The Consumption Aggregate

LECTURE 2

Today's agenda

▪ Lecture 1:
consumption expenditure is our proxy for the standard of living.

▪ Today's lecture has two goals:

1) providing a working definition of consumption expenditure

2) discussing a selection of adjustments that analysts need to implement once data have been assembled.

▪ 1) and 2) give the final form of the living standard indicator, which is used for inequality and poverty measurement.

It takes four to construct a living standard indicator

$$\text{Living standard indicator} = \frac{\boxed{1} \quad \text{nominal household consumption expenditure}}{\underset{\boxed{2}}{\text{household size}} \times \underset{\boxed{3}}{\text{temporal CPI}} \times \underset{\boxed{4}}{\text{spatial CPI}}}$$

Numerator
▪ Which expenditures, exactly?

Denominator
▪ Household size is not self-defining (boarders? guests? servants?...)
▪ How to account for inflation (temporal CPI) and differences in price levels across the national territory (spatial CPI)?

1. Which expenditures, exactly?

Analysts do not include everything

- Nominal household consumption expenditure should not be calculated by summing up all expenditures during the reference period.
- Why?
    1) We are interested in the use (consumption) of resources, not their purchase
    2) We want to capture consumption that enhances welfare.
       Think of expenditures related to funerals… would you include them?
    3) We are interested in what is "typical" consumption during the reference period (year)
       This leads as to exclude all infrequent, extra-ordinary expenses
    4) …
- These examples imply that the choice of consumption expenditures to be aggregated is selective, not straightforward.

The nominal consumption aggregate

Nominal consumption aggregate =

    monetary expenditures on food and non-food non-durable goods and services consumed

    + value of in-kind consumption

    + value of use (not *purchase*) of durables

    + value of use of owner-occupied housing.

No allowance for the value of time and leisure and no allowance for public goods.

$$\text{Living standard indicator} = \frac{\text{nominal household consumption expenditure}}{\text{household size} \times \text{temporal CPI} \times \text{spatial CPI}}$$

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2. Adjusting for household size and composition

Total, per capita or per adult equivalent expenditure?

- Ultimate interest is on individual welfare, not the welfare of a household.
- Expenditure data, however, are typically collected at the household level.
- When we want to compare the standard of living of individuals in different households, household expenditures must be adjusted to account for differences in household size and composition.
- Size
  Does a household of 2 need twice as much as a household of 1?
- Composition
  Are children's needs lower than adults'?

Adjusting for household size and economies of scale

- Larger households consume more, because there are "more mouths to feed"

- One possibility is to consider per capita consumption

- There is a subtler issue: housing, heating, transportation etc. are shared between members. Economists say that they are public goods

- Example: housing. Consumption by one member of the household does not necessarily reduce the amount available for consumption by another person within the same household. Economists say that there are significant economies of scale for housing.

- By failing to adjust for economies of scale, one might underestimate the wellbeing of large households (and overestimate that of small households).

Economies of scale: adjustment

- A popular strategy is to rescale household consumption expenditure as follows:
$$\tilde{x}_i = \frac{\tilde{x}_h}{(n_h)^\alpha} \qquad \alpha \in [0,1]$$

- $\alpha = 1$ means we assume that no goods consumed are public in the household, in which case consumption is equally divided among household members. No adjustment for economies of scale is made.

- $\alpha = 0$ means we assume that all goods consumed are public in the household. This is a purely hypothetical situation in which each individual is assumed to consume the total consumption of the household.

- In practice, α assumes conventional values. E.g. $\alpha = 0.5$ implies that a household of four persons needs twice as much as a single-person household.

Economies of scale: to adjust or not to adjust?

- When a high percentage of budget is devoted to public goods (that is, if price and quantity of housing, utilities, and durable goods are high), economies of scale are likely to be significant.

- Analysts look at the shares in the data, and decide whether to adjust.

- Rule of thumb:
  large share = adjust
  small share = do not adjust

Adjusting for household composition

- It is usually assumed that children and the elderly need less than working-age adults.

- Similarly, it is thought that women need less consumption than men.

- If that is the case, our standard of living indicator should account for differences in household composition.

