Pakistan Journal of Applied Economics (1983) vol. II, no. 2 (129–146)

IMPORTED INFLATION AND ITS IMPACT:
An Econometric Study of Pakistan Economy, 1969–81

M. Shaukat ALI*

This paper employs a general equilibrium econometric model to determine the extent of imported inflation in Pakistan during the 1970s and its impact on some related macroeconomic phenomenon. It was found that approximately 44 per cent of inflation observed during 1969 to 1981 was contributed by imports, while the remaining 56 per cent could be accounted for by domestic factors, in particular, the growth in money supply. The analysis also suggested that although higher import prices stimulated domestic production, they also tended to increase the trade deficit and to reduce real wages.

I. Introduction

Three distinct theories have been offered to explain inflation in the industrialized countries during the sixties and seventies.[1] The first theory, based on the Phillips Curve, envisages a negative correlation between the rate of growth of money wages, and hence prices, and the unemployment rate. The second, known as the Monetarist inflation theory and associated with the name of Milton Friedman, advocates a close connection between the rate of inflation and the growth rate of money supply per unit of output. The third approach emphasizes 'structural' factors as an explanation for inflation; two of these factors are of particular importance, viz., a higher growth rate of productivity in industrial sector as compared to that in services sector, and a uniform growth of nominal wages in both the sectors.

* The author is working in the Planning Commission, Government of Pakistan, Islamabad. The views expressed in the paper, however, are personal and do not necessarily reflect those of the Planning Commission.

[1] For a survey of these theories, see Frisch (1977).

The above theories however are not directly relevant to the study of developing countries like Pakistan whose heavy dependence on imports makes them vulnerable to what has come to be known as 'imported inflation'.[2] During the seventies Pakistan, as also many other developing countries, experienced a pronounced acceleration of inflation. The overall price level approximated by the GDP deflator registered an increase of 217 per cent during the decade. Several factors on the domestic front such as devaluation of Pakistani Rupee in 1972, bottlenecks on supply side, and excessive monetary expansion contributed towards this price increase, but the role played by the steep rise in world import prices during this period also cannot be ignored. According to available information, world import price index for Pakistan increased from 100 in 1969-70 to 371 in 1979-80 showing an annual average increase of 27 per cent during this period. The present study seeks to examine, in the context of a general equilibrium macroeconometric model, the relationship between worldwide inflation and the rate of domestic inflation in Pakistan. Our model also permits us to examine the impact of import prices on some important macro variables, viz., investment, employment, output and balance of trade.

II. The Model

Before we present our formal model, it is necessary to spell out the mechanism through which increases in world import prices are translated into imported inflation. Two types of effects may be considered:

1. Price (Direct) Effect

This effect pertains to one of the four channels described in the OECD Survey (1973) through which inflationary impulses are transmitted from one open economy to another. Based on a standard proposition of international trade theory that an arbitrage on traded goods will equate domestic prices of these goods with foreign prices, it is maintained that an increase in world import prices would *pari passu* raise the domestic prices of importables provided exchange rate and nominal protection rate are kept unchanged. In other words, there exists a direct international price link for traded goods and this link properly weighted by the share of traded sector in GDP constitutes a major source of imported inflation.

[2] Several Scandinavian economists, among them Aukrust (1970) and Edgren *et al.* (1973), have attempted to incorporate imported inflation by integrating the essential elements of the structural theory of inflation with a special mechanism through which inflation from abroad is transmitted to small economies.

2. *Output (Indirect) Effect*

Since imports are used as an intermediate input, reduction in import volume made necessary by higher prices will adversely affect investment. On the other hand, the price effect under (1), with given nominal wage rate, causes a reduction in the real wage to which producers respond by expanding output and employment. This increase in output will tend to exert a downward pressure on prices. However, any trade deficit arising in the wake of changes in import prices and output if not matched by an equal increase in net capital inflow would affect the money supply and hence the price level. The complete mechanism is depicted in Figure 1.

