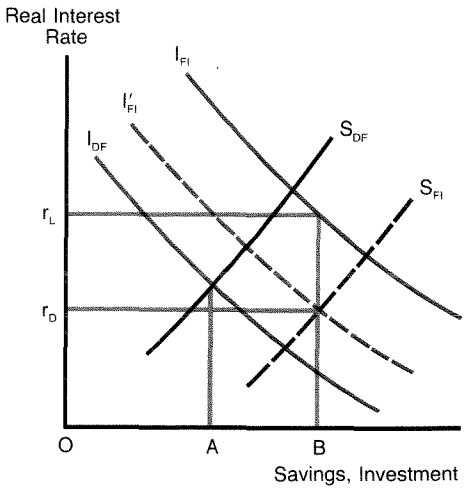
Compared to self-finance, financial intermediation also facilitates capital formation by enlarging the scope of financing, thereby making it possible for enterprises to adopt modern technology and realize economies of scale. Moreover, it enhances the productivity of capital, by developing investment expertise and instilling market discipline in the allocation of capital. Compared to direct finance, financial intermediation promotes saving, by more closely satisfying savers' liquidity preferences, by reducing risks of investment, and by packaging auxiliary services desired by savers. The consequent increase in savings and enhancement of productivity of capital combine to raise the nation's rate of economic growth.[7]

Nonetheless, despite these advantages, indirect finance is not always superior to self-finance and direct finance, regardless of the extent of each mode of finance. On the contrary, countries with a full complement of financial markets, both direct and indirect, are more likely to provide superior financial services than countries that rely on indirect finance alone. Moreover, financial intermediation is not costless. Investment in human capital in finance represents a drain on society's scarce resources which have high alternative costs. Buildings, furnishings, and extensive communication facilities also involve a significant social-overhead investment. These costs are reflected in the spread between the deposit interest rates paid to savers and the loan interest rates charged to borrowers. A large spread reflects a high cost of operation[8]—or a high degree of monopoly profit—for financial institutions.

The benefits and costs of financial intermediation may be shown graphically (Figure 2), by relating the volume of national savings or investment at various real interest rates. The curve I_{DF} is a demand-for-capital curve under conditions of direct financing. It is based on the economy's aggregate production function, and depicts the marginal productivity of capital for the economy as a whole in the absence of financial intermediation.[9] The curve I_{FI} stands

Figure 2

Benefit and Cost of Financial Intermediation



for the economy's demand for capital under conditions of financial intermediation. It lies above the I_{DF} curve to reflect the higher return to capital under financial intermediation.[10] The curve I'_{FI} lies below the curve I_{FI} by the real factor costs of financial intermediation per unit of capital.

The curve S_{DF} depicts the amount of savings forthcoming at various real interest rates when savings must be placed directly by savers with ultimate borrowers. It includes the desired retained earnings of business firms for their self-finance of investment, as well as direct purchases by savers of the securities of ultimate fund users. The curve S_{FI} stands for the economy's total savings when there is financial intermediation, which increases national savings at given real interest rates.

The equilbrium amount of savings under conditions of self-finance and direct placement is shown as OA, and that under financial intermediation is shown as OB. At OB, the real loan-interest rate charged by financial intermediaries is r_L, and the real deposit-interest rate paid by them is r_D, the difference being the real financing cost plus the institutions' profit.

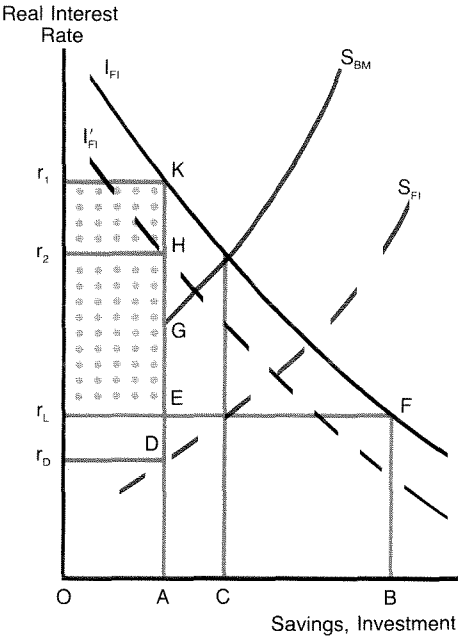
Free competition in financial markets is shown in Figure 2, where the deposit rate (r_D) and the loan rate (r_L) are both determined by market demand-and-supply forces. In most Pacific Basin countries, however, interest rates are set by the monetary authorities at levels below market-clearing levels, in the belief that low interest rates help stimulate investment and hence promote economic development. In order to insure financial institutions' profitability, deposit rates are set even lower. The situation is depicted in Figure 3, which reproduces the curves I_{FI}, I'_{FI}, and S_{FI} from Figure 2, and adds the assumption that the authorities set a ceiling deposit rate at r_D. The amount of savings provided to the financial system would be OA. Given the limited amount of savings, enterprises would be willing to pay at least a loan rate of r_1. Subtracting the cost of financial intermediation, financial institutions could then earn at least a profit of $r_D r_2$ per unit of capital.

