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INFLATION DIFFERENTIAL AND INFLATION TARGETING IN INDIA

Anuradha Patnaik[1]

ABSTRACT

The Reserve Bank of India and the Central Government, signed the Monetary Policy Framework Agreement, formally adopting a Flexible Inflation Target (FIT) as the policy tool. A peek into the inflation rates prevailing at the state level, however, shows significant inflation differential, between the state level inflation rates and the national inflation rate, which means that the inflation target will have different connotation for each state. The paper, tries to empirically explore, if this inflation differential, is due to convergenec of prices ie the Balassa- Samuelson effect. It is concluded that convergence in prices, cannot be ruled out in India.

JEL Classification: C21, C23.

Key Words: Panel Unit Root Tests, Cross Section Dependence, Moran's I, Inflation Differential

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INFLATION DIFFERENTIAL AND INFLATION TARGETING IN INDIA

1. Introduction

On the 20th of February 2015, the Reserve Bank of India and the Central Government, signed the Monetary Policy Framework Agreement, formally adopting a Flexible Inflation Target (FIT) as the policy tool. This means that when setting the policy rate, the Central Bank (RBI) will not only try to attain the inflation target, but also strive to stabilise real economic developments (Svensson (1999). As a result the objectives of monetary policy would be to maintain price stability with focus on growth and 'subdue India's chronic price volatility'. The FIT, will become functional from the financial year ending March 2017. This will be preceded by a 2 year glide path before which the RBI will seek to bring the inflation rate measured by the New CPI (which has been chosen to be the nominal anchor), to the mid-point of the band of 4 +/- 2 per cent, as provided for in the agreement, (RBI, 2015).

Considering the fact that the CPI (with base 2012), which reflects the average of prices of 448 items in rural areas and 460 items in urban areas, is definitely a representative of the prices and therefore the inflation, at the national level. However, a peek into the inflation rates prevailing at the state level, shows significant variation in the inflation rates across the states, as well as the gap between the state level inflation rates and the national inflation rate. This inflation differential among the states may be due to a number of reasons, like natural endowments of the states, the transportation costs, restrictrictions on factor mobility, a host of idiosynchatic factors, levels of development or convergence in prices. It is important to note that an inflation divergence due to price convergence, is the most difficult to handle, by the policy makers. The law of one price, forms the link between convergence and inflation divergence. The law states that if initial prices expressed in a common currency are different, would eventually converge to a common level, and this results in an inflation catchup (Rogers, 2001). This phenomenan leads to the famous Balassa-Samuelson (1964) rationale, which says that countries/ regions with initial low prices could be expected to experience high inflation following integration and convergence. Thus, states/regions with initial lower prices will experience higher inflations after convergence, resulting in continuous inflation divergence. Under such circumstances an inflation target at the national

level, will have differential implications at the state level, thus, posing a challenge to policy makers (Das & Bhattacharya, (2005).

The present paper attempts to empirically test, whether prices are actually converging across the states of India and subsequently the implications for policy. Similar studies have been conducted at the international level, by Parsley & Wei, (1996), Cecchetti et al., (2002), for the cities of USA, Rogers et. al., (2001), for Europe, Yazgan & Yilmazkuday, (2014) for Turkey, Wei & Fan, (2002), for China and Moshin & Gilbert, (2010), for Pakistan etc. At the national level, Das & Bhattacharya, (2005), Morshed et. al., (2004), have dealt with price convergence, from different perspectives. The present study is similar to Cecchetti et al., (2002), in so far as it attempts to study the implications of price convergence for inflation targeting in India, however it differs from the same, in terms of the methodology used. Panel Unit Root tests have become standard tools for measuring convergence in prices, (Cecchetti et al., (2002), Parsley & Wei, (1996) etc, the Hadri (2000) test, has not been used under Indian conditions. The novelty of the study further lies in the fact that, spatial autocorrelations, have not been used to measure convergence in prices. In addition, to the best of the author's knowledge the implications of price convergence or divergence across the states of India for inflation targeting have not been analysed. The rest of the paper is designed as follows:- The recent trends in prices and inflation, have been highlighted in section 2. Section 3, comprises of the steps of empirical analysis. The results of empirical analysis are reported in section 4, and finally section 5 concludes.

