Structural Shifts in Household Consumption:

A Comparative Study of Haryana and Chhattisgarh

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Abstract

Household consumption expenditure patterns reflect the economic and social changes occurring within a society. While lower-income households tend to allocate a larger share of their budget to basic necessities like food, rising disposable income often shifts spending toward education, healthcare, durable goods, and other discretionary items. This study analyzes the consumption behavior of households in Haryana and Chhattisgarh, using unit-level data from the 64th round (2007–08) of the National Sample Survey Organisation (NSSO) Household Consumer Expenditure Survey. Haryana, characterized by higher per capita income and a more diversified industrial and service economy, offers a contrast to Chhattisgarh, where incomes are lower and the economy is predominantly mineral-based. The Almost Ideal Demand System (AIDS) and Linear Expenditure System (LES) models are employed to estimate income and price elasticities across broad commodity groups. By aggregating consumption into food and non-food categories, the analysis investigates how household spending patterns respond to changes in income and prices. The findings reveal structural differences in consumption behavior between the two states, offering important insights for designing state-specific policy interventions aimed at promoting welfare improvements and inclusive economic growth.

Keywords: Household Consumption, Haryana, Chhattisgarh, Consumer Behaviour, NSSO 64$^{\text{th}}$ Round, AIDS Model, LES Model, Income Elasticity, Price Elasticity.

Introduction

Consumption forms the backbone of economic activity and remains a key driver of growth and social welfare. Understanding how households allocate their resources across various goods and services offers critical insights into their economic wellbeing, aspirations, and vulnerabilities. Changes in consumption behaviour often precede or accompany structural changes in the economy, making it a valuable area of study for policymakers, businesses, and researchers alike.

This paper investigates the consumption expenditure patterns of households in Haryana and Chhattisgarh using data from the 64th round (2007–08) of the NSSO Consumer Expenditure Survey. These two states offer an interesting contrast: while both are similar in terms of population size, they differ significantly in economic structure, per capita income, and human development indicators. Haryana, located in northern India, has consistently ranked among the top Indian states in terms of per capita income and has benefitted from a strong agricultural base, rapid industrialization, and a burgeoning services sector. In contrast, Chhattisgarh, located in central India, is characterized by a lower per capita income, a reliance on extractive industries such as mining, and relatively modest development indicators.

Studying the consumption behaviour in these states can provide valuable insights into how economic structure, income levels, and development outcomes shape household demand. The analysis focuses on disaggregating household consumption into broad commodity groups and applying the Almost Ideal Demand System (AIDS) and Linear Expenditure System (LES) models. These methodologies allow us to derive price and income elasticities for different categories and to assess whether basic needs dominate household budgets or whether discretionary spending is gaining significance. Through this comparative exercise, the study aims to uncover underlying trends in household behaviour that may inform more effective state-level policies for income redistribution, poverty reduction, and economic planning.

1 Literature Review

Deaton, Angus and Muellbauer, John (1980) In their pioneering paper *An Almost Ideal Demand System*, Deaton and Muellbauer developed the AIDS model to analyze consumer demand behavior with greater flexibility compared to previous models. Their framework allows for the estimation of demand functions that satisfy the theoretical properties of additivity, homogeneity, and symmetry. Using British household data, they demonstrated how the model could accurately estimate own-price and cross-price elasticities along with expenditure elasticities for various goods. A key advantage of the AIDS model is its capacity to represent real-world demand behavior while maintaining aggregation across households without imposing unrealistic assumptions. This model is particularly relevant to this study as it offers the methodological base for examining how income and price changes affect consumption patterns in Haryana and Chhattisgarh.

Deaton, Angus (1997) Deaton's book *The Analysis of Household Surveys: A Microeconometric Approach to Development Policy* provides a comprehensive guide to using household survey data, especially from developing countries like India. He emphasizes how survey data such as that from NSSO can be used to model consumer behavior, measure poverty, and analyze welfare. Deaton discusses issues like measurement errors, sample design, and the estimation of demand systems from household-level data. His emphasis on careful data handling and model selection directly informs the methodology adopted in this study, which relies on NSSO 64th Round data to estimate price and income elasticities in two contrasting Indian states.

Stone, Richard (1954) In his classic paper *Linear Expenditure Systems and Demand Analysis: An Application to the Pattern of British Demand*, Richard Stone introduced the Linear Expenditure System (LES) to model household consumption behavior. Stone's LES assumes that households first allocate income to cover minimum consumption requirements for essential goods before spending any surplus income on other items. He applied this framework to British household expenditure data for six commodity groups. Stone's LES framework is particularly suited for capturing consumption behavior among lower-income groups, where subsistence consumption is a major factor. This makes the LES model ideal for analyzing household expenditure patterns in Chhattisgarh, a state with relatively lower per capita income, as part of the comparative study.

Blundell, Richard and Duncan, Alan (1998) In *Kernel Regression in Empirical Microeconomics*, Blundell and Duncan introduce semi-parametric methods, including kernel regression techniques, to overcome the limitations of parametric models in estimating demand systems. They argue that traditional functional forms often misrepresent consumer behavior when there are nonlinearities or heterogeneities within the data. Their work emphasizes the importance of flexible modeling when dealing with microeconomic data, such as household expenditure surveys. For this project, the lessons from their research suggest the need to be cautious while fitting functional forms like AIDS and LES models and highlight the importance of verifying model robustness, especially when dealing with heterogeneous states like Haryana and Chhattisgarh.

Kumar, Anjani (2015) Kumar's article *Changing Consumption Patterns in Rural India: Implications for Food and Nutrition Security* explores the broad transformation in rural consumption behavior over recent decades. Analyzing NSSO data, Kumar finds a consistent shift away from traditional food items, such as cereals, towards higher spending on non-food items like education, healthcare, and consumer durables. The study highlights how rising rural incomes have altered consumption baskets, signaling improvements in living standards but also raising concerns about nutritional outcomes. His findings provide a relevant backdrop for this research, particularly when analyzing Haryana, where higher income levels may be associated with a greater shift towards non-essential and discretionary expenditures compared to Chhattisgarh.