But since interest-rate ceilings have been imposed in order to lower the cost of borrowing to business firms, financial intermediaries probably would not be allowed to charge the market interest rate. Instead, they would be limited to a loan rate which would allow just enough margin to cover their operating costs. The ceiling loan rate will be r_L ($r_D r_L = r_2 r_1$), at which there will be an unsatisfied excess demand for funds of EF ($=$AB). Instead of financial institutions enjoying an excess profit of $r_D DHr_2$, borrowers would receive an excess profit of $r_L EKr_1$ ($= r_D DHr_2$).

Because of the unsatisfied demand for capital, an unorganized (black) market could arise. Since the lenders in this market would tend to be small lenders operating under unfavorable conditions, their costs of operation would normally be higher than those of financial institutions operating in the organized market. The higher cost of black-market operations is shown as DG ($>$DE), and that market's supply curve is shown as S_{BM}. The intersection of I_{FI} and S_{BM} determines the total

Figure 3

Financial Repression



amount of financing effected through both regulated and unregulated markets. Total savings and investment will be OC, of which OA is channeled through the organized market and AC through the unorganized (black) market.[11]

Under the conditions of "financial repression" depicted in Figure 3, the size of the financial-intermediary sector will be smaller than in Figure 2, the difference depending on the vigor with which the unorganized market is suppressed by the monetary authorities. In the extreme case where the unorganized market is openly tolerated by the authorities—where the costs of the unorganized market are not significantly higher than those of the organized market—there might be little difference between OA and OC[12]. However, we must consider not only the impact on the volume of savings and investment, but also the efficiency of investment. I_{FI} in Figure 3 is drawn on the assumption that savings OA will be allocated by financial institutions to the most efficient borrowers in the market, although there is no assurance that this will indeed be the case. Under arbitrary allocative rules, financial institutions may distribute funds to enterprises which are less efficient, so long as they are able to pay the loan rate of r_L. This is depicted by the dots in Figure 3 in the box $r_L EKr_1$.[13] Paradoxically, under this condition, bribery of bank officials for favorable consideration of loan applications, though a social evil, could be an economic virtue. In other words, bribery might supplement a price mechanism thwarted by official repression, and thus help ensure the allocation of capital to the most efficient users.

The condition of "repressed finance" arises from a real deposit rate below market-clearing levels. The low real interest rate may be the result of a nominal rate deliberately set low in order to encourage investment, or a failure to adjust the nominal rate in keeping with rising inflation. In either case, the volume of capital formation is limited by the volume of savings forthcoming at the given real deposit rate. The lower the real deposit rate, the lower would be the degree of the economy's financial intermediation. But interest-rate liberalization, by allowing nominal interest rates to be determined by market forces, would free financial institutions to offer positive real deposit rates and thereby stimulate the growth of the financial-intermediation sector.

II. Financial Deepening in Pacific Basin Countries

We turn now to compare the financial-deepening experiences of eleven Pacific Basin countries during the 1960–78 period. Although it would be preferable to use the broadest possible measures of financial-market development, it is difficult with existing data bases[14] to devise comparable measures in a cross-country sample. Thus, this analysis focuses only on financial intermediation, since comparable data are available only on that basis. As our earlier discussion suggests, direct finance markets (despite their obvious uses) are unlikely to be important in developing economies.

Our survey has been designed to see what generalizations (if any) can be derived about the factors promoting or retarding financial deepening in countries at different stages of economic development. In terms of per capita income, the eleven countries range from less than $400 in Indonesia to more than $9,700 in the United States (1978 data). Overall, during the past two decades, this region has grown faster than any other region in the world. However, individual growth rates have varied from an average of about 3½ percent per year in the United States and New Zealand to more than 9 percent per year in Korea and Singapore. In terms of inflation, the range has also been considerable, from an annual-average rate of a little over 3 percent in Malaysia and Singapore to about 14 percent in Korea and 30 percent in Indonesia.[15].