F A O
FOOD AND NUTRITION TECHNICAL REPORT SERIES | **1**

Human energy requirements
Report of a Joint FAO/WHO/UNU Expert Consultation
Rome, 17-24 October 2001

Equivalence scales: adjustment

- If adjustments are to be made, we use equivalence scales.

- An equivalence scale calculates the "number of equivalent adults" in the household.

- An equivalence scale typically looks as follows:

$$n_{AE} = (n_{males\ 15+} \times 1) + (n_{females\ 15+} \times 0.8) + (n_{kids\ 0-1} \times 0.5)$$

- Different categories have different "weights": adults male count for 1, adult female for 0.8, …

- Once the "number of adult equivalents" n_{AE} has been calculated we rescale household consumption expenditure as follows:

$$\tilde{x}_h = \frac{x_h}{n_{AE}}$$

Equivalence scales: examples

OECD equivalence scale (OECD-I)   AE = 0.3 + 0.7 × A + 0.5 × K

The first adult is given a weight of 1. Other adults are given a weight of 0.7, to reflect economies of scale. Children are given a weight of 0.5 to reflect their lower needs.

OECD-modified scale (OECD-II)   AE = 0.5 + 0.5 × A + 0.3 × K

National Research Council (1995) $AE = (A + \alpha K)^{\theta}$

AE = # Adult Equivalents; A = # Adults ; K = # children; α in [0,1]= cost of a child relative to that of an adult; θ in [0,1], (1- θ) measures the extent of economies of scale.

*An artificial example

Household size	Equivalence scale				
	per-capita income	"Oxford" scale ("Old OECD scale")	"OECD-modified" scale	Square root scale	Household income
1 adult	1	1	1	1	1
2 adults	2	1.7	1.5	1.4	1
2 adults, 1 child	3	2.2	1.8	1.7	1
2 adults, 2 children	4	2.7	2.1	2.0	1
2 adults, 3 children	5	3.2	2.4	2.2	1
Elasticity[1]	1	0.73	0.53	0.50	0

Equivalence scales: to adjust or not to adjust?

- If children/elderly are as "expensive" as adults despite their lower nutritional requirement (*e.g.* because of very high costs for education or health), less need for adjustment.

- Rule of thumb:
  large differences in the "cost" of different household members = adjust
  small differences = do not adjust.

The international practice

Where do countries around the world fall when adjusting for household size and composition?

East Asia & Pacific

Surveys	Consumption vs Income	Household Size
Cambodia 2011	Consumption	Per Capita
Indonesia 2016	Consumption	Per Capita
Lao PDR 2012	Consumption	Per Capita
Malaysia 2016	Income	Per Capita
Mongolia 2016	Consumption	Per Capita
Myanmar 2015	Consumption	Per Capita Per Adult Equivalent
Philippines 2015	Income	Per Capita
Timor-Leste 2014	Consumption	Per Capita
Vietnam 2016	Consumption	Per Capita

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Europe and Central Asia

Surveys	Consumption vs Income	Household Size
Armenia 2015	Consumption	Per Adult Equivalent
Bosnia and Herzegovina 2004	Income	-
Kosovo 2015	Consumption	Per Adult Equivalent
Kyrgyz Republic 2013	Consumption	Per Capita
Macedonia 2017	Income	Per Adult Equivalent
Moldova 2013	Consumption	Per Adult Equivalent
Russian Federation 2008	Consumption	Per Adult Equivalent
Tajiskistan 2014	Consumption	Per Capita

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Latin America & Caribbean

Surveys	Consumption vs Income	Household Size
Argentina 2016	Income	Per Capita Per Adult Equivalent
Bolivia 2015	Income	Per Capita
Colombia 2017	Income	Per Capita
Ecuador 2013	Consumption	Per Capita
Ecuador 2018	Income	Per Capita
El Salvador 2015	Income	Per Capita
Guatemala 2014	Consumption	Per Capita
Haiti 2012	Consumption	Per Capita
Honduras 2016	Income	Per Capita
Mexico 2016	Income	Per Capita
Nicaragua 2014	Consumption	Per Capita
Panama 2008	Consumption	Per Capita
Paraguay 2017	Income	Per Capita
Peru 2017	Consumption	Per Capita