The above flow diagram suggests that the effect of increasing world prices on domestic inflation must be analyzed in a comprehensive system in which changes in trade flows, prices and outputs are all taken into account. Accordingly an attempt has been made to formulate a comprehensive, though simple and easily manageable, econometric model relevant for a developing country like Pakistan. The model has been designed to facilitate a comparative-static analysis. It is highly aggregated and follows a general equilibrium pattern. Three interlinked markets, goods, labour, and foreign

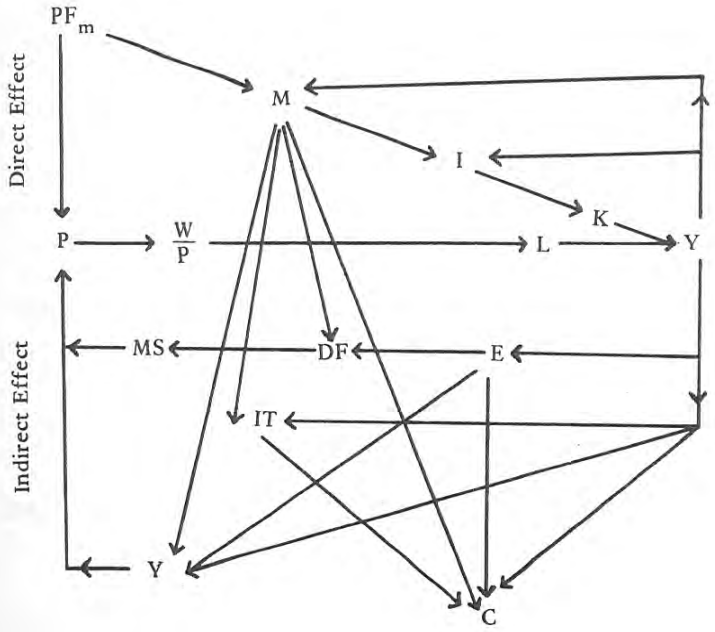

Figure 1

NOTE: For symbols, see Glossary in Table 1

exchange, with given money stock were envisaged to interact and determine the extent of imported inflation and its impact on different macro variables. The structural model along with a glossary of definitions of the symbols used for variables and parameters is presented in Table 1.

TABLE 1

Structural model

$$P = P_o \cdot PF_m^{a_1} \cdot (MS/Y^*)^{a_2} \cdot e^{a_3 \cdot D} \quad (1)$$

$$Y^* = Y - E + M \quad (2)$$

$$Y = A\,[\alpha L^{-\rho} + (1-\alpha)K^{-\rho}]^{-1/\rho} \quad (3)$$

$$\alpha A^{-\rho} \cdot (Y/L)^{1+\rho} = W/P \quad (4)$$

$$L = L_o \cdot W^{\theta} \quad (5)$$

$$K = K_o + I \quad (6)$$

$$I = I_o \cdot Y^{b_1} \cdot M^{b_2} \quad (7)$$

$$M = M_o \cdot Y^{g_1} \cdot (MPF_m/P)^{g_2} \cdot EER_m^{g_3} \quad (8)$$

$$E = E_o \cdot Y^{G_1} \cdot (PF_e/P)^{G_2} \cdot e^{G_3 \cdot D} \quad (9)$$

$$DF = PF_m \cdot M - PF_e \cdot E - NCI \quad (10)$$

$$Y + IT - S + M - E - NCI = C + I \quad (11)$$

$$IT = ty \cdot Y + tm \cdot M \quad (12)$$

Symbols:

Variables*

$\overline{P}$ = Overall price level of the economy approximated by GDP deflator.
$\overline{PF}_m$ = World import price index.
$\overline{MS}$ = Nominal money stock.
Y^* = Net availability of output for domestic consumption.
D = Dummy variable with value of 1 for the post-devaluation years and 0 otherwise.

Y = Value added or GDP at constant factor cost.
L = Employment (man-hours worked during a year).
K = Capital stock in real terms.
W = Nominal wage rate.
I = Investment in constant market prices.
M = Import of goods (c.i.f.) in real terms.
$\overline{EER}_m$ = Effective exchange rate for imports.
E = Exports of goods (f.o.b.) in real terms.
$\overline{PF}_e$ = World export price index.
DF = Current account balance (in $).
$\overline{NCI}$ = Net current invisibles (in $).
IT = Indirect taxes in constant prices.
$\overline{S}$ = Subsidies in constant prices.
C = Consumption expenditure in constant market prices.
$\overline{ty}$ = Indirect tax rate on output.
$\overline{tm}$ = Indirect tax rate on imports.

* Variable with overbars are treated as exogenous.

