

A Note on the Effects of Imported Inflation in a Small Open Economy

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In an attempt to explain the recent worldwide acceleration of inflation, economists have paid increasing attention to the patterns of international transmission of inflation. Most of the studies of this issue suggest that imported inflation has played a significant role in accelerating domestic inflation, even after granting that other structural factors within an economy have also been responsible for inflation.

Combining various monetarist or Keynesian open models, Mundell (1971), Shinkai (1973), and Turnovsky & Kaspura (1974) provided theoretical investigations about how an open economy is affected by imported inflation. Their common argument is that domestic output in an inflation-importing country will increase due to an increase in exports and a fall in imports, and a shift in demand from imported goods to domestic goods.

However, it is questionable whether the above argument is generally applicable to any economy without considering its specific structural aspects. Since these models provide only an abstract framework of the inflation-importing mechanism of some advanced countries, it would be necessary to modify these models by taking into account the structural specifications of the economy in question, such as its dependency on the foreign resources and its vulnerability to a change in international markets.

The purpose of this paper is to derive some policy implications

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for a small open economy which is structurally dependent upon, and vulnerable to, imported inflation. It will be shown that if the economy is structurally dependent upon the import sector and does not have enough domestic capacity to accommodate its demand shift, the argument of previous studies might not hold; that is, the imported inflation has neither a positive nor a negative effect on the economy. The situation will be even worse if both exports and imports are dependent upon one or two major trading partners who export inflation. In the following section, we outline the basic model for a small dependent open economy operating under a fixed exchange rate system. In Section II, we investigate the channels and the resulting effects of imported inflation on GNP, the balance of payments, and domestic price levels by the comparative static analysis method. Section III will provide an empirical study of Korea which was a typically dependent open economy during the period of 1956-1975. Lastly, we derive conclusions from the comparative static and empirical analysis together with some policy implications.

I. The Model for a Small Open Economy

We base our model on the long-run stock equilibrium specifications under a fixed exchange rate system for the following reasons. First, in the short-run, all the second round feed-back effects of imported inflation would not be captured. Second, our primary interest lies in developing a long-run strategy for a dependent open economy to cope with imported-inflation, rather than short-run measures. Third, if the economy is under a purely flexible exchange rate system, it is theoretically isolated from inflation abroad through a perfect adjustment mechanism of the balance of payments. Most of small open economies are in practice under the fixed exchange rate system.

We start from the following GNP identity:

$$(1) Y = C \left\{ Y, \frac{(1 + p_1)}{e(1 + q)} \right\} + I \left\{ Y, i, \frac{(1 + p_1)}{e(1 + q)} \right\} + G_d + \\ X \left\{ Y_f, \frac{(1 + p_1)}{e(1 + q)} \right\} - M \left\{ Y, \frac{(1 + p_1)}{e(1 + q)} \right\}$$

where Y is real national income in the inflation-importing country, p_1 is the inflation rate of the market price of domestically produced goods; q is the inflation rate of the market price of foreign goods; e is the price of foreign exchange in terms of domestic currency; i is the domestic rate of interest; and G_d is a domestic government expenditure. The rationale of separating domestic absorption into the consumption function (C) and the investment function (I) is that we are interested in the effects of imported inflation on each of these GNP components. The export function (X) and the import function (M) best represent the feature of dependence in this small open economy. That is, exports are no longer exogenously given but are closely related to the variations of a specific foreign real GNP (Y_f) and its relative price. The open economy may be dependent in terms of either the import source or the product market. It will be more dependent if it has only one or two trading partners for both imports and exports. Investment in this economy has been postulated as a function of the nominal rate rather than the real interest rate, since the latter needs the assumption of price expectation and does not reflect risk factors predominant in a small economy.¹

Second, in the monetary sector, the equilibrium condition can be set as

$$(2) L(Y, i) = L_{-1} + \theta D + \frac{sB}{1 + p_1} + \sigma$$

where L is the current demand for real money; L_{-1} is the supply of real money in the previous period; D is the real government deficit; B is the nominal balance of payments surplus; and σ is any arbitrary monetary policy. The parameters θ and s (sterilization) would measure the responsiveness of the domestic money supply to the government deficit and foreign balance, respectively.² This analysis of money supply factors enables us to investigate the channels through which the imported inflation affects the money market while it reaches a new equilibrium solution.

