Durable Goods

LECTURE 9

A fundamental presumption

- Long-lived goods (automobiles, appliances, furniture, etc.) have a positive and significant impact on living standards.
- These goods are special: measuring the increment in living standards derived from them is not as straightforward as for other goods
- This whole lecture is dedicated to durable goods

Today's four questions

1. What is a durable good?
2. Why do durable goods require special treatment?
3. How to deal with durable goods, analytically?
4. How to design a dedicated module in the questionnaire?

1. What is a durable good?

What is a durable good? – I/II

Diewert (2009: 447)

- A durable good is a consumption good that can "deliver useful services to a consumer through repeated use over an extended period of time":
  - useful services: utility, or consumption, which is what welfare analysts are after
  - extended period of time: a durable good's distinctive characteristic is that the period of time during which it delivers utility to the consumer exceeds the survey period (one year)
  - a durable good is a stock that yields a return to its owner over multiple years; this return is the value of using the good

What is a durable good? – II/II

Diewert (2009: 447)

- Housing is a durable good.
- Due to its importance, it is customary for analysts to deal with it separately from other durable goods.
- Accordingly, in this lecture we focus on consumer durable goods other than housing

2. Why do durable goods require a special treatment?

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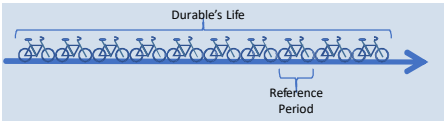
Why do durable goods require a special treatment?

- A figure worth a thousands words:



- The durables' service flow exceeds the reference period of the welfare aggregate
- The purchasing price reflects the value of the durable for its entire life
- Need to capture the value of the flow of the service during the reference period

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Source: World Bank Poverty Training presentation.

The problem with durable goods

- It is not the purchase of a good that contributes to welfare, but its use.
- This creates a wedge between household expenditure (which we can easily measure) and household consumption (we rarely observe usage directly).
- For non-durable (perishable) goods, it is safe to ignore this wedge: expenditure is a good estimate of consumption expenditure
- But for durable goods, we need to estimate the value of using the good for one year (service flow), and add this value to household consumption expenditure
- How do we estimate the value of owning or having access to durable goods during a given year?

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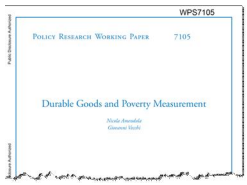
3. How to deal with durable goods, analytically?

Useful reference

Amendola and Vecchi (2014)

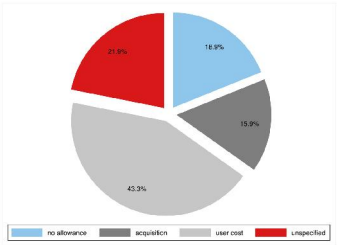


- Review of methods and current practice
- Mathematical notation used in the presentation is consistent with this paper

Three approaches

1. Acquisition Approach	2. Rental Equivalence	3. User Cost
When the good is purchased its entire value is attributed to the household welfare aggregate	If a complete set of markets for the services of durables exists, we can use the market rental value of the goods	The annual cost of holding the stock of each durable.

Durable goods in World Bank's selected poverty assessment reports



Consider your car: how to calculate its contribution to your standard of living?

Some notation first

- Let us focus on one durable good, *e.g.* cars
- Let t denote the survey year
- If we write CF_t we mean the consumption flow of the car owned by household during the survey period
- v is the "vintage" or age of the car, the number of years since it was manufactured (if v = 3 this means that the car was produced three years ago)
- s is the number of years since the household owns the car (if s = 1 it means that the car was purchased 1 year ago)
- s must be lower than or equal to v
- if s=v=0 then the hh has purchased a new car during the survey year.

Three approaches, one formula

- The consumption flow to be included in the consumption aggregate can be calculated by means of a simple formula:

$$CF_t = k_{v,t}^{s} \times p_{v,t}$$

- Interpretation: The consumption flow for a generic *v*-year old durable good purchased *s* years back in time is a fraction *k* of the current market value of the good, $p_{v,t}$ (how much the *v*-year old good is worth on the market at the beginning of the survey period)
- The coefficient *k* is typically less than one.
- This equation should be memorized.

Method 1 – Acquisition approach

- A first option consists in adding up reported purchases on durable goods (purchase values) and include them in the consumption aggregate
- This would be a mistake
- Why?
- Because it would amount to assuming that households that purchased a durable good in the survey period use it all up by the end of the year.
- On the other hand, households that own durable goods purchased before the survey period would be considered "as well off as" households that do not own any durables
- This is in stark contrast with the very definition of durable good: a good that delivers utility for a period longer than the survey year.

