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The Relative Impact of Monetary and Foreign Price Influences on Inflation in Nepal

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INTRODUCTION

Inflation in Nepal has become an issue of major political, as well as personal, importance. Many individuals in Nepal have experienced substantial increases in their living costs while facing relatively fixed levels of income. Price increases on specific essentials such as rice and sugar have, at times, led to public demonstrations of concern addressed to political authorities. To some extent this issue has become politicized because the mechanism by which prices of such essentials are set involves government action, and it therefore appears as if price inflation is a conscious political policy.

The recognition that inflation in the seventies has been a worldwide problem belies this view. Governments of industrialized as well as developing countries have been largely unable to control their price levels. The problem has become sufficiently pervasive to suggest that inflation is transmitted across national boundaries and to lead economists to develop, or rediscover, theories of such a transmission mechanism. In this paper we investigate two alternative

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views which could account for the international transmission of inflation. One view, based on the Law of One Price, argues that inflation comes about through the equalization of price levels across countries as a result of international commodity substitution. An alternative approach contends that the international transmission of inflation operates through national money supplies, with net accumulations of foreign assets translated directly into money supply increases, which in turn raise the domestic price level.

Our test of these views for the case of Nepal is based on multiple regression analysis inflation over the years 1963 to 1979. The models on which this analysis is based are discussed in the third and fourth sections of this paper, and the statistical analysis and interpretation of results are presented in section five. The section immediately following this introduction offers a general discussion of inflation in Nepal.

NEPALESE INFLATION

Inflation has been a fairly persistant problem in Nepal during the past 16 years for which we have records. From 1963 to the end of 1979 prices, as measured by the consumer price index of Kathmandu, have increased at an annual rate of 7-½ percent. During the seventies there was a slight acceleration in this rate to 8 percent, with some years of double digit inflation, particularly 1974, when prices surged at a rate of 21 percent.

In discussions of inflation in Nepal there is generally widespread recognition of the significance of Indian price inflation as an important contributing factor. Dr. Maxwell Fry, in his lectures on financial development in Nepal, stated, "It seems to be a commonly held view in Nepal that the Nepalese economy is so closely tied to India that inflation in Nepal is solely a result of inflation in India."[1] Dr. Pradhan argues from a rather strict open-economy point of view that "...irrespective of an expansionary or contractionary monetary policy, inflation is bound to occur in Nepal, if there is inflation in India."[2] Dr. Pradhan's contention assumes a very high degree of Nepalese-Indian commodity substitution, which leaves Nepalese prices

1 Maxwell J. Fry, Resource Mobilization and Financial Development in Nepal, Kathmandu: CEDA, 1974, pp. 40–41.

2 B B. Pradhan, "Monetary Policy and Price Situation in Nepal," in B. Dhungana and N. Kayastha, eds.. Studies on Prices (Nepal), Kathmandu: CEDA, 1977, p. 5.

determined by Indian prices, implies that domestic monetary changes are dissapated through the balance of payments, and allows little scope for money supply effects on Nepalese prices.

In an empirical study which directly tests the effects of money, Indian prices and other variables on inflation in Nepal, Dr. H.D. Pant supports the view that money has no significant effect on prices. He concludes, on the basis of regressions covering annual data from 1962/63 to 1972/73, that "...changes in money supply ... appear to have played only a marginal role in explaining changes in prices in Nepal."[3] He then goes on to endorse Dr. Pradhan's view that monetary changes impact on the balance of payments and are not reflected in the domestic price level. This conclusion necessarily depends upon the assumption of a high degree of commodity substitution between Nepal and India, a condition which would also imply a strong association between Indian aud Nepalese inflation rates–a result Dr. Pant was unable to confirm. Possibly the limited number of observations available relative to the number of variables in the models estimated as well as the dominance of food-grain prices in the regressions, was responsible for the negative results with respect to the Indian price and monetary variables.

