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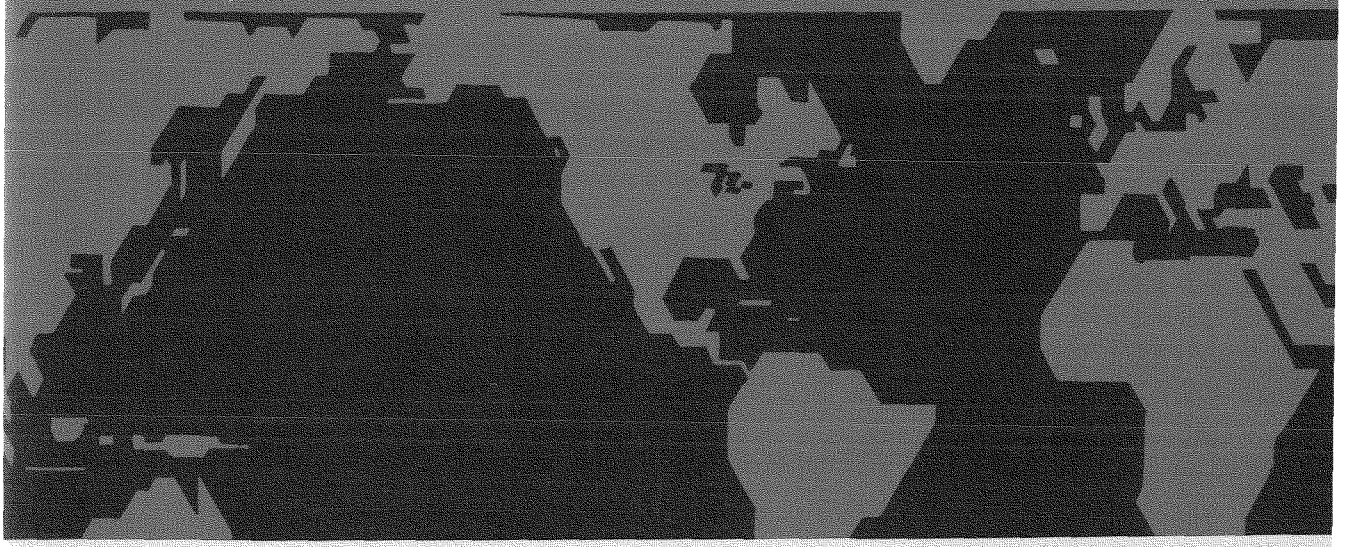

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Central-Bank Policy Towards Inflation

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Two basic approaches to the question of imported inflation can be found in the recent literature. The first, which might be called cost-push, views the rise in import prices as raising the cost of imports and, hence, domestic prices.[1] The second approach, which might be called world-monetarist, regards the world price level as determined by the world demand and supply of money. To the extent that national economies are closely integrated through trade, capital flows, and fixed exchange rates, world inflation will spread to all such economies and result in general price increases.[2] Both approaches reach a common conclusion: a national central bank cannot do much to stabilize the domestic level, in the absence of a freely floating exchange rate of the national currency.

This paper calls attention to the special assumptions upon which the validity of that policy conclusion depends. In general, when the assumptions are relaxed, the central bank is no longer viewed as totally helpless in coping with imported inflation. Instead, under certain specified circumstances, it could be quite effective in stabilizing domestic prices in the face of price increases abroad.

By equating cost increases with price increases, the cost-push approach focuses exclusively on the supply side of the market, and thus ignores any (domestic or foreign) adjustments on the demand side. In failing to distinguish between individual price increases and general-price-level increases, this approach also ignores the aggregate-budget constraint on market demand. Rising import prices lead to a general price increase only if permitted by central-bank policy, which influences aggregate demand through its control over the domestic money supply. Cost-push thus implicitly assumes an accommodating monetary policy, which validates any tendency for domestic prices to rise as a result of import-price increases. Since the cost-push approach does not present a complete theory, dealing as it does with only one side of the market, we shall ignore it in the rest of this paper and consider only the monetarist approach.

The world-monetarists argue that in an open economy the national central bank has no control over the domestic money supply, so long as exchange rates are not freely flexible. The conclusion follows from the assumption of homogeneous products throughout the world, so that the domestic price level in an "open economy" cannot diverge very far from the world price level.[3] The homogeneous-products assumption, thus, defines away the very problem this paper is focused upon.