Ravallion, Martin (2000) In *Should Poverty Measures Be Anchored to the National Accounts?*, Ravallion explores the disconnect often observed between survey-based consumption measures and national accounts aggregates. He critiques the potential inconsistencies and suggests methodologies to reconcile the two, emphasizing the importance of household surveys for understanding micro-level economic realities. His insights are critical for this study as it involves analyzing NSSO survey data for Haryana and Chhattisgarh. Acknowledging potential limitations in the data and ensuring careful interpretation of findings are crucial when drawing conclusions about consumption patterns and welfare at the state level.

Himanshu (2010) In *Towards New Poverty Lines for India*, Himanshu provides a detailed analysis of poverty and consumption patterns based on NSSO rounds. He argues that India's poverty measurement needs to move beyond calorie-based norms and embrace more dynamic measures reflecting actual living standards. His work highlights how consumption patterns have shifted over time, with food expenditure shares declining even among the poor. The paper's emphasis on regional disparities and the changing structure of consumption is highly pertinent to the present study, which contrasts a relatively affluent state (Haryana) with a less developed one (Chhattisgarh), both in terms of income levels and consumption diversification.

2 Data & Sources

This study relies on nationally representative household survey data to examine the evolving food consumption patterns in Haryana and Chhattisgarh. The primary data source is the National Sample Survey Office (NSSO) Consumer Expenditure Survey (CES), which provides detailed information on household spending across various food categories and socioeconomic groups. Specifically, we utilize data from the 64th round to analyze the food consumption and non food consumption patterns across these states.

The NSSO 64th round data captures detailed information on household expenditure on a wide range of items, including food (such as cereals, pulses, milk, fruits, and vegetables), fuel and light, clothing and footwear, education, healthcare, durable goods, and miscellaneous non-food items. It provides a comprehensive picture of both essential consumption and discretionary spending, enabling a nuanced analysis of household priorities and living standards.

Studying the consumption behaviour in these states can provide valuable insights into how economic structure, income levels, and development outcomes shape household demand. The analysis focuses on disaggregating household consumption into broad commodity groups and applying the Almost Ideal Demand System (AIDS) and Linear Expenditure System (LES) models.

3 Methodological Literature Review

There are multiple ways to estimate a demand system, but all of them are aimed at arriving at demand functions that satisfy some desirable properties. In particular, consider four properties of demand functions on the basis of which demand theory is built.

1. **Additivity:** The total *value* of Hicksian/Marshallian demands is total expenditure (by Duality). Formally, the property of additivity of demand is expressed as

$$\sum_k p_k g_k(x, p) = x,$$

   where h_k is the Hicksian demand function, g_k is the Marshallian demand function and x is total expenditure. Additivity follows the linearity of the consumer's budget constraint.

2. **Homogeneity:** Perhaps the toughest property to satisfy, homogeneity states that the Hicksian demand functions are homogeneous of degree 0 in prices (i.e. $h_i(u, \lambda p) = h_i(u, p)$) and the Marshallian demand functions are homogeneous of degree 0 in total expenditure and prices (i.e. $g_i(\theta x, \theta p) = g_i(x, p)$). This property is also related to the linear constraint and implies that only relative prices matter in determining demand.

3. **Symmetry:** The cross-price derivatives of the compensated demand functions must be symmetric, i.e., $s_{ij} = s_{ji}$. This property can be expressed equivalently in terms of the compensated cross-price elasticity of demand and budget shares as $w_i e^c_{ij} = w_j e^c_{ji}$. This property comes from applying Young's Theorem to the cost function *assuming continuous derivatives exist.* Note that symmetry is a property stemming from the consistency of consumer preferences.

4. **Negativity:** The $n \times n$ matrix formed by the elements $\frac{\delta h_i}{\delta p_j}$, $\forall i, j$ must be negative semi-definite, i.e., the quadratic form

$$\sum_i \xi_i \sum_j \xi_j \frac{\delta h_i}{\delta p_j} \leq 0.$$

   Intuitively, this follows from the concavity of cost and thus, from the consistency of consumer preferences.

Then, each of the following subsections deals with different methods to estimate demand with a focus on these four properties

3.0.1 Stone's analysis

The estimation of demand systems is initially motivated by Stone (1954a), based on the fact that the elasticity of demand (both for income and prices) is dimensionless, and can be estimated as the parameters of a log-linear regression equation.

Following is a logarithmic demand function:

$$\log(q_i) = \alpha_i + e_i \log x + \sum_{k=1}^{n} e_{ik} \log p_k \quad (1)$$

where, e_i is total expenditure elasticity, e_{ik} is the cross price elasticity of the k^{th} price on i^{th} demand, q_i is the quantity demanded, p_i is the current price of k^{th} good, and x is the total expenditure.

Stone estimated the demand function for 48 categories of food consumption over the period 1920-38 (N = 19). Restrictions are required in equation (1) to preserve degrees of freedom. Stone solves this problem by decomposing the cross-price elasticities according to Slutsky Equation that yields

$$e_{ik} = e^*_{ik} - w_k e_i,$$

where, e^*_{ik} is the compensated price elasticity and w_k is the budget share.

Enforcing homogeneity ($\sum_{k=1}^{n} e^*_{ik} = 0$), and creating a general price index P as a budget share the weighted sum of log prices, we arrive at the estimating equation:

$$\log q_i = \alpha_i + e_i \log\left(\frac{x}{P}\right) + \sum_{k=1}^{n} e^*_{ik} \log\left(\frac{p_k}{P}\right) \quad (2)$$

Note that while (1) was in uncompensated terms, (2) is in Hicksian terms, where there are no income effects in price responses. This allows us to restrict the analysis to a set of K closely related goods, preserving degrees of freedom.

Stone's analysis uses time series data for each of the categories of food consumption. To account for the changes in tastes, Stone introduced a time trend θ_{it} and implemented first differences (to minimize serial correlation). This gives the final estimating equation of Stone's analysis:

$$\Delta[\log q_i - \bar{e}_i \log x/P] = \theta_i + \sum_{k \in K} e^*_{ik} \Delta \log(p_k/P) \quad (3)$$

where $\bar{e}_i$ is the expenditure elasticity estimated from the budget study.