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Middle East & North Africa

Surveys	Consumption vs Income	Household Size
Egypt 2008	Consumption	Per Capita
Iraq 2012	Consumption	Per Capita
Jordan 2010	Consumption	Per Capita
Lebanon 2011	Consumption	Per Capita
Djibouti 2017	Consumption	Per Adult Equivalent
Morocco 2013	Consumption	Per Capita
West Bank and Gaza 2011	Consumption	Per Adult Equivalent
Yemen 2005	Consumption	Per Capita

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South Asia

Surveys	Consumption vs Income	Household Size
Afghanistan	Consumption	Per Capita
Bangladesh 2016	Consumption	Per Capita
Bhutan 2017	Consumption	Per Capita
Sri Lanka 2016	Consumption	Per Capita
India 2011	Consumption	Per Capita
Pakistan 2013	Consumption	Per Adult Equivalent
Maldives 2016	Consumption	Per Capita

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Sub-Saharan Africa

Surveys	Consumption vs Income	Household Size
Côte d'Ivoire 2015	Consumption	Per Capita
Kenya 2015	Consumption	Per Adult Equivalent
Malawi 2010	Consumption	Per Capita
Mozambique 2014	Consumption	Per Capita
Nigeria 2010	Consumption	Per Adult Equivalent
South Africa 2014	Consumption	Per Capita
Tanzania 2014	Consumption	Per Adult Equivalent
Uganda 2011	Consumption	Per Adult Equivalent
Zambia 2015	Consumption	Per Adult Equivalent
Zimbabwe 2011	Consumption	Per Capita

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$$\text{Living standard indicator} = \frac{\text{nominal household consumption expenditure} \checkmark}{\text{household size} \times \text{temporal CPI} \times \textit{spatial CPI}}$$

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3. & 4. Adjusting for purchasing power

Nominal vs. real expenditure
useful vocabulary

- In real life, it is always the case that different households face different prices when purchasing the same exact good.

- Differences can arise over time (inflation) or across geographical areas (cost-of-living differences).

- In this context, nominal expenditure simply means unadjusted for price differences.

- Real is the opposite of nominal. A real expenditure is one adjusted for purchasing power.

Is nominal consumption expenditure a good measure of the living standard?

- In general, no.

- When the price level of commodities and services changes over time, so does the purchasing power of money.

- Welfare comparisons must be carried out keeping constant the purchasing power of households.

Adjusting for differences in purchasing power
terminology

- A consumer price index (CPI) measures changes in the prices of goods and services that households consume.

- CPIs are commonly referred to as deflators.

- A CPI (or deflator) is typically used to convert nominal consumption expenditures (or incomes) into real terms.

Temporal and spatial deflators

1) Inflation (time)
   Temporal (monthly, yearly) price index

2) Cost-of-living differences across the national territory (space)
   Spatial price index

Price indices are typically expressed as a proportion of some reference price level:
- Price index = 1 (or 100) → current price level is the same as the reference level
- Price index > 1 (or 100) → current price level is higher than the reference level
- Price index < 1 (or 100) → current price level is lower than the reference level

Example: inflation matters

- Assume all households in the country are identical (same size, composition, etc.)

- Assume consumption expenditure x = $1,000 for all households

- Assume inflation = 5% per month during the survey year

- Note: this is a high inflation rate... what would that be on a yearly basis?

- Assume that each month 1/12 of the households are interviewed

- Assume that the poverty line equals $ 750

No adjustment for inflation

Question: how much is the incidence of poverty?

