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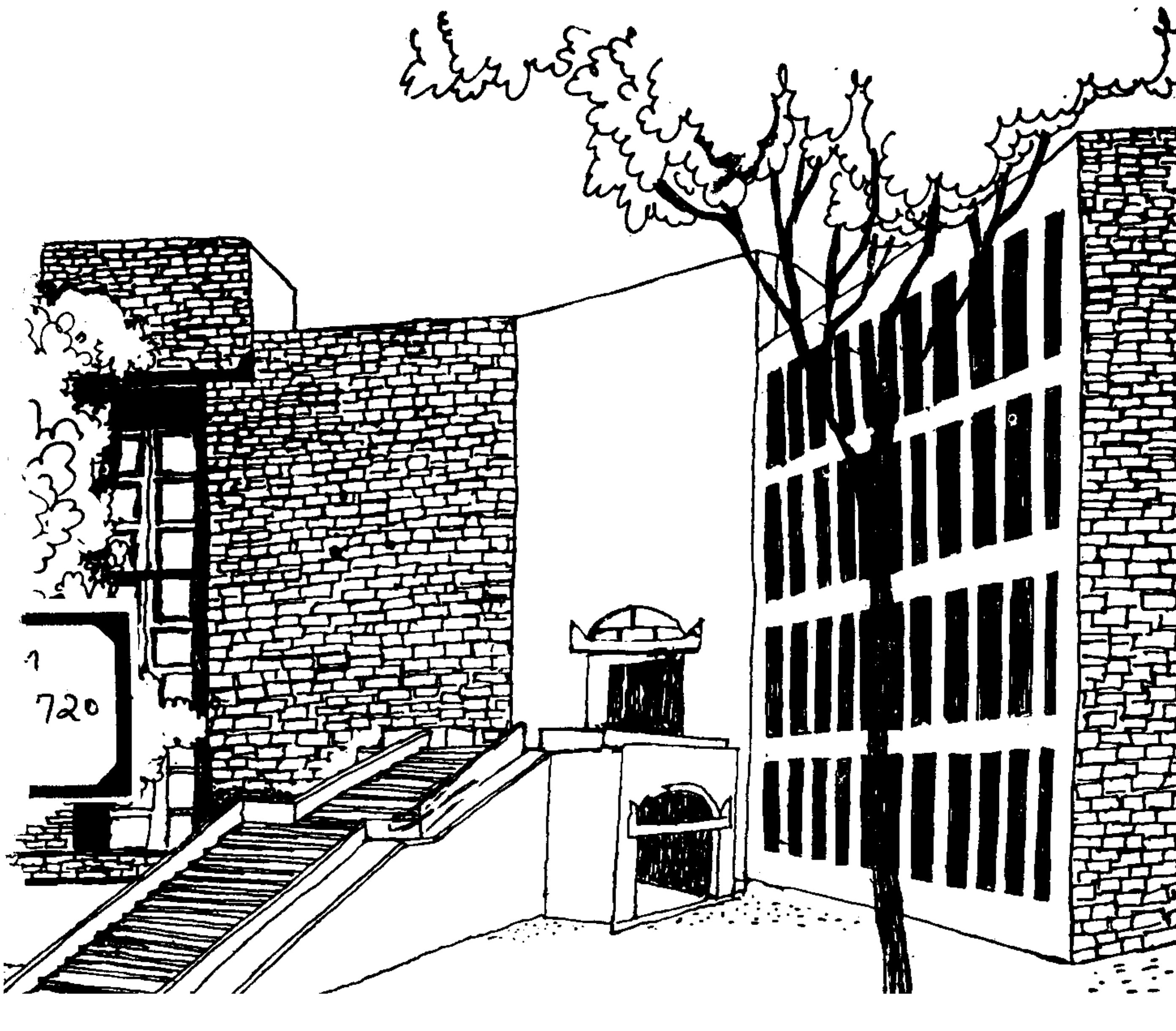

DOES INFLATION-UNEMPLOYMENT TRADE-OFF EXIST IN INDIA?

