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A MODEL OF INFLATION FOR BANGLADESH

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The study formulates a model of inflation for Bangladesh using a detailed approach which concentrates both on aggregate supply and demand. The final model consisting of nine semi-reduced form equations is empirically tested. The empirical test of the inflation equation of the model shows that the significant variables for inflation are agricultural and import bottlenecks, government expenditure, rate of interest, wage rate, bank credit and expected inflation. The signs of the coefficients of agricultural bottlenecks, rate of interest and credit show the dominance of the supply-side cost-push effect while the signs of the coefficients of import bottlenecks, government expenditure, wage and expected inflation show the dominance of the demand side effect.

The policy shocks applied to the model reveals that devaluation reduces output and investment. Reduction in bank credit reduces output, investment and export while increasing prices. A simultaneous increase in exchange rate and decrease in bank credit reduces output, export and investment, and increases price inflation or in effect leads to stagflation.

1. Introduction

Theoretically, there are two prominent views regarding the causes of inflation and the remedies for it: the monetarist view and the structuralist view. Monetarists (Harberger, 1963; Vogel 1974) view inflation as a monetary phenomenon which results from an increase in monetary growth greater than increases in real output. To check inflation, the monetarists recommend policies which usually concentrate on the reduction in the growth rate of money supply.

On the other hand, the old structuralists (Sunkel, 1960; Hagger, 1977; Argy, 1970) view inflation essentially as a phenomenon resulting from various structural constraints faced by developing countries. They recommend policies which help eliminate these structural constraints.

The new structuralists' (Taylor, 1983; Buffie, 1984; Lim, 1985) focus on inflation is different from that of the old structuralists. They emphasize the perverse effects of credit and monetary contraction on the price level in the short run. They view credit as a main source of

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working capital in the developing countries. Therefore, according to them, contraction of credit dampens aggregate supply/output and aggravates the inflationary condition or leads to stagflation.

Bangladesh has been suffering from high inflation since its birth in 1971. The average rate of inflation since the 1970s and up to the present has been one of the highest among the developing countries. A rapid increase in the price level has adversely affected different income groups and the task of economic development, thereby resulting in economic instability. This paper attempts to develop a model of inflation for Bangladesh to trace the causes of inflation and provide policy recommendations for its cure.

2. The Model

A detailed approach is used to formulate the model by focussing on both aggregate demand and supply in order to determine how policy variables can affect prices.

2.1. Aggregate Supply

A neo-classical production function is assumed, where output depends on the three inputs: (1) labor, (2) capital stock and (3) raw materials. Raw materials are of two types: domestic and imported. Capital stock is assumed fixed in the short-run. Notationally:

$$(1) \quad Q = Q(L, R_D, R_{IM}, K)$$

where Q is output, L is labor, R_D is domestic raw material, R_{IM} is imported raw material and K is fixed capital.

It is assumed that the working capital for variable factor inputs is entirely borrowed at nominal interest rate $R1$. It is also assumed that revenue keeps pace with the current pace of inflation. Therefore, the profit maximization problem is:

Maximize

$$\begin{aligned}(2) \quad \pi = \; & (1 + PE) \; P.Q(L, R_D, R_{IM}, K) \\ & - (1 + R1)\, W.L - (1 + R1)\, PD.R_D \\ & - (1 + R1)\, DPI.R_{IM}\end{aligned}$$

Subject to

$$(3) \qquad L.W. + R_D.PD + R_{IM}.DPI \le LOB$$

where π is profit, P is output price, $R1$ is bank interest rate on loans and advances or bank lending rate, W is nominal wage, PD is price of domestic raw materials, DPI is domestic price of imported raw materials, PE is expected price inflation, and LOB is bank loan.

The profit maximizing demands for labor (L), domestic raw materials (R_D) and imported raw materials (R_{IM}) are as follows:

$$(4) \quad L_D = L_D(WR\,(1 + R1 - PE), PDR(1 + R1 - PE), DPIR(1 + R1 - PE), K, LOBR)$$

$$(5) \quad R_{D_D} = R_{D_D}(WR\,(1 + R1 - PE), PDR(1 + R1 - PE), DPIR(1 + R1 - PE), K, LOBR)$$

$$(6) \quad R_{IM_D} = R_{IM_D}(WR\,(1 + R1 - PE), PDR(1 + R1 - PE), DPIR(1 + R1 - PE), K, LOBR)$$

where WR is real wage (W/P), $DPIR$ is relative domestic price of imported raw materials (DPI/P), PDR is relative price of domestic raw materials (PD/P) and $LOBR$ is real bank loan (LOB/P).