At issue is not the theoretical validity of the monetarist approach, which we do not dispute, but rather its general applicability. Despite the rapid integration of the world economy in the last thirty years, inflation rates have varied widely from country to country even during an era of relatively stable exchange rates. The following table shows the dispersion of consumer-price changes in two selected periods for 41 major industrial and developing nations:

	Average annual rates of change (%)	
All Countries[4]	*1950-63*	*1963-72*
1. Weighted mean	3.85	5.08
2. Coefficient of variation	1.29	1.04
3. Range of variation	–0.6 to 38.1	1.2 to 35.2
Industrial Countries (14)		
1. Weighted mean	2.79	3.96
2. Coefficient of variation	0.55	0.20
3. Range of variation	1.8 to 5.4	3.1 to 6.0
Developing Countries (27)		
1. Weighted mean	9.41	10.74
2. Coefficient of variation	1.47	1.43
3. Range of variation	–0.6 to 38.1	1.2 to 35.2

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

The data indicate a high degree of variation of inflation rates among the 41 countries in both periods, 1950-63 and 1963-72. However, this variation was much smaller among the industrial countries than among the developing countries. Moreover, between the first and second periods, national inflation rates converged markedly among the industrial countries, but not among the developing nations. It appears that, at least for developing countries, international economic integration is far from perfect, and international product differentiation is the norm rather than the exception.

These observations point to the need for a further elaboration of the world-monetarist approach so as to account for this wide dispersion of national inflation rates. We should explicitly take into account both product differentiation and its implications for domestic monetary policy.

The next section presents a simple monetarist model that attempts to incorporate some of these considerations. It shows that the national central bank is not necessarily helpless in coping with imported inflation, and that the effectiveness of domestic monetary policy for price stabilization depends critically on the degree of openness of the economy—measured by the elasticity of substitution between domestic and foreign products on the one hand and by the ratio of imports to GNP on the other.[5] Secondly, it decomposes the impact of imported inflation on domestic price level into a "monetary effect" and a "resource effect," and shows that mere sterilization of reserve increases in order to offset the "monetary effect" would be insufficient for domestic-price stabilization, as it ignores the "resource effect" of imported inflation.

Finally, by generalizing the world-monetarist model to the case of differentiated products, the analysis provides an explanation of the international dispersion of national inflation rates in a way not accounted for in the version of the model which assumes homogeneous products.

The final section presents a series of empirical tests of the model, utilizing data for eight Pacific Basin countries for the period 1948-73. The model provides a satisfactory explanation of the domestic inflation in most of those countries, with imported inflation playing a significant role in nearly all eight. The results lend support to the view that the developing nations have a greater monetary independence for combating imported inflation than the developed countries do.

I. Two-Sector Monetarist Model of Imported Inflation

A) The model and analysis

The model consists of nine equations, six definitional and three behavioral. Readers who are interested only in the policy implications, not the formal analysis, may skip this sub-section and go to the next. The symbols used are explained along with the equations.

$$(1) \quad M = ky^*P$$

$$(2) \quad P \equiv (d/y^*)P_d + (m/y^*)EP_m$$

$$(3) \quad M \equiv R + C$$

$$(4) \quad R \equiv R_o + P_dx - EP_mm$$

$$(5) \quad x = x(T)$$

$$(6) \quad m = m(T)$$

$$(7) \quad T \equiv P_d/EP_m$$

$$(8) \quad y \equiv y^* + x - m/T$$

$$(9) \quad y^* \equiv d + m/T$$

Equation (1) states that in equilibrium the money supply is equal to the nominal amount of money demand, the latter being proportional to the nominal amount of domestic expenditure. It is a variant of the familiar quantity equation $MV=PQ$, where V is the income velocity of money, and Q the national output. Equation (1) sets $k=1/V$ and changes Q to real domestic expenditure.[6] Equation (2) defines the index of domestic-expenditure prices as a weighted average of the domestic-product and foreign-product prices, the weights being the proportions of domestic expenditure spent on the respective products. Equation (3) abstracts from the fractional-reserve system and defines the money supply as the sum of the foreign reserves and domestic credits in the central bank's portfolio. Equation (4) states that the foreign reserves at the end of the period equal the amount at the beginning of the period plus the trade balance during the period, assuming no net international capital flows. Equations (5) and (6) assume both national output and world output to be given, so that the world's demand for the nation's exports and the nation's demand for imports are functions only of the terms of trade. Equation (7) then defines the terms of trade as the ratio of the price of the domestic product to that of the foreign product, both stated in terms of the national currency. Equation (8) defines national output to be equal to domestic expenditure plus exports minus imports, all stated in equivalent units of the domestic product. Equation (9) defines domestic expenditure as the sum of domestic spending for both domestic product and foreign product, both in equivalent units of the domestic product.