In a further empirical study of prices in Nepal H.M. Pant finds both money supply and Indian price variables to be significant determinantsof the Nepalese price level.[4] The elasticities with respect to these two variables are extremely low, however, with values of .12 for Indian prices and summing to .25 for the money supply. Furthermore. the use of levels for all variables rather than rates of change introduces the strong likelihood of autocorrelated residuals in the model, tending to bias upwards the computed t–statistics upon which the reported significance of this coefficients is based.

These studies leave some doubt as to the importance of either money or Indian prices as a source of inflation in Nepal. It is the goal of this paper to investigate further the explanatory power of these two variables in an open-economy model of Nepalese inflation.

THEORETICAL CONCERNS

The mechanism (or mechanisms) responsible for transmitting inflation between

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3 H.D. Pant, "Inflation] in Nepal: A Macro Study," in Studies on Prices (Nepal), pp. 11-23.

4 H.M. Pant, "An Econometric Analysis of the General Level of Prices in Nepal," The Economic Journal of Nepal, Vol. 1, No. 4 (Oct–Dec. 1978) pp. 68–89.

nations linked by fixed exchange rates (or less than perfectly flexible exchange rates) is subject to some debate. The strong version of the Monetary Approach to the Balance of Payments (MBOP) states that the domestic price level, P_o is the product of the exchange rate, X_a times the world price level, P_w. This hypothesis is based on the "Law of One Price" which asserts that perfect international commodity substitution insures that domestic prices are equal to foreign prices times the exchange rate.

Under this assumption changes in world prices cause changes in domestic prices, with the domestic price level completely determined by world prices. An implication of this hypothesis is that the domestic money supply does not influence domestic prices. Instead domestic money accommodates to the changing level of prices with domestic money rising or falling through the balance of payments until the nominal money supply equals nominal money demand.

Mathematically the model can be demonstrated as follows. (For a detailed analysis see Johnson)[5].

$$P_D = P_W X \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad 1.$$

The domestic price level, P_D, equals the world price level, P_w, times the exchange rate, X.

$$M_s = M_D \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad 2.$$

In equilibrium the nominal money supply, M_s, equals nominal money demand, M_D.

$$M_D = P_D KY \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad 3.$$

Nominal money demand equals the domestic price level times KY where Y is real income, and $K = 1/v$, where v is velocity.

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5 H G. Johnson, "The Monetary Approach to Balance of Payments Theory". The Monetary Approach to the Balance of Payments, J. A. Frenkel and H. G. Johnson (eds). Toronto: University of Toronto Press, 1976.

$$M_s = h(R + D) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad 4.$$

Money supply is some multiple, h, of monetary base. The monetary base in turn is composed of foreign reserves, R, and a net domestic component, D.

Substitute 1 and 4 into 3 and solve for R.

$$R = \frac{P_w XKY}{h} - D \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad 5.$$

If world prices rise, or the exchange rate depreciates, raising the domestic price level, the money supply must rise until equilibrium is restored. If the domestic authorities do not increase D, international reserves flow into the home country until $M_s = M_D$.

There is a second, and older, version of the international transmission of inflation under fixed exchange rates, originating with Hume. Consider the following often cited quote:[6]

> Suppose four-fifths of all money in Great Britain to be annihilated in one night, and the nation reduced to the same condition, with regard to specie, as in the reigns of the Harrys and Edwards, what would be the consequence ? Must not the price of all labour and commodities sink in proportion, and everything be sold as cheap as they were in those ages? What nation could then dispute with us in any foreign market, or pretend to navigate or to sell manufactures at the same price, which to us would afford sufficient profit ? In how little time, therefore, must this bring back the money which we had lost, and raise us to the level of all the neighboring nations? Where, after we have arrived, we immediately lose the advantage of the cheapness of labour and commodities; and the further flowing in of money is topped by our fullness and repletion.