Substituting equations (4), (5) and (6) into equation (1), we obtain the profit maximizing output supply (QS) as follows:

$$(7) \quad QS = QS(WR(1 + R1 - PE), DPIR(1 + R1 - PE), PDR(1 + R1 - PE), K, LOBR)$$

Rewriting equation (7)

$$(8) \quad QS = QS(WR, R1, PE, DPIR, PDR, K, LOBR)$$

Capital stock (K) is measured as follows:

$$(9) \quad K_t = (1 - \delta)\, K_{t-1} + I_{t-1}$$

where

δ = Depreciation rate
I = Investment

The depreciation rate is measured as 0.06.

The domestic price of imported raw material (*DPIR*) is assumed to be determined by its supply and demand in the domestic market.

Rewriting equation (6) which is the profit maximizing demand for imported raw materials, we obtain the demand for imported raw materials:

(10) $R_{IM_D} = R_{IM_D}(WR, R1, PE, PDR, DPIR, K, LOBR).$

The supply, therefore, mainly depends on the import bottlenecks (IB) and to some extent on the price and agricultural bottlenecks (AB). Import bottlenecks can be considered in terms of tariffs, quotas, devaluation or exchange rate. All these imply higher costs of import, that is higher IB and thereby lower supply of imported raw materials, in the domestic market. The supply of imported raw materials in the domestic market depends upon the availability of foreign exchange. Higher output largely originating from agricultural sectors, either by requiring lower food import or by increasing export earnings from the agricultural sector, can make available more foreign exchange for importing inputs or raw materials. The tighter the agricultural bottleneck, the lower will be the output from the agricultural sector, the higher will be the requirement for importing food, the lower will be the export earnings, the lower will be the foreign exchange available for importing raw materials, the lower will be the supply of imported raw materials in the domestic market. Agricultural bottleneck arises mainly from poor transportation and communications systems, adverse climatic conditions, primitive and backward systems used in the method of production, etc. So, we denote the supply of imported raw materials as:

(11) $R_{IM_S} = R_{IM_S}(DPIR, IB, AB)$

Assuming prices fluctuate to bring about equilibrium, the price equation of the imported raw materials can be obtained as follows:

(12) $DPIR = DPIR(WR, R1, PE, PDR, K, LOBR, IB, AB)$.

The supply of domestic raw materials is assumed to depend on its own price, availability of bank credit, import bottleneck and agricultural bottleneck. Supply is considered affected by agricultural bottleneck because some of the raw materials directly come from the agricultural sector. The tighter the agricultural bottleneck, the lower will be the supply of domestic raw materials. The supply of domestic raw materials is assumed to be negatively related with import bottlenecks because the supply of domestic raw materials from the agricultural or other sectors depends on the use of imported machineries and equipment. The supply of domestic raw materials is also assumed to be positively related with bank credit. The greater the availability of bank credit, the greater will be the supply of raw materials because bank credit is used as working capital. So, we denote the supply of domestic raw materials:

(13) $R_{D_S} = R_{D_S}(PDR, AB, LOBR, IB)$

Rewriting equation (5) which is the profit maximizing demand for domestic raw materials, we obtain the demand for domestic raw materials:

(14) $R_{D_D} = R_{D_D}(WR, R1, PE, PDR, DPIR, K, LOBR)$

Assuming prices of domestic raw materials, *PDR*, fluctuate to bring about equilibrium, we get the price of domestic raw materials as follows:

(15) $PDR = PDR\ (WR, R1, PE, DPIR, K, LOBR, AB, IB)$

Substituting equation (15) into equation (12) we get

(16) $DPIR = DPIR\ (WR, R1, PE, IB, AB, LOBR, K)$

Similarly substituting equation (12) into equation (15) we obtain

(17) $PDR = PDR\ (WR, R1, PE, IB, AB, LOBR, K)$

Substituting equations (16) and (17) into equation (8) we get the following:

(18) $QS = \quad QS\,(WR, R1, PE, IB, AB, LOBR, K)$

QS in equation (18) is the gross output inclusive of the value of imported inputs. Real GNP (*YR*) nets out the value of imported inputs. *YR* should have the same form of equation as in equation (18), that is:

(19) $YR = YR\,(WR, R1, PE, IB, AB, LOBR, K)$

2.2 *Wage*

Wages is assumed to be positively related to expected inflation and negatively related to the unemployment rate of the previous period:

(20) $W \; = W(PE, UT_{t-1})$

where W is nominal wage, and UT_{t-1} is the unemployment rate of the previous period.