To facilitate analysis, set the units of measurement and initial conditions such that initially $P = P_d = P_m = E = 1$, and the trade balance is zero. Then, by assuming a fixed exchange rate, and upon differentiating and substituting, we obtain the following relations:

$$(10) \quad dP = dM/M_o - dy^*/y^*_o,$$

$$(11) \quad dM^s = dC + (x' - m' + m_o)\, dT, \quad x'<o \text{ and } m'>o,$$

$$(12) \quad dy^* = (-x' + m' - m_o)\, dT,$$

$$(13) \quad dT = dP_d - dP_m,$$

and

$$(14) \quad dP = (d/y^*)_o\, dP_d + (m/y^*)_o\, dP_m,$$

where x' and m' are the derivatives of x and m with respect to T, and the subscript o indicates the initial value.

Imported inflation in the absence of domestic credit expansion

By setting $dC = O$, equations (10)–(14) can be solved to obtain:

$$(15) \quad dP = (\overline{ME} + \overline{re})\,(dP_d - dP_m)$$

where

$$(16) \quad \overline{ME} \equiv -(x' - m' + m_o)\,/\,M_o,$$

and

$$(17) \quad \overline{re} \equiv -(x' - m' + m_o)\,/\,y^*_o.$$

Equation (15) shows that the "terms-of-trade effect" of imported inflation on the domestic price level may be decomposed into a "monetary effect" ($\overline{ME}$) and a "resource effect" ($\overline{re}$). The former indicates the change in central-bank foreign reserves as a ratio of the initial domestic money supply resulting from a change in the terms of trade. The result is positive in the normal case where the elasticities of export demand and import demand are sufficiently large such that the trade balance improves with a fall in the terms of trade.[7] The latter equation measures the net proportionate change in the nation's real domestic expenditure, measured in equivalent units of domestic product, resulting from changes in exports and imports induced by a change in the terms of trade.[8] Thus, a trade surplus resulting from a rise in import prices would be inflationary, because of the induced domestic monetary expansion coupled with a resultant drain of resources from the economy.

Equations (14) and (15) can be solved jointly to obtain dP and dP_d as functions of dP_m only:

$$(18)\quad dP_d = (1 - 1/A)\, dP_m$$

$$(19)\quad dP = \left[1 - (1/A)\,(d/y^*)_o\right] dP_m,$$

where $(20)\quad A \equiv \overline{ME} + \overline{re} + (d/y^*)_o.$

Equations (18)–(20) indicate that the impact of imported inflation on the domestic prices depends systematically on the extent of the "monetary effect" and "resource effect" on the one hand, and the size of the import ratio (i.e. imports divided by domestic expenditure) on the other. The former effects are directly related to the elasticities of substitution between foreign and domestic products such that when these products are highly homogeneous—i.e. when the elasticities of substitution between the two products in the import-demand and export-demand functions are both very large—dP and dP_d will both approach dP_m. The same result is obtained in the world-monetarist approach under the assumption of perfectly homogeneous products worldwide.

The import ratio $(m/y^*)_0$, or its complement (d/y^*), also enters into Equations (18) and (19). Other things being equal, the larger the import ratio, the larger will be the impact of imported inflation on domestic prices.

Equations (18) and (19) enable us to distinguish between the determination of the national-output price (say, the GNP deflator) and the determination of the national-expenditure price (say, the consumer-price index). This distinction is significant to an open economy with domestic products that are not perfectly homogeneous with foreign products.

Effectiveness of national monetary policy

To what extent can a central bank in an open economy effectively control the domestic money supply and thereby maintain domestic price stability in the face of imported inflation? By setting $dP_m=O$, equations (10)–(14) can be solved to obtain:

$$(21)\quad dM = (1 - \overline{ME}/A)dC > O,$$

$$\text{and } (22)\quad dR = -(\overline{ME}/A)dC,$$

which state that expansions (or contractions) in central-bank domestic credit will be partially effective in expanding (or contracting) domestic money supply—but not fully effective, because of the resultant reserve loss (or gain).[10]

If the central bank has at least partial control over the domestic money supply, how should domestic credit be adjusted to check imported inflation?