2. Prices and Inflation Across the States: Trends

The problem underlying the study, gets clearly pronounced by analysing the trends in prices and inflation in India. The table no. 1 below reports rural, urban and rural and urban combined, CPI (base 2012) data for a total of 22 states and union territories of India for the month of March 2015. It is clearly evident that, even though the CPI measures the same basket of commodities for all the states and UT, there is significant variation in the same, across the states and UTs. At the rural level, while the national averge of CPI is 121, the minimum is 117.4 (in Delhi) and the maximum is 123.3 (Rajasthan and Bihar). Similarly at the urban level, while the national avarage is 119.9, the minimum CPI is 113.7(Uttarakhand) and the maximum is 123.9 (Karnataka). For the rural urban combined CPI the national average is 120.1, while the minimum is 116.6 (Uttarakhand) and maximum at 123.5

(Karnataka). Needless to mention that that the gap between the highest and lwest CPI is very high. So also prices at the state level are very different from the national average.

Table1: State/UT wise CPI for March 2014 and 2015 (Provisional) (Base 2012=100)

State/UT	Rural			Urban			Combined		
	CPI Mar. 14	CPI Mar. 15	Inflation rate	CPI Mar. 14	CPI Mar. 15	Inflation rate	CPI Mar. 14	CPI Mar. 15	Inflation rate
J& K	112.1	120.2	7.23	112.7	118.9	5.5	112.3	119.7	6.59
HP	116.3	122.6	5.42	112.6	116.6	3.55	115.6	121.5	5.1
Punjab	112.6	119.1	5.77	113.3	118.4	4.5	112.9	118.8	5.23
Uttarakhand	114	118.4	3.86	110.8	113.7	2.62	112.8	116.6	3.37
Haryana	112.3	118.9	5.88	112	116.9	4.38	112.2	118	5.17
Delhi	112.6	117.4	4.26	114.2	119.8	4.9	114.1	119.7	4.91
Rajasthan	114.5	123.2	7.6	112.6	118.6	5.33	113.8	121.6	6.85
UP	115.2	119.9	4.08	115.1	119.1	3.48	115.2	119.6	3.82
Bihar	118.1	123.2	4.32	115.5	119.4	3.38	117.7	122.6	4.16
Assam	115.1	118.6	3.04	114.3	118	3.24	114.9	118.5	3.13
W B	116.4	119.5	2.66	115.9	119.3	2.93	116.2	119.4	2.75
Jharkhand	115.7	120.3	3.98	113.8	117.6	3.34	115	119.3	3.74
Odisha	112.4	122.2	8.72	112.6	118.7	5.42	112.5	121.2	7.73
Chhattisgarh	117.4	126.1	7.41	111.6	117.7	5.47	115.2	122.8	6.6
M P	114.8	119.5	4.09	113.8	119.9	5.36	114.4	119.7	4.63
Gujarat	113.3	120	5.91	111.5	117.1	5.02	112.3	118.4	5.43
Maharashtra	112.9	121	7.17	112.2	117.1	4.37	112.4	118.4	5.34
A P	114.5	121.7	6.29	113.6	120	5.63	114.2	121.1	6.04
Karnataka	114	123.1	7.98	116.4	123.9	6.44	115.3	123.5	7.11
Kerala	115.3	122.3	6.07	115.5	122.4	5.97	115.4	122.3	5.98
Tamil Nadu	113.9	120.7	5.97	113.8	120.9	6.24	113.8	120.8	6.15
Telangana	111.5	118.5	6.28	114	118.8	4.21	112.9	118.7	5.14
All India	**114.6**	**121**	**5.58**	**113.7**	**119.1**	**4.75**	**114.2**	**120.1**	**5.17**