2.3 *Aggregate Demand*

The demand for gross output is composed of investments, consumption expenditures on home goods, exports and environment expenditures:

(21) $QD = \quad CHR + IR + GR + XR$

where *QD* is demand for gross output, *CHR* is the real consumption expenditure on home produced goods, *IR* is real investment, *XR* is the real export and *GR* is the real government expenditure. Government expenditures are assumed to be exogenously determined by central authorities.

2.4 *Investment*

Investment is assumed to be a function of the interest rate on loans, fixed capital, working capital which can be thought of as bank loan, the real wage, expected inflation, agricultural bottleneck and import bottleneck. That is:

(22) $IR \; = \quad (R1, K, LOBR, PE, WR, AB, IB)$

The higher the rate of interest, the lower will be the investment. The higher the *LOBR*, the higher will be the investment. Tighter agricultural and import bottlenecks will imply lower supply of imported and domestic raw materials and thereby higher domestic prices for imported and domestic raw materials, which in effect increase the cost of production and reduce investment. Similarly the real wage is assumed to be negatively related to investment while expected inflation is positively related to investment. An increase in the capital stock will decrease the marginal productivity of capital and therefore investment will decrease.

2.5 *Exports*

Exports are assumed to depend on available capacity and its utilization. Capacity is represented by *YR*. Capacity utilization in turn is constrained by imported inputs. The availability of imported inputs depends upon their price in the domestic market. Therefore, export is a function of *YR* and *DPIR*, i.e.:

(23) $XR = XR\ (YR, DPIR)$

Substituting equation (16) into equation (23), the following is obtained:

(24) $XR = XR\ (YR, AB, IB, R1, LOBR, WR, K, PE)$

2.6 *Consumption*

Consumption of home produced goods is a function of real income (*YR*), real balance (*MR*) and the import bottleneck (*IB*). The higher the income, the higher will be the consumption. A tighter import bottleneck means less imported goods available for consumption which in effect implies higher consumption of home produced goods. Consumption is assumed to be positively related with real balances (*MR*) which is measured by (M/P) where *M* is money supply and *P* is price level. Notationally

(25) $CHR = CHR\ (YR, IB, MR)$

Price Determination

Equilibrium implies that quantity demanded for home produced goods must be equal to its supply. That is

(26) $QS = QD$

Substituting equation (21) in the right-hand side of equation (26) we get

(27) $QS = CHR + IR + XR + GR$

The semi-reduced form equations for *IR, XR,* and *CHR* are equations (22), (24) and (25) respectively. Substituting them on the right-hand side and substituting equation (19) on the left-hand side of equation (27) and assuming price adjusts to bring about equilibrium, we obtain the following equation for inflation:

(28) $\hat{P} = P(\hat{AB}, \hat{IB}, \hat{W}, \hat{LOBR}, \hat{K}, \hat{G}, \hat{PE}, \hat{R1}, \hat{MR})$

where *P* is price and the hat (^) denotes the percentage change.

2.7 *Dummy Variable*

Some dummy variables are included in different equations to represent the following:

DUM = Dummy variable, 1 for 1971/72 and after for independence); 0 otherwise.
D2 = Dummy variable, 1 for 1979 and after for introduction of flexible exchange rate; 0 otherwise.
D3 = Dummy variable, 1 for nationalization from 1971/72 to 1976-77; 0 otherwise.
D4 = Dummy variable, 1 for 1971/72 and 1975/76 for devaluation; 0 otherwise.
D5 = Dummy variable, 1 for 1974 and 1979 for oil shock; 0 otherwise.

3. Empirical Analysis

3.1 *Estimation of Expected Inflation*

Expected inflation (*PE*) is estimated under three models of expectations formation namely: (1) adaptive expectations, (2) extrapolative expectations and (3) rational expectations. The equations in the model are then estimated by using the expected inflation generated from the above-mentioned mechanism.

