Measurement of Poverty

- D.D.Kosambi:
  - It is more important to shape history than to write it.
  - It is more important to eliminate (alleviate) poverty than to measure it.
    - Dandekar and Rath:
      - Poverty in India- Employment
    - Amrtya Sen:
      - Poverty and Famine - entitlement

Why measure?

- Compare same area over time
- Compare two states – same year
- Assess impact of (alleviation) programs
- Help developing future plans

Measuring un-measurable

- Inflation, intelligence, love, beauty
  - Abstract concepts
  - Can be measured only if operationalized
  - Validity always debatable
    - In USA blacks often showed low IQ
    - Blacks less intelligent?
    - Perhaps index reflects environment and not innate ability
  - Mis-measure of Man : Stephen J. Gould

Poverty Index

- Poverty line –
  income below which a person regarded as poor

- Head count - % people below poverty line

- Does not pay attention to " how far below"?

- Income gap based index
  $I = \sum (Z - X_i) / Z;$ $X_i < Z$
  Z – poverty line
  X_i income of i^{th} individual

- Does not pay attention to inequality among poor

Amartya Sen's axiomatic approach:

- Focus axiom-index insensitive to income of 'non-poor'
- Monotonicity – income of poor↑ index must ↓
- Transfer – income transferred rich → poor, index must ↓
- Relative deprivation – index must ↓ if inequality among poor ↓

- Amartya Sen gave the only index that satisfies all the above

- $P = H \{ I + (1-I) G \}$
- G- Gini coefficient of inequality among poor

All indices depend critically on **'Poverty line'**

How to get 'Poverty Line'?

- List essential commodities
- List quantities needed (q_i)
- Check prices (p_i)

$\forall \sum q_i p_i$

- Each step very difficult
  - List of essentials change with time, place, community

- Are the following essential?

• Meat	no	for a vegetarian	
• Fish	yes	for a Saraswat	
• Cocoanut		yes	for a keralite
• Alcohol		yes	for a tribal

How much is needed?

- No clear answer
- Perhaps nutrition experts can tell us
- They provide recommendations
  - Not reliable
  - Revised often – always downwards
    - Second world war- Norwegians starved
      Got less of fat, Heart disease declined,
      Revise requirement downward

How much is needed?(cont.)

- How to decide protein requirement?
  - If on zero protein : death
  - If on just enough protein: intake = output
    Very difficult to measure
- Calorie requirement
  - Intake of healthy adults who maintain weight
  - American soldiers used for study
  - Applicable to Indian villagers?

P.V.Sukhatme's work

- Is Indian diet protein deficient?
  - If yes – need protein supplement
    - Lysene fortified bread (like iodine fortified salt)
    - Common Indian diet (cereal + pulse) has enough protein content
    - People cannot eat enough!

- So it is calorie deficient and not protein.

- Solution- provide employment / income

- Can intake of healthy well fed cases give us calorie requirement?

- No. Low intake – calories used more efficiently

- Poverty line is problematic
- Indices based on these are problematic

Proposed index

- Index should reflect FELT NEED and lack of fulfillment
- Criteria should be intrinsic- reflecting behavior of people

- Engel's law:
- As total income increases, proportion spent on food declines

- As income increases,
  - Expense on cereals increases
  - At a decreasing rate
  - Finally saturates
  - Saturation level is the FELT REQUIREMENT

- Deficiency compared to saturation level is FELT DEPRIVATION
- Should be used to construct a poverty index
- How to estimate Saturation level?

A suitable model

- Saturating hyperbola
  - $Y = VX/(K+X)$
  - $X \to \infty$, $Y \to V$ (saturation level)
  - $dY/dX = KV/(K+X)^2$ $\downarrow$ as $X \uparrow$
  - K – rate constant
    - Low K – quick saturation
  - X – total income
    - Difficult to observe
    - Surrogate variable -total expenditure
  - Y – expenditure on a commodity (cereals)

