

Tracking Poverty in Kenya: Methods and Measures

David Stifel (Lafayette College)

Luc Christiaensen (World Bank)

Presentation at the national poverty workshop

Nairobi, 21 March 2005

Objectives

- **Methodologies and methodological issues** in tracking poverty in the absence of annual and comparable household expenditure data
- Discussion of **preliminary** results of the evolution of poverty in Kenya over the past decade

Key Messages

- Consistent message coming out of the monetary and non-monetary data
 - Noticeable improvements in **Nairobi**
 - Some improvements in **rural** areas
 - Mixed results for **other urban** areas
- While we will discuss methodologies for tracking indicators of monetary poverty in the absence of expenditure data...
 - ...need for more systematic and regular data collection to track monetary indicators of poverty*
- Critical need for triangulation when examining evolution of poverty, especially when looking at monetary indicators

Outline

1. Available Poverty Information Base
 - non-monetary and monetary poverty
2. Non-Monetary Indicators of Poverty
 - Enrollments
 - Child Nutrition
 - Infant Mortality Rates
3. Monetary Indicators of Poverty
 - Asset Poverty (“*Statistical Asset Index*”)
 - Poverty Mapping Methods (“*Economic Asset Index*”)
 - Linking Macro and Micro Data
4. Concluding Remarks

Information Base

- Demographic and Health Surveys (DHS)
 - 1993, 1998 and 2003
 - Comparable over time
 - *No expenditure module*
- Welfare Monitoring Survey (WMS)
 - 1997
 - Comparability issues with earlier (and future) years
 - *Expenditure module*
- Macro data - national accounts
 - Annually available
 - Comparable over time
 - Private consumption, but no expenditure module or distributional data

Evolution of Non-Monetary Poverty

Primary enrollment rates improved substantially,
 ...child malnutrition rates declined,
 ...but secondary enrollment still around 1993 levels,
 ...and infant mortality rates have risen.

National	1993	1998	2003	Difference		
				1993 to 1998	1998-2003	1993-2003
<i>Enrollment rates</i>						
Primary (6-13 yrs)	75.6	85.5	90.1	9.8	4.6	14.5
Secondary (14-17 yrs)	76.8	75.1	77.4	-1.7	2.3	0.6
<i>Infant mortality</i>						
	73.8	78.6	82.4	4.8	3.8	8.6
<i>Stunting prevalence</i>						
	33.3	33.0	30.9	-0.2	-2.1	-2.4

Most progress in rural areas and Nairobi, while limited progress or deterioration in other urban

Difference	1993-98	1998-2003	1993-2003
Rural			
primary enrollment (6-13yrs)	10.0	4.5	14.5
secondary enrollment (14-17yrs)	-0.7	2.1	1.4
infant mortality*	5.2	4.2	9.4
stunting prevalence (%)	0.0	-2.3	-2.3
Urban (w/out Nairobi)			
primary enrollment (6-13yrs)	4.9	5.7	10.6
secondary enrollment (14-17yrs)	-3.9	3.7	-0.2
infant mortality*	--	--	--
stunting prevalence (%)	3.4	2.6	6.0
Nairobi			
primary enrollment (6-13yrs)	13.2	5.7	18.9
secondary enrollment (14-17yrs)	1.3	6.7	8.1
infant mortality*	--	--	--
stunting prevalence (%)	3.2	-7.2	-4.0

Evolution of Monetary Poverty: Standard Practice

- Use expenditure surveys to estimate and compare poverty over time
 - expenditures (consumption) provide most comprehensive measure of household welfare
- Yet, even if available, often not w/o problems in practice either
 - Expenditure surveys provide snapshots
 - often sensitive to rainfall patterns especially in agrarian rainfall dependent economies
 - Need for appropriate price data and deflators
 - Differences in questionnaire and survey design raise issues of comparability

Alternative methodologies

- Asset Indices and Linking macro and micro data
- Asset indices
 - Instead of comparing expenditures, we explore the evolution of assets over time
 - Available from DHS surveys which are comparable in design and questionnaires across time
 - Two techniques to generate asset indices
 - Statistical technique – Factor/principal component analysis
 - Prediction techniques – Regression analysis