Third, we specify the following balance of payments equation in nominal terms:

1 A similar argument can be found in Shaw (1973) Ch. 2.

2 See Takayama (1972).

$$(3) B = (1 + p_1) X \left\{ \frac{1 + p_1}{e(1 + q)}, Y_f \right\} - e(1 + q) M \left\{ Y, \frac{1 + p_1}{e(1 + q)} \right\} \\ + K(Y, i - i_f)$$

The import function has been specified in terms of GNP and relative price as usual. The capital inflow is viewed to be affected by both the level of real GNP and the interest rate differential (instead of the domestic interest rate itself), $i - i_f$, where i_f is the foreign rate.

Lastly, we have to specify the relationships among prices. We postulate that the domestic price level $(1 + p_1)$ is affected by both the demand pull factor, $(Y_t - Y_{t-1})$ and the cost-push factor (i and $1 + q$). The *overall* price level $(1 + p)$ for all domestic and imported goods will be the results of the response to both the domestic inflation rate (P_1) and the imported inflation rate (q). That is,

(4) $P_1 = 1 + p_1 = F \{ Y_t - Y_{t-1}, i, e(1 + q) \}$; domestic price level

(5) $P = 1 + p = \partial_1(1 + p_1) + \partial_2 e(1 + q)$; over-all level

where capital letters P_1 and P signifies the levels and lower cases p_1 and p indicate the inflation rates.

The above basic model provides a framework with which we can investigate the effects of imported inflation on various sectors of the economy. The results will depend upon the magnitudes of responsiveness in each sector and various parameters. The investigation can be of a theoretical or empirical nature. In the next sections, we provide a theoretical investigation and its interpretation followed by an empirical study.

II. Comparative Static analysis of Imported Inflation

The question of interest is how an imported inflation, $(1 + q)$, will affect each of the aggregate variables of the economy; i.e., real GNP, the balance of payments, and the domestic inflation rate, (p) . We can identify major channels through which imported inflation exerts initial impacts on various sectors by differentiating equations from (1) to (5) with respect to the inflation rate of the import price index (q). The result is the following simultaneous equation system:

$$(6) \begin{pmatrix} (1 - C_y - I_y) & -I_i & 0 & \lambda & 0 \\ & L_y & L_i - s/(1+p) & 0 & \phi \\ K_y - e(1+q)M_y & K_i & -1 & \psi & 0 \\ & -F_y & -F_i & 0 & 1 \\ 0 & 0 & 0 & -\theta_1 & 1 \end{pmatrix} \begin{pmatrix} \frac{dY}{dq} \\ \frac{di}{dq} \\ \frac{dB}{dq} \\ \frac{dP_1}{dq} \\ \frac{dP}{dq} \end{pmatrix} = \begin{pmatrix} \frac{dD^*}{dq} \\ 0 \\ \frac{dB^*}{dq} \\ -\frac{dP^*}{dq} \\ \theta_2 \end{pmatrix}$$

where $\lambda = - (C_r + I_r) / e (1 + q)$

$$\phi = M_r / (1 + p)^2 - \theta D / (1 + p)$$

$$\psi = X + X_r (1 + p_1) / e (1 + q) - M_r$$

$$\frac{dP^*}{dq} = F_q$$

$$\frac{dD^*}{dq} = - (C_r + I_r) (1 + p_1) / e (1 + q)^2,$$

and
$$\frac{dB^*}{dq} = e M + (1 + p_1) / e (1 + q)^2 \cdot \{ (1 + p_1) X_r - e (1 + q) M_r \}$$

with subscript r denoting partial differential with respect to relative price, $(1 + p_1) / e (1 + q_1)$