Parameters

a_1 = Elasticity of P with respect to PF_m.
a_2 = Elasticity of P with respect to MS/Y*.
a_3 = Coefficient for dummy variable.
A = Scale parameter of the production function.
α = Distribution parameter.
ρ = Substitution parameter.
θ = Wage rate elasticity of labour supply.
σ = $1/1+\rho$
b_1 = Output elasticity of investment.
b_2 = Import elasticity of investment.
g_1 = Income elasticity of demand for imports.
g_2 = Price elasticity of demand for imports.
g_3 = Effective exchange rate elasticity of demand for imports.
G_1 = Output elasticity of supply for exports.
G_2 = Price elasticity of supply for exports.
G_3 = Coefficient for dummy variable.

Since the model contains certain non-linear relations, it needs to be linearized for estimation which is carried out either through total differentiation (marginal changes) or log differentiation (proportionate changes).

The latter framework has been adopted here and accordingly the model in log differential form is given in Table 2. The rest of this section presents the rationale of the behavioural equations employed in our model.

TABLE 2*

Model in log differential form

$$P' = a_1 PF'_m + a_2 (MS' - Y^{*\prime}) \quad (1')$$

$$Y^{*\prime} = (Y/Y^*)Y' - (E/Y^*)E' + (M/Y^*)M' \quad (2')$$

$$Y' = \alpha A^{-\rho} (Y/L)^{\rho} L' + (1-\alpha)A^{-\rho} (Y/K)^{\rho} K' \quad (3')$$

$$L' = Y' + \sigma P' - \sigma W' \quad (4')$$

$$W' = (1/\theta) L' \quad (5')$$

$$K' = (I/K) I' \quad (6')$$

$$I' = b_1 Y' + b_2 M' \quad (7')$$

$$M' = g_1 Y' + g_2 (PF'_m - P') + g_3 EER'_m \quad (8')$$

$$E' = G_1 Y' + g_2 (PF'_e - P') \quad (9')$$

$$DF' = (PF_m \cdot M/DF) (PF'_m + M') - (PF_e \cdot E/DF) (PF'_e + E') - (NCI/DF) (NCI') \quad (10')$$

$$YY' + IT \cdot IT' - SS' + MM' - EE' - NCI \cdot NCI' = CC' + II' \quad (11')$$

$$IT' = (ty \cdot Y/IT) (ty' + Y') + (tm \cdot M/IT) (tm' + M') \quad (12')$$

* Variables with prime (') are log differentials. It seems advisable here to indicate the way the identities have been transformed into proportionate changes. Let us take equation (2): $Y^* = Y - E + M$. Taking total differential, $dY^* = dY - dE + dM$. Dividing through by Y^* and making some manipulations, yields $dY^*/Y^* = (Y/Y^*)(dY/Y) - (E/Y^*)(dE/E) + (M/Y^*)(dM/M)$ or $Y^{*\prime} = (Y/Y^*) Y' - (E/Y^*) E' + (M/Y^*) M'$, which exactly corresponds to equation (2). [For similar differentiation, see Taylor and Black, (1974)]. The percentage change thus derived differs slightly from the percentage change derived in a discrete-time model where Y' would be equal to DY_t/Y_{t-1} rather than dY/Y. This is so because in discrete time model one is interested in the behaviour of variables *over time* whereas in a static-simulation model like ours the prime interest lies in the behaviour of variables *before and after the exogenous disturbance at a given point of time.*

Price Equation

The first equation of the model defines the overall price level of the economy and is therefore the most crucial one in the system. Domestic inflation has been assumed to be a function of both external and internal factors. Foreign import price and the money stock per unit of real net output are taken as the most important external and internal factors respectively. Moreover, a dummy variable has been used to isolate the effects of devaluation announced in 1972.

The inclusion of PF_m is based on the hypothesis of an international price link. In terms of growth rates, the term (a_1 PF_m') determines that element of domestic inflation which emerges directly from increases in world import prices. The coefficient a_1, which defines the elasticity of domestic overall price level with respect to foreign import prices (i.e., (dP/dPF_m) (PF_m/P)), may be considered as the transmission coefficient. The magnitude of this coefficient in our case need not be indentical to unity, in contrast to the formula of the Scandinavian model.[3]

The second term in the price equation, $(MS/Y^*)^{a_2}$, captures inflation arising from internal factors. In addition, it facilitates tracing out the indirect effects of changes in PF_m on P. Relating variations in P to variations in MS/Y^* in the absence of changes in PF_m appears to be reminiscent of the old quantity theory of money, but actually it differs from the latter in the sense that the coefficient a_2 need not be equal to one. In fact the variable MS/Y^* has been adopted from the Monetarist model of inflation as developed by Friedman (1970) and tested by Anna Schwartz (1973); however, our output variable has been defined in terms of net availability rather than total GDP. It may be noted that the inclusion of MS/Y^* intensifies the simultaneity of the model, suggesting that price level is not entirely exogenous to the production process. While P determines employment and hence output, output also affects P.