Several points are worth noting. First, perfect commodity price arbitrage is not assumed. A depletion in money lowers prices. Second, in modern terminology, the temporarily

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6 David Hume, "Of the Balance of Trade", International Finance, R. N. Cooper (ed.). Baltimore: Penguin, 1972, p. 27.

lower prices draw in foreign reserves increasing the money supply until the domestic prices level has returned to its original level. Hence, while inflation is still imported, the transmission mechanism is from foreign money to domestic money to domestic prices, and not foreign prices to domestic prices to domestic money.

The evidence in favor of the "Law of One Price" is not overwhelming. (See Kreinin and Officer[7] for a survey of recent empirical literature). More recently, Allen, testing for the determinants of inflation in Switzerland found both foreign prices and domestic money to cause inflation.[8] Thus, there is some evidence that both direct price effects, and direct monetary effects determine domestic inflation.

For Nepal the circumstantial evidence in favor of the direct transmission of price effects seems more convincing. The simple correlation between Indian and Nepalese price movements is quite high, and considerable anecdotal evidence on cross-border commodity substitution does exist. However, the strong relation between the two price levels may be the result of a common underlying causal variable rather than being evidence of a strong direct price effect. For example, a monetary expansion in India leads to an increase in Indian prices and a flow of money into Nepal. The accumulation of foreign assets in Nepal increases the money supply in this country and hence the Nepalese price level. Therefore, what is essentially a monetary inflation shows up as a coincident movement in the two price levels, and may be interpreted as a direct effect of rising Indian prices on Nepalese prices. Conclusions based on only simple correlations between price levels are obviously suspect.

In this paper we, like Allen, take an eclectic approach to inflation in Nepal. We test the hypothesis that inflation in Nepal is a function of both foreign inflation and domestic monetary expansion. Because of the close geographic proximity and large scale Nepalese trade with India, the relevant foreign inflation rate is taken as Indian. Second, we do not directly address the question of whether Nepalese money can be controlled by Nepalese authorities. However, recent studies by McNown indicate that the money supply in Nepal is endogeneous.[9]

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7 M E. Kreinin and L. H. Officer, The Monetary Approach to the Balance of Payments: A Survey, Princeton: International Finance Section, Princeton University, 1978.

8 S. D. Allen, "Swiss Inflation and the two versions of the Monetary Approaches to the Balance of Payments", Atlantic Economic Journal Vol. 8 (July, 1980), pp. 13–19.

9 R. F. McNown, "International Constraints on Macroeconomic Policies in Nepal: 1957–1978. The Economic Journal of Nepal, Vol. 3. No. 1 (January-March, 1980) pp. 37—48 and "A Test of the Monetary Approach to the Balance of Payments for Nepal, 1958–1978," The Economic Journal of Nepal. Vol. 3. No. 4 (October–December, 1980) pp. 1–14.

Hence, significance on the monetary variable is consistent with the Humean mechanism sketched above of foreign money to domestic money to domestic prices.

MODEL, DATA AND METHODOLOGY

The regressions tested were of the form

$$\overset{*}{P}_N = a + b(\overset{*}{XP}_I) + c\overset{*}{M}_N \quad \ldots \quad .. \quad .. \quad \ldots \quad \ldots \quad 6.$$

and

$$P_N = a + b_1 \overset{*}{X} + b_2 \overset{*}{P}_I + c\overset{*}{M}_N \quad \ldots \quad .. \quad \ldots \quad \ldots \quad 7.$$

Where

$\overset{*}{P}_N$ = inflation rate in Nepal

$\overset{*}{XP}_I$ = Nepalese/Indian exchange rate times the price level in India converted to percentage changes

$\overset{*}{M}_N$ = percent growth in Nepalese Money (M_1)

$\overset{*}{X}$ = percent change in the Nepalese/Indian exchange rate.

$\overset{*}{P}_I$ = percentage change in the Indian

All data are quarterly and are from *International Financial Statistics*. Because of a change in the definition of money in 1970 III to exclude foreign liabilities, we test two time periods, 1963 III - 1979 IV and 1970 III - 1979 IV. The exchange rate is calculated by converting India/U.S. and Nepal/U.S. exchange rates (Period average, line rf. in I.F.S.) to the Nepal/India rate. Unless perfect arbitrage is assumed, the calculated series may diverge from the official exchange rate. Two versions of the model were tested because Indian inflation and changes in the exchange rate may not have equal effects on Nepalese inflation.