By setting dP=O, we obtain from equation (10)–(14):

$$(23)\quad dC/M^s_o = -\left(\frac{\overline{ME}+\overline{re}}{d/y^*}\right) dP_m$$

which states that in the normal case where a trade surplus results from inflation abroad, the central bank should be able to maintain domestic price stability by contracting domestic credit. Moreover, the required credit contraction is the larger, the more closely the domestic product and the foreign product are substitutes, and the larger is the ratio of imports to domestic expenditures.

B) Policy implications

The analytical results, stated in equations (19), (20), (21), and (23) above, may be summarized as follows:

a) In the absence of domestic credit expansion or contraction, the impact of imported inflation on domestic prices depends systematically on the "degree of openness" of the economy, which in turn is determined by the substitutability between domestic products and foreign products on the one hand, and the ratio of imports to domestic expenditures on the other. Operationally, product substitutability is reflected in the size of the induced change in the country's trade balance relative to both its domestic money supply and domestic expenditures. The larger the sum of these two ratios, and the larger the ratio of imports to domestic expenditures, the larger will be the impact of import-price increases on domestic prices. Only in the extreme case, where both the induced change in the trade balance and the import ratio are very large, will import-price increases be *fully*

reflected in domestic-price increases.

b) The central bank in an open economy can have at least partial control over the domestic money supply, again depending upon the "degree of openness" of the economy as defined above. However, even in a highly open economy, domestic credit expansion or contraction will affect domestic money supply as a result of induced changes in the domestic demand for money which are brought about by changes in real expenditures and domestic prices.

c) Hence, the central bank could effectively use domestic-credit policy for combating imported inflation. However, the usual prescription of a simple "sterilization policy"—whereby central-bank domestic credits are adjusted merely to offset fluctuations in its foreign assets—would not be sufficient for achieving domestic price stability. The reason is that this prescription fails to take into account the "resource effect" of imported inflation (i.e. the reduction in supply of goods to the domestic economy).

The above analysis deals only with the efficacy of central-bank price-stabilization policy in an open economy. Its *feasibility* and *desirability* are separate matters.

First, the duration of inflation abroad may be critical in determining a central bank's ability to continue using domestic-credit policy for offsetting imported inflation. Such a policy is apt to be more viable when the problem of foreign inflation is short-run rather than long-run in nature.

Second, central-bank policy instruments are still quite rudimentary in many developing countries. Open-market operations are often infeasible where central banks hold few marketable domestic assets, especially in countries where the development of domestic money markets has been stifled by an official low-interest-rate policy. Central-bank discount policy is often ineffective at a time when the banking sector is already awash with liquidity arising from balance-of-payments surpluses. Adjustments in reserve requirements are sometimes subject to statutory ceilings. For lack of alternatives, many central banks have relied largely on moral suasion to control the growth of domestic credit. Altogether, the room for maneuver is frequently limited.

Thirdly, even if a central bank is well endowed with flexible policy instruments, a policy of systematic sterilization of foreign assets through domestic-credit contraction is tantamount to a deliberate switch from domestic assets to foreign assets in the central bank's portfolio. Given the amount of national savings, this implies a substitution of investments in liquid foreign assets for domestic capital formation.[11] The desirability of such a policy may be questioned, especially where national savings are very limited and act as a constraint on economic development.

The effectiveness of central-bank policy for price stabilization thus depends upon circumstances. Central banks generally should be able to use domestic-credit policy to maintain domestic price stability a) when inflation abroad is of relatively short duration, b) when the economy is relatively "closed" in the sense defined in this paper, and c) when the central bank is able to employ flexible domestic-credit policy. However, both the feasibility and the desirability of such policy action may be doubtful when none of these conditions is fulfilled. In this situation, domestic price stability may not be feasible without adjusting the exchange rate of the national currency.[12]

II. Empirical Tests for Pacific Basin Countries

How well does the monetarist model we have described explain the inflationary experiences of countries with fairly open economies? To answer this question, we analyzed 1948-73 data for eight Pacific Basin countries with varying degrees of dependence on trade, levels of development, and rates of inflation.[13] Using regression procedures, we attempted to answer these questions:

(1) Is inflation in the Pacific Basin countries a monetary phenomenon consistent with the quantity equation $MV = PQ$?

(2) Has imported inflation significantly affected inflation rates in those countries? That is to say,

in terms of the quantity equation, have changes in P_m significantly affected P?

(3) Can central banks control the money supply and thereby combat imported inflation, if the exchange rates for their respective currencies are not freely floating—i.e., is M controllable by the monetary authorities?