Following Sarantis (1984), the *PE* is specified under adaptive expectations as follows:

(29) $PE_t = \quad PE_{t-1} + 0.45(\hat{P}_{t-1} - PE_{t-1})$

PE is specified under simple adaptive expectations as follows:

(30) $PE_t = \quad \hat{P}_{t-1}$

PE is specified under extrapolative expectations as follows:

(31) $PE_t = \hat{P}_{t-1} + 0.9(\hat{P}_{t-1} - \hat{P}_{t-2})$

Following Mishkin (1983), a theoretical statistical procedure has been used to specify forecasting equation under rational expectations. Following Gochoco (1984), various lag lengths and various combinations of the variables were used. Finally, the forecasting equations are specified as follows:

(32) $PE_t = \hat{P}_t(P_{t-1}, \hat{R1}_{t-1}, L\hat{O}BR_{t-1})$

(33) $PE_t = P_t(\hat{P}_{t-1}, \hat{P}_{t-2}, LO\hat{B}R_{t-1}, L\hat{O}BR_{t-2}, \hat{R1}_{t-1}, \hat{R1}_{t-2})$

The equations of the model are estimated by using Barro's (1978) two-step procedure.

3.2 *Estimation of the Model*

The model is estimated using national time-series data from 1959-60 to 1985-86. The equations are estimated using ordinary least squares (OLS) method and the instrumental variables (IV) method. The estimation is done in log form for all the equations in the model except the inflation equation. The inflation equation is estimated in growth rate form.

The equations of the model are estimated by using all 5 types of PE which are generated under adaptive, simple adaptive, extrapolative and rational expectations (equations 29 to 33). In terms of standard errors of regression, explanatory power, F-statistics and significance level, the estimated model using equation (32) under rational expectations is considered as the best. The results are reported in Tables 1 and 2.

3.2.1 Wage equation

Expected inflation (*PE*) is significant with the expected positive sign. Lagged unemployment rate is not significant.

Table 1 - OLS Version of the Model Using Rational Expectations (RATI)

1.	W_t	= 0.32	+ 0.02 UT_{t-1}	- 0.05 DUM	+ 0.96* $RATI_t$	+ 0.41** URI_t
		(0.58)	(0.58)	(-0.44)	(9.46)	(2.67)
		D.W. = 1.58	F-Statistic = 323.34			R^2 = 0.99
2.	$DPIR_t$	= 2.40**	+ 0.009 AB_t	- 0.11 IB_t	+ 0.07 $R1_t$	+ 0.10 $LOBR_t$
		(2.49)	(1.45)	(-0.43)	(1.49)	(0.54)
		+ 0.68** WR_t	- 0.13 K_t	-0.06 *DUM*	- 0.20 *D2*	+ 0.01 *D4*
		(2.42)	(-0.85)	(-0.35)	(-1.06)	(0.18)
		+ 0.51*** $RAT1_t$	+ 0.73** $UR1_t$			
		(1.98)	(2.15)			
		D.W. = 1.85	F-Statistic = 25.14			R^2 = 0.92
3.	PDR_t	= 1.44*	+ 0.006 AB_t	+ 0.13 IB_t	+ 0.08* $R1_t$	- 0.40* $LOBR_t$
		(3.22)	(1.44)	(0.82)	(3.74)	(-3.67)
		- 0.30*** WR_t	+ 0.08 K_t	+ 0.01 *DUM*	+ 0.63* $RAT1_t$	
		(-2.05)	(0.70)	(0.08)	(3.61)	
		D.W. = 1.84	F-Statistic = 378.32			R^2 = 0.99
4.	IR_t	= 0.31	- 0.30 $R1_t$	+ 0.83* K_t	+ 0.15 $LOBR_t$	- 0.05 WR_t
		(0.62)	(-1.50)	(9.96)	(1.61)	(-0.39)
		- 0.75* $RAT1_t$	- 0.99* $UR1_t$	- 0.0002 AB_t	- 0.03 IB_t	
		(-6.48)	(-8.00)	(-0.90)	(-0.33)	
		+ 0.02 *DUM*	- 0.13* *D3*	+ 0.07 D5		
		(0.32)	(-2.54)	(1.25)		
		D W. = 2.10	F-Statistic = 130.37			R^2 = 0.98
5.	XR_t	= 3.54***	- 0.38 YR_t	- 0.004 AB_t	+ 0.37*** IB_t	- 0.007 $R1_t$
		(1.90)	(-1.03)	(-1.04)	(2.04)	(-0.18)
		+ 0.60* $LOBR_t$	+ 0.38*** WR_t	+ 0.17 K_t	- 0.32*** *DUM*	
		(4.07)	(1.91)	(1.57)	(-2.01)	
		- 0.44** $RAT1_t$	-0.38 $UR1_t$	+ 0.02 *D2*	+ 0.07 *D4*	
		(-2.38)	(-1.59)	(0.18)	(0.87)	
		D.W. = 2.73	F-Statistic = 38.93			R^2 = 0.95
	CHR_t	= 1.12***	+0.77* YR_t	+0.08 IB_t	+ 0.003 *DUM*	
		(1.70)	(6.56)	(1.44)	(0.07)	
		D.W. = 1.13	F-Statistic = 119.43			R^2 = 0.94
	YR_t	= 4.45*	- 0.0008 AB_t	- 0.02 IB_t	+ 0.30** $LOBR_t$	- 0.02 WR_t
		(12.72)	(-0.18)	(-0.09)	(2.75)	(-0.16)
		+ 0.10 K_t	- 0.10 *DUM*	- 0.003 $RAT1_t$	+ 0.20 $UR1_t$	
		(1.00)	(-1.01)	(-0.02)	(1.03)	
		D.W. = 1.46	F-Statistic = 18.77			R^2 = 0.85