Preliminary tests indicate that M_1 outperforms the M_2 definition of money. Consequently, only those results obtained from M_1 are reported. These tests also indicated that a

distributed lag outperformed unlagged versions of the model. In all cases, the regressions reported in Table 1 are estimated using a third degree Almon lag.[10]

The procedure followed was first to determine the optimal lag lengths for equation 6 for both time periods by minimizing the standard error of the regression.

$$\overset{*}{P}_N = a + b\,(\overset{*}{X}p_1\,) + c\overset{*}{M}_N \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad 6.$$

These results are reported as Regressions 1 and 4, Table 1. The same lag lengths obtained in Regressions 1 and 4 were used to estimate equation 7.

$$P_N = a + b_1\,\overset{*}{X} + b_2\,\overset{*}{P}_I + c\overset{*}{M}_N$$

but $\overset{*}{X}$ and $\overset{*}{P}_N$ were allowed to take on their own coefficients. Finally, Regressions 3 and 6 allow $\overset{*}{X}$ and $\overset{*}{P}_I$ to vary in lag length.

An F-test designed to compare restricted with unrestricted models was employed to select between these alternative specifications[11] ,where needed, autocorrelation was corrected by the

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10 The Almon lag technique is a procedure for estimating a distributed log function by assuming this function to be approximated by a polynomial of fairly low order. A distributed lag simply specifies the dependent variable to be a function of past aswell as current values of the independent variables. The Almon lag technique requires the prior specification of the length of the lag and the degree of the approximating polynomial. See the discussion on pages 151—159 of H. Kelejian and W. Oates, Introduction to Econometrics. New York: Harper and Row, 1974.

11 This is the common test of linear restrictions sometimes referred to as the how test, The test is based on the F-statistic,

$$F = \frac{(ESSR_R - ESS_u)/r}{ESSu/d}$$

Where ESS_R is the error sum of squares for the restricted model, ESSu is the error sum of squares for the unrestricted model, r is the number of restrictions, and d is the number of observations minus the number of parameters in the unrestricted model. F will have the F—distribution with r and d degrees of freedom, and the restrictions will be rejected for F values larger than the corresponding critical value. In our cases the restricted model is embodied in regressions 1 and 4 in which X and P_I are forced to have identical coefficients.

Regression 1 is compared with regressions 2 and 3, and 4 is compared with 5 and 6 as corresponding unrestricted models.

For details on these tests of linear restrictions seeKelejian and Oates, pp. 179—181.

Cochrane-Orcutt Technique.[12]

EMPIRICAL RESULTS

A summary of the six regressions is presented in Table 1-where the sums of the distributed lag coefficients are given in the columns headed by the respective independent variables.

The results in Table 1 indicate that money affects Nepalese inflation in both periods, but ($\overset{*}{X}P_I$) is only significant over the entire time period, (Regressions 1 and 4). For the shorter time period, ($\overset{*}{X}P_I$) has the wrong sign, but is insignificant. However, our results are very sensitive to the number of variables allowed in the regression. For the longer time period when $\overset{*}{X}$ and $\overset{*}{P}_I$ are allowed to take on their own coefficients, money is insignificant, (Regression 2 and 3). The results for the shorter period show on significant variables, (Regressions 5 and 6). We conjecture that this problem may result from multi-collinearity, especially in the shorter period where the number of degrees of freedom is low.

Because of this ambiguity in the results some further analysis of these regressions is in order. The F-tests for the restrictions imposed by equations 1 and 4 (see Table 2) reveal that these restrictions are consistent with the data. Neither permitting the coefficients on Indian price and exchange rate variables to differ from one another (regressions 2 and 5) nor allowing the lag distributions of these two variables to differ in length (regressions 3 and 6) leads to any significant improvement in the performance of the model. Consequently the restricted equations, involving fewer parameters, are to be preferred on grounds of statistical efficiency. For the purpose of further discussion, details on the distributed lag coefficients for the two restricted equations (1 and 4) are presented in Table 3.