To test the first proposition, we rearranged terms in the quantity equation to obtain $P = MV/Q$. Taking logarithms and differentiating with respect to time, we obtain[14]

$$(24) \quad \dot{P} = \dot{M} + \dot{V} - \dot{Q}$$

Hence, one would expect changes in the money supply to have a positive effect on domestic prices, and changes in real domestic expenditure (or output) to have a negative effect. Since changes in the money supply may be offset by changes in velocity, however, it is also important to test our assumption of stable velocity.

The first set of regressions reported in Table 1 is based on equation (10), which is a variant of equation (24), and is of the general form:

$$(25) \quad \dot{P} = a_o + a_1\dot{M}_{-1} + a_2\dot{M}_{-2} + \ldots + a_n\dot{y}^* (\text{or } \dot{y})$$

where:

$\dot{P}$ = annual percent change in the CPI index,

$\dot{M}$ = annual percent change in domestic money supply (currency and demand deposits; subscript denotes number of years lagged),

$\dot{y}^*$ = annual percent change in real domestic expenditure (measured in constant 1963 dollars),

$\dot{y}$ = annual percent change in real GNP (measured in constant 1963 dollars).

With this format, any change in velocity will be captured by the constant term. In addition, this specification permits the money supply to affect prices with lags, whereas our formal model posits instantaneous adjustment.[15] Both real GNP and real domestic expenditure were tried as explanatory variables, and the best results are presented in Table 1.

On the whole, this very simple specification works quite well for all countries except New Zealand. Except for the latter, the regression equation explains between 40 to 80 percent of the variation in inflation rates; all the variables have correct signs; the constant term is insignificant (implying no changes in velocity); and the Durbin-Watson statistics are reasonably good. At least one money-supply variable is statistically significant in every case but New Zealand, and a lag of two years typically generates the best results. Not surprisingly, the regression results with the real-income or real-expenditure variables do not differ significantly, and in subsequent regressions we only report the results using real output as the explanatory variable.

To test the imported-inflation hypothesis, we added an import-price term to equation (25) to obtain

$$(26) \quad \dot{P} = a_o + a_1\dot{M}_{-1} + a_2\dot{M}_{-2} + \ldots + a\,\dot{P}_m + a\,\dot{y},$$

where:

$\dot{P}_m$ = annual percent change in the import price index in the current period (or in some cases lagged one year).

$\dot{C}$ = annual percent change in central-bank domestic assets.

Part (b) of Table 1 reports the results when the money supply is included as an explanatory variable. The import-price variable is highly significant and positive for the three developed countries (Australia, Japan, and New Zealand) as well as for the Philippines; it is significant about the 10-percent level for all remaining countries except Malaysia. Thus, imported inflation appears to have been a significant factor contributing to domestic inflation in nearly all these countries during the 1948-73 period.

Moreover, the addition of the import-price term tends to reduce the coefficients of the money-supply variables as well as the values of the t statistic associated with them. This is not surprising, since we would expect rising import prices normally to increase a country's foreign-exchange reserves, and thereby lead to an expansion in its money supply—provided no offsetting action were undertaken by the monetary authorities. Thus, changes in import prices and

Table 1

(a) Regression Results With Import Prices Excluded

$$\dot{P} = \alpha_0 + \alpha_1 \dot{M}_{-1} + \alpha_2 \dot{M}_{-2} + \ldots + \alpha_n \dot{y} \text{ (or } \dot{y}^*)$$

COUNTRY	α_0	$\dot{M}_{-1}$	$\dot{M}_{-2}$	$\dot{y}$	$\dot{y}^*$	$\bar{R}^2$/D.W.	D.F.
Australia	.23	.43**	.41**		−.08	.79	19
	(.43)	(5.44)	(5.30)		(.68)	1.61	
Republic of China	6.18*	.09	.22**	−.77**		.41	17
	(1.76)	(.73)	(2.32)	(2.87)		2.22	
Japan	−.49	.14**	.19**		−.05	.45	16
	(.26)	(2.16)	(2.74)		(.44)	1.47	
Korea	3.51	.07	.32**	−2.55		.51	16
	(.50)	(.47)	(2.44)	(.57)		1.84	
Malaysia	.83	.11*	.16**		−.15**	.54	12
	(.12)	(1.93)	(2.94)		(2.94)	2.60	
New Zealand	4.16**	.06	.05	−.02		0	19
	(5.09)	(.61)	(.50)	(.57)		.72	
Philippines	2.22	.43**	.15**		−.51**	.77	18
	(1.44)	(5.00)	(2.27)		(3.67)	2.06	
Thailand	−.66	.18	.35**	−.11		.50	18
	(.33)	(1.36)	(3.38)	(.91)		1.83	