Evolution of household assets

Sample Means of Household Assets for Use in Asset Index

	2003	Differences		
		1993 to 1998	1998 to 2003	1993 to 2003
House floor of low quality (mud, dung, sand)	62.1	-5.1	-1.3	-6.4
House roof of low quality (thatch)	22.6	-7.6	-5.1	-12.7
Drinking water - piped or public tap	31.6	1.6	-2.5	-1.0
Flush toilet	11.0	1.9	-0.8	1.1
No toilet	16.2	-2.8	1.4	-1.4
Electricity connection	16.0	3.7	1.5	5.1
Owns a radio	73.6	11.3	10.5	21.7
Owns a TV	19.4	6.9	6.4	13.3
Owns a refrigerator	4.3	1.0	0.5	1.4
Owns a bike	29.3	1.9	5.3	7.2
Head with only primary education	47.9	-0.2	2.6	2.4
Head has secondary education or higher	30.2	7.8	-0.4	7.4
Years of head's educational attainment	6.0	1.0	0.3	1.3
Sample size	8,561			

All variables (except last) are dummy variables (1=yes, 0=no)

= "negative" asset

Breakdown of Changes in Household Assets

	Differences (1993 to 2003)		
	Rural	Other Urban	Nairobi
House floor of low quality (mud, dung, sand)	-3.3	5.9	-13.5
House roof of low quality (thatch)	-13.8	-1.7	0.2
Drinking water - piped or public tap	-1.2	-12.5	-0.6
Flush toilet	0.1	-17.3	13.2
No toilet	-0.1	0.0	-3.4
Electricity connection	1.2	0.1	20.6
Owns a radio	23.2	11.5	15.3
Owns a TV	10.0	12.8	27.9
Owns a refrigerator	0.6	-3.2	8.7
Owns a bike	9.8	3.2	-3.6
Head with only primary education	4.2	4.8	-7.7
Head has secondary education or higher	6.3	-3.0	10.6
Years of head's educational attainment	1.2	0.4	1.3

All variables (except last) are dummy variables (1=yes, 0=no)

= "negative" asset

Asset Index Weights

		Rural	Urban without Nairobi	Nairobi
1	House floor of low quality (mud, dung, sand)	-0.25	-0.16	-0.14
2	House roof of low quality (thatch)	-0.15	-0.08	-0.01
3	Drinking water - piped or public tap	0.10	0.07	0.05
4	Flush toilet	0.13	0.18	0.23
5	No toilet	-0.11	-0.06	-0.04
6	Electricity connection	0.20	0.30	0.37
7	Owns a radio	0.13	0.10	0.09
8	Owns a TV	0.20	0.25	0.22
9	Owns a refrigerator	0.11	0.14	0.12
10	Owns a bike	0.05	0.02	0.02
11	Years of head's educational attainment	0.14	0.11	0.07

Poverty Changes based on Statistical Asset Index

Headcount Ratio

	1993	1998	2003
National	58.3	50.2	42.8
Rural	59.3	52.0	44.2
Urban without Nairobi	46.1	44.2	47.8
Nairobi	50.2	40.1	28.5

→ Decline in national poverty driven by decline in rural poverty and poverty in Nairobi; stagnation of poverty in other urban areas

→ Are these results credible, especially large decline in poverty in Nairobi?

Economic Asset Index

- Statistical Asset Index
 - Easy to calculate
 - But, the index is not grounded in economic theory → coefficients are not directly interpretable
 - It concerns relative poverty only
- Economic Asset Index
 - Weights are anchored in consumption measures and thus in economic theory
 - It concerns absolute poverty
 - Techniques used to calculate it similar to those used in poverty mapping

Poverty Mapping Basics:

- Estimate model of per capita expenditures using WMS (1997)
 - Level limited by representativity
- Explanatory variables – common to both WMS & DHS
- Predict per capita expenditures at household level in the DHS (1993, 1998 and 2003)
- Calculate poverty measures

Poverty Mapping...