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12 Autocorrelation is the condition of non-independence of the error terms of different observations. The presence of this condition leads one to attribute too much explanatory power to the independent variables in a regression. The Cochrane-Orcutt technique is an iterative procedure for simultaneously estimating the magnitude of autocorrelation and eliminating it from the regression equa. The value of presented in Table 1 is the estimate of the coefficient of autocorrelation obtained by this technique

For details on the Cochrane-Orcutt technique, see J. Johnston, Econometric Methods, New York,: McGraw-Hill, 1972, pp. 262—263.

The results of regression 1 are quite sensible in all respects. The R^2 is quite satisfactory for a regression involving percentage changes of quarterly data, and the Durbin-Watson statistic indicates no significant autocorrelation. The sums of the lag coefficients for both independent variables are statistically significant and correctly positive. The distributed lag pattern shown in Table 3 shows that the Indian price variable has its most powerful impact in the immediate quarter, and that this effect dies out after two additional quarters have passed. The monetary variable does not begin to have an impact on inflation until one quarter has elapsed, and the effect of this variable builds in strength through the third quarter, and after the fourth quarter it loses all significance. Thus the direct price effect is more immediate, whereas the monetary impact takes some time to reach its maximum force on the rate of inflation. The sums of the lag coefficients indicate the long run impact of each of the variables on the rate of inflation. A one percent rate of inflation in India or a one percent growth in Nepal's money supply, for example, would lead to .74 percent and .60 percent rates of Nepalese inflation, respectively.

Regression 4, covering the shorter period of the seventies, is less satisfactory. The R^2 is quite high and the Durbin Watson statistic does not indicate any significant degree of autocorrelation. The sum of the lag coefficients on the monetary variable, while corectely positive and statistically significant, has an unreasonably high value, suggesting that a one percent growth in the money supply leads to a 3.29 percent rate of price increase. An even more troubling result is the negative sign on the sum of the lag coefficients for the price variable. While this sum is not statistically significant, many of the individual lag coefficients are, and those for the quarters of lowest lags are negative and statistically significant. Unfortunately neither of the companion unrestricted regressions for this period (regressions 5 and 6) are any better in this respect. The only safe conclusion from these anomalous results is that the rate of Indian inflation has not had a direct positive effect on Nepalese inflation during the seventies, while monetary changes have been an important source of price inflation in Nepal during this period.

SUMMARY AND CONCLUSION

The contention that monetary changes exert little influence on inflation in Nepal has been rather decisively rejected by the statistical tests reported in this paper. Indian inflation has also been shown to have been an important explanatory variable over the longer period studied here, but its effect on Nepalese inflation since 1970 is placed under some question by the shorter period regress-ions. These results are undoubtedly sensitive to the fact that we have had

to use the price index for Kathmandu to measure the rate of Nepalese inflation. As Kathmandu is some distance from India and represents one of the most highly monetized regions of the country, one should not attempt to apply the conclusions of this study to the whole of Nepal, especially to those regions close to India and less sensitive to Nepalese monetary changes. It could reasonably be argued that what we have tested is a model of inflation in Kathmandu, not a model of Nepalese inflation.

While the longer period regressions give grounds for caution, the 1970–1979 estimates imply that the traditional reservattons concerning flexible exchange rates have little bearing on the Nepalese economy. Our results for this later period contradict the assumption of strong international commodity substitution and the law of one price. The argument that exchange rate adjustments will lead directly to compensating changes in domestic prices is not consistent with our post–1970 results.