The eleven countries also exhibit a variety of banking structures. Banks in Indonesia, Korea, and Taiwan are predominantly owned by the government. Malaysia, New Zealand, the Philippines, and Thailand each has a mixed banking system, with one or two large state-

owned banks competing with a large number of private banks. Banks in Australia, Japan, Singapore, and the United States are all privately-owned, with the government owning and operating only development and export-credit institutions.

Finally, all of these countries have experimented with a variety of interest-rate policies. Most of them, including the United States, have maintained rigid controls on bank deposit-interest rates for small savers. However, New Zealand since March 1976 and Singapore since July 1975 have lifted such interest-rate ceilings. Some countries, because of regulated interest rates and inflation, have exhibited negative real deposit-interest rates—but others have shown very high positive rates. We will later examine how these variations have affected financial growth in these countries.

The degree of financial intermediation of a nation might be measured by the proportion of national wealth held through financial intermediaries. Lacking adequate data on national wealth, we may assume that national output is proportionate to national wealth, so that financial intermediation can be measured instead by the ratio of the *consolidated* assets of each nation's financial intermediaries to national output.

We may distinguish three types of financial intermediaries: the monetary authorities, the deposit-money banks, and non-bank financial institutions (savings institutions, credit unions, insurance companies, etc.). Banks are differentiated by their ability to accept demand (i.e., checkable) deposits and thus to expand the money supply by creating demand deposits against themselves, whereas non-bank financial institutions must discharge their liabilities by drawing on their demand deposits at banks.

In measuring the magnitude of a nation's financial sector, what is relevant is the total claims of financial intermediaries on non-financial sectors: government, business, households, and the rest of the world. Claims of financial institutions on each other thus should be netted out. This means not only inter-bank claims, but also the monetary authorities' claims on banks and non-bank financial institutions, bank reserves held at the central bank, and cash reserves of banks and non-bank financial institutions.

Financial Intermediation, 1978

The degree of financial intermediation is shown by the total consolidated assets of each country's financial sector and their distribution between foreign and domestic assets—all expressed as ratios to national output (Table 1). In each category, the eleven countries are ranked according to the magnitude of the ratio into four groups: (I) High, (II) Medium-High, (III) Medium-Low, and (IV) Low, degrees of financial intermediation.

Most (but not all) of these countries showed about the same rankings in terms of total assets (TA/Y) as in terms of domestic assets (DA/Y). By both criteria, Japan, Singapore, Taiwan, and the United States exhibited the highest degree of financial intermediation in 1978. New Zealand stood by itself in a second group; then followed Australia, Korea, Malaysia, the Philippines, and Thailand; and lastly, Indonesia fell far behind the others in financial intermediation.

It is tempting to seek some explanations for these rankings. For example, one might hypothesize that financial development is a "luxury" good in the process of economic development.[16] This would suggest that income levels can explain observed differences in financial intermediation. However, the extent of financial intermediation is itself a determinant of income levels through its effect on growth. Thus, to isolate the effects of income on financial development would require a simultaneous-equation model describing growth processes and their two-way relationship to financial development—a difficult task given the notorious difficulty of modelling growth processes.

More importantly, however, there are hazards in constructing a practical, cross-country measure of the extent of financial development even if the income/financial-deepening relationship is well understood. It may surprise some, for example, to see that Japan, Singapore, and Taiwan had higher financial-inter-

mediation ratios in 1978 than the United States (Column 1 of Table 1). Generally we assume that the United States has the world's best-developed and most innovative financial markets, and that New Zealand and Australia are also well advanced. In contrast, financial markets and institutions in Japan, Singapore, and Taiwan are considered to be much less developed and shackled by official restrictions.

How can the observed financial-intermediation ratios square with this general impression? Part of the answer may lie in the composition of financial assets. In 1978, foreign assets as a ratio to national output were several times larger in Singapore and Taiwan than in the United States (Column 3). This reflects the fact that financial institutions in these highly open economies engage in international financial intermediation—i.e., borrowing and lending abroad—to a much larger relative extent than do U.S. institutions. This is particularly true for Singapore, where international assets accounted for nearly one-half of the total assets of financial institutions in 1978. But when we exclude foreign assets, the degree of domestic financial intermediation in 1978 was higher in the United States than in either Singapore or Taiwan.