(b) Regression Results with Import Prices Included

$$\dot{P} = \alpha_0 + \alpha_1 \dot{M}_{-1} + \alpha_2 \dot{M}_{-2} + \ldots + \alpha_m \dot{y} + \alpha_n \dot{P}_m$$

COUNTRY	α_0	$\dot{M}_{-1}$	$\dot{M}_{-2}$	$\dot{y}$	$\dot{P}_m$	$\bar{R}^2$/D.W.	D.F.
Australia	−.13	.21**	.18**	.19**	.58**	.93	18
	(.22)	(3.89)	(2.98)	(2.19)	(6.03)	2.52	
Republic of China	13.9**	−.02	.08	−1.11**	.10	.55	15
	(3.81)	(.21)	(.84)	(4.66)	(1.62)	1.96	
Japan	2.44	.13**	.14**	−.20	.32**	.70	18
	(1.27)	(2.05)	(2.05)	(1.58)	(6.32)	.96	
Korea	9.87	−.09	.14	−.22	.35	.43	8
	(1.26)	(.64)	(1.24)	(.80)	(1.74)	1.57	
Malaysia	.79	.08	.11	−.22**	.04	.49	11
	(.94)	(1.34)	(1.67)	(2.73)	(.23)	2.53	
New Zealand	2.53**	.11	−.03	.08	.40**	.44	17
	(2.62)	(1.48)	(.35)	(.62)	(3.98)	1.81	
Philippines	1.19	.27**	.23**	−.38**	.25**	.77	17
	(.80)	(2.45)	(3.53)	(2.49)	(2.97)	1.52	
Thailand	−1.16	.16	.39**	−.10	.20	.35	15
	(.56)	(.95)	(2.48)	(.74)	(1.73)	1.85	

t statistics in parentheses

** Statistically significant at the 5% level

* Statistically significant at the 10% level

in the money supply are not truly independent of each other.

The critical issue for policy purposes is whether the money supply can be controlled. If changes in domestic credit are fully offset by changes in international reserves, monetary policy is ineffective in combating imported inflation. As a simple test of this proposition, we ran the following regression for each country:[16]

$$(27) \quad \dot{R}_i = a_o + a_1\dot{R}_w + a_2\dot{C}_i + a_3\dot{E}_{-1}$$

where:

$\dot{R}_i$ = percent change in central-bank foreign assets of country *i*.

$\dot{R}$ = percent change in world international reserves.

$\dot{C}$ = percent change in central-bank domestic assets.

$\dot{E}_{-1}$ = percent change in the exchange rate (domestic currency units / U.S. dollar) lagged one year.

The domestic-credit variable had large negative coefficients which were statistically significant for the three developed countries (Australia, Japan, and New Zealand). For the developing countries, either the variable was statistically insignificant (China, Malaysia, Philippines), or its coefficient was positive (Korea) or negative but small (Thailand). The world-reserve variable was also highly significant for the developed countries, but not for the developing countries. Thus, the results suggest that independent monetary policy under a fixed-exchange-rate regime may be more difficult for developed countries than for the developing countries.[17]

In conclusion, the following inferences may be drawn from the regression results:

(1) A monetarist model helps explain the magnitude of inflation in the Pacific Basin region.

(2) During 1948-73, imported inflation appears to have contributed significantly to domestic inflation in nearly all Pacific

Table 2
Regression Results For Reserve Changes

$$\dot{R} = \alpha_o + \alpha_1\dot{R}_w + \alpha_2\dot{C}_i + \alpha_3\dot{E}_{-1}$$

COUNTRY	α_o	$\dot{R}_w$	$\dot{C}_i$	$\dot{E}_{-1}$	$\bar{R}^2$/D.W.	D.F.
Australia	5.69	.93**	–.79**	–.15	.87	10
	(1.27)	(2.74)	(5.91)	(.63)	1.64	
Republic of China	32.4**	.24	–.25	–.32	0	17
	(2.68)	(.25)	(.95)	(.57)	1.95	
Japan	13.35**	3.64**	–.89**	6.82**	.82	16
	(2.13)	(7.15)	(5.39)	(3.77)	2.40	
Korea	38.5*	–2.18	1.09**	–.43*	.29	19
	(1.81)	(1.46)	(3.17)	(1.91)	2.13	
Malaysia	2.91	.21	.07	–2.9**	.30	10
	(.88)	(1.18)	(1.57)	(2.3)	2.20	
New Zealand	4.32	2.43**	.64*	1.08**	.46	20
	(.52)	(3.48)	(1.83)	(2.17)	2.40	
Philippines	–94.90	8.50	1.69	–.93	0	20
	(1.03)	(1.29)	(.40)	(.35)	1.97	
Thailand	11.74**	–.12	–.12*	–4.26	.24	13
	(4.18)	(.57)	(2.06)	(1.07)	1.37	

t statistics in parentheses

** Statistically significant at the 5% level

* Statistically significant at the 10% level.