Table 1 — (Continued)

$\hat{P}_t$	= 0.12*	+ 0.001 $\hat{AB}_t$	- 0.08 $\hat{IB}_t$	+ 0.06 $\hat{G}_t$	+ 0.01 $\hat{R1}_t$
	(3.61)	(-0.54)	(-0.57)	(0.47)	(0.47)
	+ 0.09 $\hat{W}_t$	- 0.13 $\hat{K}_t$	- 0.79* $\hat{LOBR}_t$	+0.06 DUM	-0.001 $\hat{RAT1}_t$
	(0.51)	(-1.14)	(-5.87)	(1.62)	(-0.01)
	D.W. = 2.56	F-Statistic = 9.98		R^2 = 0.78	

[a]Values in parentheses indicate the t-values of the estimated coefficient.
*Significant at one percent level. **Significant at 5 percent level. ***Significant at 10 percent level.

All R-squared are adjusted R-squared.

Table 2 — IV Version of the Model Using Rational Expectations (RATI)

1. $DPIR_t$	= 2.24**	+ 0.01**AB_t	+ 0.23 IB_t	- 0.004 $R1_t$	
	(2.46)	(2.24)	(1.25)	(-0.11)	
	+ 0.41*** $LOBR_t$	+ 0.41***WR_t	- 0.25**K_t	- 0.38*DUM	
	(1.86)	(1.90)	(-2.23)	(-3.33)	
	- 0.05 $D2$	+ 0.07 $D4$	+ 0.56**$RAT1_t$	+ 1.03*$UR1_t$	
	(-0.50)	(0.97)	(2.54)	(3.33)	
	D.W. = 2.37	F-Statistic = 40.21		R^2 = 0.95	
2. PDR_t	= 1.50*	+ 0.007 AB_t	+ 0.05 IB_t	+0.10*$R1_t$	- 0.60*$LOBR_t$
	(3.37)	(1.56)	(0.34)	(4.37)	(-5.20)
	- 0.23***WR_t	- 0.17***K_t	+ 0.021 DUM	+ 0.64 $RAT1_t$	
	(- 1.62)	(1.74)	(0.28)	(4.47)	
	D.W. = 1.79	F-Statistic = 454.55		R^2 = 0.99	
3. IR_t	= - 0.22	- 0.04***$R1_t$	+ 0.89*K_t	+ 0.17 $LOBR_t$	+ 0.08 WR_t
	(-0.41)	(-2.03)	(12.63)	(1.72)	(0.67)
	- 0.77*$RAT1_t$	- 0.97*$UR1_t$	- 0.008 AB_t	- 0.14 IB_t	+ 0.03 DUM
	(-7.25)	(-6.74)	(-0.03)	(-1.35)	(0.81)
	- 0.08 $D3$	+ 0.06 $D5$			
	(-1.60)	(0.99)			
	D.W. = 2.09	F-Statistic = 132.93		R^2 = 0.99	
4. XR_t	= 0.60	+ 0.34 YR_t	+ 0.005 AB_t	+ 0.59*IB_t	- 0.04 $R1_t$
	(0.36)	(0.90)	(0.12)	(3.32)	(-1.17)
	+ 0.56**$LOBR_t$	0.16 WR_t	+ 0.18 K_t	- 0.11 DUM	
	(2.41)	(0.73)	(1.68)	(-1.08)	
	- 0.84*$RAT1_t$	- 0.52***$UR1_t$	- 0.24* $D2$	+ 0.02 $D4$	
	(-3.83)	(-1.87)	(2.13)	(0.43)	
	D.W. = 192	F-Statistic = 38.27		R^2 = 0.95	