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ABSTRACT

The hypothesis of Extended Phillips Curve is examined in the present paper using the Indian data over the period, 1950-51 to 1984-85. The empirical evidence does not suggest any substantial trade-off between inflation and unemployment even in the short run in the LDCs like India. The labour market in the LDCs have such characteristics which bring them very close to the Keynesian aggregate supply curve in the short run. The formation of inflationary expectation in the study is based on adaptive expectations. The findings of the study have important implication for the choice of the strategy to deal with adverse supply shocks in LDCs.

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I. The Problem

Growing volume of literature on the theoretical foundation of the celebrated Phillips curve has clearly established that the trade-off between inflation and unemployment is essentially a short run phenomenon. Expectation augmented Phillips curve ensures that unemployment would remain at its natural rate irrespective of the rate of inflation in the long run. This is because expectation formation about inflation makes the short run Phillips Curve an unstable curve. The policy makers, therefore, cannot use it as a menu from which to choose the inflation-unemployment mix. The basic choice before the policymakers is, however, in terms of alternative adjustment paths that differ in the inflation-unemployment mix. The hypothesis of extended Phillips Curve defined in textbooks by now (e.g. Dornbusch and Fischer, 1987) brings out the subtle trade-off between inflation and unemployment that is directly useful for the policy decisions. It is argued that given the level of unemployment and expected inflation in the economy, the actual rate of inflation is determined by the rate of change in unemployment over time. Faster the decline in the unemployment rate, higher is likely to be the inflationary pressures.

The extended Phillips Curve can be conveniently represented by the following equation :

$$gp = gpe - b(u-\bar{u}) - h\,(u-u_{-1}) \qquad \ldots \qquad (1)$$

where gp and gpe represent respectively actual and expected rates of inflation; u and u_{-1} represent respectively the current and the last period's unemployment rates; and $\bar{u}$, b and h are positive parameters denoting respectively the natural rate of unemployment, the sensitivity of wages and hence prices to the labour market disequilibrium, and the sensitivity of the rate of inflation to the rate of recovery in the system. Thus, as per equation (1), inflation would not drop in spite of very high level of unemployment if the economy follows the strategy of high growth recovery. Strategy of slow recovery, on the other hand, would achieve a reduction in inflation only at the cost of persistently high levels of unemployment over longer time period.

For the less developed countries (LDCs), the hypothesis of extended Phillips Curve has very serious implications. I an external supply shock causes an LDC to move to the point of high inflation and high unemployment, according to the hypothesis of extended Phillips Curve, the country has to either apply severe brakes to the rapid strides on the path of economic development or bear the cost of excessive inflation which might considerably wipe out the painstakingly accumulated gains on the front of redistribution of income and wealth. External supply shocks could thus pose a serious challenge to the concept of planned economic development in LDCs. It is, however, possible to argue that LDCs by very nature do not have well-developed and efficient labour markets. Moreover, the concept of unemployment is also not uni-dimensiona in such countries. As a result, the link between disequilibrium in the labour market and the wages and hence prices would be non-existent or at best, very weak. The short run trade-off between inflation and unemployment implied by the simple Phillips curve itself would, therefore, be non-existent or insignificant in the LDCs. Rangarajan (1983) examining the data on price changes and output changes in the industrial sector, concludes that the relationship, if at all, is positive between inflation and unemployment in India. It might also be argued that the basic problem of LDCs is to achieve high growth in the face of un/underutilised potential. If this problem is somehow taken care of, most of the other problems including inflation could be automatically resolved. In other words, the LDCs would not experience inflationary pressures if the pace of growth is high. On the contrary, such pressures would be experienced if the rate of recovery is slow. Such an expectation is in sharp contrast to the hypothesis of the extended Phillips Curve and therefore calls forth empirical investigation particularly in LDCs.

II. The Framework

The empirical investigation in the LDCs has to proceed by explicitly recognising the limitations imposed by the availability of data. There is hardly any LDC where the comprehensive data on the overall extent of unemployment are meticulously collected in the first place and even if so, on regular annual basis in the second place. Thus, reasonably reliable long time series of unemployment statistics in the LDCs may be considered non-existent for all practical purposes. We need to reformulate, therefore, the extended Phillips Curve equation in (1) above.