Stone was able to estimate own price elasticities, cross-price elasticities, and income elasticities for each commodity group, but not without contradictory results. For instance, in the equation estimating the demand for bananas, oranges, and bananas are complements, while in the equation estimating the demand for oranges, they are substitutes. Clearly, the symmetry property $w_i e^*_{ji} = w_j e^*_{ij}$ does not hold, and we need an alternate empirical strategy.

3.1 Linear Expenditure System (LES)

The neoclassical theory of consumer choice serves as the foundation for the process utilized in this context to establish the characteristics of the demand system. According to Pollak (1971), this approach is predicated on the idea that a normal consumer's utility function may be divided into discrete partial functions, denoted by the notation $U(q1, q2, q3, \dots)$, which can then be combined collectively following a monotonic transformation. A Stone Geary utility function is the outcome of this:

$$U = \sum f_i(q_i) = \sum_{i=1}^{n} \beta_i \log(q_i - \gamma_i), \quad (4)$$

The consumption level of the i-th good is represented by q_i in this formula, and the utility function's parameters are β_i and γ_i. We maximize U while adhering to a budget, or the total cost of all goods, in order to ascertain the behavioral linkages. This budget constraint can be expressed as follows:

$$\sum_{i=1}^{n} p_i q_i = x \quad (5)$$

where p_i = **price of the ith good**, and x = **total expenditure on n goods**. A system of behavioral demand equations can be obtained by optimizing the constrained equations.

$$p_i q_i = p_i \gamma_i + \beta_i \left(x - \sum_{k=1}^{n} p_k \gamma_k \right) \quad (6)$$

The concave cost function is derived as:

$$C(u,p) = \sum p_k \gamma_k + u \prod p_k^{\beta_k} \quad (7)$$

To meet the budget constraint and the regularity criterion, which states that x must be greater than or equal to $\sum p_k \gamma_k$ in order for q_i to be greater than or equal to γ_i, the adding-up condition requires that parameters $\beta_i^{'} s$ be non-negative and that the parameters add up to one. This formula suggests a fair preference structure by guaranteeing that the total of β_i equals 1. These limitations must apply in order for $C(u,p)$ to be concave and for (6) to follow from limited utility maximization. As a result, these demand functions meet the requirements for adding-up restriction, homogeneity in prices and total spending, and regularity, which suggests that the utility function is quasi-concave. The subsistence parameter, denoted by γ_i, is also known as the minimum needed amounts. This implies that the individual first purchases γ_i units of good i at a cost of $\sum p_k \gamma_k$ which is called '**committed**' or '**subsistence expenditure**'. The total cost of subsistence is $\sum p_k \gamma_k$. This leaves $x - \sum p_k \gamma_k$ as '**supernumerary expenditure**'. The distribution of $\beta_i^{'} s$ indicates how a customer spends his excess money on various goods.

Our cost function shows that the fixed cost element, $\sum p_k \gamma_k$, allows for no substitution at all. In addition, there is a term, $\prod p_k^{\beta_k}$, which permits the purchase of utility at a constant price; this term is similar to the price index that indicates the marginal cost of living because it is the weighted geometric mean of the prices. Now, we want to determine the group's spending elasticities, cross price, and own price (non-compensated) using (6). The following is an expression for them:

$$\eta_{ii} = \frac{p_i \frac{\partial q_i}{\partial p_i}}{q_i} = \frac{\gamma_i (1 - \beta_i)}{q_i} - 1 \tag{8}$$

$$\eta_{i,j} = \frac{p_j \frac{\partial q_i}{\partial p_j}}{q_i} = -\beta_i \frac{p_j \gamma_j}{p_i q_i} \tag{9}$$

$$\eta_m = \frac{M \frac{\partial q_i}{\partial M}}{q_i} == \frac{M \beta_i}{q_i p_i} \tag{10}$$

Commodity i will be price inelastic since its own price elasticity will always have an absolute value less than one when γ_i is positive and $0 < \beta_i \leq 1$. Comparably, when γ_i is negative, commodity i will always have a price elasticity of one because its absolute value will always be greater than one. The cross-price effects are negative when the $\gamma_i^{'}$s are positive, suggesting that the income impacts outweigh the substitution effects. From (10), we find that expenditure elasticity can be obtained on the basis of the equation $w_i = \frac{p_i q_i}{x}$, the budget share of commodity i, and an estimate of the marginal expenditure share parameter β_i. We can combine them with the additivity restriction of $\sum \beta_i = 1$ and find that $\sum \eta_m w_i = 1$. Due to the adding-up constraint, the demand system from (6) contains a total of $2n$ structural parameters, of which $2n-1$ are independent parameters. The independent parameters are $n-1$ of which are β_i's and n are γ_i's.

3.2 Rotterdam Model

Named after its place of origin, the Rotterdam demand system deals with the *change* in consumption patterns over time, rather than dealing in levels. The model was originally estimated by Barten and Theil, and later formally estimated by Deaton (1974) in *Econometrica*.

The starting point of the Rotterdam framework is identical to Equation (1) in Stone's analysis:

$$\log(q_i) = \alpha_i + e_i \log x + \sum_{j=1}^{n} e_{ij} \log p_j \quad (11)$$

Totally differentiating both sides of Equation (11), we get

$$d \log q_i = e_i d \log x + \sum_{j=1}^{n} d \log p_j \quad (12)$$

Just like Stone's analysis, we can use the elasticity representation of Slutsky's decomposition $e_{ij} = e_{ij}^* - e_i w_i$ (notation follows from 2.2.1) to rewrite Equation (12) in compensated terms:

$$d \log q_i = e_i \left(d \log x - \sum w_i d \log p_i \right) + \sum_j e_{ij}^* d \log p_j \quad (13)$$

which is the differential of Stone's equation.

Unlike the functional form of the LES which is inherently restrictive, the benefit of the Rotterdam model is that it allows us to impose various combinations of restrictions on homogeneity, symmetry, and additivity.

Now, the symmetry property of demand is given by the condition $w_i e_{ij}^* = w_j e_{ji}^*$, i.e., it includes budget shares of goods i and j. To account for this, multiply both sides of (13) by w_i to get:

$$w_i d \log q_i = w_i e_i \left(d \log x - \sum w_j d \log p_j \right) + w_i \sum_j e_{ij}^* d \log p_j \quad (14)$$

$$w_i d \log q_i = b_i d \log \bar{x} + \sum c_{ij} d \log p_j \quad (15)$$

where $d \log \bar{x} = d \log x + \sum w_k d \log p_k$, $b_i = w_i e_i$, and $c_{ij} = w_i e_{ij}^*$. Here, b_i represents the marginal proportion of spending on good i, and $\bar{x}$ is an index representing the proportional change in real total expenditure.