Answer: if no action is taken to adjust for month-to-month inflation rates, then the headcount poverty rate equals 0%.
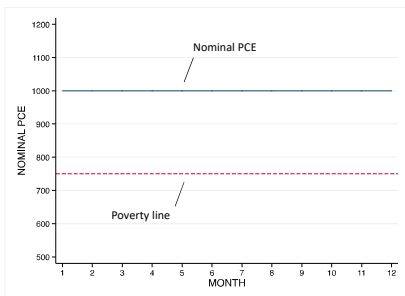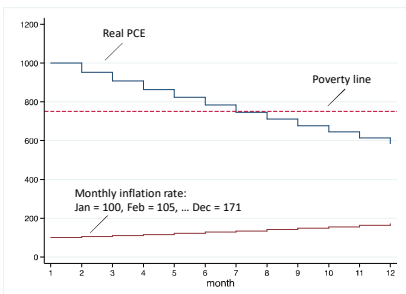

Nominal to real

- Now let us adjust for within-the-year inflation

- We divide nominal expenditures by the monthly CPI.

- We obtain real expenditures

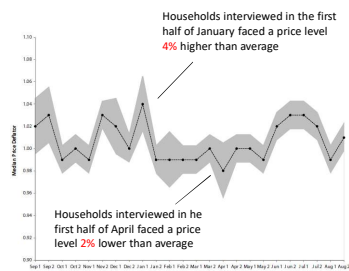| month	xnom	cpi	xreal
1	1000	100.0	1000
2	1000	105.0	952
3	1000	110.3	907
4	1000	115.8	864
5	1000	121.6	823
6	1000	127.6	784
7	1000	134.0	746
8	1000	140.7	711
9	1000	147.7	677
10	1000	155.1	645
11	1000	162.9	614
12	1000	171.0	585

Adjustment for inflation

Question: how much is the incidence of poverty?

Answer: if we adjust for the month-to-month inflation rates, then the headcount poverty rate equals **50%** (remember that the poverty line is 750 in our example).
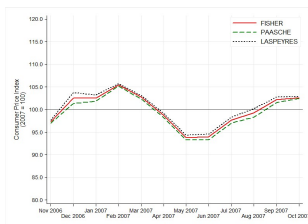
Real PCE

Poverty line

Monthly inflation rate:
Jan = 100, Feb = 105, ... Dec = 171

month

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Kenya 2015

KIHBS 2015/16, Paasche Index

Households interviewed in the first half of January faced a price level **4%** higher than average

Households interviewed in he first half of April faced a price level **2%** lower than average

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* Iraq 2007

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LASPEYRES

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What are price indices (or deflators) exactly?

- Many indices exist:
  - Laspeyres
  - Paasche
  - Fisher
  - Törnqvist
  - …

- We focus on Laspeyres and Paasche.
- Q. Why?
- A. In lecture 1 we concluded that our best strategy for proxying living standard is either x/P or x/L, with a preference for the former.

The Laspeyres index

- The single most popular index among both economists and international statistical agencies.
- According to the ILO Bureau of Statistics, 114 out of 187 countries use the Laspeyres formula.

The Laspeyres index: definition

- The Laspeyres index answers the question:

  "what is the cost of a fixed basket of commodities purchased in the base period relative to its cost at the base period market prices?"

$$L^t = \frac{p^t . q^0}{p^0 . q^0}$$

- p^t vector of prices faced in period t;
- p^0 reference set of prices

The Laspeyres index: interpretation

- When applied to bundles of individual households, a Laspeyres index that equals 1 (or 100) implies that the household in the current period can afford to buy the same bundle as she consumed in the previous period.

Example of Laspeyres Index

Items in the basket	Quantity in the basket	Price in base year (2015)	Price in current year (2019)
Rice	10 kg	1.2	1.5
Shoes	1 pair	4	5
Cost of the basket		16	20

- To calculate the index, divide the cost of the basket in 2019 by its cost in 2015 giving 20/16=1.25.

- This says that prices have risen by 25% over the period.

The Laspeyres index: comment

- A key feature of the Laspeyres formula is that it tends to overstate the rise in the cost of living by not allowing any substitution between goods to occur (Diewert, 2001).

- To the extent to which price and demanded quantity are negatively correlated, the Laspeyres index provides an upper bound to the "true cost of living" faced by a household.

The Paasche index

- The Paasche index is the one that most welfare analysts opt for.
- Deaton and Zaidi (2002) explain why.