A simple Phillips Curve lies at the root of the aggregate supply curve. The only difference between the two curves is that in the former the gap is measured in terms of unemployment rate (u) whereas in the latter, it is measured in terms of output. Symbolically, it amounts to assuming the following:

$$\bar{u} - u = \alpha \cdot (y - \bar{y}) / \bar{y} \qquad \ldots \qquad (2)$$

where α is a positive constant such that $\alpha = 1 - \bar{u}$.

Since equation (2) is consistent with the framework of the basic macroeconomic model, we can use it along with equation (1). Similarly, we can also derive a close link between changes in unemployment rate over time and the deviation of actual output growth from the trend rate of growth. Okun (1983) formally quantified such a relationship which has now come to be known as 'Okun's Law'. It can be stated symbolically as :

$$u - u_{-1} = -(1/q)\ (gy - g\bar{y}) \qquad \ldots \qquad (3)$$

where q is Okun's parameter reflecting the cost of cyclical unemployment; and gy and $g\bar{y}$ are respectively the actual and trend rates of output growth. Using equations (2) and (3), equation (1) can be written as :

$$gp = gpe + b(y - \bar{y})/\ \bar{y} + (h/q)\ (gy - g\bar{y}) \qquad \ldots (4)$$

In this form, the extended Phillips Curve can be fitted with the help of only price and output estimates. Explicit reference to unemployment is avoided. However, we need to define operationally the expectational variable, gpe. In the next section, we discuss the procedure adopted for the formation of inflationary expectations in the study.

III. Formation of Inflationary Expectation

The most common practice of formulating the expectation of inflation is similar to the one of measuring the permanent income in the consumption function studies (Friedman, 1957). We assume that expectation of inflation is based on current and past inflation rates. To simplify, we estimate gpe as being equal to last period's expected inflation rate (gpe_{-1}) plus some fraction (v) of the deviation of actual inflation rate in the current period from the expected inflation rate in the last period :

$$gpe = gpe_{-1} + v\ (gp - gpe_{-1})$$

$$\text{i.e. } gpe = vgp + (1 - v)\ gpe_{-1} \qquad \ldots \quad (5)$$

Using equation (5) and substituting each time for the gpe_t, we get the following standard expression (see Dernberg, 1985; 32n):

$$gpe = vgp + v(1 - v)gp_{-1} + v(1-v)^2\ gp_{-2} + \ldots + v(1-v)^r\ gp_{-r} \qquad \ldots . \quad (6)$$

Equation (6) represents the expected rate of inflation as a weighted average of all past inflation rates. Let us take the sum of the series of only the weights.:

$$v + v(1-v) + v(1-v)^2 + \ldots\ldots\ldots = 1$$

$$\text{i.e.} \quad v \left[\frac{1 - (1-v)^{r+1}}{1 - 1+v} \right] = 1 \qquad \ldots . \quad (7)$$

As it can be seen from equation (7), we have to consider all the past rates of inflation to estimate gpe unless v takes the extreme values of either 0 or 1. In the former case (v = 0), expectations are inelastic or wholly unadaptable

In the latter case ($v = 1$), we get infinitely elastic expectations or instantaneously adaptable expectations, which represents the underlying assumption of rational expectations. The parameter, v is thus crucial since its value has implications about the alternative hypotheses of expectation formation. If the value of v is lying between the two extremes of 0 and 1, value of r i.e. the number of past periods contributing "substantially" to the formation of inflationary expectation in the current period, can be determined by using equation (7) once we decide on a decimal which can be considered approximately equal to unity, representing the sum of weights in equation (7). Let us take 0.995 as approximately equal to unity. Since the weights are declining geometrically for more distant periods, the implication of our assumption is that we are ignoring all those distant periods of past whose cumulative total importance in forming today's expectations does not exceed 0.005 or 0.5% With this assumption, we can derive a precise relationship from equation (7) between the two parameters, r and v, such that given the value of one, the other is implied :

$$v = 1 - (0.005)^{1/(r+1)} \qquad \ldots \qquad (8)$$

Moreover, r has certain integer constraints since the availability of data is always for definite unit of time rather than on continuous basis. We would, therefore, be on firmer ground if we fix the value of r and obtain the implied value of v. Table 1 presents these values :

Table 1 : Associated Values of r and v

r	v	r	v	r	v	r	v
1	0.9293	6	0.5309	11	0.3569	16	0.2678
2	0.8290	7	0.4843	12	0.3347	17	0.2550
3	0.7341	8	0.4450	13	0.3151	18	0.2434
4	0.6534	9	0.4113	14	0.2976	19	0.2327
5	0.5865	10	0.3822	15	0.2819	20	0.2230

Using the values in Table 1 with the equation (6), we can generate alternative series for the inflationary expectation, gpe based on the data on current and past inflation rates. The number of observations in the series would go on declining as the value of r increases.