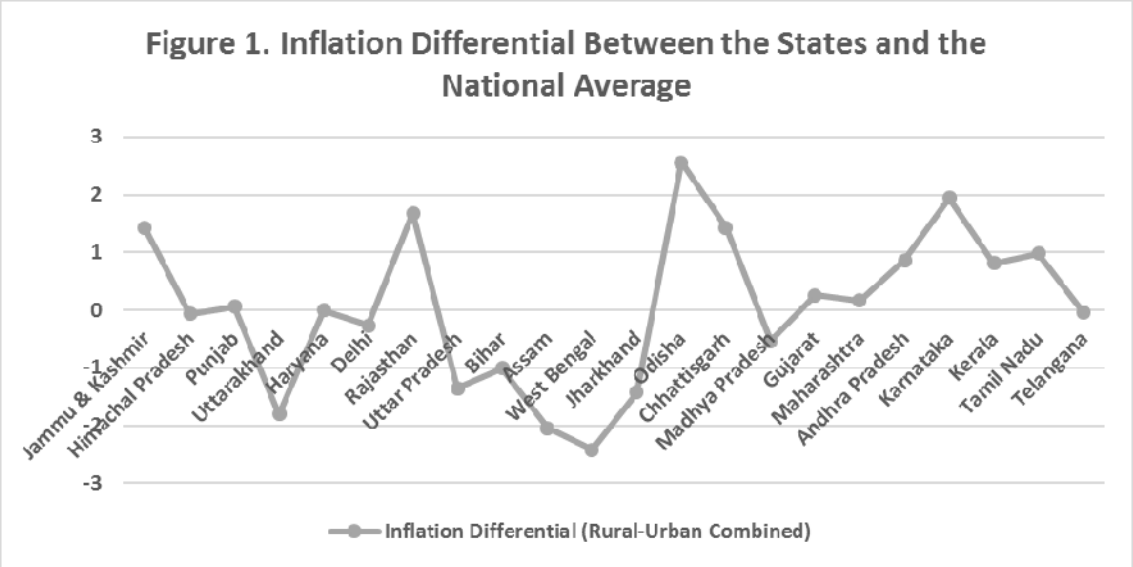
Source: Ministry of Statistics & Programme Implementation

The year on year inflation rates of all the states and union territories mentioned above, in comparision to the national average, at the rural, urban and rural-urban combined, for March 2015 has also been reported in the table no.1 given below.

It clearly shows that there is significant variation in the inflation rates at the rural level. The highest inflation rate of 8.72% (Odisha) is way above the national average of 5.58% and the state wise minimum of 2.66% (West Bengal). Similarly, the highest inflation rate for the urban centres for the said period is 6.24% (Tamil Nadu), and the lowest is 2.62% (Uttarakhand). The national average of 4.75%, is not even mid-way between the minimum and maximum inflation rates. The rural urban combined inflation rates are again varying considerably, with the maximum at 7.73% (Odisha) and the minimum of 2.75% (West Bengal).

The argument can be further strengthened by analysing the combined (rural + urban) inflation rate differential with respect to the national average, which has been graphically represented in figure 1 below. The figure clearly shows that the inflation rates of the states are diverging from the national average considerably. Out of the 22 states and UT considered, the inflation rates of only four states (ie Haryana, Himachal Pradesh, Punjab and Telangana), differ from the national average by less than +/- 0.1 points. The inflation rate in states like Odisha and Karnataka, is approximately 2+% above the national average and the inflation rates of West Bengal and Assam is less than 2% of the national average. Rest of the states have inflation rates within the band of +/-2% of the national average.

It can also be concluded that, an announced 4% inflation target at the national level, would mean a reduction in inflation rate, for states like Odisha, Rajasthan, Karnataka, J& K etc, whereas for states like West Bengal, Uttarakhand, Jharkhand etc, it will be contrary. As a result, the inflation target may push up the inflation expectations in the current low inflation states, and cause future higher inflation in these states. The inflation target may also highlight the real interest rate differential (real interest rate is higher for low inflation states), among the states, resulting in a fall in the investments in these states.