Basin countries examined.

(3) Imported inflation appears to have affected domestic prices more strongly in the developed countries than in the developing countries in the region. Since the latter countries tend to have larger import ratios than the former, this finding illustrates the danger of relying on the import ratio as the sole measure of the degree of "openness" of a national economy.

(4) Independent monetary policy also appears to be less feasible for the developed countries than for the developing countries in the sample. This finding helps explain the wider dispersion of inflation rates among the developing countries than among the developed countries, to the extent that the developing countries are less well integrated into the world economy.

FOOTNOTES

1. Turnovsky, S. J. and Andre Kaspura, "An Analysis of Imported Inflation in a Short-Run Macroeconomic Model," *Canadian Journal of Economics,* 7 (August 1974).

Kwack, Sung, "Price Linkages in an Interdependent World Economy: Price Responses to Exchange Rate and Activity Changes," paper prepared for the NBER Conference on Research in Income and Wealth, "Price Behavior: 1965-1974," November 21-23, 1974 in Washington, D.C.

2. Shinkai, Yoichi, "A Model of Imported Inflation," *Journal of Political Economy,* 81 (July-August 1973).

3. The world-monetarist approach dates back to David Hume in the eighteenth century. Its modern revival arises from the writings of Harry G. Johnson and Robert A. Mundell. It is important to note that Johnson's model is a balance-of-payments model, and the focus of Mundell's analysis is on the "seigniorage" problem. Neither of these articles expressly dealt with the determination of the domestic price-level.

Johnson, Harry G., "The Monetarist Approach to Balance of Payments Theory," in his *Further Essays in Monetary Economics* (Harvard University press, 1973).

Mundell, Robert C., "Seigniorage and the Optimum World Central Bank," in his *Monetary Theory: Inflation, Interest, and Growth in the World Economy* (Goodyear: 1971).

4. The 41 countries are Austria, Belgium, Canada, Denmark, France, Germany, Italy, Japan, Netherlands, Norway, Sweden, Switzerland, The United Kingdom, The United States (industrial countries); Argentina, Australia, Brazil, Chile, China (Republic of), Colombia, Egypt, Finland, Greece, Iceland, India, Iran, Ireland, Israel, Korea, Malaysia, Mexico, New Zealand, Pakistan, Philippines, Portugal, South Africa, Spain, Sri Lanka, Thailand, Turkey, and Venezuela (developing countries).

5. Intuitively, the product-differentiation concept should be extended to cover differentiation between domestic and foreign financial assets. That, however, has not been accomplished in this model, which for simplicity abstracts from international capital flows. The implicit assumption is that, for the majority of countries today, the substitutability between foreign and domestic financial assets is so small that the domestic capital market may be considered virtually insulated from foreign capital markets. Nevertheless, the abstraction from international capital flows remains a major shortcoming of the model for application to other circumstances.

6. Note that the traditional monetary theory assumes the demand for real balances to be a function of real income or wealth, not real expenditures. In equation (1), we emphasize the motive for holding domestic money as for anticipated or potential expenditures at home, including those on both domestic and imported products, but excluding foreigners' purchases of the country's exports. The shift in emphasis will have implications on the type of price indices dealt with in the model, as to be shown below.

7. The "monetary effect" becomes negative, i.e., a reserve drain instead of a reserve gain, when the initial volume of imports is sufficiently large such that the enhanced import cost resulting from higher import prices exceeds the sum of the induced increase in exports and reduction in imports. An illustration of the case is the large trade deficits sustained by many countries as a result of the 1973 increases in oil-import prices. In such instances, since the "monetary effect" and the "resource effect" must always be in the same direction, the import price increases are deflationary, rather than inflationary to the economy.

8. Note that although the measurement of changes in real income is beset with the index-number problems, the "resource effect" as defined in this paper—being a ratio of the trade balance to the initial domestic expenditure—is devoid of such problems. It is, thus, a concept as fully operational as that of the "monetary effect." The outflow of real resources induced by inflation abroad corresponds to the "seigniorage effect" in Mundell's model. See Mundell (1971).