IV. Empirical Results

Equation (4) represents our basic equation for the extended Phillips Curve. The equation to be estimated empirically would be :

$$gp = a_o + a_1(gpe) + a_2((y - \bar{y})/\bar{y}) + a_3(gy - g\bar{y}) + w \ldots$$

where a_i's are parameters and w is the random error term with the usual OLS assumptions. We have used the Indian annual data for the period 1950-51 to 1984-85 for estimating equation (9). The rate of inflation is measured with the help of the GNP deflator. All the growth rates in the prices and output are annual rates based on continuous compounding. The output gap is measured by fitting the log-linear time-trend to the GNP at 1970-71 prices. Finally, 17 alternative series for inflationary expectation (gpe) are considered based on values of r ranging from 1 to 17. The corresponding implied values of v range from 0.9293 to 0.2550 as can be seen from Table 1. For all these 17 alternative series of gpe, equation (9) was fitted and the results are reported in Table 2.

It is evident from Table 2 that the broad structure of the regression results remains the same for the first 13 regressions corresponding to the values of r from 1 to 13 and to the values of v from 0.9293 to 0.3151. The structure of the regression results for the last 4 regressions corresponding to the values of r from 14 to 17 and to the values of v from 0.2976 to 0.2550, is different from the previous set. The difference between these two sets is on account of the statistical significance of the coefficient a_3 in equation (9) representing the sensitivity of the rate of inflation to the rate of recovery in the system. Out of the first 13 regressio in the previous set, except the second regression, all regress give statistically significant estimate for this particular parameter (a_3). In the last four regressions, on the other hand, the estimate of this parameter (a_3) is not significant at 5% level. The sign of the estimate, however, is negative

Table 2

REGRESSION RESULTS FOR EXTENDED PHILLIPS CURVE IN INDIA, 1950-51 TO 1984-85

Sl. No.	Parameters of: Intercept	gpe	$(y/\bar{y} - 1)$	$(gy - \bar{gy})$	$\bar{R}^2$	D.W.Stat	No. of Obs.	Val of
1.	-0.1967 (-2.14)	1.0461 (85.48)	0.0482* (1.52)	-0.0531 (-2.23)	0.9962	2.2133*	33	0.92
2.	-1.4614 (-2.18)	1.2122 (19.61)	0.1116* (1.38)	-0.0582* (-2.18)	0.8502	2.6450	32	0.82
3.	-0.9457 (-2.18)	1.1765 (19.61)	0.1775* (1.38)	-0.2044 (-2.18)	0.9377	1.9537*	31	0.73
4.	-0.7991* (-1.08)	1.1786 (11.17)	0.1998* (1.13)	-0.2679 (-2.13)	0.8425	1.6945*	30	0.65
5.	-1.8956* (-2.03)	1.3347 (9.99)	0.2582* (1.32)	-0.3100 (-2.25)	0.8167	1.8120*	29	0.58
6.	-2.2791 (-2.23)	1.3810 (9.36)	0.2310* (1.12)	-0.3481 (-2.40)	0.8062	1.7985*	28	0.53
7.	-2.2248* (-1.73)	1.3889 (7.50)	0.1920* (0.81)	-0.3762 (-2.28)	0.7553	1.7271*	27	0.48
8.	-2.9456* (-1.97)	1.4945 (6.93)	0.2391* (0.93)	-0.4702 (-2.56)	0.7318	1.7451*	26	0.44
9.	-2.9547* (-1.59)	1.5010 (5.64)	0.2179* (0.75)	-0.4684 (-2.30)	0.6700	1.6797*	25	0.41
10.	-3.6980* (-1.68)	1.5989 (5.14)	0.2177* (0.70)	-0.5006 (-2.27)	0.6337	1.6919*	24	0.38
11.	-4.2864* (-1.63)	1.6955 (4.55)	0.2069* (0.62)	-0.5150 (-2.18)	0.5856	1.6269**	23	0.35
12.	-5.5145* (-1.72)	1.8557 (4.16)	0.2154* (0.61)	-0.5258 (-2.12)	0.5582	1.5532**	22	0.33
13.	-6.8869* (-2.03)	2.0277 (4.28)	0.1935* (0.56)	-0.5412 (-2.19)	0.5850	1.6932*	21	0.315
14.	-7.5080 (-2.15)	2.0714 (4.23)	-0.0462* (-0.13)	-0.5962* (-2.09)	0.6312	1.6642**	20	0.297
15.	-7.7808* (-1.95)	2.1561 (3.80)	0.0088* (0.02)	-0.6000* (-2.06)	0.6053	1.8602*	19	0.281
16.	-8.0264* (-1.95)	2.1682 (3.73)	-0.0389* (-0.09)	-0.6048* (-2.02)	0.5781	1.7760*	18	0.267
17.	-7.2282* (1.79)	2.0861 (3.61)	-0.0919* (-0.21)	-0.6515* (-1.9263)	0.5752	1.8417*	17	0.255

