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Inflation and Per Capita Income in India

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Abstract: This paper examines the relationship between consumer price inflation (CPI) and per capita net state domestic product (PCNSDP) across Indian states using a balanced panel dataset spanning 2014-15 to 2024-25. The study draws on official data from the RBI's Handbook of Statistics. After constructing a balanced panel of 24 states and Union Territories over 11 years (264 observations), applying a suite of panel econometric estimators: pooled OLS, one-way fixed effects (entity), two-way fixed effects, random effects GLS, between estimator, and first-differences. Model selection follows the Hausman specification test. Unit-root diagnostics using augmented Dickey–Fuller tests indicate that both series carry non-stationary behaviour in levels, motivating the first-differences specification. The two-way fixed effects model—which accounts for both time-invariant state heterogeneity and common macroeconomic shocks—yields a statistically significant positive coefficient on CPI inflation ($\beta = 0.0049$, $p = 0.046$), while the first-difference estimator produces a significant negative coefficient ($\beta = -0.0084$, $p < 0.001$). The Hausman test ($p = 0.91$) favours random effects over one-way fixed effects. Taken together, these results suggest that the inflation–income relationship in India is nuanced: short-run income growth is dampened by inflationary shocks, but within-period cross-sectional variation, once purged of state and year effects, shows a mild positive co-movement consistent with demand-pull dynamics. The paper contributes a rigorous methodological treatment of India's state-level inflation–income nexus and discusses policy implications for monetary and fiscal coordination.

Keywords: Consumer Price Index, Per Capita NSDP, Panel Data, Fixed Effects, Random Effects, Hausman Test, Indian States, Inflation-Income Nexus

I. INTRODUCTION

The relationship between inflation and economic growth has been a central and contested theme in macroeconomics. Classical economists viewed moderate inflation as a natural by-product of expanding output, while structuralists argued that inflation reflected supply-side rigidities rather than demand pressure. In the context of a large federal developing economy like India, the inflation–income nexus takes on particular complexity: monetary policy is centralised, but price dynamics and income levels vary dramatically across states due to differences in agricultural dependence, industrial structure, fiscal capacity, and demographic profiles.

India provides an especially valuable laboratory for this analysis. The country is home to some of the fastest-growing sub-national economies in the world (Karnataka, Telangana, Maharashtra) as well as states that remain at very early stages of structural transformation (Bihar, Uttar Pradesh, Jharkhand). The introduction of a unified Consumer Price Index (CPI) at the state level from 2014 onwards—compiled under a methodologically consistent framework linking state-level inflation to state-level income.

This paper exploits precisely this data availability to conduct a rigorous panel econometric investigation of the CPI–PCNSDP relationship. Specifically, we address three questions:

2. Does the direction and magnitude of this relationship change when controlling for unobserved state heterogeneity and common macroeconomic shocks?

The remainder of the paper is structured as follows. Section 2 reviews the relevant literature. Section 3 describes the data and the construction of the balanced panel. Section 4 presents the empirical methodology. Section 5 reports and discusses the results. Section 6 offers policy implications and Section 7 concludes.

II. LITERATURE REVIEW

A. The Theoretical Framework

The theoretical foundations for the inflation–growth relationship are rooted in several strands of thought. Mundell (1963) and Tobin (1965) proposed that moderate inflation reduces real returns on money, inducing a portfolio shift into real capital and thereby stimulating investment. This 'Mundell–Tobin effect' predicts a mildly positive relationship between inflation and growth. Conversely, Fischer (1993) and Barro (1995) demonstrate empirically that inflation—particularly at high levels—is unambiguously detrimental to growth through multiple channels: it distorts price signals, erodes real wages, shortens investment horizons, and increases economic uncertainty.

A critical contribution is Sarel's (1996) identification of a structural break: below approximately 8 percent, the inflation-growth effect is negligible or slightly positive; above this threshold it turns strongly negative. This nonlinearity has been replicated across many datasets and is particularly relevant for India, where the sample mean CPI inflation in our panel is 5.1 percent—a level that sits in the moderate zone.

B. Evidence From India And Emerging Economies

At the national level, Mohanty and John (2015) found that inflation above 6 percent significantly impairs India's GDP growth. Kumar and Paramanik (2020) used time-series methods to document a negative relationship between CPI and real output growth over 2012–2019. Rangarajan (2020) argues that India's inflation targeting framework, adopted in 2016, has been successful in anchoring expectations but may have inadvertently tightened monetary conditions in states experiencing structural price pressures.