More importantly, the financial-intermediation ratios, TA/Y or DA/Y, describe only the indirect-finance portion of a nation's financial activities. As we have seen, despite the many advantages of indirect finance, a financial system dominated by such a system may reflect stunted growth in capital markets. There is a great deal of complementarity among self-finance, direct finance, and indirect finance, so that a well-developed financial system may combine aspects from each of these modes of finance. Just because one country boasts a higher financial-intermediation ratio than another does not mean that it has a more advanced financial system than the other country.

Financial Deepening, 1960–78

While international comparisons of financial-intermediation ratios might be misleading indicators of financial development, we may gain much useful information from an intertemporal study of the growth of the appropriate ratios within each nation (Table 2). In terms of growth of total-asset ratios, Indonesia and Taiwan ranked at the top in the 1960–78 period, with very high annual growth rates, 9.4 and 7.0 percent respectively. These ratios reflected in part their low degree of financial in-

Table 1
Assets/Output Ratios, 1978
(percent)

Total Assets/Output (TA/Y)		Domestic Assets/Output (DA/Y)		Foreign Assets/Output (FA/Y)	
(I) Japan	194	(I) Japan	188	(I) Singapore	93
Singapore	189	United States	101		
Taiwan	121	Singapore	96	(II) Taiwan	35
United States	108	Taiwan	86	Malaysia	24
(II) New Zealand	82	(II) New Zealand	78	(III) Philippines	15
Malaysia	79			Thailand	12
		(III) Australia	61	Indonesia	11
(III) Korea	67	Korea	56	Korea	10
Thailand	67	Malaysia	55		
Australia	65	Thailand	55	(IV) Japan	6
Philippines	63	Philippines	47	United States	6
				Australia	4
(IV) Indonesia	41	(IV) Indonesia	29	New Zealand	4

Y = Gross national (or domestic) product.
TA = Total consolidated assets of the financial sector (= DA + FA).
DA = Consolidated domestic assets of the financial sector .
FA = Foreign assets of the financial sector.

Source: Based on data in International Monetary Fund, *International Financial Statistics*, various issues.

termediation at the beginning of the 1960–78 period. Next came Malaysia, Singapore, the Philippines, Korea, Thailand, and Japan, with financial-growth rates ranging from 2.6 percent to 4.7 percent. Most of these countries, except Japan and Singapore, started out with relatively low financial-intermediation ratios. The United States stood alone in the third rank with a modest financial growth rate of only 0.7 percent per year. Lastly, both New Zealand and Australia sustained net declines in financial intermediation during the 1960–78 period, with average annual declines of 0.3 and 0.5 percent respectively.

We see then that the rate of financial deepening tends to be negatively related to the initial value of the total-asset ratio. One may assume that, as a rule, opportunities of financial growth abound at an early stage of financial development, and then diminish as the market becomes saturated with financial institutions. In order to isolate the effects of the initial ratio, we can fit a downward-sloping logarithmic curve to the financial-growth rates and the initial total-asset ratios in Chart 1.[17] By this standard, which measures growth in relation to each country's initial total-asset ratio, Singapore and Taiwan stood out with the most rapid financial growth, and Australia and New Zealand with the slowest growth. In between, Japan and Malaysia had above-average growth, while Thailand and the United States had below-average growth.

Chart 1

Financial Growth Rates and Initial Financial-Intermediation Ratios

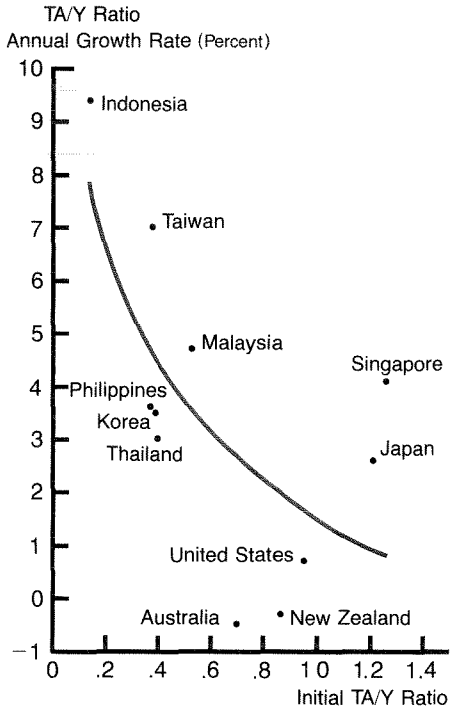


Table 2

Financial Deepening: Growth of Total Assets/Output Ratio (TA/Y)