Estimate the following model...

$$\ln y_{ci} = X_{ci}^{WMS'} \mathbf{b} + u_{ci}$$

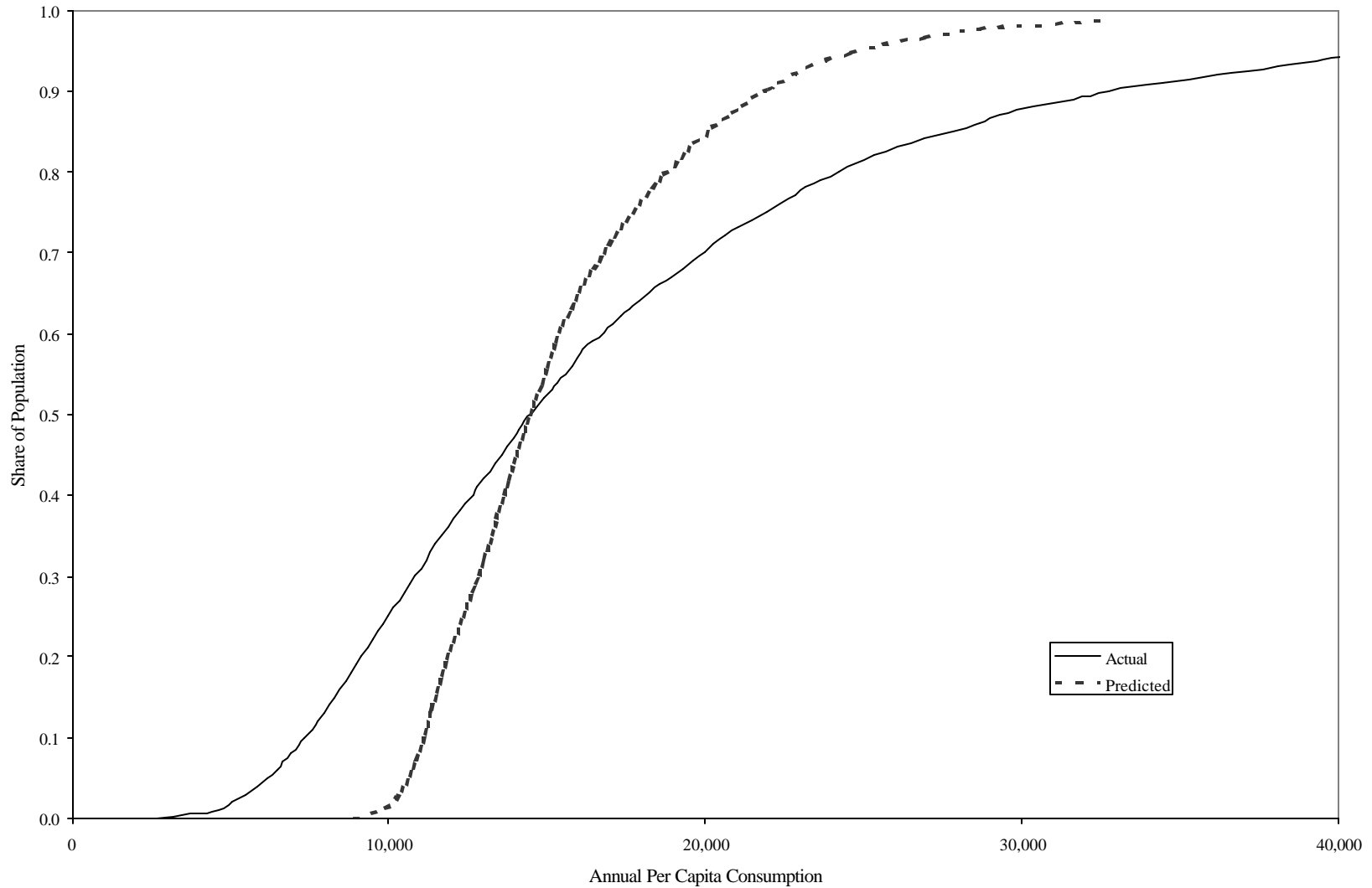
Then using the estimated parameters, predict...

$$\ln \hat{y}_{ci} = X_{ci}^{DHS'} \hat{\mathbf{b}} + \hat{u}_{ci}$$

Why include the predicted error?

- Because $X\hat{\mathbf{b}}$ explains only a portion of the observed consumption. This may be due to:
 - Unobserved factors which also explain the variation in the observed consumption, but which are not included in the model
 - Model misspecifications
 - Measurement error in the observed consumption
- To account for the first two factors, an estimate of the error term is added to the predicted consumption. In poverty mapping it is usually assumed that there is no measurement error.