The state-level dimension has received less systematic attention. Nair and Eapen (2012) analysed inter-state inflation divergence but focused on wholesale price indices. More recently, Banerjee and Bhattacharya (2021) found significant heterogeneity in the transmission of national monetary policy shocks to state-level output, underscoring the need for panel approaches that explicitly account for state fixed effects.

Internationally, Bick (2010) and Kremer et al. (2013) employ panel threshold models across developing countries and consistently confirm the threshold nature of the inflation–growth nexus. These findings motivate our use of panel estimators that control for country (state) heterogeneity.

C. Methodological Considerations

A key econometric challenge is that simple pooled OLS conflates the 'between' variation (do higher-inflation states have lower incomes?) with the 'within' variation (does inflation rising in a state reduce its income?). The former likely captures structural differences (e.g., Bihar has both high inflation and low income partly for the same structural reasons), while the latter captures the causal channel of interest. This motivates the use of fixed effects (FE) estimators which purge time-invariant heterogeneity. The additional inclusion of time fixed effects (two-way FE) controls for pan-India macroeconomic cycles—such as the COVID-19 recession in 2020-21 or the global commodity price surge in 2022-23—that simultaneously affect all states.

III. DATA AND SAMPLE CONSTRUCTION

A. Data Sources

Variable 1 – Per Capita Net State Domestic Product (PCNSDP): Sourced from Table 20 of the RBI Handbook of Statistics. The data are at constant prices (base year 2011-12) and cover 33 states and Union Territories from 2011-12 to 2024-25.

Variable 2 – Average Annual CPI Inflation (General): Sourced from Table 108, RBI Handbook of Statistics are available for 35 states/UTs from 2014-15 to 2024-25. Arunachal Pradesh is explicitly noted as unavailable. The CPI is based on combined (rural + urban) indices.

B. Panel Construction And Balancing

The two datasets were merged on state name and year. The following exclusions were made to ensure a balanced panel:

- Arunachal Pradesh: Excluded from CPI table (data not available).
- Dadra & Nagar Haveli, Daman & Diu, Lakshadweep: Present in CPI table but absent from PCNSDP table.
- Gujarat (2023, 2024), Andaman & Nicobar Islands (2024), Chandigarh (2024), Goa (2024), Manipur (2024), Mizoram (2024), Nagaland (2024), Sikkim (2024): PCNSDP not reported. These states were excluded entirely to maintain balance.

Final balanced panel: 24 states/UTs × 11 years = 264 observations.

Table 1: States Included in the Balanced Panel

	State / UT	Region
1	Andhra Pradesh	South
2	Assam	North-East
3	Bihar	East
4	Chhattisgarh	Central
5	Delhi	North
6	Haryana	North
7	Himachal Pradesh	North
8	Jammu & Kashmir	North
9	Jharkhand	East
10	Karnataka	South
11	Kerala	South
12	Madhya Pradesh	Central
13	Maharashtra	West
14	Meghalaya	North-East
15	Odisha	East
16	Puducherry	South
17	Punjab	North
18	Rajasthan	North
19	Tamil Nadu	South
20	Telangana	South
21	Tripura	North-East
22	Uttar Pradesh	North
23	Uttarakhand	North
24	West Bengal	East

C. Variable Transformation

PCNSDP is transformed to its natural logarithm (ln_PCNSDP) to reduce skewness, stabilise variance, and allow the regression coefficient on CPI to be interpreted as a semi-elasticity: a one-percentage-point increase in inflation is associated with a $\beta \times 100$ percent change in per capita income.

IV. DESCRIPTIVE STATISTICS

Table 2: Summary Statistics – Balanced Panel (N = 264)

Statistic	PCNSDP (₹)	ln(PCNSDP)	CPI Inflation (%)
Observations	264	264	264
Mean	1,05,758.77	11.4445	5.1045
Std. Deviation	51,988.32	0.5144	1.7050
Minimum	23,223	10.0529	0.50
Q1	64,003	11.0667	4.00
Median	96,016	11.4723	5.00
Q3	1,40,836	11.8554	6.00
Maximum	2,83,093	12.5535	13.00

Table 3: Year-Wise Panel Means

Year	Mean PCNSDP (₹)	Mean CPI Inflation (%)
2014-15	83,364	6.50
2015-16	89,167	5.15
2016-17	95,924	4.18
2017-18	1,01,252	3.68
2018-19	1,07,343	3.41
2019-20	1,09,367	4.69
2020-21	1,00,904	7.06
2021-22	1,08,254	5.37
2022-23	1,14,606	6.29
2023-24	1,22,579	5.22
2024-25	1,30,588	4.60

Notable features emerge from Table 3. PCNSDP grew from ₹83,364 in 2014-15 to ₹1,30,588 in 2024-25, a cumulative real growth of approximately 57 percent. Inflation peaked at 7.06 percent in 2020-21 during the COVID-19 pandemic—which also caused a sharp contraction in mean PCNSDP—and was lowest at 3.41 percent in 2018-19. The data thus span two distinct regimes: moderate inflation pre-

pandemic (2014–2020) and elevated, volatile inflation post-pandemic (2020–2024).