	Country	Initial Year	Initial Ratio	Ratio in 1978	Average Annual Growth (%)
(I)	Indonesia	1966	0.14	0.41	9.4
	Taiwan	1961	0.38	1.21	7.0
(II)	Malaysia	1969	0.53	0.79	4.7
	Singapore	1968	1.26	1.89	4.1
	Philippines	1963	0.37	0.63	3.6
	Korea	1962	0.39	0.67	3.5
	Thailand	1961	0.40	0.67	3.0
	Japan	1960	1.21	1.94	2.6
(III)	United States	1960	0.95	1.08	0.7
(IV)	New Zealand	1960	0.86	0.82	−0.3
	Australia	1960	0.70	0.65	−0.5

Source: Based on data in International Monetary Fund, *International Financial Statistics*, various issues.

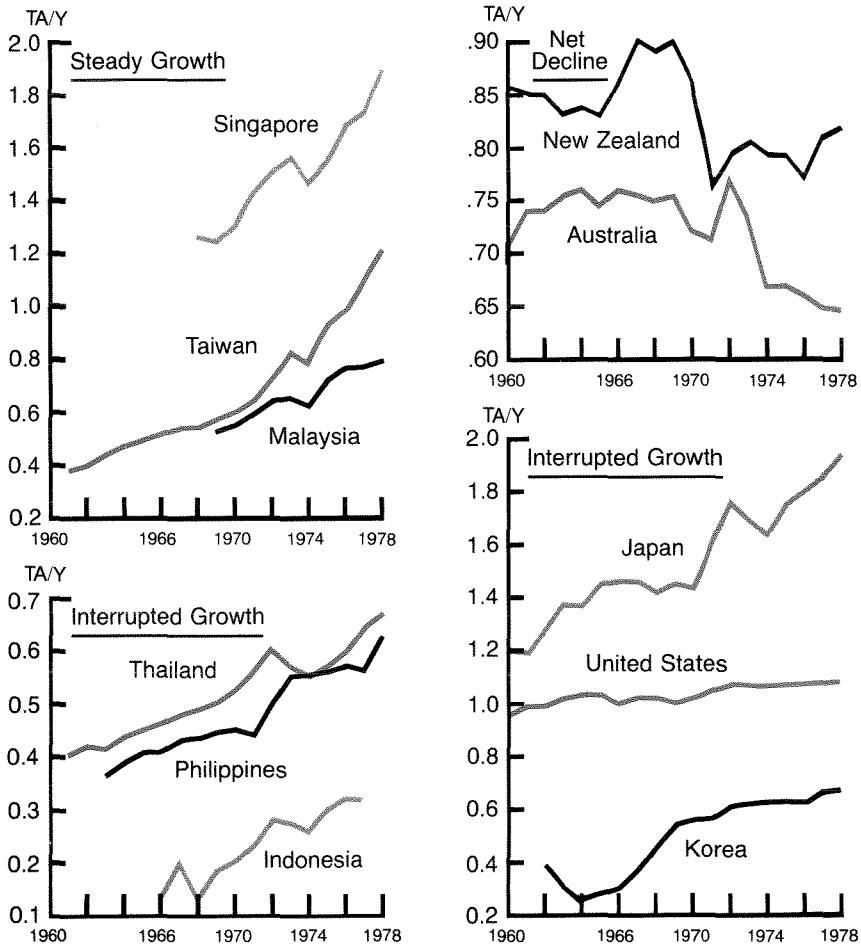
tween, Japan and Malaysia had above-average growth, while Thailand and the United States had below-average growth.

Average financial-growth rates indicate the long-run trend of financial deepening. But it may also be of interest to examine how financial deepening evolved over time in each country (Chart 2). Three countries—Malaysia, Singapore and Taiwan—showed nearly uninterrupted growth in the TA/Y ratio (Panel a). Two countries—Australia and New Zealand—both attained a high level of financial intermediation by the 1960's but sustained sharp declines in the TA/Y ratio in the following decade (Panel b). The other six countries all achieved net financial growth, but their growth was marked by prolonged periods (two years or more) of zero growth or declines in the TA/Y ratio (Panels c and d).