3.3 Theoretical Restrictions

Using Equation (15), we can express theoretical restrictions on the model parameters. Deaton (1974) outlines five versions of the Rotterdam model based on varying restrictions:

- **Additivity:**
$$\sum_k b_k = 1 \quad \text{and} \quad \sum_k c_{kj} = 0 \ \forall j \quad (16)$$
- **Homogeneity:**
$$\sum_k c_{jk} = 0 \ \forall j \quad (17)$$
- **Symmetry:**
$$c_{ij} = c_{ji} \ \forall i, j \quad (18)$$

Additivity is a theoretical assumption and cannot be empirically tested, while **Homogeneity** can be verified. The negativity property of demand is indirectly satisfied through the Slutsky substitution matrix being negative semi-definite — ensured by the restrictions on c_{ij}.

3.4 Empirical Estimation

Deaton (1974) estimates the Rotterdam model using UK data from **1900-1970** — excluding wartime and rationing periods to avoid budget distortions. Goods are classified into nine categories:

- Food
- Footwear & Clothing
- Housing & Household Expenditure
- Fuel & Light
- Drinks & Tobacco
- Travel & Communication
- Entertainment
- Other Goods
- Other Services

The demand system is estimated using **Maximum Likelihood Estimation (MLE)**.

3.5 Results and Insights

- All own-price elasticities are found to be **negative** — consistent with economic theory.
- The negativity condition, requiring non-positive eigenvalues of the substitution matrix, is largely satisfied.
- **Homogeneity**, however, contradicts the empirical data. Interestingly, given homogeneity, **symmetry** is less restrictive to enforce.

The Rotterdam model supports more flexible theoretical tests than the **LES**. Since homogeneity is rejected, Deaton hints at alternative models like the **Almost Ideal Demand System (AIDS)** (covered in the next section).

3.6 An Almost Ideal Demand System

The Almost Ideal Demand System (Deaton and Muellbauer, 1980) takes demand system analysis a step further and has advantages over the translog and Rotterdam models in that it provides an arbitrary first-order approximation to any demand system, exactly satisfies the axioms of choice, aggregates over consumers without using parallel linear Engel curves, has a functional form consistent with known household-budget data, is easy to estimate, and can be used to test the restrictions of homogeneity and symmetry, simultaneously.

The AIDS model is estimated under the assumption of weak separability of preferences which permits budgeting in stages. The model makes use of PIGLOG class of preferences that permit exact aggregation over consumers.

It is assumed that market demands result from a preference ordering, as derived from an expenditure or cost function, that is, the minimum expenditure necessary to achieve a given utility level at a given set of prices. Consider the following general cost function (Deaton and Muellbauer, 1980a, p. 313):

$$\log c(u,p) = (1-u)\log\{a(p)\} + u\log\{b(p)\} \quad (19)$$

where, u lies between 0 (subsistence) and 1 (bliss), $a(p)$ and $b(p)$ are positive linearly homogeneous functions of subsistence and bliss.

The functional forms for $a(p)$ and $b(p)$ are assumed as follows:

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$$\log\{a(p)\} = a_0 + \sum_k \alpha_k \log p_k + \frac{1}{2}\sum_k\sum_j \gamma^*_{kj}\log p_k \log p_j \quad (20)$$

$$\log\{b(p)\} = \log\{a(p)\} + \beta_0 \Pi_k p_k^{\beta_k} \quad (21)$$

where, $\alpha_i, \beta_i,$ and γ^*_{ij} are parameters.

Substituting the above in the general cost function:

$$\log c(u,p) = (1-u)\log\{a(p)\} + u[\log\{a(p)\} + \beta_0 \Pi_k p_k^{\beta_k}]$$

$$= \log\{a(p)\} + u[\beta_0 \Pi_k p_k^{\beta_k}]$$

The AIDS cost function is thus:

$$logc(u,p)a_0 + \sum_k \alpha_k \log p_k + \frac{1}{2}\sum_k \sum_j \gamma *_k j \log p_k \log p_j + u\beta_0 \Pi_k p_k^{\beta_k} \quad (22)$$

Note that $c(u,p)$ is linearly homogeneous in p iff $\sum_i a_i = 1$, $\sum_j \gamma^*_{kj} = \sum_k \gamma^*_{kj} = \sum_j \beta_j = 0$

By Shephard's Lemma,

$$\frac{\partial c(u,p)}{\partial p_i} = q_i$$

$$\implies \frac{p_i \partial c(u,p)}{c(u,p)\partial p_i} = \frac{p_i q_i}{c(u,p)}$$

$$\implies \frac{\partial \log c(u,p)}{\partial \log p_i} = w_i \quad (23)$$

[1] Taking the derivative of (22):

$$w_i = \alpha_i + \frac{1}{2}\sum_j (\gamma^*_{ij} + \gamma^*_{ji}) \log p_j + \beta_i p_i u \beta_0 \Pi_k p_k^{\beta_k - 1} \Pi_{k \neq i} p_k^{\beta_k}$$

$$w_i = \alpha_i + \sum_j \gamma_{ij} \log p_j + \beta_i u \beta_0 \Pi_k p_k^{\beta_k} \qquad (24)$$

where,

$$\gamma_{ij} = \frac{1}{2}(\gamma^*_{ij} + \gamma^*_{ji}) \qquad (25)$$

We now invert (22) to get the indirect utility function (Note that $c = x$ where x is the total expenditure):

$$\log x = \log P + u\beta_0 \Pi_k p_k^{\beta_k}$$

The indirect utility function is thus:

$$u(x,p) = \frac{\log(x/P)}{\beta_0 \Pi_k p_k^{\beta_k}}$$

Substituting the above in (24):

$$w_i = \alpha_i + \sum_j \gamma_{ij} \log p_j + \beta_i \log(x/P) \qquad (26)$$

Note that here,

$$\log P = a_0 + \sum_k \alpha_k \log p_k + \frac{1}{2}\sum_k \sum_j \gamma^*_{kj} \log p_k \log p_j \qquad (27)$$

[1] It is defined as the representation of market demands as if they were the outcome of decisions by a rational representative consumer.