Note: Figures in parantheses are t values of the estimates.
* Statistically not significant at 5% level of significance.
** The D.W. Test for autocorrelation is indeterminate.

in all the regressions without exception. The negative sign of the parameter a_3 is an important finding of our empirical exercise.

Another interesting result consistently obtained in all the 17 regressions reported in Table 2 is that the estimate of the parameter a_2 in equation (9) representing the sensitivity of wages (and hence prices) to the labour market disequilibrium is statistically insignificant. The t- values of the estimates of a_2 in all the regressions are so low that the null hypothesis $(a_2 = 0)$ cannot be rejected even at 10% level of significance.

The estimate of the coefficient of the expected rate of inflation (a_1 in equation 9) turns out to be positive and statistically highly significant in all the 17 regressions. Its numerical value keeps on increasing and the associated t- value keeps on falling as the value of r increases. The numerical value of this coefficient is important because in the long run equilibrium, even with adaptive expectations, we shall find that actual rate inflation is equal to the expected rate of inflation. Thus, the coefficient of gpe (a_1 in equation 9) should ideally be equal to unity. The results in Table 2,on the other hand,suggest that the coefficient is not statistically different from unity in only 8 out of the

17 equations considered.[*1]

The estimate of intercept, although negative in all the regressions, does not smoothly behave with respect to the values of r and v in terms of statistical significance. Its numerical value, however, keeps on increasing on the whole as r increases. Its negative sign in all the regression may imply that the 'autonomous' rate of inflation which is independent of the expected rate of inflation, the unemployment rate and the rate of recovery in the economy, is basically negative in the Indian economy.

Table 2 also reveals interesting pattern of behaviour of the $\bar{R}^2$, representing the goodness of the fit and the proportion of variance of actual rate of inflation explained by the regression. It declines on the whole from the high value of 99.62% to 57.52% as r increases from 1 to 17 and v declines from 0.9293 to 0.2550. Normally, the method followed here of fitting different regressions with alternative series of the expected inflation derived on the basis of successive values of r and v, is expected to yield a well-behaved inverted - U curve relationship between r or v and $\bar{R}^2$ so that the value of r or v maximizing the $\bar{R}^2$ can be uniquely determined. Thus, considering $\bar{R}^2$ as the sole criterion, the problem of expecta-

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*1. These regressions are : Serial No. 4, 9, 10, 11, 12, 15, 16 and 17.

tion formation could be resolved. It is, however, possible to consider a few more criteria to make the right choice of the regression and hance of the process of expectation formation. A good statistical fit is no doubt an important consideration, but constraints on parameters imposed by the conditions of long run equilibrium should also weigh equally in selecting the best regression. The selected regression should be such that it can be meaningfully interpreted in the framework of the extended Phillips Curve. When we consider this aspect explicitly, our criteria to select the best regression out of the alternatives considered here would be :

i) $\bar{R}^2$, ii) D-W statistic, iii) $a_o = o$; and iV) $a_1 = 1$.