To help explain these diverse patterns, we should seek to determine what might account for the broad changes in the trend of financial growth in the various countries. For public policy, short-term fluctuations in the financial-intermediation ratio are hardly of interest. On the other hand, it would be desirable to find

Chart 2

Growth of Financial Intermediation Ratios (TA/Y), 1960–78



out if changes in financial-growth trends are subject to any systematic influences under policy control.

This can be done by examining the movement of the financial-intermediation ratio in 27 different episodes, comparing it with the corresponding average real-deposit rate, i.e. the nominal deposit rate minus the consumer-price inflation rate (Table 3). According to our theoretical analysis, the real deposit rate plays a key role in determining the extent of financial intermediation, especially under conditions of "repressed finance." The condition describes well the financial markets in most of the countries studied, with the nominal deposit rate fixed inflexibly in the face of consumer price inflation.

All the episodes with falling financial-intermediation ratios were associated with negative real deposit rates, some as large as minus 34 percent in Taiwan in 1974 and minus 19 percent in Indonesia in 1972–74. All of these episodes reflected attempts to maintain stable nominal deposit rates in the face of high domestic inflation rates. On the other hand, all the episodes with rising financial-intermediation ratios were associated with positive real deposit rates—or, if negative (Indonesia in 1974–78, Japan in 1974–78, and Korea in 1976–78), with a significant increase in the real deposit rate from the

Table 3
Relationship Between Financial Deepening and Real Deposit Rate

	Period	Total Assets/Output (TA/Y)	Real Deposit Rate (%)
Australia	1960–64	Rising (from 0.70 to 0.76)	3.10
	1964–69	Flat (from 0.76 to 0.75)	1.37
	1969–78	Falling (from 0.75 to 0.65)	−2.94
Indonesia	1968–72	Rising (from 0.13 to 0.28)	14.2
	1972–74	Falling (from 0.28 to 0.26)	−18.8
	1974–78	Rising (from 0.26 to 0.41)	−1.9
Japan	1960–72	Rising (from 1.21 to 1.76)	−0.14
	1972–74	Falling (from 1.76 to 1.64)	−11.08
	1974–78	Rising (from 1.64 to 1.94)	−2.69
Korea	1962–64	Falling (from 0.39 to 0.25)	−11.03
	1964–72	Rising (from 0.25 to 0.61)	10.75
	1972–76	Flat (from 0.61 to 0.62)	−7.17
	1976–78	Rising (from 0.62 to 0.67)	−1.99
Malaysia	1969–78	Rising (from 0.53 to 0.79) except for dip in 1974	3.87: except −5.5 in 1973–74
New Zealand	1960–67	Rising (from 0.86 to 0.90)	0.30
	1967–76	Falling (from 0.90 to 0.77)	−3.81
	1976–78	Rising (from 0.77 to 0.82)	0.79
Philippines	1963–78	Rising (from 0.37 to 0.63) except flat in 1973–75	2.83: except −8.7 in 1970–74
Singapore	1968–78	Rising (from 1.26 to 1.89) except for dip in 1974	4.3: except −16.2 in 1973–74
Taiwan	1961–78	Rising (from 0.38 to 1.21) except for dip in 1974	6.67: except −34.0 in 1974
Thailand	1961–72	Rising (from 0.40 to 0.60)	5.6
	1972–74	Falling (from 0.60 to 0.55)	−8.5
	1974–78	Rising (from 0.55 to 0.67)	3.1
United States	1960–72	Rising (from 0.95 to 1.07)	1.2
	1972–78	Flat (from 1.07 to 1.08)	−2.0

preceding period. The only exception was Japan during 1960–72, when a substantial rise in the TA/Y ratio took place in spite of a small negative real deposit rate. This case may have reflected a very strong propensity to save through financial institutions, coupled with a vigorously growing national economy. However, Japan's TA/Y ratio fell sharply in 1972–74, when the real deposit rate dropped to a negative 11 percent.

Sustained positive real deposit rates have meant rising financial intermediation in all cases except one: Australia in 1964–69, when the TA/Y ratio remained virtually unchanged instead of rising. But Malaysia, Singapore, and Taiwan, the only countries with nearly uninterrupted financial growth, were also the only countries that consistently maintained high real deposit rates. In all three cases, the only decline in the financial-intermediation ratio occurred in 1973–74, when high inflation rates turned their real deposit rates briefly negative. The Philippines also showed steady financial growth, except for a two-year period (1973–75) when the TA/Y ratio remained flat, in line with a sharp decline in the real deposit rate.