Actual vs. Predicted Per Capita Expenditures



Error term has two components...

$$u_{ci} = \mathbf{h}_c + \mathbf{e}_{ci}$$

Location component (c) – allows for spatial correlation

Household component (ci) – allows for individual differences in the error term (heteroskedasticity)

These error components are drawn from distributions, the variances of which are functions of the data.

... Poverty Estimates

Use predicted values of y to predict poverty measures (e.g. FGT measures)...

$$\hat{P}_a = \frac{1}{n} \sum_{i=1}^n \left(\frac{z - \hat{y}_i}{z} \right)^a \mathbf{1}(z > \hat{y}_i)$$

Run 100 simulations (draws from the error term), and report average poverty measure & standard errors.

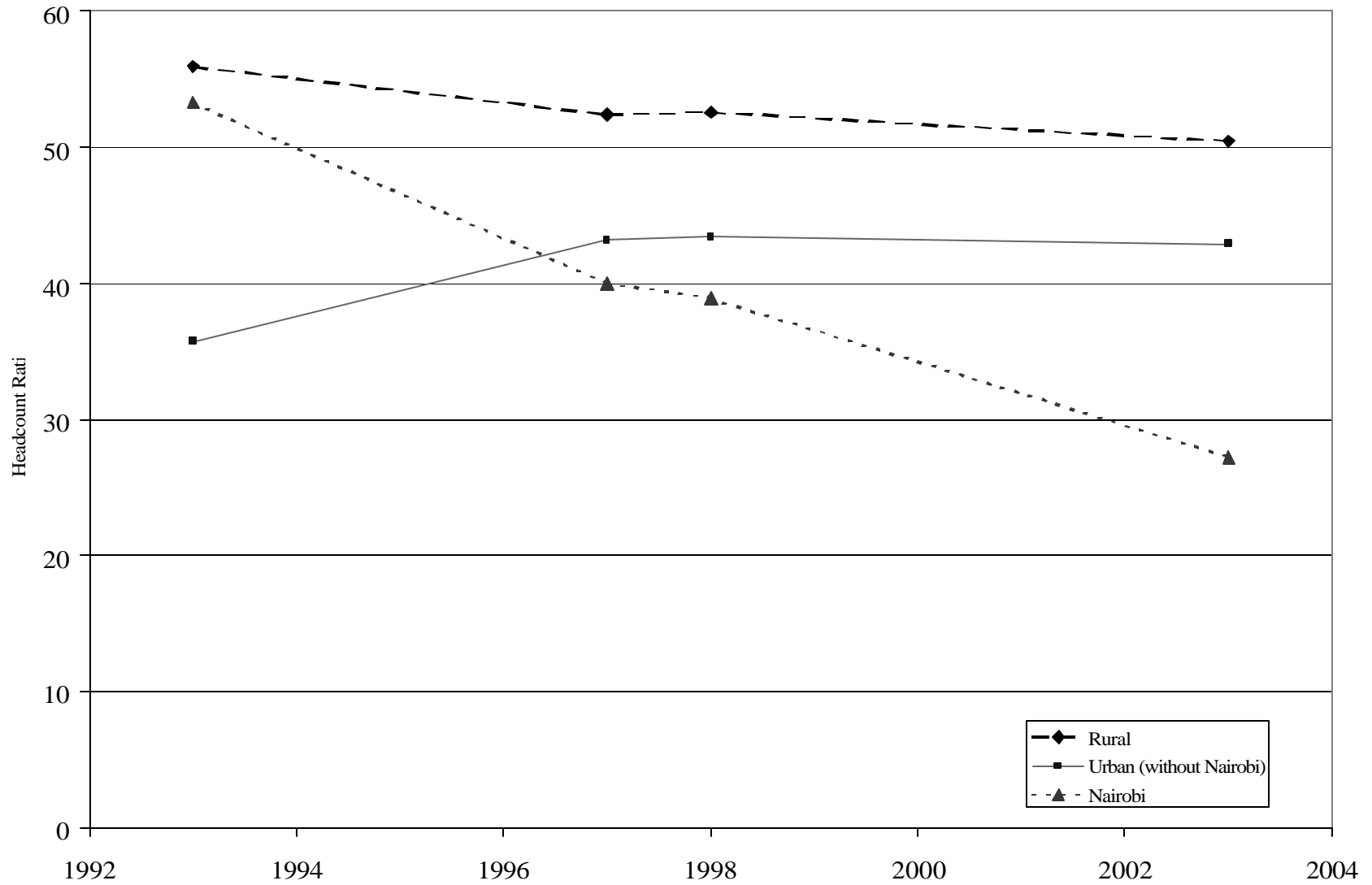
Estimated asset weights

	Rural	Urban w/o Nairobi	Nairobi
<i>Household Demographics</i>			
Share of HH members age 0-5		-1.105	-1.019
Share of HH members girls age 6-15		-1.167	-1.315
Share of HH members boys age 6-15		-0.955	
Share of HH members women age 16-25		-0.246	-0.494
Share of HH members women age 26-65	0.513		
Share of HH members men age 26-65	0.746		
<i>Household Education</i>			
Share of HH members with post secondary educ			0.443
Dummy: HH head with primary education		-0.139	
Dummy: HH head with secondary education	0.152		
Dummy: HH head with post secondary education		0.128	
<i>Housing & Assets</i>			
Dummy: House floor of low quality (mud, dung, sand)	-0.287		