On the other hand the monetary variable is an important source of price changes, and therefore control of this variable is essential for the control of inflation. To the extent that domestic monetary affairs are determined by the balance of payments under fixed exchange rates, the monetary authority is powerless to contain inflation. A flexible rate system breaks the connection between the foreign sector and the money supply, and, according to our post–1970 estimates, exchange rate adjustments are not a source of price instability. While caution is suggested because of the anomalous nature of some of our results, the strong direct price effect estimated for the long period regressions, and the possible sensitivity of our results to the use of the Kathmandu price index, the evidence here is consistent with the claim that a move towards exchange rate flexibility may lead to greater control of inflation in Nepal.

Table 1 Dependent Variable = Nepalese Inflation.

Regression	Time Period	Constant a	Exchange Rate $\dot{X}$	Inflation (India) $\dot{P}_I$	Exchange Rate Times Inflation $\dot{X}\dot{P}_I$	Noney (Nepal) $\dot{M}_N$	R^2	F.	Standard error of the Regression	D.W.
1	1963 III– 1979 IV	–.016 (1.92)			.74 (2.71)* M =12	.60 (2.31)** M =7	.59	8.08 (8,45)	.0264	2.09
2	1963 III– 1979 IV	–.009 (.83)	.99 (3.10)* M =12	.80 (1.85)*** M =12		.34 (0.90) M =7	.62	5.64 (12,41)	.0267	2.22
3[1]	1963 III– 1979 IV	–.000 (.025)	.68 (2.42)** M =11	.53 (2.09)** M =5		.27 (0.83) M =7	.63	5,56 (12,40)	.0255	2,20
4[2]	1970 III– 1979 IV	–.099 (4.49)			–.30 (1.56) M =8	3.29 (4.95)* M =12	.93	22.13 (8,14)	.0131	2.31
5[3]	1970 III– 1979 IV	–.069 (1.04)	–1.73 (1.51) M =8	–0.53 (1.34) M =8		2.76 (1.48) M =12	.94	12.46 (12,10)	.0143	2.56
6[4]	1970 III– 1979 IV	.013 (0.32)	–2.32 (1.64) M =7	–0.21 (0.66) M =4		.49 (0.46) M =12	.94	14.65 (12,10)	.0133	2.64

Notes: M = lag length; (t scores in parentheses)

* significant at .01; ** significant at .05; *** significant at .10

[1] rho = –0.127; [2] rho = –0.669; [3] rho = –0.713; [4] rho = -0.707

Table 2

Tests of Restrictions on Parameters

Restricted regression	Unrestricted regression	Degrees of freedom	Computed F-value	Critical 5% F-value
1	2	4,41	1.871	2.60
1	3	5,40	2,046	2.45
4	5	4,10	.4232	3.48
4	6	4,10	.9038	3,48

Note : The restriction regressions are to be rejected if the computed F-value exceeds the corresponding critical value.

Distributed Log Patterns

	Regression 1 (1963 III – 1979 IV)				Regression 4 (1970 III – 1979 IV)			
	$\overset{*}{XP}_I$		$\overset{*}{M}_N$		$\overset{*}{XP}_I$		$\overset{*}{M}_N$	
Lag	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
0	.1915	3.532	–.0663	–1.036	–.2346	–2.760	.1783	2.191
1	.1071	3.234	.1719	2.750	–.2485	–3.137	.4249	4.715
2	.0557	1.814	.2166	3.427	–.1663	–2.316	.5246	5.719
3	.0307	.9627	.1486	2.482	–.0368	–.7184	.5122	6.019
4	.0257	.8382	.0489	.7875	.0413	2.486	.4224	5.795
5	.0339	1.212	–.0014	–.0224	.1693	3.699	.2899	4.891
6	.0489	1.828	.0786	1.245	.1484	2.779	.1494	3.057
7	.0614	2.323	—	—	–.0200	–.3728	.0357	.8051
8	.0730	2.583	—	—	—	—	–.0165	–.3820
9	.0688	2.552	—	—	—	—	–.0274	–.6532
10	.0451	1.548	—	—	—	—	.2023	4.434
11	–.0046	–.0936	—	—	—	—	.5428	7.588