In sum, the real deposit rate appears to play a significant role in financial deepening. A positive rate sustained over a number of years all but assured financial growth, whereas a sustained negative real deposit rate nearly always brought about financial stagnation or decline. There were some exceptions to this rule, but in each case, financial growth accompanied a significant rise in the real deposit rate, even when the rate itself remained negative.

We do not claim that the real deposit rate was the only factor determining the financial growth rate. Rapid economic growth and a high savings propensity helped offset the effects of a negative real deposit rate during several periods of vigorous financial growth—Indonesia during 1974–78, Japan during 1960–72, and Korea during 1976–78. Yet despite these exceptions, the real deposit rate consistently played a key role in stimulating financial growth in most of the episodes analyzed here.

III. Summary and Conclusions

The economic literature suggests that organized financial markets, and financial intermediation in particular, possess certain advantages over self-finance in terms of promoting savings and efficiency of investment. The analysis in this paper focusses on financial intermediation for reasons of data consistency, but it is important to remember that direct finance also plays a major development role in countries with fully developed financial markets.

Financial intermediation ratios in 1978 were significantly higher in Japan, Singapore, and Taiwan than in Australia, New Zealand, and the United States. The explanation lies partly in Singapore and Taiwan's high degree of international intermediation, and partly in Japan, Singapore and Taiwan's relative lack of alternative channels of financing, compared with the other developed economies.

In terms of growth over time, Malaysia, Singapore, and Taiwan achieved nearly uninterrupted financial growth during the data period. In contrast, Australia and New Zealand sustained net declines in their degree of financial intermediation. The other six nations all recorded growth in financial intermediation, but with varying periods of stagnation or setback.

The real deposit interest rate played a critical role in setting the pace of each nation's financial growth. Positive real deposit rates maintained over a number of years invariably led to financial deepening, while negative real deposit rates (even over brief periods) could result in sharp financial disintermediation against an otherwise strongly upward trend. Other factors, such as a vigorously growing economy with a high propensity to save, occasionally offset the adverse effects of a negative real deposit rate—for instance, in Japan during 1960–72. However, such reversals were relatively rare, and failed to contradict the hypothesis that a negative real deposit rate is detrimental to financial deepening.

Because of the importance of financial deepening for economic growth, economic policy should be aimed at reducing inflation, which by definition lowers the real deposit rate. Where inflation cannot be brought down quickly, interest rates should be allowed to adjust with sufficient flexibility to permit a positive real rate of return to savings.

FOOTNOTES

1. See for instance, John G. Gurley and Edward S. Shaw, "Financial Intermediaries and the Savings-Investment Process," **Journal of Finance,** May 1956, pp. 257–77. Hugh T. Patrick, "Financial Development and Economic Growth in Underdeveloped Countries," **Economic Development and Cultural Change,** January 1966, pp. 174–89; Edward S. Shaw, **Financial Deepening in Economic Development,** Oxford, 1973; Ronald I. McKinnon, **Money and Capital in Economic Development,** Brookings, 1973; Ronald I. McKinnon, ed., **Money and Finance in Economic Growth and Development,** Marcel Dekker, 1976; Donald J. Mathieson, "Financial Reform and Capital Flows in a Developing Economy," **International Monetary Fund Staff Papers,** September 1979, pp. 450–489.

2. By economic growth is meant an increase in per capita real income over time. The relevant economic literature generally regards increases in the savings rate resulting from financial deepening as growth enhancing in the short run. It does not deal with the long-run question of whether the growth-enhancing effect would eventually be offset by declining marginal productivity of capital as capital accumulates, so that in the "steady-state" the growth rate is independent of the savings rate. This paper follows the tradition of the financial-deepening literature by considering only the short-run effects on economic growth, excluding the "steady state" considerations.

3. No consideration is given in this paper to financing by foreign capital. However, as a rule, foreign capital is attracted by the nation's growth prospects, which in turn depend critically on how well the nation is able to mobilize and utilize its own national savings. Thus, ultimately, national capital formation must depend on the efficiency of its financial system.

4. See McKinnon, **Money and Capital in Economic Development,** Brookings, 1973, ch. 2, pp. 5–21, for an analysis of this point.