Table 2 — (Continued)

$$
\begin{array}{llllll}
CHR_t = & 0.62 & + 0.86^{*}\, YR_t & + 0.08\, IB_t & - 0.05\, DUM & \\
 & (0.89) & (7.15) & (1.67) & (-1.15) & \\
 & \text{D.W.} = 1.15 & & \text{F-Statistic} = 180.31 & & R^2 = 0.97
\end{array}
$$

$$
\begin{array}{llllll}
YR_t = & 4.32^{*} & - 0.001\, AB_t & - 0.09\, IB_t & + 0.34^{**} LOBR_t & + 0.07\, WR_t \\
 & (12.70) & (-0.34) & (-0.57) & (2.67) & (0.55) \\
 & + 0.08\, K_t & - 0.03\, DUM & + 0.007\, RAT1_t & + 0.21\, UR1_t & \\
 & (0.85) & (-0.30) & (0.04) & (1.23) & \\
 & \text{D.W.} = 1.26 & & \text{F-Statistic} = 18.92 & & R2 = 0.86
\end{array}
$$

$$
\begin{array}{llllll}
\hat{P}_t = & 0.04^{***} & + 0.005^{*} \hat{AB}_t & - 0.24^{**} IB_t & + 0.26^{*}\, G_t & + 0.07\, \hat{RI}^{*}_t \\
 & (2.02) & (3.16) & (-2.64) & (3.15) & (3.65) \\
 & - 0.40^{*} \hat{W}_t & - 0.02\, \hat{K}_t & - 0.81^{*}\, LO\hat{B}R_t & + 0.10^{*} DUM & + 0.39^{*}\, R\hat{A}T1_t \\
 & (-3.05) & (-0.33) & (-10.56) & (3.93) & (3.77) \\
 & \text{D.W.} = 2.34 & \text{F-Statistic} = 32.52 & & & R^2 = 0.93
\end{array}
$$

3.2.2 Domestic price equation for imported raw materials (*DPI*R)

The agricultural bottleneck (*AB*) variable is significant with a positive sign as expected. Real bank loan (*LOBR*) is significant with the expected positive sign. An increase in the quantity of bank loans has a positive effect on aggregate supply and investment, which increases the demand for imported raw materials, which in effect increases *DPIR*. The coefficient of the real wage (*WR*) has a positive sign implying the substitutability between labor and imported raw materials. When *WR* increases, the demand for imported raw material increases, which in effect increases *DPIR*. The coefficient of capital stock (*K*) is negative and significant which shows the dominance of supply side cost-push effect. The coefficient of *PE* is significant with a positive sign which is obvious from both aggregate supply and demand considerations. An increase in *PE* decreases the cost of borrowing, and increases aggregate supply which results in a higher demand for imported raw materials and thereby, an increase in the price. *PE* has the same effect on *DPIR* through its effect on investment.

3.2.3 Price equation for domestic raw materials (*PDR*)

The coefficient of *LOBR* is significant with a negative sign which shows a direct effect from the supply side. An increase in LOBR increases the supply of domestic raw materials by making working capital available and therefore decreases *PDR*. The coefficient of the interest rate on loans (*R1*) is significant and positive which gives evidence of a direct effect of the increase in the cost of borrowing. The coefficient of *WR* is significant and negative. This implies that an increase in *WR* decreases the demand for domestic raw materials and price due to a decrease in aggregate supply. The coefficient of *K* is significant with a positive sign. An increase in *K* increases aggregate supply and demand for domestic raw materials and thereby *PDR*. The coefficient of *PE* is also significant and positive. *PE* exerts an upward push on *PDR* since it has a positive effect on aggregate supply by lowering the cost of borrowing.