To be consistent with demand theory it is necessary that we impose restrictions on (22) and (25) which imply restriction on parameters of AIDS function (26). These are:

$$(Adding\ up): \sum_{i}^{n} \alpha_i = 1; \sum_{i}^{n} \gamma_{ij} = 0; \sum_{i}^{n} \beta_i = 0 \qquad (28)$$

$$(Homogeneity): \sum_{j} \gamma_{ij} = 0 \qquad (29)$$

$$(Slutsky\ symmetry): \gamma_{ij} = \gamma_{ji} \quad (30)$$

The *negativity* can be tested for any given estimate by calculating the eigenvalues of the Slutsky matrix. Deaton and Muellbauer propose calculating the eigenvalues of k_{ij}.

In the estimating equation, the constant term or α_i represents an average budget share in the absence of changes in relative price and real expenditure. The βs are the expenditure coefficients and represent the change in i^{th} expenditure share with respect to change in real income, everything else is held constant. The expenditure coefficients are positive in the case of luxury commodities [2]

Demand Estimation Using AIDS Model

We estimated the demand functions for each commodity group individually using the Almost Ideal Demand System (AIDS) framework. As outlined earlier, when there are no changes in the prices of other commodity groups or in real expenditure, the budget share for a commodity remains constant and is determined by the parameter α. Variations in relative prices influence the budget share through the parameter γ, while changes in real expenditure affect it through the parameter β. This approach follows the original construction of the AIDS model by Deaton and Muellbauer (1980).

For our analysis, we classified the consumption basket into six broad commodity groups, and the corresponding results from the AIDS regressions are presented below.

Table 1: AIDS Regression Results: Chhattisgarh (64th Round)

Commodity	α	β	γ_{i1}-γ_{i3}	γ_{i4}-γ_{i6}
Food	0.0703**	-0.10904**	0.06749*; -0.0061; -0.0277***	-0.0032*; -0.0133***; -0.0134**
Clothing, Bedding & Footwear	0.00187	-0.0055**	-0.00309; 0.0393; 0.00024	0.00106; -0.0151; -0.0025
Fuel	0.3175	-0.026**	-0.0095; -0.0073***; -0.0005	-0.00702; -0.0267***; -0.00014
Medical & Education	0.2367***	0.0478***	-0.0108*; -0.0061; 0.0012	0.02667*; -0.0199***; -0.0028*
Miscellaneous	0.1732***	0.067***	-0.0327*; -0.0131***; 0.03228	-0.0147*; 0.1035***; -0.0281**
Durables	0.2002***	0.0258***	-0.0114*; -0.0067**; -0.0055**	-0.0028*; -0.0285***; 0.04696*

[2]This is calculated as

$$k_{ij} = \gamma_{ij} + \beta_i \beta_j \log(x/P) - w_i \delta_{ij} + w_i w_j$$

where δ_{ij} is the Kronecker delta.

4 Diagnostic Tests and Interpretation

4.1 Additivity

The sum of the α coefficients is approximately 0.9999, which is very close to 1, satisfying the additivity condition. Similarly, the sum of the β coefficients is around 0.009, which is sufficiently close to zero, confirming that this requirement is also fulfilled.

$$\sum \gamma_{i1} = \sum \gamma_{i2} = \sum \gamma_{i5} = 0, \quad \sum \gamma_{i3} = \sum \gamma_{i6} = 0.00002, \quad \sum \gamma_{i4} = 0.00001$$

Given that these values are either zero or extremely close to zero, restriction is deemed to be satisfied.

4.2 Homogeneity

This restriction holds across all commodity groups, except for expenditure on *fuel* and *clothing and bedding*. The deviation in these cases can be attributed to the following factors:

1. There may have been insufficient consideration of the dynamic aspects of consumer behaviour, as spending on certain items tends to be inflexible in the short run. Explaining variations in such expenditures may require the inclusion of additional variables, such as lagged dependent variables or time trends.

2. The omission of price expectations could also be a contributing factor. This suggests that the frequency with which different goods are purchased plays an important role in determining how expenditures respond to price changes, especially in the context of rapid absolute or relative price shifts.

3. Finally, it may be inappropriate to assume that the index representing the distribution of household budgets and demographic structure is independent of the average budget level and the prevailing price vector.

4.3 Symmetry

The symmetry condition, which requires that cross-price effects between goods be equal, is not satisfied for the majority of commodity groups. This deviation is observable directly from the estimated γ coefficients.

4.4 Interpretation of β and γ Coefficients

The interpretations align with standard demand theory:

- β represents the expenditure elasticity component.

- γ coefficients reflect own-price and cross-price elasticities, explaining how price changes affect budget shares across commodities.

4.5 Interpretation of α Coefficient

Holding other factors constant, the α coefficient represents the budget share allocated to a particular commodity. For example, an α of 0.0703 for *food* implies that approximately 7.03% of total expenditure is spent on food, assuming constant prices and income levels. Similar interpretations extend to other commodity groups.

Table 2: AIDS Regression Results: Haryana (64$^{\text{th}}$ Round)

Commodity	α	β	γ_{i1-i3}	γ_{i4-i6}
Food	0.14*	-0.097*	0.043*, 0.003**, -0.0001	-0.009*, -0.0243*, -0.006*
Clothing, Bedding & Footwear	0.06	-0.0047*	-0.0009, 0.006*, 0.0003	-0.003*, 0.0001, -0.0018
Fuel	0.14	-0.015*	-0.0013, 0.002, 0.015*	-0.004*, -0.015*, -0.002*
Medical & Education	0.347*	-0.043*	-0.006, -0.006*, -0.012*	0.061*, -0.044*, -0.007*
Miscellaneous	-0.04	0.045*	-0.027*, -0.003, -0.005**	-0.036*, 0.121*, -0.021*
Durables	0.34*	0.029	-0.007*, -0.002, 0.0014	-0.007*, -0.037*, 0.038*

4.6 Additivity

The sum of the α coefficients is 0.99, which is very close to 1, indicating that the additivity condition is nearly satisfied. Similarly, the sum of the β coefficients is 0.008, which is close to zero, thus fulfilling the required condition. Moreover, the sums $\sum \gamma_{i1}$, $\sum \gamma_{i2}$, $\sum \gamma_{i3}$, $\sum \gamma_{i4}$, $\sum \gamma_{i5}$, and $\sum \gamma_{i6}$ are all very close to zero, confirming the satisfaction of additivity across price coefficients.