9. Formal relationships between the "monetary effect" and "resource effect" and the elasticities of substitution may be derived as follows: From aggregate-utility functions of a constant-elasticity-of-substitution type (CES function), both the export demand and import demand can be expressed as functions of the terms of trade. Their partial derivatives with respect to the terms of trade are positively related to the elasticities of substitution.

10. Equation (21) suggests that domestic credit expansion will have a positive effect on domestic money supply, regardless of the degree of openness of the economy. The result is at variance with that obtained from world-monetarist models, which hold that the national central bank cannot control the domestic money supply in an open economy, since domestic credit expansion will be exactly offset by foreign-reserve losses. The difference arises from the fact that (i) we assume product differentiation, whereas the world-monetarist models assume homogeneous products; and (ii) the demand for real balances is a function of real domestic expenditure in our model, but a function of real national income in the world-monetarist models. The result is that a domestic-credit expansion in our model brings forth a rise in the nominal demand for money through an import surplus (i.e. $dy^*/dC > 0$) and a rise in the domestic-expenditure prices ($dP/dC > 0$), both of which will induce the public to hold a larger amount of the

domestic money. In contrast, by assuming homogeneous products, the world-monetarist models rule out any induced changes in the domestic-price level; by relating demand for real balances to real income, rather than real expenditure, they also preclude any effects changes in trade balance might have on the demand for real balances.

11. Shaw, Edward, "International Money and International Inflation: 1958-1973," Federal Reserve Bank of San Francisco, *Business Review*, this issue.

12. It can be shown, by letting E to vary so as to set dR to zero, that a nation can be completely insulated from inflation abroad under freely floating exchange rates.

13. The eight countries included in the sample, along with three key economic indicators, are listed below:

Country	*Imports/GNP (1972)*	*Per Capita Income (1972)*	*CPI Inflation Rate (1960-72)*
Australia	0.15	US $2,980	3.0%
Republic of China	0.43	490	3.3
Japan	0.08	2,320	5.8
Korea	0.26	320	13.0
Malaysia	0.45	430	1.2
New Zealand	0.23	2,560	4.6
Philippines	0.17	220	6.5
Thailand	0.21	220	2.2

Sources: International Monetary Fund, *International Financial Statistics*, March 1975; Asian Development Bank, *Key Indicators of Developing Members Countries of ADB*, October 1974; and International Bank for Reconstruction and Development, *World Bank Atlas*, 1974.

14. Harberger, Arnold C., "Some Notes on Inflation," in *Inflation and Growth in Latin America*, Werner Baer and Isaac Kerstenetsky, eds. (Yale University Press, 1964).

Vogel, Robert C., "The Dynamics of inflation in Latin America, 1950-1969," American Economic Review, 64 (March 1974).

Meiselman, David, "Worldwide Inflation: A Monetarist View," American Enterprise Institute paper, 1974.

In each case the authors were interested in explaining inflation in Latin America and assumed that the domestic money supply was subject to the control of the national monetary authorities.

15. Current changes in the money supply are not included as an explanatory variable, since the data on prices are annual averages, whereas the money-supply data are for end-of-years. Inclusion of the current period's money supply would be equivalent to having changes in prices *lead* changes in money supply by six months on average.

16. Johnson's specification actually compares growth in domestic credit in the individual country to that in the rest of the world, and includes a comparable real income variable. We found the latter variable to be insignificant in most cases, however.

17. The results, however, are suggestive but not conclusive, since an equally plausible explanation might be that the developed countries pursued a deliberate sterilization policy, whereas the developing countries did not. See, for instance, the article by Joseph Bisignano in this issue.

Appendix:

Symbols used in the model.

Endogenous variables

- M: money supply.
- y*: real domestic expenditure expressed in units of domestic product.
- P: index of domestic-expenditure prices.
- d: real national expenditure on the domestic product.
- m: volume of imports.
- x: volume of exports.
- P_d: price of domestic product.
- R: foreign reserves in the central bank's portfolio.
- T: the nation's terms of trade, i.e., the ratio of its export price to its import price, both in terms of the national currency.

Exogenous variables:

- y: real national output in units of domestic product.
- R_o: central bank's foreign-reserve holding at the beginning of the period.
- C: domestic credits extended by the central bank.
- E: exchange rate of the national currency per unit of foreign currency.
- P_m: price of foreign product.

Parameter

- k: positive constant