3.2.4 Investment equation

The coefficient of capital stock is highly significant but surprisingly with a positive sign. One reason may be the positive association between capital and aggregate supply on output. There is a positive association between output and investment which results in a positive relation between capital stock and investment over the years. The coefficient of *R1* is significant with a negative sign as expected. *PE* came out significant but with a negative sign, maybe because of the high inflationary trend in Bangladesh and the instability of its economy. Some sort of signalling can be considered as existent. Another reason may be that high inflationary expectations encourage hoarding more than investment, that is, investors shift from investment to hoarding. The coefficient of unexpected inflation (*UR*) is also significant with a negative sign as expected.

3.2.5 Export equation

The coefficient of import bottleneck (*IB*) is significant with a positive sign. This finding could be traced to the fact that this study measures import bottleneck by the depreciation of currency. The coefficient of *LOBR* is positive and significant as expected. The coefficient of *PE* is significant with a negative sign, implying *PE* increases domestic price level and discourages export. The coefficient of unanticipated price inflation is significant and negative as expected.

3.2.6 Consumption equation

The coefficient of real balance (*M*/*P*) is insignificant and when dropped from the equation, the adjusted R^2 increases. The coefficient of real income is highly significant with a positive sign as expected.

3.2.7 Aggregate supply/output equation

The coefficient of *LOBR* is significant with a positive sign. This gives evidence to the effect of bank loan as working capital from the supply side.

3.2.8 Inflation equation

Real balances (*M*/*P*) are expected to affect inflation through aggregate demand brought about by an increase in consumption. As mentioned earlier, the coefficient of real balances was insignificant in the consumption equation. The coefficient of real balances was also insignificant in the inflation equation. When this variable was dropped, the adjusted R^2 increased. So, finally the real balances variable was dropped from both consumption and inflation equations.

The coefficient of agricultural bottleneck (*AB*) is significant and positive under rational expectations. From the demand side, the increase in *AB* reduces aggregate demand through exports and investment. So a downward push on prices is expected. From the supply side, an increase in *AB* reduces aggregate supply and pushes prices up. The sign of the coefficient of *AB* in the inflation equation is positive which means that the cost-push supply-side effect is dominant.

Unlike AB, the coefficient of import bottleneck (*IB*) is significant with a negative sign. This shows the dominance of the demand side effect.

The wage variable is expected to exert an upward push on price inflation through the supply side, and to exert a downward push through aggregate demand. The coefficient of the wage is significant, with a negative sign. This implies that the demand-side effect is greater than the supply-side cost-push effect. The coefficients of expected inflation and government expenditure (*G*) are significant, with a positive sign. Therefore the demand-side effect dominates.

The coefficient of the bank lending rate (*RI*) is significant, with a positive sign. This implies that the supply-side cost-push effect is greater than the demand-side effect.

The coefficient of bank loan (*LOBR*) is significant, with a negative sign. From the demand side the increase in *LOBR* increases aggregate demand through export and investment. An upward push on the price level is expected. From the supply side, the increase in *LOBR* increases the aggregate supply by making working capital available. A downward push on the price level is expected. The negative sign of the coefficient of *LOBR* in the inflation equation shows a strong working capital cost-push effect.

4. Simulation of Alternative Policies and Trends

This study also attempts to see how changes in policy affect different endogenous variables in the model. In order to do that, various simulation runs for the period 1978 to 1986 are made where certain policy variables are changed.

Three types of policy shocks are tested on the model, namely: (a) the exchange rate is increased by 30 percent; (b) bank credit is cut by 30 percent; and (c) exchange rate is increased by 30 percent while bank credit is decreased by 30 percent. The results are reported in Tables 3, 4 and 5. The following findings are obtained from the policy runs.

(1) Devaluation reduces output and investment. It also reduces price inflation. The reduction in output is much greater than the reduction in price inflation.

(2) Reduction in bank credit reduces output, investment, and export while increasing prices. The finding contradicts with the policy recommendation of contracting credit to cure inflation.

(3) A simultaneous increase in exchange rate and decrease in bank credit, which is the usual recommendation of the IMF as a cure for inflation, reduces output, export and investment, and increases price inflation. In effect, this type of policy leads to stagflation.