4.7 Symmetry

The table clearly shows that the symmetry condition is not met for any set of price coefficients.

4.8 Homogeneity

For each commodity group, the condition $\sum_j \gamma_{ij} = 0$ is approximately satisfied (very close to zero), thus meeting the requirement for homogeneity.

4.9 Interpretation of β and γ

The interpretation of the β and γ coefficients remains consistent with the earlier discussion.

4.10 Interpretation of α

Holding all other factors constant, the budget share allocated to food is approximately 14%. Similar interpretations apply to the other commodity groups.

5 Elasticity

The tables present own-price, cross-price, and income elasticities, where figures marked with a (#) are statistically insignificant. Own-price elasticities for durables, medical and education, and miscellaneous goods are not reported due to the absence of price and quantity data, with only expenditure information available. Positive income elasticities

Table 3: Elasticities: NSS 64^{th} Round (Chhattisgarh)

Group	**Food**	**Clothing**	**Fuel**	**Durables**	**Med Edu**	**Misc.**
Food	-0.96	-0.08	0.06	0.05	-0.04	-0.27
Clothing	0.03(#)	0.62	0.002(#)	0.002(#)	0.01(#)	-0.19
Fuel	0.12	-0.16	0.6	0.02(#)	0.08	0.29
Durables	0.32	0.41	0.06(#)	N.A.	0.004(#)	0.22
Med Edu	-0.18(#)	0.19(#)	-0.2(#)	-0.01(#)	N.A.	0.26
Misc.	-0.05(#)	0.19	0.14	-0.06	0.03	N.A.
Total exp^	0.34	0.96	0.85	1.63	1.44	1.44

Table 4: *

Source: NSS Round 64^{th} (Chhattisgarh Household Consumption Expenditure Data)

Table 5: Elasticities: NSS 64^{th} Round (Haryana)

Group	**Food**	**Clothing**	**Fuel**	**Durables**	**Med Edu**	**Misc.**
Food	-0.99	-0.03	-0.04	-0.04	-0.08	-0.24
Clothing	-0.04(#)	-0.94	-0.02(#)	-0.01(#)	-0.03	0.08
Fuel	-0.11	-0.02(#)	-0.87	-0.03	-0.08	-0.23
Durables	-0.18	-0.03(#)	-0.17	N.A.	-0.26	-0.48
Med Edu	0.12(#)	0.03(#)	0.05(#)	-0.18	N.A.	-0.73
Misc.	-0.09	0.07	0.03(#)	-0.04	-0.09	N.A.
Total exp^	0.16	0.82	1.05	2.71	2.43	1.36

Table 6: *

Source: NSS Round 64^{th} (Haryana Household Consumption Expenditure Data)

across all categories indicate that all goods are normal. Food, clothing, and fuel, with income elasticities less than one, are identified as necessities, whereas durables, medical and education, and miscellaneous goods are considered luxuries. Own-price elasticities for the available commodities are negative and approximately unitary. Most cross-price elasticities are negative, implying complementarity among goods. However, the miscellaneous category exhibits positive cross-price elasticities with both clothing, bedding and footwear, and fuel, indicating substitutability between these groups.

6 Separability

The sub-group expenditure regressions for Chhattisgarh, encompassing cereals, fruits, intoxicants, animal products, and other commodities, indicate strong separability across groups. Most cross-price and cross-expenditure effects are statistically insignificant, suggesting limited interdependence between categories. However, cereals and pulses show notable interlinkages, and meaningful interactions are observed within the food group, particularly between cereals and fruits. Increases in fruit prices impact both cereals and intoxicants, likely reflecting budget adjustments among lower-income households. Fuel prices are largely independent of food, clothing, and other groups, emphasizing fuel's

Table 7: *

Source: NSS 64th Round (Chhattisgarh Household Consumption Expenditure)

	Cereals Value	Fruits Value	Intoxicants Value	Animal Value	Processed Value	Fuel Value	Clothing Footwear Value	Bed Value
Cereals Price	6.91*	-0.39	-2.62	-0.94	-0.01	-3.92	-0.09	0.09
Fruits Price	-13.05*	20.69*	4.72*	-8.82*	-4.44*	-10.75*	0.63	-0.63
Intoxicants Price	-0.23	-0.14	0.31*	0.52	-0.14	-0.07	-0.04	0.04
Animal Price	-8.54*	-2.77*	2.35	3.82*	-1.13*	-2.37*	-0.24*	0.24
Processed Price	-0.06	0.01	0.03	-0.05	0.69	-1.62	0.21	-0.21
Fuel Price	-39.05*	-4.69	9.07	12.83	11.98*	40.51*	1.17	-1.17
Total Food Expenditure	0.42*	0.14*	0.06*	0.16*	0.06*	0.09*	-0.01	0.004*
Total Clothing Bed Expenditure	-0.7*	0.35*	0.31	0.19	-0.39*	-0.65*	0.95*	0.05*
Total Medical Education Expenditure	-0.02	-0.01	-0.02	-0.0001	-0.0001	-0.01	0.002	-0.003
Miscellaneous Expenditure	-0.09*	0.003	0.001	0.04*	0.06*	0.01	-0.001*	0.002*
Durables Expenditure	0.03	0.04*	-0.03	-0.01	-0.004	0.01	0.002	-0.002

Table 8: Estimation Results: Haryana Household Consumption Expenditure (NSS 64$^{\text{th}}$ Round)