Dummy: House roof of low quality (thatch)	-0.168		
Dummy: Drinking water - piped (public or private)			0.523
Dummy: Flush toilet		0.072	
Dummy: Electricity connection		0.264	
Dummy: Owns a refrigerator	0.363	0.436	
<i>Cluster & District Characteristics</i>			
Cluster average share with post secondary education			1.572
Cluster average head with primary education		-0.344	
Cluster average head with post secondary education			1.061
Cluster average HH with low quality roofs	-0.119		
Cluster average HH owns refrigerator	0.711		
Cluster mean asset index	0.140		
District average HH with access to piped water		0.288	
Constant	10.406	10.421	9.877
R ²	0.21	0.37	0.51
Number of observations	8,940	1,558	280

Poverty Evolution: Econometric Asset Index

P₀ (standard error)	1993	1997 (Base)	1998	2003
National	54.0	50.4	50.1	47.5
Rural	56.1 2.3	52.4 1.7	52.3 2.1	50.3 2.1
Urban (w/o Nairobi)	34.3 6.1	43.2 3.3	42.3 3.5	42.1 5.6
Nairobi	53.3 10.6	40.0 9.3	38.9 8.5	27.2 5.7

Poverty Mapping Estimates



Observations

- Issues with Economic Asset Index Results
 - Rural poverty falling slightly
 - Non-Nairobi urban poverty rising and then stagnating
 - Implausible fall in Nairobi's poverty? Data representative?
- Issues with Economic Asset Index Methodology
 - Parameter stability → time-varying RHS variables (rainfall)
 - Data determining the best fit → parameters with “wrong” sign
 - More theoretical approach → larger prediction error?
 - It remains a series of snapshots