Using Cramer's Rule, we get the following comparative static results:

$$(7) \frac{dY}{dq} = \left\{ \frac{dD^*}{dq} \cdot L_i - \left(\frac{s}{1+p} \right) \lambda K_i \frac{dp_1^*}{dq} \right\} / |J|$$

$$(8) \frac{dB}{dq} = \left\{ (1 - C_y - I_y) L_i \frac{dB^*}{dq} + \lambda \phi \{ K_y - e (1 + q) M_y \} \right\}$$

$$(-F_1 \partial_2) / |J|$$

$$(9) \frac{dP_1}{dq} = \left\{ (1 - C_y - I_y) L_i \frac{dp^*}{dq} - \left(\frac{s}{1+p} \right) K_i F_y \frac{dD^*}{dq} \right\} / |J|,$$

where J is the Jacobian of the system (1) through (5) and $|J|$ is the determinant of the matrix in (6).

1. *Transmitting Channels*

The mathematical comparative-static result shows us that there are mainly three channels — demand-shift effect, (dD^*/dq) , balance of payments effect, (dB^*/dq) , and price effect, (dp^*/dq) , through which an imported inflation is transmitted to various sectors of the economy. These channels reflect initial direct impacts of the imported inflation. Their interactions and feed-backs will determine the overall effects on the economy.

A. *Demand-Shift Effect*

The rise in import prices will result in some substitution of domestic products for imports, and since it reduces relative price, $\frac{(1+p_1)}{e(1+q)}$ we call it the demand-shift effect. The magnitude of this effect depends upon various factors of the economy. In general, the demand-shift in developing countries will be less significant than that in developed countries. And the demand-shift in the investment sector of a developing economy will be smaller than in the consumption sector, because investment goods are usually more difficult to produce domestically. Even among developing economies, the magnitude will differ, depending upon the type of development strategies—import substitution or export expansion. In short, even though an imported inflation is most likely to bring about a positive demand-shift effect, its magnitude should be carefully evaluated.

B. *Balance of Payments Effect*

As far as the balance of payments effect is concerned, the final outcome would be ambiguous in terms of its sign. If the economy's

export industry is of a simple remanufacturing type, and its price elasticity is high, then the burden of import bills, due to an increase in import price plus a relative reduction in exports, might bring about not only a deterioration in the terms of trade, but also an actual balance of payments deficit, and vice versa. Therefore, the net effect on the balance of payments will depend upon the structure of the export industry. The more dependent it is upon imports for raw materials and intermediate goods, the stronger will be the negative impact of an imported inflation.

C. Price Effect

The price effect shows us how domestic price levels will be affected by imported inflation. The more it is positively affected, the more the positive demand-shift effect and balance of payments effect will be offset. The price effect combined with an increased import price index will contribute to the increase in the consumer price index, ($P = 1 + p$).

2. The Overall Effects of Imported Inflation

Imported inflation is viewed as affecting the domestic economy through the three channels above. It should be noted, however, that these three channels are reflecting only first-round effects. The ultimate effects of imported inflation upon domestic output (real GNP), the balance of payments (B/P), and domestic price levels will be a combined result of the effects in the various sectors of the economy. The mathematical derivation in equations (7), (8), and (9), reveals an ambiguous sign relationship in the overall effects, but they do seem to be crucially dependent upon the signs of initial impacts-e.g., demand-shift effect, balance of payments effect, and price effect.

To derive practical, meaningful comparative static results, let us assume:

a) A positive demand-shift effect ($dD^*/dq > 0$) since the increase in import prices will direct some portion of import demand toward domestic goods in general.

b) An ambiguous balance of payments effect ($dB^*/dq \cong 0$), since we don't know *a priori* whether the economy would satisfy the Marshall-Lerner condition.³

³ Turnovsky & Kaspura (1974) assume that the Marshall-Lerner condition would hold.

c) A positive price effect ($dq_1/dq > 0$), since domestic producers will, in general, increase the price level due to international market conditions and cost increases in raw materials. Then, the overall effect of import inflation is summarized as follows:

First, the effect of imported inflation on real GNP (dY/dq) is ambiguous. It depends crucially upon the magnitude of the demand-shift effect and the price effect. The greater the demand-shift effect, the greater the likelihood of an increase in GNP. The increase in real GNP due to imported inflation will be reinforced if domestic prices are relatively independent of import prices. We

First, the effect of import inflation on real GNP (dY/dq) is ambiguous. It depends crucially upon the magnitude of the demand-shift effect and the price effect. The greater the demand-shift effect the greater the likelihood of an increase in GNP. The increase in real GNP due to imported inflation will be reinforced if domestic prices are relatively independent of import prices. We can also argue that if a certain economy lacks these preconditions, it is likely to experience a decline in real GNP due to imported inflation. Thus, the conventional argument that imported inflation will bring about an increase in real GNP, via increased absorption and exports, cannot hold, if these preconditions are not fully satisfied.

Second, the effects of imported inflation on the "overall" balance of payments (dB/dq not dB^*/dq) is also ambiguous.

However, once we consider the dependence of an export industry on import materials, it is likely to reveal deterioration in both terms of trade and the actual balance of payments. Previous studies based upon the strict Marshall-Lerner condition could only be meaningful if the economy satisfies this condition and has no crucial dependence on import goods.

Third, inflation in import goods will increase upward pressure on domestic inflation if there is a high degree dependence on import materials in domestic goods production.

In short, the comparative static results based upon the model of a small dependent open economy show us that imported inflation will result in neither an increase in real GNP nor an improvement in the balance of payments, unless the economy has reasonable high substitutability, a smaller imports share, and less dependence

on one or two import sources.

III. An Empirical Study—The Case of Korea

We present an empirical study of this model applied to Korea during the last two decades (1956-1975).⁴ The case study of Korea has been attempted for a variety of reasons. It has the necessary dependent characteristics in terms of economic structure—high weights (40%) of foreign sectors in GNP components, lack of diversified import sources (imports from and exports to the U.S. and Japan are over 70% of the total), and a high dependence on imported raw materials and intermediate goods. In addition, the data (especially the import price index) was available over a relatively longer period, which is essential for this kind of long-run study.

The reduced form of the estimation model and its results are presented on the next page. Yearly data and common unit (Korean won) have been adopted to avoid conversion problems. The two-stage least square estimation method has been employed. Because the regressions are well fitted, with reasonably high R^2 's and t -ratio's, the following interesting facts seem to be revealed through the estimation. (See Table 1).

1. Despite the fact that the Korean economy has pursued a high rate of economic growth, the economy has suffered significantly from imported inflation during the period, 1973-1975. Regression results suggest that an abnormally high import price index could have contributed to deteriorating the balance of payments, and a slower growth rate of real GNP.
2. The dependence of the domestic price level on the import price level (on the import price index) is amazingly high, reflecting the structural nature of the economy.
3. The domestic inflation has been due to cost-push factors rather than demand-pull factors. That is, the demand control was relatively more successful than the cost control was.

⁴ Otani (1975) presents a quarterly empirical model applied to the Phillipine case. He showed that the influence of imported inflation in Phillipine was substantial, especially during 1972-74.

4. The balance of payments effect on the domestic money supply was almost negligible. This is a plausible result since there existed a balance of payments deficit and government controls over the exchange market during this entire period.

Table 1

SIMULTANEOUS EQUATION RESULTS OF
KOREAN ECONOMY 1956-1975

- (1) Consumption: $C = 283.32 + 0.6044 Y - 0.1519$
 (6.73)(40.95) (-1.08)
 $\left[\frac{1 + p_1}{e(1+q)} \right]; \hat{R}^2 = 0.99$
 $d = 1.38$
- (2) Investment: $I = 338.06 + 0.3261 Y + 0.2228$
 (5.69)(23.56) (1.37)
 $\left[\frac{1 + p_1}{e(1+q)} \right] - 3.6355 i; \hat{R}^2 = 0.98$
 $d = 1.50$
- (3) Imports: $IM = 423.20 + 0.39991 Y + 0.4739$
 (-10.51)(28.27) (3.53)
 $\left[\frac{1 + p_1}{e(1+q)} \right]; \hat{R}^2 = 0.98$
 $d = 1.66$
- (4) Capital Inflow: $K = -35.33 + 0.0315 Y - 0.7836 (i - i_f);$
 (-2.86)(6.67) (-1.19)
 $\hat{R}^2 = 0.70$
 $d = 0.72$
- (5) Wholesale Price Index: $P_1 = 14.22 + 1.493 (1 + q) - 3.4389 i -$
 (1.42)(19.44) (-5.55)
 $0.0060 (Y_t - Y_{t-1}); \hat{R}^2 = 0.90$
 $d = 2.10$