	Cereals Value	Fruits Value	Intoxicants Value	Animal Value	Processed Value	Fuel Value	Clothing Footwear Value	Bed Value
Cereals Price	20.44*	-3.23	-9.04	-6.06	-2.12	-4.16	-1.96	1.96
Fruits Price	-5.48	16.94*	17.12*	-24.72*	-3.87	-11.28	0.27	-0.27
Intoxicants Price	-0.81*	-0.19	0.68*	0.12	0.19	0.68*	0.03	-0.03
Animal Price	17.68*	1.75	-0.86	15.1*	1.69	-14.55*	0.16	-0.16
Processed Price	-4.27	-2.78	6.59	-1.49	1.95*	13.16*	1.04	-1.04
Fuel Price	0.09	-0.18	0.94	3.62	-4.48	1.27	-0.62	0.62
Total Food Expenditure	0.17*	0.13*	0.55*	0.08*	0.08*	0.05	-0.01	-0.01
Total Clothing Bed Expenditure	-0.15	0.13	-0.02	-0.6	0.65	0.13	0.93*	0.07*
Total Medical Education Expenditure	0.02	0.02	0.03*	-0.06*	-0.004	0.02	0.004	-0.004
Miscellaneous Expenditure	-0.003	0.02*	0.02	-0.03	0.01	0.001	-0.006*	0.007*
Durables Expenditure	-0.01	-0.01	0.006	0.02	-0.004	0.002	-0.001	0.002

Table 9: *

Source: NSS 64th Round (Haryana Household Consumption Expenditure Data)

role as an essential good. Expenditures on clothing and bedding demonstrate strong interdependence, necessitating dedicated allocation. Medical and education spending is largely self-contained, with only mild associations such as a weak link between animal product consumption and medical expenses, potentially due to health-related lifestyle changes. The miscellaneous group behaves mostly independently but shows some association with processed foods and durables. Overall, in the 2007–08 period, Chhattisgarh households exhibited structured consumption patterns aligned with two-stage budgeting: broad allocation across major categories followed by decisions within groups. The rigid compartmentalization of expenses reflects the constraints faced by lower-income households, who are unable to easily substitute between categories such as food, education, or clothing. Necessities dominate the consumption basket, and shifts towards luxury goods are infrequent. Traditional consumption patterns persist, with households distinctly planning expenditures on food, fuel, clothing, and medical care, showing minimal responsiveness to relative price changes.

7 Linear Expenditure System

In accordance with the methodology, alongside the Almost Ideal Demand System (AIDS), the Linear Expenditure System (LES) model was employed In accordance with the methodology, alongside the Almost Ideal Demand System (AIDS), the Linear Expenditure System (LES) model was employed to estimate household consumption patterns across six major commodity groups using data from the 64th round of the NSSO survey. The grouping of commodities was based on data availability and fits well within the

Group	Column 1		Column 2	
	Min. qty (γ_i)	**Marginal share (β_i)**	**Min. qty (γ_i)**	**Marginal share (β_i)**
Food	38.36969	0.7005579	786.4608	0.7969595
Clothing	-0.0006652#	0.1545141	1.645795	0.1166919
Medical & Education	1.000016	0.0000002#	0.9999323	0.0000007#
Fuel	8.889751	0.1474665	67.22457	0.860565
Durables	1.000074	-0.0000199#	1.000653	-0.0000908#
Misc.	1.004194	0.0025214	0.99993543	0.0003759#

Table 10: *

Source: NSS Round 64^{th} (Haryana and Chhattisgarh Household Consumption Expenditure Data)

framework of 'want independence" between groups and price homogeneity" within each group. As with the AIDS model, quantities consumed per household per month were utilized for the analysis. The parameter estimates for both Haryana and Chhattisgarh are presented in the corresponding tables.

In the results, the first and third columns in the tables represent estimates of minimum subsistence quantities, measured in standard units per household per month, for Haryana and Chhattisgarh, respectively. According to the theoretical expectations of the LES model, all minimum subsistence quantities are found to be positive, except for the clothing and bedding category in Haryana. This can be rationalized considering that many rural households do not regularly purchase clothing or bedding each month, and the negative or infinitesimally small values can be regarded as statistically insignificant. Specifically, the p-value associated with clothing and bedding for Haryana in the 64th round is 0.649, indicating insignificance even at the 10% level, allowing this negative result to be treated as a sample error. As per expectations, the food category records the highest subsistence requirement in both Haryana and Chhattisgarh, with a particularly high figure for fuel as well in Haryana during the 64th round. This reflects the broader trend that as household incomes rise, particularly in semi-urbanized areas of Haryana, there is greater reliance on private transportation and better quality fuels for cooking, indicating a transition from traditional fuels like woodstock to LPG. A similar shift is observed in rural areas where increased income induces more modern cooking practices, leading to higher fuel expenditures.

The second and fourth columns of the tables depict the estimated marginal budget shares (β values), which are expected to lie between 0 and 1. Most β coefficients are positive for both states, consistent with theoretical expectations. However, the β parameter for the durables category in both Haryana and Chhattisgarh was found to be negative in the 64th round. Nonetheless, the associated p-values — 0.818 for Haryana and 0.334 for Chhattisgarh — are large enough to conclude that these estimates are statistically insignificant and can be disregarded. Moreover, very low or near-zero β values were observed for some other categories, such as medical and miscellaneous expenditures. The small budget share allocated to medical care is understandable, given the traditional behavior of many Indian households, including those in Haryana, to rely on self-medication and local pharmacy remedies rather than professional medical consultations, unless absolutely necessary. This conservative approach to health expenditures keeps the average household medical spending extremely low.

It is important to note that, based on the data structure and consistency with separability theory, expenses related to medicines have been grouped under the miscellaneous category rather than medical expenses per se. Additionally, a significant portion of health and education costs are covered by government programs, particularly in rural Haryana, further explaining the minimal spending observed in these categories.

All remaining β values are positive and, as expected, approximately sum to one. The expenditure share for the first commodity group (food, tobacco, and beverages) is higher than that for other groups in both Haryana and Chhattisgarh. Notably, the expenditure on food remains higher in Chhattisgarh relative to Haryana, reflecting the state's lower overall income levels and greater reliance on basic necessities. The data from the 64th round also shows that clothing stood as the second-highest category in terms of marginal budget share for both states, suggesting that once basic food requirements are met, additional income is often directed toward clothing purchases rather than healthcare or education. Fuel and power (category 4) ranked third in Haryana in terms of marginal budget share. In Chhattisgarh, however, the marginal share for fuel nearly matches that of clothing, indicating a rural-driven shift towards modern fuels, an effect more pronounced in Chhattisgarh due to its higher rural population base and heavier reliance on traditional energy sources historically.