Production Structure

Equation (3) defines production structure and is responsible for determining the supply side of the economy. To take account of the variations in the relative factor shares in developing countries, we have used the constant-elasticity-of-substitution (CES) production function as proposed by Arrow, Chenery, Minhas, and Solow (1961):

[3] This formula is expressed as: $P=P_w+a_s (V_e - V_s)$, where P defines domestic rate of inflation, P_w the world rate of inflation, a_s the share of non-traded sector, and $(V_e - V_s)$ the difference between the rates of growth of labor productivity in traded sectors. See Aukrust (1970) and Edgren (1973).

$$Y = A\,[\alpha L^{-\rho} + (1-\alpha)\,K^{-\rho}\,]^{-1/\rho}$$

A in this expression is a scale parameter, α and $(1-\alpha)$ are distribution parameters, and ρ is substitution parameter with $1/1+\rho = \sigma$ as the elasticity of substitution between capital and labor. The value of σ ranges from zero to infinity.

Factor use and Factor Price

Equation (4) in the labor demand equation has been derived from the first order conditions for profit maximization: it equates the marginal product of labor with the real wage rate. As far as labor supply is concerned, it is assumed to be a function of nominal wage rate:

$$L = L_o \cdot W^{\theta}.$$

This formulation avoids the classical dichotomy between labor market and the rest of the economy. Further, it also avoids the assumption of a labor-surplus economy where additional labor can be hired without affecting the prevailing wage rate.

Equation (6) defines demand for capital stock. Instantaneous adjustment between desired and actual stock of capital has been assumed, though partial adjustment of the Nerlove type could also be employed. Investment itself is assumed to be function [equation (7)] of GDP (acceleration principle) and level of imports. Although the return to capital has not been explicitly included in the model, it can easily be computed by dividing the amount of value added left over after paying wage bill, by the capital stock:

$$r = (1/K)\cdot(PY-WL).$$

Once changes in W, L and r are known the effects on functional distribution of income can also be traced out.

Foreign Exchange Market

Equation (8) specifies the import demand function. GDP, relative import prices and effective exchange rate for imports are used as the dependent variables.[4] Inclusion of effective exchange rate signifies that adjustments

[4] Following Meade (1951, p.59), this function defines marginal propensity to import with reference to national income rather than aggregate expenditure. Meade's innovation permits its use even in a

in exchange rate or revisions in import tariffs affect the decisions of importers to import. Supply of exports were related to the level of output and relative export prices. Again a dummy variable is used to take care of the effect of devaluation on exports. Equation (10) defines the deficit in the current account of the balance of payments; this deficit is met from foreign capital inflows.

Balancing of Aggregate Demand and Aggregate Supply

Equation (11) balances aggregate demand and supply. Supply comes from two sources – domestic production and foreign resources defined as the difference between the trade gap and net current invisibles which include both factor and non-factor services. Demand consists of expenditures on consumption and investment. Since expenditure is expressed in market prices, an element of indirect taxes less subsidies has been added in equation (11). Indirect taxes are assumed to be proportional to GDP and the level of imports [equation (12)], while subsidies are treated as exogenous.

One of the variables in the model may be determined residually from (11). Following the convention of national income accountig methodology in Pakistan, consumption is left to be determined by this closing identity. Implicitly, the growth rate of consumption will be determined by the relationship:

$$C' = (Y/C)\,Y' + (IT/C)IT' + (M/C)M' - (E/C)E' - (S/C)S' - (NCI/C)NCI' - (I/C)I'.$$

This completes the description of our model. In all, the model contains 20 variables and 12 independent equations. Among the variables, MS, EER_m, S, NCI, ty and tm are assumed to be exogenously given to the system. World trade prices, PF_m and PF_e, for a typical small open economy like Pakistan can safely be treated as given, implying that the country can import or export as much as it wants at given world prices. This leaves exactly 12 endogenous variables – P', Y*', Y', L', W', K', I', M', E', DF', C', IT', to be uniquely determined by 12 equations. The model is thus completely determinate.