Table 3 — 30 Percent Increase in Exchange Rate

YEAR	*DPIR*	*PDR*	*CHR*	*XR*	*IR*	*YR*	$\hat{P}_{GNP}$	$\hat{P}_{CPI}$
1978	8.1932	1.7654	1.3211	19.3163	-6.3210	-2.9490	0.0029	-0.0009
1979	8.1932	1.7654	2.0234	20.0241	-3.0710	-2.9267	-0.0035	0.0010
1980	8.2181	1.7419	2.4000	20.5341	-5.8201	-2.9267	-0.0009	0.0002
1981	8.2281	1.7419	2.6124	20.5861	-4.3802	-2.9490	-0.0028	0.0007
1982	8.2181	1.7419	2.7306	20.5872	-5.2132	-2.9490	-0.0199	0.0056
1983	8.2181	1.7419	2.778	21.2012	-4.5887	-2.9267	-0.0161	0.0046
1984	8.1932	1.7654	2.8253	21.2021	-4.9997	-2.9267	-0.0044	0.0012
1985	8.1932	1.7654	2.8253	20.8671	-4.6882	-2.9490	-0.0037	0.0010
1986	8.1932	1.7654	2.8489	20.9031	-4.8230	-2.9267	-0.0133	0.0037

Table 4 — 30 Percent Reduction in Bank Credit

YEAR	*DPIR*	*PDR*	*XR*	*IR*	*YR*	$\hat{P}_{GNP}$	$\hat{P}_{CPI}$
1978	-19.0718	35.6751	-20.4369	-10.2467	-15.8799	-0.0122	-0.0101
1979	-19.0531	35.6751	-22.5102	-5.3664	-15.8605	0.0301	0.0147
1980	-19.0345	35.6751	-23.3210	-9.2296	-15.8605	0.0606	0.0498
1981	-19.0531	35.6751	-23.6263	-7.3260	-15.8605	0.0707	0.0581
1982	-19.0718	35.6751	-23.6273	-9.1230	-15.8605	0.0255	0.0209
1983	-19.0531	35.6751	-23.6274	-8.2626	-15.8605	0.0129	0.0106
1984	-19.0718	35.6751	-23.6274	-8.6329	-15.8605	0.0344	0.0282
1985	-19.0531	35.6751	-23.6274	-8.2148	-15.8605	0.0484	0.0397
1986	-19.0531	35.6751	-23.6274	-8.9827	-15.8605	0.0256	0.0210

Table 5 — 30 Percent Increase in Exchange Rate and 30 Percent Decrease in Bank Credit

YEAR	*DPIR*	*PDR*	*XR*	*IR*	*YR*	$\hat{P}_{GNP}$	$\hat{P}_{CPI}$
1978	-12.4412	38.0384	-7.5239	-12.2430	-18.3418	-0.0093	-0.0109
1979	-12.4210	38.0384	-8.3660	-8.6322	-18.3418	0.0266	0.0257
1980	-12.4210	38.0384	-8.4025	-14.6281	-18.3418	0.0597	0.0501
1981	-12.4210	38.0384	-8.4236	-11.2419	-18.3418	0.0679	0.0588
1982	-12.4210	38.0384	-8.4932	-13.9226	-18.3418	0.0056	0.0265
1983	-12.4210	38.0384	-8.5643	-12.4396	-18.3418	-0.0032	0.0152
1984	-12.4210	38.0384	-8.5643	-13.4630	-18.3418	0.0300	0.0295
1985	-12.4210	38.0384	-8.5643	-12.6443	-18.3418	0.0446	0.0408
1986	-12.4210	38.0384	-8.5643	-13.2232	-18.3418	0.0123	0.0248

5. Conclusions

The study suggests that the high inflation rate experienced by Bangladesh results from different bottlenecks inherent in the economy such as the agricultural and import bottlenecks, which act to hinder the supply of output and can thus be considered as capacity constraints. Hence, the policy to reduce inflation should focus on the removal of such capacity constraints rather than simply reducing money supply or credit. Capacity can be increased by encouraging physical investment through the availability of raw materials, working capital, political stability and other policies which create a more conducive atmosphere for investment.

The findings of this study show that an unqualified policy of reducing money supply to cure inflation as recommended for example in the usual IMF adjustment program may be counterproductive for the developing countries. This recommendation considers only the demand side. According to this view, if money supply is controlled, demand will be dampened, and prices will not go up very fast. However, this view ignores the effect of the contraction of money supply or credit on aggregate supply or output. In developing countries where bank credit is a source of working capital, the reduction of money supply or credit will reduce investment output, and employment as well as raise price rather than cure inflation. If supply cannot be increased because of structural bottlenecks, and lack of working capital, the solution to the inflation problem is not to force demand by contracting credit or money supply. To cure inflation, care must be taken that the problems regarding bottlenecks are addressed and credit is not severely curtailed if stagflation is to be avoided.

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