The simple Pearson correlation between ln_PCNSDP and CPI in the pooled panel is r = −0.037 (p = 0.545), and the Spearman rank correlation is ρ = −0.026 (p = 0.679). Both are statistically indistinguishable from zero, indicating that naive pooled association is uninformative and that panel methods are necessary to identify the true relationship.

V. EMPIRICAL METHODOLOGY

A. The Panel Data Model

The general panel data model takes the form:

$\ln(PCNSDP_{it}) = \alpha + \beta\, CPI_{it} + \mu_i + \lambda_t + \varepsilon_{it}$ ... (1)

where i indexes states (i = 1, ..., 24), t indexes years (t = 2014-15, ..., 2024-25), μ_i is a state-specific unobserved effect capturing time-invariant characteristics (geography, historical institutions, infrastructure stock), λ_t is a year-specific effect capturing common macroeconomic shocks, and ε_{it} is the idiosyncratic error term. The parameter of interest is β, the semi-elasticity of per capita income with respect to inflation.

B. Unit Root Testing

With T = 11 time periods, formal panel unit root tests have limited power. We implement augmented Dickey–Fuller (ADF) tests on each state-level series independently. For ln_PCNSDP, no unit (0 out of 24) rejects the null of a unit root at 5 percent significance. For CPI inflation, only 4 out of 24 states reject the null. This suggests both series are I(1) in levels, motivating estimation in first differences to avoid spurious regression.

C. Estimators Employed

4. Pooled OLS: Ignores panel structure; provides a benchmark but is inconsistent if state effects are correlated with CPI.

5. One-Way Fixed Effects (Entity FE): Demeans each variable within states, removing μ_i. Consistent under endogeneity of μ_i with regressors.

6. Two-Way Fixed Effects (Entity + Time FE): Controls for both μ_i and λ_t. Estimated with heteroskedasticity-robust standard errors (HC1).

7. Random Effects GLS: Treats μ_i as uncorrelated with regressors; efficient but inconsistent if this assumption fails.

8. Between Estimator: Regresses state means of ln_PCNSDP on state means of CPI; captures only cross-sectional variation.

9. First Differences (FD): Regresses Δln_PCNSDP on ΔCPI; eliminates all time-invariant heterogeneity and is robust to I(1) series.

D. Model Selection: Hausman Test

The Hausman (1978) test evaluates whether the difference between FE and RE coefficients is systematic. Under H_0 (RE consistent), $\beta_{FE} - \beta_{RE}$ should be zero. The test statistic is:

$$H = (\beta_{FE} - \beta_{RE})^2 / (Var(\beta_{FE}) - Var(\beta_{RE})) \sim \chi^2(1)$$

Rejection of H_0 implies that unobserved state effects are correlated with CPI inflation, and FE is the preferred estimator.

VI. RESULTS

A. Main Regression Results

Table 4: Panel Regression Results – Dependent Variable: ln(PCNSDP)

Estimator	CPI β	Std. Error	t / z	p-value	Model Preferred?
Pooled OLS	-0.0113	0.0186	-0.61	0.545	No (benchmark)
One-Way FE (Entity)	-0.0065	0.0054	-1.22	0.222	Hausman: No
Two-Way FE (State+Year)	+0.0049	0.0024	2.01	0.046*	Yes (preferred)
Random Effects GLS	-0.0065	0.0053	-1.23	0.219	Hausman: Yes
Between Estimator	-0.0970	0.2705	-0.36	0.722	No (cross-sect. only)
First Differences	-0.0084	0.0024	-3.55	<0.001***	Yes (short-run)

* p < 0.05; *** p < 0.001

B. Hausman Test And Model Selection

The Hausman test yields $\chi^2(1) = 0.012$, $p = 0.914$. We fail to reject H_0, implying that the state-specific effects are not systematically correlated with CPI inflation after controlling for year effects. Random effects is the preferred specification in the one-way model. However, since both the ADF evidence and economic reasoning support including time effects, we treat the two-way fixed effects model as our preferred specification for the within estimates, as it controls for both state heterogeneity and aggregate business-cycle shocks. The RE estimate is reported alongside for robustness.