The assumption of constant money supply in a model of an open economy involving trade deficit/surplus appears somewhat disturbing. As suggested in the Monetary Approach to the balance of payments developed by Johnson (1972) and Mundell (1971), money stock in an open economy is the sum of international reserves (R) and domestic currency and deposits

model with full employment. The effect of changes in aggregate expenditure on demand for imports can not be excluded even if income remains unchanged. Secondly, relative prices were used to capture substitution.

(H), implying that changes in money stock may come either from foreign sources or from domestic sources. Algebraically:

$$MS = R + H$$

$$MS' = (R/MS)R' + (H/MS)H'.$$

While assuming $H' = 0$ is quite understandable, a similar assumption for R' in fact negates the feedback from balance of payments to money supply. To see the rationale of such an assumption, one should first find out what determines R'. Theoretically, any change in international reserves equals the gap between current and capital accounts of the balance of payments, i.e.,

$$R' = \frac{\triangle R}{R} = (ER/R)\,(FK - DF)$$

where FK and DF represent net foreign capital inflows and current account deficit in dollar terms and ER is exchange rate. This suggests that trade deficit would change R and hence money supply only if it is not matched by an equal inflow of foreign capital.

Presented below are some relevant figures about Pakistan's balance of payments during the past few years.

TABLE 3

Year	Deficit (million US $)	Changes in reserves (million US $)	Per cent of deficit financed by changes in reserves
1977-78	600	+315	0
1978-79	1113	−270	24
1979-80	1140	+362	0
1980-81	991	+219	0
1981-82	1556	−235	15
1982-83*	1045	+417	0

*Estimates.

Source: Annual Plans, Planning Commission.

As one can see, in four out of six years there has been a build-up of foreign reserves despite heavy trade deficits ranging between 600 million dollars to 1140 million dollars. Only for two years changes in reserves were used to finance the deficit. Based on Pakistan's experience during the recent past it was assumed that the government would be in a position to acquire enough foreign aid to cover the deficit caused by the rise in import prices. This explains our assumption of an unchanged money stock.

III. Data Sources and Estimation of Structural Parameters

The data used for estimating the model in structural form comes mostly from government sources (Pakistan, 1981). The absolute values of the variables involved in the differentiation of equations (2), (6), and (11) are arithmetic averages computed from the data for the years 1969-70 to 1979-80. The ratios ($PF_m \cdot M/DF$), ($PF_e \cdot E/DF$), and NCI/DF in equation (10′) pertain to 1979-80. The indirect tax ratios in equation (12′) are again simple averages of the last five years' data.

Money stock figures are in current prices and include money in circulation plus demand deposits. Figures for imports, exports, GDP and investment are in constant prices of 1969-70.

The coefficients of the behavioural equations (1′), (7′), (8′), and (9′), were derived from regression equations estimated by the Ordinary Least Squares method for the period 1969-70 to 1980-81. The results are presented in Table 4.

The transmission coefficient under partial analysis is 0.394 implying that every one per cent increase in world import prices has been directly raising price level in Pakistan by 0.394 per cent. The significant coefficient for dummy variable in the price equation suggests that devaluation of Pakistani Rupee in 1972 has once-for-all shifted the price structure of the economy upwards.

The output elasticity of investment is 0.50. Given the observed average propensity to invest at the sample mean of 0.16, the estimated marginal propensity to invest for this non-linear investment function is 0.08, which appears considerably low.

The import demand function was estimated using both absolute and relative import prices. The latter specification yields better results both in terms of t ratios and R^2. The estimate, 2.246, of income elasticity of demand for imports implies on the average a marginal propensity to import of 0.23 – a fairly high coefficient which when compared with the corresponding propensity to export of 0.138 [implicit in equation (9′)] tends to explain the perpetual deficit in the trade balance of the country. The price elasticity of imports rises from 0.442 to 0.742 when substitution

TABLE 4

Results of the regression equations (estimated by OLS)