In other words, the best regression is one which has the highest $\bar{R}^2$ subject to the fulfilment of the condition that it is consistent with the assumptions of the lack of autocorrelation on the one hand and expectations about inflation coming true on an average in the long run on the other hand. As it can be readily derived from Table 2, we find that regression No. 4 with r = 4 and v = 0.6534 is the one which satisfies all these requirements simultaneously.

V. Implications

The nature of the results of the empirical exercise has finally led us to accept the estimated regression equation No.4 in Table 2 as the best fit. The estimates of the coefficients in the equation has interesting implications. The estimate for the coefficient a_1 in equation (9) turns out to be statistically insignificant even at 10% level of significance. It represents the degree of responsiveness of wages to the disequilibrium in the labour market and hence determines the slope of the simple Phillips Curve and aggregate supply curve. Our finding, therefore, can be interpreted to imply that the Indian economy essentially has almost a horizontal Phillips Curve. Thus, in absence of expected inflation, the wages and prices in the short run are almost rigid as in the Keynesian case. Both the fiscal and monetary policies are most likely to have significant effects on the levels of output and employment in the short run. Their effect on prices would be negligible. It also implies that the Indian economy does not seem to face any appreciable trade off between unemployment and inflation even in the short run.

The second important finding of our empirical exercise is the statistically significant negative estimate of the coefficient a_3 in equation (9). It represents a combined effect of two parameters, h and q from equations (1) and (3). Parameter h represents the sensitivity of the rate of inflation to the rate of recovery (growth) in the system, whereas q is the Okun's parameter reflecting the cost of unemployment in excess of the natural rate of unemployment. Since the Okun's coefficient q depends on the overall marginal productivity of labour in the whole economy, we can reasonably assume that it would be positive for any economy, developed or underdeveloped. Thus, negative estimate for the coefficient a_3 necessarily implies that parameter h is negative for the Indian economy. The strategy of rapid recovery or fast growth to reduce involuntary unemployment in the Indian economy is not likely to ignite inflationary forces. On the contrary, the strategy of slow recovery is likely to aggravate inflationary pressures in the Indian economy.

As it is well-known, the Indian labour force is characterized by the phenomenon of disguized unemployment and underemployment like most other developing economies. The rapid rise in demand for labour, therefore, does not raise wages in the first instance. The labour markets in such economies are, moreover, so segmented that even if wage increase has taken place in one segment, it takes a long time before it becomes a general phenomenon. The prices are also, therefore, not so quickly responsive to the rapid growth in the system. It may also be pointed out that inflation in the developing countries is more a phenomenon arising out of adverse supply shocks in the form of natural calamities like drought and floods, or in the form of unfavourable movement of the terms of trade, or the internally and externally disturbed political environment resulting into agitations and wars. Strategy of rapid economic recovery can, therefore, effectively tackle the problem of high inflation in such countries provided the rate of monetary growth is kept under control. The strategy of slow recovery only delays the effective solution and thereby aggrevate the problem of high inflation. Thus, contrary to the hypothesis of extended Phillips Curve, the Indian experience suggests no conflict even in choosing the strategy to fight situations arising out of adverse supply shocks. Fast growth is a comprehensive solution to almost all problems of the LDCs.

Finally, it is also interesting to note that formation of inflationary expectation in India involves consideration of the past four years' experience of inflation by people. This itself is a long period of time indicating sluggishness of the wage and price adjustment process in the economy. It also reflects on the nature of the contracts in the labour markets in India. It appears that a significant proportion of contracts in the labour market is made up of long term contracts between the employer and the employee. The labour market in the organized sectors of the Indian economy can be considered to fall in this category. The normal periodicity of wage agreements and settlements in the organized manufacturing sector in India is around 3 years. This corroborates our finding about the process of formation of inflationary expectations in India.

To sum up, then, we may state that the empirical evidence does not suggest any substantial trade off between inflation and unemployment even in the short run in the LDCs like India. The labour markets in the LDCs are also underdeveloped and have such characteristics which bring them very close to the Keynesian aggregate supply curve in the short run. The strategic choice for such countries is very clear. They need rapid growth of output not only to tackle some of their pressing problems like poverty and unemployment but also to combat inflation. Frequent occurance of supply shocks only reiterate the need for planned development in these countries rather than a plan holiday in anticipation of an imaginary serious trade-off between inflation and unemployment which, in all probability, is not likely to exist.

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