C. Interpretation Of Two-Way Fixed Effects Result

The two-way FE coefficient is $\beta = +0.0049$ ($p = 0.046$). After controlling for all time-invariant state characteristics (μi) and all year-specific common shocks (λt), a one-percentage-point increase in CPI inflation is associated with approximately 0.49 percent higher per capita income in that state in that year. This positive sign is consistent with demand-pull inflation: periods of robust local economic activity drive up both income and prices simultaneously. The magnitude, however, is small and just clears the 5 percent significance threshold, indicating a weak channel.

D. First Differences Result

The first-differences estimate is $\beta = -0.0084$ ($p < 0.001$). A one-percentage-point increase in CPI inflation from one year to the next is associated with a 0.84 percent lower growth rate in per capita income. This is the clearest causal estimate in the paper: by differencing, we eliminate all state-specific and most structural confounders, and the negative coefficient aligns with the cost-push and uncertainty channels of the inflation–growth literature. High inflation—particularly supply-driven inflation such as food price spikes—compresses real household incomes and investment.

E. State-Level Heterogeneity

Table 5 Reports Within-State Correlations Between Ln(Pcnsdp) And Cpi For Each State.

Table 5: State-Wise Within-Period Correlations:

ln(PCNSDP) vs CPI

State	Pearson r	p-value	Direction
Andhra Pradesh	-0.052	0.880	Negative (ns)
Assam	+0.084	0.807	Positive (ns)
Bihar	+0.070	0.838	Positive (ns)
Chhattisgarh	-0.193	0.570	Negative (ns)
Delhi	-0.691	0.019	Negative (sig)
Haryana	+0.187	0.581	Positive (ns)
Himachal Pradesh	-0.243	0.472	Negative (ns)
Jammu & Kashmir	-0.486	0.130	Negative (ns)
Jharkhand	-0.109	0.749	Negative (ns)
Karnataka	-0.144	0.674	Negative (ns)
Kerala	-0.125	0.715	Negative (ns)
Madhya Pradesh	+0.143	0.674	Positive (ns)
Maharashtra	-0.080	0.814	Negative (ns)
Meghalaya	-0.354	0.285	Negative (ns)
Odisha	-0.120	0.726	Negative (ns)
Puducherry	-0.191	0.573	Negative (ns)
Punjab	+0.188	0.579	Positive (ns)
Rajasthan	+0.038	0.912	Positive (ns)
Tamil Nadu	-0.069	0.841	Negative (ns)
Telangana	+0.106	0.756	Positive (ns)
Tripura	-0.140	0.682	Negative (ns)
Uttar Pradesh	+0.221	0.514	Positive (ns)
Uttarakhand	-0.181	0.594	Negative (ns)
West Bengal	-0.052	0.879	Negative (ns)

ns = not significant at 5%; sig = significant at 5%

Delhi is the only state with a statistically significant within-correlation ($r = -0.691$, $p = 0.019$), reflecting that its service-sector economy responds more sharply to inflationary episodes. Among northern states, the relationship tends to be negative; among poorer eastern and central states (Bihar, Assam, Uttar Pradesh), within-period correlations are mildly positive, possibly because agricultural income shocks drive both output and food prices simultaneously.

F. Diagnostic Tests

Table 6: Diagnostic Statistics

Test	Statistic	p-value	Conclusion
ADF unit root – ln_PCNSDP	0/24 reject	—	I(1) in levels
ADF unit root – CPI	4/24 reject	—	Near I(1) in levels

Hausman (FE vs RE)	$\chi^2(1) = 0.012$	0.914	RE preferred (one-way)
Breusch-Pagan LM (heteroskedasticity)	LM = 2.219	0.136	Homoskedastic residuals
Pooled OLS Durbin-Watson	DW = 0.237	—	Strong serial correlation

The very low Durbin-Watson statistic (0.237) from Pooled OLS confirms severe serial correlation, further motivating panel estimators over pooled OLS. Homoskedasticity of pooled residuals (Breusch-Pagan p = 0.136) is not a concern for our preferred two-way FE model which already uses robust standard errors.

VII. DISCUSSION

The findings of this paper point to a nuanced, multi-layered relationship between inflation and per capita income in Indian states. Three key insights emerge:
First, the level-based pooled and single-FE estimates yield negligible and statistically insignificant coefficients. This is not an absence of a relationship but rather a reflection of the compositional confounders. Richer states tend to have lower inflation (Delhi, Karnataka, Maharashtra) while poorer states face structurally elevated food and fuel prices. This 'between' effect works in the negative direction but is orthogonal to the causal channel.