1.	$\log P$	=	0.489	+	0.394 $\log PF_m$ (0.54)	+	0.406 $\log (MS/Y^*)$ (3.38)	+	0.173 D (2.70)	
					$R^2 = 0.99$; D.W. = 1.78					
7.	$\log I$	=	1.750	+	0.500 $\log Y$ (8.40)	+	0.212 $\log M$ (1.80)			
					$R^2 = 0.89$; D.W. = 1.65					
8.	$\log M$	=	− 14.300	+	2.246 $\log Y$ (10.64)	−	0.742 $\log (PF_m/P)$ (−3.75)	−	0.744 $\log EER_m$ (−3.39)	
					$R^2 = 0.95$; D.W. = 1.99					
8a.	$\log M$	=	− 22.400	+	3.142 $\log Y$ (5.13)	−	0.442 $\log PF_m$ (−2.20)	−	0.520 $\log EER_m$ (−2.90)	
					$R^2 = 0.92$; D.W. = 1.62					
9.	$\log E$	=	− 1.040	+	0.807 $\log Y$ (1.60)	−	0.302 $\log (PF_e/P)$ (−0.51)	+	0.150 D (0.78)	
					$R^2 = 0.60$; D.W. 0.94					
9a.	$\log E$	=	− 19.300	+	2.947 $\log Y$ (3.80)	−	0.985 $\log PF_e$ (−0.80)	+	0.366 D (1.90)	
					$R^2 = 0.69$; D.W. = 1.21					

Note: Figures in parentheses are t ratios.

between domestically produced and imported goods is allowed.

The relative price coefficient in the export function [equation (9) of Table 4] has a perverse sign but it is also statistically insignificant. The export function estimated with absolute price (PF_e only), though it still has the wrong sign, did improve the results in respect of other variables (Y and D) as well as in terms of overall explanatory power and autocorrelation. The coefficient for the dummy variable is now significant suggesting that the devaluation has positively affected the export volume. The income elasticity, 2.947, is highly significant and has therefore been used in the subsequent analysis whereas the price coefficient has been omitted.

The parameters of the production function could not be estimated through regression because of data constraints. Labor share in value-added was derived from the information on sources of income reported by Ahmed (1982). Using the latest Household Income and Expenditure Survey 1979, Ahmed reports 31 per cent of the total income coming from wages and salaries and 53 per cent from self-employment. We assumed that 1/3 of this 53 per cent belongs to labor and 2/3 to capital. This gives the labor share to be 0.48 and the capital share (assuming linearly homogenous production function) to be 0.52. For elasticity of substitution, σ, we benefited from Behrman (1970); his estimates of σ for different sectors range between 0.2 to 0.8. For Pakistan's economy as a whole, we adopted $\sigma = 0.50$ which implies ρ=1. Finally, a national estimate of 2.5 was used for θ implying that within the relevant time period, a 1 per cent increase in demand for labor raises the nominal wage rate by 0.4 per cent.

Since some of the structural parameters are estimated from the past data while others are just imposed, the model becomes basically a combination 'econometric-simulation model' and calls for some sort of sensitivity analysis particularly with respect to the assumed values of σ and θ. Accordingly, the model was simulated under two alternatives (though other alternatives would be equally justified): one with assumed value of σ=0.5 and θ=2.5; the other with σ=0.75 and θ=2.0. The latter allows for a greater degree of substitution between labor and capital and assumes a relatively steeper supply curve of labor.

IV. Solution of the Model and Results

The structural model analyzed so far depicts the qualitative and quantitative mechanisms of the economy in terms of direct determinants, as structural coefficients convey only the direct (partial) effects of changes in predetermined variables. What is required is to trace back all the endogenous variables to their more basic or ultimate determinants, i.e. to reduce the model to a form in which direct and indirect effects are combined. This

can be done by expressing each endogenous variable explicitly in terms of exogenous variables alone.

The model, for this purpose, can be written in a matrix form as:

$$A \cdot B = D \cdot Z$$

where B is a column vector (12x1) of the log changes in endogenous variables, A is a square matrix (12x12) of the structural coefficients of endogenous variables, Z is a column vector (8x1) of the log changes in exogenous variables and D is a matrix (12x8) of the coefficients of exogenous variables. The solution is given by:[5]

$$B = A^{-1} \cdot D \cdot Z = \pi \cdot Z$$

The general equilibrium responses of endogenous variables to a one per cent increase in world import prices under the two alternatives sets of assumptions regarding the values of σ and θ are presented in Table 5. The section that follows analyzes the results under the first alternative. The implications of the second alternative are briefly mentioned at the end.