Linking macro to micro data

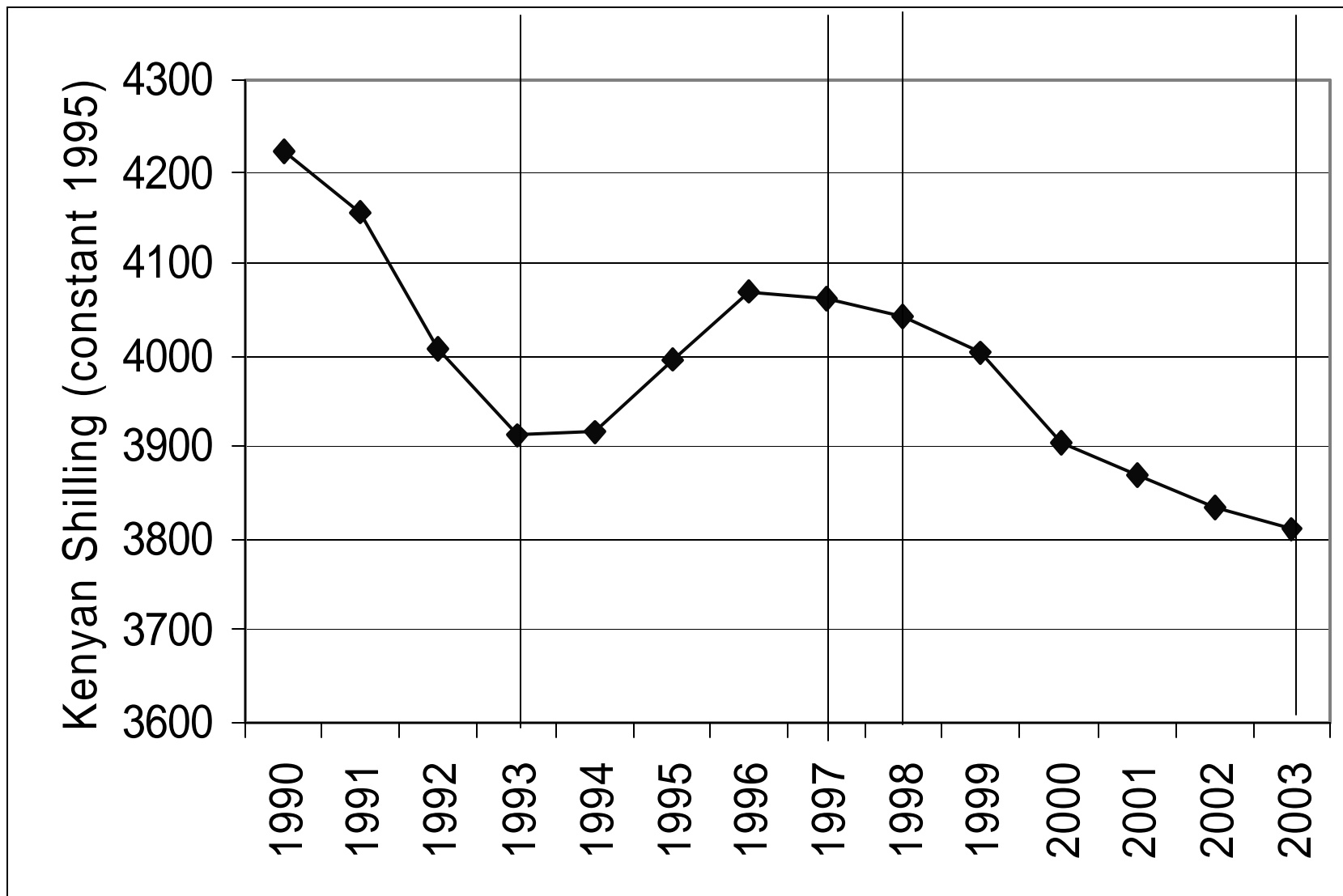
- National accounts data are
 - Annually available
 - Comparable
 - Aggregate
- These features could be exploited to examine the evolution of poverty by linking them with household consumption surveys
 - Classify households in three groups according to sector of employment of household head as observed in 1997 WMS
 - Apply historical sectoral GDP growth rates
 - Allow for structural transformation based on observed urbanization patterns