3. Steps of Empirical Analysis

The present study employs the Consumer Price Index (CPI), of the states, excluding Telangana, as a measure of prices and inflation rate. Monthly data of the same (CPI), for the period January, 2011 to December, 2014 (ie 48 cross-section observations of 28 states), was collected from the Open Government Data (OGD) Platform India, of the Government of India. The empirical methodology involves the following two steps:-

Step I: Estimation of Moran's I, for each of the 48 cross section of CPI data, both at urban and rural level.

Moran's I measures spatial autocorrelations, in cross section data. Significant Moran's I would mean correlation among values of a variable. The present study interprets these spatial autocorrelations, to be symbolising convergence in price. Since there are 48 sets of observations, both at rural as well as urban level, 48 each, (for rural and urban CPI), Moran's I values are estimated.

Moran's I gives the correlation among values of a single variable strictly attributable to their relatively close locational positions on a two-dimensional surface, introducing a deviation from the independent observations assumption of classical statistics (Griffith 2009). Positive spatial autocorrelation occurs when similar values (high/low) of a variable are clustered together and negative values occur when dissimilar values are clustered in space (Shaban 2006). Moran's I is estimated as follows:

$$I = \left(\frac{n}{s_0}\right) \sum_{i=1}^{N} \sum_{j=1}^{N} w_{ij} x_i x_j / \sum_{i=1}^{n} x_i^2 \quad \ldots(1)$$

Where n is the number of observations, wij is the element in the spatial weight matrix w corresponding to the region (i,j), observations xi and xj are deviations from mean values for region i and j respectively, and s0 is the normalising factor equal to the sum of the elements of the weight matrix, i.e., s0 = ΣiΣj wij. The spatial weight matrix is constructed on the basis of a local neighbourhood around each geographical unit. In the present case these weights are row standardised, with zero on the diagonal and some non-zero off the diagonal. With a null hypothesis of no global spatial autocorrelation, the expected value of I is given as:

$$E(I) = -\frac{1}{N-1} \quad \ldots(2)$$

If the computed I is larger than the expected value, then the overall distribution of variable y can be seen as being characterized by positive spatial autocorrelation and if the computed I is smaller than the expected value, the overall distribution of y is characterized by negative spatial autocorrelation. Moran's I ranges between -1 to 1, positive values of I show very strong spatial correlation and vice versa (Patnaik & Deshpande, 2013).

Step II: Estimation of Panel Unit Root tests of the CPI data.

(a) To further strengthen the cross sectional dependence argument as highlighted by the Moran's I results, the Pesaran CD test, and the Breusch-Pagan LM test, for cross-sectional dependence in panels, have been estimated.

(b) If the panel data of the 28 states over 48 observations, is found to be stationary, it implies that the prices are converging. The present study employs the Hadri (2000), panel unit root test to test for stationarity and subsequently draws conclusions about convergence in the CPI across the states, for the above mentioned period. The Hadri (2000) test has been chosen specifically because of (1) the presence of cross sectional dependence in the data, (2) the time series in the panel is too long. Hadri (2000) considers the following two models:-

$$y_{it} = r_{it} + \varepsilon_{it} \quad (3)$$

$$y_{it} = r_{it} + \beta_{it} t + \varepsilon_{it} \quad (4)$$

$$r_{it} = r_{it-1} + u_{it} \quad (5)$$

Where y_{it} is the series for which panel unit root test is being conducted, over the period t=1, 2, 3….T, and across i=1, 2…. N, and ε_{it} and u_{it} are zero-mean i.i.d. normal errors. If the variance of u_{it} were zero, then r_{it} will just be a constant and y_{it} would be trend stationary. Using this logic, the Hadri LM test, tests the following hypothesis:-

$H_0: \lambda = \frac{\sigma_u^2}{\sigma_\varepsilon^2} = 0$ verses $H_a: \lambda > 0$

The stationary hypothesis is simply $\sigma_u^2 = 0$. Since the ε_{it}*s* are assumed *i.i.d.*, then under the null hypothesis y_{it} is stationary around a level in equation 3 and trend stationary in equation 4 and the alternative being, at least one of the series is non stationary, the test statistic is asymptotically normally distributed (Hadri, 2000).