The elasticity of domestic inflation to world import prices, taking both the direct and indirect effects into account, comes out to be 0.359. Two main conclusions can be drawn from this. First, as the overall inflation in Pakistan during the 1970s has been to the extent of 217 per cent while the index of world import prices increased by 270 per cent, the elasticity of 0.359 suggests that approximately 44 per cent of the observed inflation during this period has been contributed by inflation from abroad while the remaining 56 per cent is accounted for by factors other than foreign import prices. Such an overwhelming extent of imported inflation indicates the limited ability of the government in controlling price increases; it also reflects the high vulnerability of Pakistan's economy to economic fluctuations abroad. Secondly, since the inflation elasticity under simultaneous solution, 0.359, is smaller than the direct elasticity of 0.394 (i.e., the transmission coefficient reported earlier), it means that the indirect effect of PF_m on domestic inflation which channels through (MS/Y*), is negative. With money stocks maintained at their existing level, this is possible only if the output effect of PF_m is positive. Our analysis indicates that a 1 per cent increase in PF_m raises, through interactions, the level of output by 0.132 per cent. This is partly because expensive imports encourage import substi-

[5] The matrix π (12x8) would contain the reduced-form coefficients of the elasticities for all the endogenous variables with respect to all of the exogenous variables. The first column of the solution matrix is our main concern as it contains such elasticities with respect to PF_m.

TABLE 5
Likely effects of a 1 per cent increase in PF_m

Variable		Per cent change	
		Alternative I (σ=0.5; θ=2.5)	Alternative II (σ=0.75; θ=2.0)
1.	P	0.359	0.347
2.	Y*	0.086	0.115
3.	Y	0.132	0.162
4.	L	0.260	0.307
5.	W	0.104	0.154
6.	K	0.014	0.028
7.	I	0.028	0.055
8.	M	−0.179	−0.121
9.	E	0.388	0.437
10.	DF	2.682	2.75
11.	C	0.096	0.128
12.	IT	−0.033	0.012
Real wage rate		−0.255	−0.193
Labor productivity		−0.128	−0.145
Extent of imported inflation		44.5%	43.0%

tution and partly because the first-round increase in price level makes it profitable for producers to employ additional labor and expand output.

The output growth leads us to the question of factor use and factor productivity. As far as the former is concerned, it may be seen from Table 5 that expansion in output has taken place mainly through an increase in employment rather than capital stock. It appears that there exists in the economy a strong tendency to switch towards labor-intensive technology with increasing cost of imported machinery. In fact, the import price elasticity of employment is fairly high (0.26).[6] Had we assumed a fixed wage

[6] It must be clarified here that the resulting increase of 0.26 per cent in employment does not necessarily mean a 0.26 increase in the number of workers employed. It is an increase in the number of man-hours worked which may come either through an employment of additional workers, or thorugh an extension of working hours of the already employed workers, or through a combination of the two.

rate, as in the case of a labor-surplus economy, the elasticity would have been even higher.[7] With increasing employment, labor productivity (i.e., output per man-hour) has declined by 0.128 per cent. A partial explanation of this effect is the sharp decline in the capital-labor ratio (0.246 per cent). On the other hand, productivity of capital shows an increase of 0.118 per cent which may be attributed to the fact that higher import cost of capital induces: (a) a more efficient use of capital and (b) a greater utilization of under-utilized capacity through employment of additional labor. These rates of growth in factor productivity weighted by the respective factor shares in output indicate that total factor productivity has remained almost constant and therefore the output growth has been exclusively on account of expansion in physical units of factors. Incidently, the elasticity of output with respect to employment (dlogY/dlogL) as implicit in the results is 0.51 which appears quite reasonable and hints at the reliability of the results.

Imports decline by 0.74 per cent as a direct consequence of the increase of one per cent in PF_m relative to the domestic price level. But this decline is partially neutralized by the positive effect on import demand generated through the interaction of different forces in a general equilibrium framework where PF_m is allowed to affect, *inter alia*, the domestic price level and income. The net fall in imports is thus only of the order of 0.179 per cent. This extremely low price elasticity of imports in a general equilibrium setting assumes importance given that the trade deficit of the country increases by 2.68 per cent for every one per cent increase in world import prices.