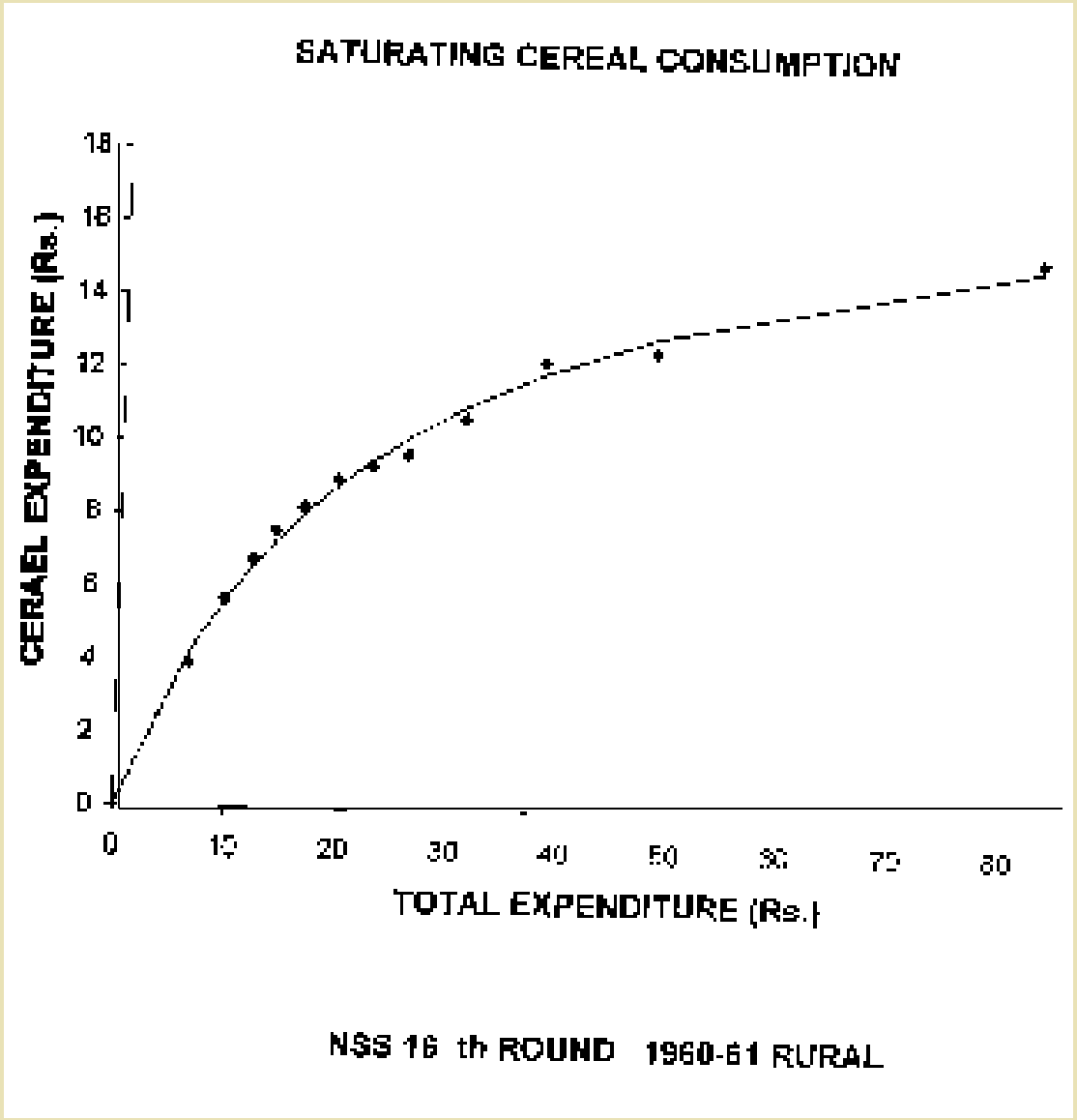
- $Y/X = V/(K+X)$
- for X small compared to K, $Y/X = V/K$
- i.e. V/K represents fraction of income spent on a commodity
- Larger the value of V/K,

  higher the priority given to that commodity

  in spending money (at limiting income)

Data

- NSSO:
  - Data on
    - family expenditure on different commodities
    - Total expenditure
    - From 1967 To 1983- rural as well as urban
  - Hyperbola model fitted to
    - Each year data rural/ urban separately
    - Illustrative graph


SATURATING CEREAL CONSUMPTION
CEREAL EXPENDITURE (Rs.)
0
2
4
6
8
10
12
14
16
18
0
10
20
30
40
50
60
70
80
TOTAL EXPENDITURE (Rs.)
NSS 16 th ROUND 1960-61 RURAL

- Index based on V will be
  - Free of arbitrary poverty line
  - A reflection of felt need
  - Based on observed behavior

The index:

$$P = \sum f_i \{ 1- y_i / V \}$$

Sum over expenditure classes

Results I

- Hyperbola model fits well for all data sets

- In all rounds value of V/K for cereal highest (0.6 –0.9)
- In most rounds V/K for ‘fuel and light’ comes next (0.01-0.05)
- Other commodities- sequence changes from round to round
- What about poverty index itself?

Results II

Poverty index based on cereal consumption

Year	Rural	Urban
1960-61	0.68	0.30
1965-66	0.65	0.27
1969-70	0.55	0.32
1977-78	0.48	0.31
1986-87	0.43	0.29
1989-90	0.30	0.21

- Rural poverty more than urban
- Gradual decline over years

- Any corroborative evidence?
- Low attendance at public work
- Dr. Arole's experience

Other applications of Hyperbola

- Seed germination
  - % seeds germinated Vs days
- Prey ingestion rate as function of prey density
- Enzyme kinetics
  - Velocity of conversion Vs substrate concentration
- Fish growth model
  - Weight or length Vs age
- Hormone receptor model
  - Bound estrogen Vs free estrogen