Per Capita GDP in Kenya

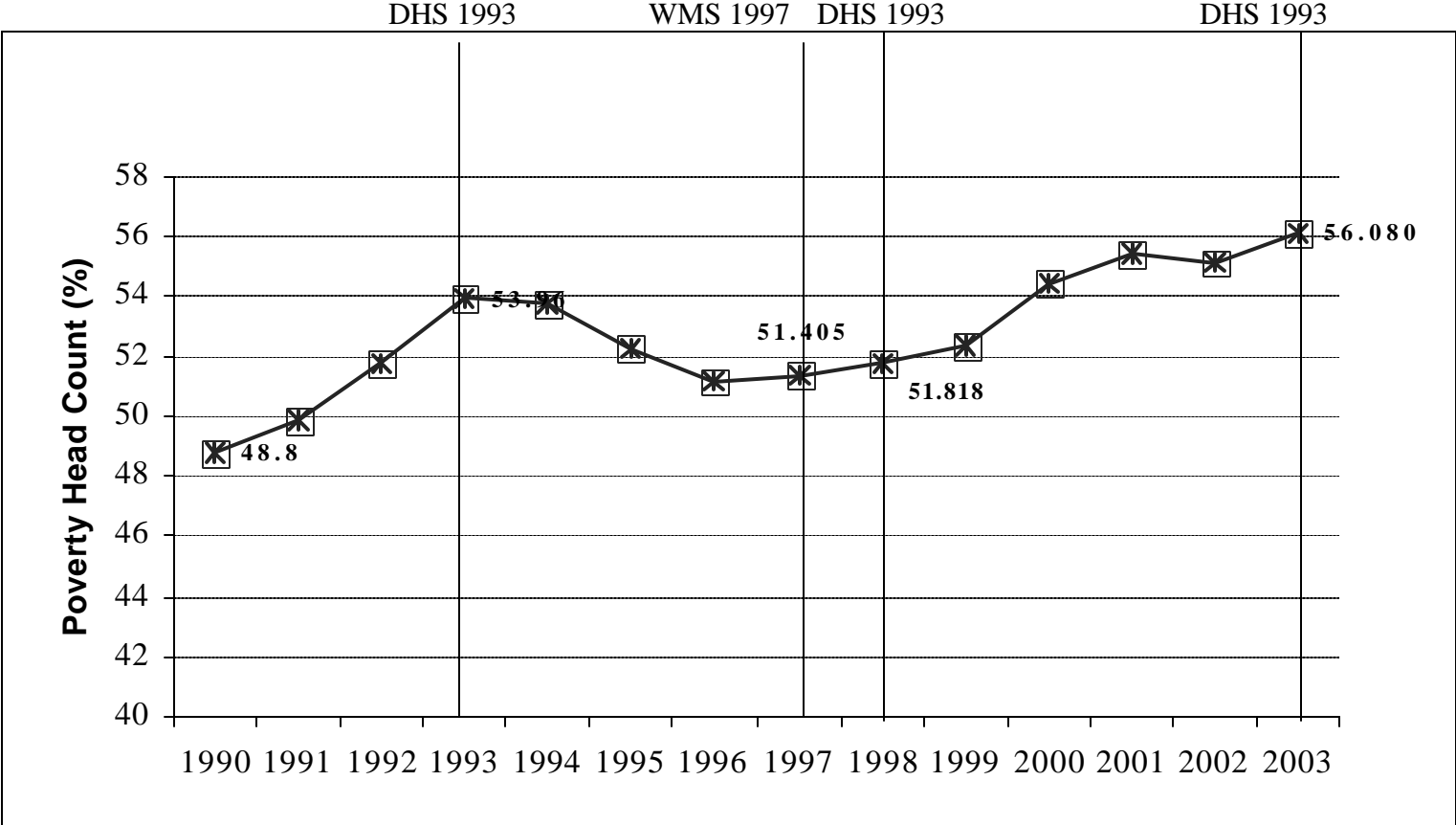
DHS 1993

WMS 1997 DHS 1998

DHS 2003



Poverty Change – Macro-Micro Linkages



Concluding Remarks

- Critical requirements for assessing evolution of poverty are:
 - Comparability of data, survey and questionnaire design
 - Regular availability of data, b/c annual variations
- Evolution of non-monetary indicators of poverty
 - More robust information base (3 rounds of DHS)
 - Overall progress in enrollments (especially primary), child malnutrition and stagnation in secondary enrollment and deterioration in infant mortality
 - Progress mainly driven by rural areas and Nairobi, and much less so by other urban areas where child malnutrition actually increased

Concluding Remarks (2)

- Evolution of Monetary poverty
 - Poorer information base in Kenya
 - Standard approach, while preferable, currently not feasible in Kenya and not without problems either
 - Survey comparability (e.g. recall periods)
 - Prices & temporal deflation
 - Asset indices
 - Statistical asset index – quick but dirty – lacks a theoretical base
 - Economic asset index – better theoretical foundation, but more data intensive and time consuming, and further fine-tuning is required
 - Both standard and asset indices approaches are *an art and not entirely a science*

Concluding Remarks (3)

- Emerging Hypotheses:
 - Rural poverty declining in rural areas
 - Poverty increasing in other urban areas
 - Poverty in Nairobi declining, but are samples appropriate?
- Work in progress and critical importance of triangulating the results using different methods (including participatory poverty assessments → need for recall data)