Our experiment under alternative II suggests the insensitivity of the extent of imported inflation to the numerical values assigned to the parameters σ and θ. With σ=0.75 and θ=2.0, the imported inflation turns out to be 43 per cent as compared to 44.5 per cent under alternative I. However, the differences in the implications observed in the case of employment, wage rate (nominal as well as real), and output are quite substantial. The magnitude of employment growth rises from 0.26 per cent to 0.307 per cent. Since lowering the value of θ is expected to reduce employment (and raise wage rate), the larger gain in employment under alternative II suggests that the employment-encouraging impact of allowing a greater degree of substitution between labor and capital is more than offset by the employment discouraging impact of assuming a smaller value of θ. On the other hand, the wage-depressing effect of a higher value of σ appears to be much less than the wage-raising effect of a smaller θ. As domestic inflation does not

[7] With labor supply taken as a function of wage rate, the overall gains to labor get split into: (a) employment gains and (b) gains in terms of wage increase.

seem to be quite sensitive to the varying values of these parameters whereas the wage rate is, the difference in the behaviour of the real wage under the two alternatives is highly significant. The fall in the real wage rate amounts to 0.255 per cent in alternative I whereas under alternative II it is only 0.193 per cent.

V. Summary and Conclusions

This study is primarily concerned with quantifying the extent of imported inflation in Pakistan during the 1970s along with its impact on certain macro variables, namely, output, employment, capital formation and balance of payments. An aggregate econometric model in general equilibrium framework was designed to carry out the study so that both direct and indirect effects are taken into account. The structural parameters of the model were estimated from the data pertaining to 1969-70 to 1980-81. A sensitivity analysis was carried out for those parameters which could not be estimated from the past data. The findings reveal that:

1. Approximately 44 per cent of the inflation obseved in Pakistan during the 1970s has been contributed by inflation from abroad through higher import prices;
2. Increasing cost of imports tended to stimulate domestic production possibly *via* import substitution;
3. Expansion in output thus realized has taken place mainly through increase in employment rather than in capital stock since capital became expensive in the wake of increasing import prices;
4. When both direct and indirect effects are properly accounted for, every one per cent increase in the world import prices for Pakistan seems to have increased its trade deficit by about 2.7 per cent and reduced real wage rate by about 0.2 per cent.

Planning Commission
Government of Pakistan

References

Ahmed, Maqbool, 1982, Salient features of household income and expenditure survey, 1979, Quarterly Research Review, 4: 1–19.

Arrow, K.J., H.B. Chenery, B.S. Minhas and R.M. Solow, 1961, Capital-labor substitution and economic efficiency, Review of Economics and Statistics, 43: 228-232.

Aukrust, Odd, 1970, PRIM I: A model of the price and income distribution mechanism of an open economy, Review of Income and Wealth, 16(1): 51-78.

Behrman, J., 1970, Sectoral elasticities of substitution between capital and labor in a developing economy: Time series analysis in the case of postwar Chile, Discussion paper No. 153, University of Pennsylvania, Philadelphia.

Edgren, G., K. Faxen and Clas-Erik Ohdner, 1973, Wage formation and the economy, London: Allen and Unwin.

Friedman M., 1970, A theoretical framework of monetary analysis, Journal of Political Economy, 78(2): 193-238.

Frisch, Helmut, 1977, Inflation theory 1963-1975: A 'second generation' survey, Journal of Economic Literature, 15(4): 1289-1317.

Johnson, Harry G., 1972, Inflation and the monetarist controversy, Amsterdam: North-Holland Publishing Co.

Meade, J.E., 1951, The theory of international economic policy, Vol.I, The balance of payments, London: Oxford University Press.

Mundell, R.A., 1971, Monetary theory, interest and growth in the world economy, Goodyear Publishing Co.

OECD, 1973, The international transmission of inflation, OECD Economic Outlook, special section, July: 81-96.

Pakistan, Government of, 1981, Pakistan Economic Survey 1980-81, Islamabad, Finance Division, Economic Adviser's Wing.

Pakistan, Government of, Annual Plan, 1981-82, Islamabad, Planning Commission.

Schwartz, Anna J., 1973, Secular price changes in historical perspective, Journal of Money, Credit, Banking, Part II, 5(1): 243-269.

Taylor, Lance, and Stephen L. Black, 1974, Practical general equilibrium estimation of resource pulls under trade liberalization, Journal of International Economics, 4: 37-58.