5. Central banks are also financial intermediaries, because their currency creation channels a portion of the nation's private savings to the Government. Also, central banks often lend directly to the Government and businesses.

6. For a succinct statement of the economic benefits of financial intermediation, see James C. Van Horne, **Function and Analysis of Capital Market Rates,** Prentice-Hall, 1970, pp. 6–7.

7. These propositions can be built into a simple Harrod-Domar model of economic growth:

$$Y = Y(K, F) \tag{1}$$

and

$$S = S(Y, F) \tag{2}$$

where Y, K, and F designate real national output, real capital stock, real savings, and a measure of the nation's degree of financial intermediation. Differentiate (1) with respect to time to obtain

$$\dot{Y} = Y_K\dot{K} + Y_F\dot{F} \tag{3}$$

where Y_K and Y_F are partial derivatives of Y with respect to K and F, and a dot over a variable indicates its rate of change over time. Now, assume that the savings function is homogeneous of first degree with respect to Y, such that (2) may be rewritten as

$$S = S(F)Y \tag{2'}$$

Then, by equating savings with net investment,

$$S = \dot{K} = S(F)Y \tag{4}$$

and substituting (4) into (3) we obtain

$$\dot{Y} = Y_K S(F)Y + Y_F\dot{F} \tag{5}$$

Now, by definition, economic-growth rate

$$g \equiv \dot{Y}/Y \tag{6}$$

Substitute (5) into (6) to obtain

$$g \equiv Y_K S(F) + Y_F\dot{F}/Y \tag{7}$$

Equation (7) states that the **degree** of financial intermediation affects a nation's economic growth rate through its impacts on the marginal productivity of capital (Y_K) and the savings rate (S); moreover, financial **growth** ($\dot{F}$) directly enhances economic growth in proportion to the marginal productivity of financial intermediation relative to the national product (Y_F/Y).

Note that this analysis excludes considerations of the "steady state" growth path (see note 2 above).

8. Including the cost of government regulation, such as that which arises from requiring financial intermediaries to hold interest-free reserves against either assets or deposits. McKinnon shows that the real reserve cost rises geometrically with the rate of inflation in the economy. See Ronald I. McKinnon, "Financial Repression and the Liberalization Problem within Less-Developed Countries" in **The Past and Prospects for World Economic Order,** edited by A. Lindbeck and E. Lundberg (forthcoming).

9. The benefits and costs of financial intermediation give rise to the question of the optimal size of a nation's financial sector. For an analysis of the problem, see U Tun Wai, "The Optimal Size and Ideal Structure of Financial Markets in Developing Countries," **International Monetary Fund,** DM/78/74, August 1978.

10. For a more formal analysis of the role of financial intermediation in economic growth, see Lewis J. Spellman, "Economic Growth and Financial Intermediation," in **Money and Finance in Economic Growth and Development,** edited by Ronald I. McKinnon, 1976, pp. 11–22.

11. The addition of the unorganized market to the diagrammatic analysis is due to Sho-Chieh Tsiang, "Fashions and Misconceptions in Monetary Theory and Their Influences on Financial and Banking Policies," **Zeitschrift fur die Gesamte Staatswissenschaft,** December 1979, pp. 584–604.

12. This factor partially accounts for the frequent failure to find significant effects of real interest rates in empirical studies of national savings. See Vincente Galbis, "Theoretical Aspects of Interest Rate Policies in Less Developed Countries," **International Monetary Fund,** DM/79/7, February 1979.

13. This form of diagrammatic presentation is due to Maxwell Fry, "Money and Capital or Financial Deepening in Economic Development?" **Journal of Money, Credit, and Banking,** November 1978, pp. 464–475.

14. The only available source of internationally comparable data is the International Financial Statistics (IFS) database. The financial intermediation measure developed here is the broadest indicator of financial-market development calculable with that data.

15. For Indonesia, the data refer to the period from 1966 to 1978.

16. Goldsmith found that the income elasticity of demand for financial assets was greater than unity for both developed and less-developed countries. See Raymond W. Goldsmith, **Financial Structure and Development,** Yale, 1969, Table 4–11, p. 204.

17. The regression equation is $r_{FG} = 1.52 - 3.22\ 1n(TA/Y)_0$, $R^2 = 0.44$, where r_{FG} is the average annual rate of growth of the TA/Y ratio, and $(TA/Y)_0$ is the initial ratio of total assets to national output.

P.O. Box 7702
San Francisco, California 94120