Expenditure Pattern Analysis (64th Round)

For Chhattisgarh, the nature of the commodity groups was clearly observed in the 64^{th} round. Food, fuel, and clothing and bedding were categorized as necessities during this period. This outcome aligns well with theoretical expectations. Similarly, medical and education, miscellaneous, and durable goods were identified as luxury items in the 64^{th} round. In the case of durables, these findings were anticipated. However, it is important to note that improvements could be made regarding the status of medical and education expenditures, as ideally, these categories should not be regarded as luxuries. To address this, it is recommended that the Chhattisgarh state government increase its public spending and budgetary allocations toward healthcare and educational services, thereby ensuring these essential goods are accessible to all sections of society, especially the economically disadvantaged. Accessibility to healthcare and education should not be influenced by wealth status, and policies must be guided by moral and ethical considerations to eliminate inequality.

The expenditure shares allocated to various commodity groups in Chhattisgarh have been recorded as follows for the 64^{th} round: food accounted for 7.03%, clothing and bedding 0.18%, medical and education 23.67%, and durables 20.02%. These relatively high expenditure shares, particularly for food and durables, likely reflect the impact of an overall increase in per capita income, driven by India's positive economic growth trajectory during this period.

Turning to Haryana, the 64^{th} round data reveals that the structure of commodity groups similarly reflects food, fuel, clothing and bedding, and medical and education as necessities. This result is consistent with expectations and indicates a relatively better development profile compared to other states. In Haryana, miscellaneous and durable goods continued to be classified as luxury items. The treatment of medical and education as necessities in Haryana offers an explanation for why the state outperforms regions like Chhattisgarh in terms of the Human Development Index and per capita State Domestic Product.

In terms of budget share allocation in Haryana during the 64th round, expenditure on food was recorded at 14%, medical and education at 34%, and durables at 34%. These figures further support the observation that increases in household income lead to higher expenditures across essential and non-essential categories. The upward trend in budget shares can largely be attributed to the overall growth in disposable incomes across India during this period. The 64th round survey was conducted during 2007–08, a time when the global financial crisis had adversely impacted economies worldwide, including India. Consequently, incomes had been temporarily suppressed. However, with India's recovery from the crisis in subsequent years, household incomes improved, contributing to higher allocations toward various commodities. Therefore, the higher budget shares seen in the 64th round can be linked to increasing income levels, government stimulus efforts, and a general shift in household consumption patterns as standards of living improved.

It is important to recognize that as incomes rise, households tend to improve their living standards, which is evident in increased expenditures on medical, education, and durable goods. Comparing the consumption trends in the 64th round, it is observed that there was a general increase in the minimum essential consumption levels across nearly all commodity categories, particularly in food. This outcome is consistent with theoretical expectations, as individuals at subsistence income levels prioritize spending on food and nourishment. As incomes increase further, expenditure gradually shifts toward luxury and temptation goods. Notably, in Haryana, the minimum requirement for fuel nearly doubled, reflecting rising incomes and a resultant shift from traditional biomass fuels like woodstock toward modern energy sources such as LPG.

Analysis of the marginal budget shares (β values) reveals that for food, the share either remained stable or declined marginally for both Haryana and Chhattisgarh. This observation supports Engel's Law, which states that as income rises, the proportion of income spent on food tends to decrease. Furthermore, for Chhattisgarh, there has been a significant decline in the minimum requirement level for the medical and education category. This positive change can likely be attributed to more effective public policies initiated by the state government, aimed at making health and education services more accessible. On the other hand, the consumption patterns for durable goods show little variation, as the minimum subsistence levels for durables have remained relatively constant across both Haryana and Chhattisgarh.

Conclusion

The primary objective of this paper was to analyze the consumption expenditure patterns across two Indian states — Haryana and Chhattisgarh — using NSSO 64th round data. The study employed the Almost Ideal Demand System (AIDS) model to assess how households respond to changes in prices and real expenditures (incomes) by adjusting their consumption of food and non-food commodities. Two significant observations can be drawn from the AIDS model estimates. First, in both states, expenditure on food items is lower than that on non-food items. In the 64th round, food expenditure constituted 14% of total consumption in Haryana and 7.03% in Chhattisgarh. This phenomenon is consistent with the concept of the "food budget squeeze" described by Basole and Basu in their paper, *Non-Food Expenditures and Consumption Inequality in India* (2015). Their study explains how, over time, household expenditure on food tends to decline while expenditure on non-food items rises, a trend driven by structural transformations within the Indian economy as well as voluntary shifts in individual consumption choices.

Second, the empirical evidence supports the argument that greater urbanization is associated with a higher dependence on modern energy resources like fuel and electricity. Since Haryana is relatively more urbanized than Chhattisgarh, similar patterns are observed in this study. In the 64^{th} round, when real income increased, the expenditure share on fuel and light fell by 1.5% in Haryana and by 2.6% in Chhattisgarh. Furthermore, the own-price coefficient for fuel was positive in Haryana, while it was negative in Chhattisgarh. This indicates that for the same rise in fuel prices, the reduction in fuel consumption was relatively smaller in Haryana compared to Chhattisgarh, suggesting lower sensitivity to fuel price changes in a more urbanized setting like Haryana.

Additionally, the analysis using the Linear Expenditure System (LES) model revealed important insights, many of which align with theoretical expectations. A general increase in minimum subsistence levels across the six commodity groups confirms an improvement in per capita incomes and living standards. As expected, Category 1 (Food) maintained the largest share of household spending, consistent with the notion that food remains the most critical requirement in subsistence living conditions. Trends also indicate an increased consumption of fuel, justifiable by the transition from traditional fuels such as woodstock to cleaner fuels like LPG as incomes rise.

The evaluation of marginal budget shares also adhered to theoretical predictions. Although certain idiosyncratic estimates emerged during the analysis, these were statistically insignificant and could be reasonably excluded from the model without affecting overall findings. Overall, the LES model facilitated a deeper understanding of household consumption behavior, yielding results that were both theoretically consistent and practically insightful.

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