4. Empirical Results:-

The spatial autocorrelation tests have been reported in table 2, the Pesaran CD test, and the Breusch-Pagan LM test have been reported in table no. 3, and the panel unit root test results have been reported in table 4 below. All these tests have been conducted at the rural as well as urban level.

Table 2: Summary of Moran's I results

	Significant Moran's I	Range of significant spatial autocorrelation
Rural	7 out of 48 cross section units considered	0.12 to 0.15 (in 6 units considered) 0.25 (in one cross section unit)
Urban	15 out of 48 cross section units considered	-0.28 to o.23

The Moran's I results have been reported only in terms of number of significant Morans'I values. From table no. 2 above, it is clear that spatial autocorrelation of the CPI across the selected states in rural areas is very sparce, as the Moran's I values are significant for only 7 cross sectional units out of the 48 observations considered. Also in case of significant Moran's I, the spatial autocorrelation is very low (below 15%). At the urban level, however, there appears to be a relatively higher level of spatial autocorrelation. The Moran's I is significant in 15 out of the 48 cross-sectional unit considered at the urban level, also the range of significant spatial autocorrelation is higher than at the rural level. Since the Moran's I is significant in the cross sectional units, cross sectional dependence is evident in the data. To further strengthen the existence of cross sectional dependence of the prices the Pesaran cd

test and Breusch and Pagan test for cross sectional dependence for cross sectional dependence have been estimated. Both the tests, for rural as well as urban CPI, fail to accept the null of no cross sectional dependence as reported in the table no. 3 below.

Table 3: Tests for Cross –Sectional dependence

	Z(calculated Pesaran statistic for CD)	p-value	χ^2(calculated Breusch & Pagan statistic for cd)	p-value
Rural	53.5013	2.2e-16	3675.508	2.2e-16
Urban	70.3237	2.2e-16	5581.396	2.2e-16

The Hadri's panel unit root test results as reported in table no. 4 below, fails to accept the null of stationarity in the CPI urban as well as rural data, which means at least one panel is non stationary. This also implies that neither the rural prices nor the urban prices are converging.

Table 4: Panel Unit Root Test Results

	Z (the calculated Hadri statistic)	p-value
Rural	430.152	$2.4e^{-16}$
Urban	425.2669	$2.2e^{-16}$

5. Summary of Results and Conclusions:-

From the results of empirical analysis it is clear that:-

a) Spatial autocorrelation among the prices though sparce, is occurring. In urban areas it is relatively higher than in rural areas. Thus, convergence in prices cannot be ruled out completely.
b) The cross sectional dependence of the CPI, is further supported from the Pearson's cd test and the Breusch and Pagan test. This further supplements the argument for convergence in prices.
c) The panel unit root test, however fails to accept the null of stationarity, both at the rural as well as urban level. Since the Moran's I values have not been significant in a number of years, it is natural to get non stationarity in the Hadri test (which has an alternative as: at least one of the series is non stationary).

Thus, it can be concluded that the convergence of prices cannot be ruled out completely in India. The significant Moran's I, and the cross sectional dependence tests (Pearson's cd test and the Breusch and Pagan test) are in conformity with the findings of Das & Bhattacharya, (2005). With further deepening of the inclusive growth objective of the central government and greater integration of the states, convergence of prices will be the natural outcome.

Since a single inflation target at the national level, has different conotations for the states due to the underlying inflation differential, the need of the hour, for the RBI, is to eradicate the inflation differential caused due to the idiosynchratic factors, so that when full convergence in prices occurs, the inflation differential will be managable.

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