$$(6) \text{ Consumer Price Index: } P = 2.02 + 0.898 p_1 + 0.1814 q ;$$

$$(0.26) \quad (6.18) \quad (0.89)$$

$$\hat{R}^2 = 0.98$$

$$d = 0.46$$

$$(7) \text{ Export: } X = 2216.04 + 1.8759 Y_f + 2.4655$$

$$(-5.66) \quad (6.98) \quad (2.87)$$

$$\left(\frac{1 + p_1}{e(1 + q)} \right); R^2 = 0.79$$

$$d = 1.54$$

$$(8) \text{ Money Supply: } M/P = 2.2950 + 1.2973 M + 0.533 D -$$

$$(0.19) \quad (19.51) \quad -1 \quad (0.41)$$

$$0.024 B ; R^2 = 0.97$$

$$-3.11) \quad d = 1.62$$

$$(9) \text{ Interest Rate: } i = 19.4996 + 0.0202 Y - 0.2848 M/P ;$$

$$(-2.56) \quad (8.18) \quad (-5.87)$$

$$R^2 = 0.42$$

$$d = 0.92$$

Note: The figures in parenthesis are t-ratios and \hat{R}^2 is adjusted R^2 and d is the Durbin-Watson Statistic.

Data: IMF *International Financial Statistics* and The Bank of Korea, *Monthly Statistical Bulletin*.

IV. Conclusion

We have investigated how a small open economy can be affected by imported inflation. Both theoretical and empirical interpretations suggest that if the economy is of a structurally dependent nature, the vulnerability of the economy to an inflationary shock from abroad would be great.

As we have analyzed, the fiscal and monetary policy in such an economy will clearly have to face harder obstacles since it has to cope with both domestic and foreign inflation. Its foreign exchange policy becomes increasingly important since a devalua-

tion has the same effect as an imported inflationary shock. Because of the fact that in this type of economy the effects of fiscal and monetary policy are *difficult to conjecture* (due to barriers in capital markets and tax systems), policy implication will be limited to a structural one casting some insights upon development strategy.

First, a small open economy should aim at increasing both domestic substitutability, and the diversity of import sources to minimize inflationary shocks from abroad. It goes without saying that the substitutability will be increased if the export industry has a large domestic base. In this context, the development strategy for enlarging the domestic market as well as foreign market should not be overlooked or understated.⁵

Second, even if a fixed exchange rate system seems to be inevitable in many developing economies, it should be flexible enough to be adjusted whenever there is a need. This would be a difficult task for a country such as Korea which has induced a lot of foreign capital for development purpose. However, it should also be noted that a one-time inflationary shock from abroad will deteriorate the balance of trade ultimately making another devaluation unavoidable, thereby causing an acceleration of the inflationary shock. Thus, a proper devaluation in advance could help in minimizing this kind of acceleration of inflation. The recent imported inflationary shock in Korea would have been less damaging, had there been a more flexible adjustment mechanism in its exchange rate.

Third, it seems natural to conclude that for such a dependent open economy the long-run efforts for building a better economic structure should also be systematically developed in parallel with compatible short-run solutions—proper fiscal-monetary policies and a reasonably flexible exchange rate system.

Lastly, it is important to note that an imported inflation could bring about a slower real GNP growth, or even a decline in real GNP (negative growth) if the economy's foreign sector is highly dependent upon a few trading partners and does not have enough domestic absorption capacity.

⁵ Chenery & Syrquin (1975) also emphasized this fact in terms of long-run development policy.

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