Second, once we control for both state and year effects, a positive contemporaneous association emerges (two-way FE: $\beta = +0.0049$). This is consistent with demand-pull inflation: within a given state, years of stronger economic activity coincide with higher price pressures. The coefficient is modest and borderline significant, suggesting this channel is economically weak in the Indian context—perhaps because the Reserve Bank of India's inflation targeting from 2016 has dampened the demand-pull mechanism.

Third, the first-differences estimate is unambiguously negative and highly significant ($\beta = -0.0084$, $p < 0.001$). This captures the short-run, year-on-year dynamic: a rise in inflation erodes real income growth. This is particularly relevant for policy: when inflation surges (as in 2020-21 following supply disruptions), it suppresses per capita income growth even in states that are otherwise on strong growth trajectories. The 2020-21 observation—where mean CPI hit 7.06 percent and mean PCNSDP fell by 8 percent—is the most dramatic single illustration of this negative short-run transmission.

Taken together, these results suggest that India faces a structural inflation–growth trade-off: demand-driven expansions that push up prices in the short term do not harm incomes (two-way FE), but supply-side inflationary shocks that raise prices without stimulating output do significantly dampen income growth (FD). This distinction has profound implications for the design of stabilisation policy.

VIII. POLICY IMPLICATIONS

Monetary Policy: The RBI's flexible inflation targeting framework (target: 4%, band: ±2%) appears appropriate given our finding that inflation below 6–7 percent shows limited harmful effects on income. However, the sharp negative FD coefficient underscores the importance of preventing inflationary surges. Particular vigilance is warranted during supply shocks—food price volatility, fuel prices, and rupee depreciation—that cause CPI to spike without any corresponding income expansion.

State Fiscal Policy: Since inflation impacts states very differently—high within-state variation in CPI correlations—a uniform national response may be inadequate. State governments should invest in food logistics, storage infrastructure, and supply chain resilience to reduce the supply-side component of local inflation, particularly in vulnerable eastern and north-eastern states.

Distributional Concerns: Even where aggregate PCNSDP and inflation co-move positively, income distribution matters. Inflation disproportionately hurts the poor. Future research should examine the inflation–poverty relationship at the state level, for which NFHS and NSS household data would be essential.

IX. LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

Several limitations qualify our findings. First, T = 11 is a short panel; unit root tests have low power, and panel cointegration tests (Pedroni, Kao) would require $T \geq 20$.

Second, the analysis is bivariate; a structural model controlling for state expenditure, investment rates, and agricultural output share could isolate the CPI–PCNSDP channel more cleanly. Third, the CPI series is available only from 2014, precluding analysis of the pre-inflation-targeting era. Fourth, Jammu & Kashmir's CPI series has a structural break in 2019-20 due to the bifurcation of the state, which we have retained as a single entity in line with the source data's treatment.

Future research could profitably employ: (i) panel threshold models to test for a non-linear inflation threshold at the state level; (ii) spatial econometric models that account for cross-state inflation spillovers via migration and trade; and (iii) disaggregated CPI components (food, fuel, core) to identify which price categories are most damaging to income growth.

X. CONCLUSION

This paper presents a rigorous panel econometric analysis of the relationship between CPI inflation and per capita net state domestic product across 24 Indian states and Union Territories over 2014-15 to 2024-25. Using a strictly balanced panel of 264 observations and a hierarchy of estimators from pooled OLS to two-way fixed effects and first differences, we establish the following:

- The pooled and simple fixed-effects estimates show no significant association, reflecting heterogeneous structural factors across states.
- The two-way fixed effects model (state + year effects) reveals a weak but statistically significant positive co-movement ($\beta = +0.0049$, $p = 0.046$), consistent with demand-pull dynamics operating within states.
- The first-differences estimator documents a robust negative short-run effect ($\beta = -0.0084$, $p < 0.001$): inflationary surges suppress year-on-year income growth.
- The Hausman test favours random effects over one-way FE, suggesting that state-specific heterogeneity in inflation is not strongly correlated with structural income differences after accounting for time effects.

These findings have direct relevance for monetary and fiscal policymakers. Keeping inflation within the RBI's target band is not merely a nominal anchor; it is a material determinant of real income growth. Supply-side price pressures, in particular, act as a direct tax on income growth and deserve priority attention in policy design. This paper provides, to our knowledge, the first comprehensive panel econometric treatment of the CPI–PCNSDP relationship using the post-2014 harmonised state-level CPI data.

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