The Paasche index: definition

- The Paasche index:

"what is the cost of a fixed basket of commodities purchased in period t relative to its cost at the base period market prices?"

$$P^t = \frac{p^t \cdot q^t}{p^0 \cdot q^t}$$

- q^t vector of quantity purchased in period t;
- p^t vector of prices faced in period t;
- p^0 reference set of prices

The Paasche index: interpretation

- When applied to bundles of individual households, a Paasche index that equals 1 (or 100) states that an household could have consumed the same bundle in the base period as she is consuming in the current period.

The Paasche index: comment

- The Paasche formula does not allow for the substitution of products or services at the base period prices.

- To the extent to which price and demanded quantity are negatively correlated, it provides a lower bound to the "true cost of living" faced by the household.
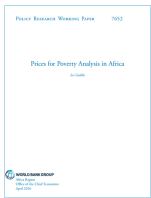

Paasche vs. Laspeyres

- While calculating the Laspeyres index for a new period requires only new price data, calculation of the Paasche index for a new period requires new price data and new quantity data (or alternatively new price data and new expenditure data) for each new period.
- The Paasche index is rarely calculated by statistical agencies because it is data demanding.
- Given the poverty analyst's preference for Paasche, it is common to estimate it based on household budget surveys.
- This is not as straightforward as it might seem.

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*The Fisher index

- When both indices can be obtained, a recommended solution is to calculate an average of the two.

- The Fisher index is defined as the geometric average of the Laspeyres and Paasche indices:

$$F^t = \sqrt{L^t \times P^t}$$

Measuring prices

Policy Research Working Paper   7652

Prices for Poverty Analysis in Africa

WORLD BANK GROUP

- A beautiful and useful paper

- It reviews the academic literature about prices for poverty measurement in Africa

Market prices are not unit values (and viceversa)

- Unit values are defined as the ratio of expenditure to quantity.

- Unit value for household h, good j, at time (or region) r: $uv_j^h(r) = \frac{x_j^h(r)}{q_j^h(r)}$

- Unit values suffer from quality bias: richer households tend to buy higher quality foodstuffs, for instance.

- Hence, unit values cannot be treated as if they were market prices.

Kenya 2015
KIHBS 2015/16,
Price deflator by Country

- Light to dark green = low prices

- Light to dark purple = high prices

Lessons learned

- Data providers should be mindful of the definition of household membership, because of the importance of adjusting for household size.
- Household characteristics (gender, age, etc.) are key for the computation of equivalence scales.
- Adjustment for cost-of-living differences:
  - temporal CPI is needed to adjust for within-survey inflation;
  - spatial CPI is typically computed from household surveys, which must allow for it.
- Market prices (collected through price surveys) are different from unit values (calculated on the basis of household budget surveys).

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References

Required readings:

Deaton, A. and S. Zaidi (2002), Guidelines for constructing consumption Aggregates for welfare analysis, LSMS Working Paper no. 135, World Bank, Washington DC.(chap. 4, 5)

Suggested readings:

Chen, S., & Ravallion, M. (1996). Data in transition: Assessing rural living standards in southern China. China economic review, 7(1), 23-56.

Diewert (2004), Durable and user costs, in ILO (2005), Consumer Price Index Handbook.

Gaddis, I. (2016). Prices for poverty analysis in Africa. The World Bank.

Gibson, J. (2007). A guide to using prices in poverty analysis. World Bank, Washington, DC.

Haughton, J. and Khandker, S. R. (2009). Handbook on poverty and inequality. Washington, DC: World Bank. (chap. 5)

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Thank you for your attention

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Homework

Exercise 1 – Engaging with the literature

- Chen, S., & Ravallion, M. (1996) underline the importance of adequately measuring prices for poverty and inequality estimates.
- Haughton, J. and Khandker, S. R. (2009, ch 5) discuss the sensitivity of poverty estimates to household size adjustments.

- Write a short essay (not to exceed 3000 characters) where you summarize their main findings.

Exercise 2 – A guide to using prices in poverty analysis
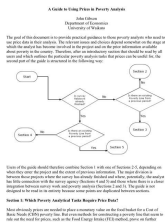
Read Gibson (2007), and write a short essay where you summarize, even schematically, the main recommendations.