The acquisition approach in practice

$$CF_t = k_{v,t}^{s} \times p_{v,t}$$

$$k_{v,t}^{s} = \begin{cases} 1 & if\ s = 0 \\ 0 & if\ s > 0 \end{cases}$$

- If $s>0$, then $k=0$, and $CF_t=0$
  Interpretation: items purchased before the survey year ($s>0$) do not contribute to the household's well-being.
- Does it make economic sense?
- No
- If $s=0$, then $k=1$, and $CF_t=p_{v,t}$
  Interpretation: items purchased during the survey year ($s=0$) contribute to the household's well-being for their full value ($p_{v,t}$ captures the present value of all services provided by the durable over its entire economic life)
- Does it make economic sense?
- No

Method 2 – Rental equivalence

- Ideally, one could try to estimate the utility that derives from owning (or using) a durable good by collecting information on how much it would cost to rent it for a year.
- In principle, this is doable - in practice, it is not.
- Most countries have no markets for renting most durable goods, and when markets exist it is difficult (impossible?) to control for quality.
- Not recommended

*The rental approach in practice

$$CF_t = k^s_{v,t} \times p_{v,t}$$

$$k^s_{v,t} = \frac{R_{v,t}}{p_{v,t}}$$

- Assume that consumers can rent a car
- Let $R_{v,t}$ denote the current market rental value of the *v*-year-old durable good
- If *k* is specified as in the formula here (it can be interpreted as the share of the good's value that is consumed in the current period), then $CF_t = R_{v,t}$
- Interpretation: the CF equals the market rental value of the durable owned by the household
- Does it make economic sense?
- Yes
- Is it empirically viable?
- Most likely, no.

Method 3 – User Cost

- We introduce the user cost approach through a conceptual experiment
- Consider a household that owns a durable good.
- Notation: let p_t denote the market value of a particular good at the beginning of the survey year t (we forget about the age of the good for a second)
- The household faces two options:
  1. to sell the durable good;
  2. to use the durable good.

The user cost approach – I/II

sell	use
If the household sells the durable good, and invest the revenue on the financial market, at the end of the year, the household receives $p_t(1+i_t)$ where i_t is the market nominal interest rate.	If the household uses the durable good and sells it at the end of the year, the household obtains $p_t(1+\pi_t)(1-\delta_t)$ were π_t is the inflation rate during the year t and δ_t is the annual depreciation rate (due to both physical deterioration and loss of market value).

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The user cost approach – II/II

- The consumption flow is the difference between the value of the two options at the end of the year: this is the cost that the household is willing to pay for using the durable good for one year:

$$CF_t = p_t(1+i_t) - p_t(1+\pi_t)(1-\delta_t)$$

which can be approximated by:

$$CF_t = p_t(i_t - \pi_t + \delta_t) = p_t(r_t + \delta_t)$$

CF is the consumption flow from durables

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The consumption flow, interpreted

$$CF_t = p_t(i_t - \pi_t + \delta_t) = p_t(r_t + \delta_t)$$

- Two cost components:

1. Opportunity cost
   $p_t r_t$ is the foregone real interest, i.e. the interest one could have earned if one had invested the money in a bank account instead of the consumer good.
2. Depreciation
   $p_t \delta_t$ is the drop in value of the good during the course of the year.

- Problem: how to estimate the depreciation rate (delta) in practice?

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The user cost approach in practice

- Using our formula:

$CF_t = k^s_{v,t} \times p^s_{v,t}$

- Note that if

$k^t_{v,t}(u) = r_t + \delta_t$

- then

$CF_t = (r_t + \delta_t)p_{v,t}$

- which is what we have derived through the conceptual experiment seen before.

Estimating CF_t based on the user cost approach

$CF_t = p_t(r_t + \delta_t)$

- Of the two "ingredients" needed to compute CF_t, r_t is the easiest to obtain: it comes from sources external to the survey.
- Instead, the depreciation rate δ_t , which measures the loss (or gain) in value that durable goods experience with age due to physical deterioration and market value change, must be estimated.
- How to estimate δ_t?
  - Do bicycles depreciate at the same rate as refrigerators?

Estimating the depreciation rate – I/II

- We can write: $p_{1,t} = (1 - \delta_1)p_{0,t}$
- And similarly: $p_{2,t} = (1 - \delta_2)p_{1,t}$
- Then: $p_{2,t} = (1 - \delta_2)(1 - \delta_1)p_{0,t}$
- Proceeding iteratively gives: $p_{v,t} = \prod_{i=1}^{v}(1 - \delta_i)p_{0,t}$

Estimating the depreciation rate – II/II

- Given:

$$p_{v,t} = \prod_{i=1}^{v}(1-\delta_i)p_{0,t}$$

- The "secret" consists in modelling δ_i. Many options:
  1) the geometric depreciation model
  2) the straight line depreciation
  3) others not covered here…

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The geometric model

- Depreciation rate constant over time: $\delta_i = \delta$
- Market value of age *v* durable simplifies to: $p_{v,t} = (1-\delta)^v p_{0,t}$
- Depreciation rate given by : $\delta = 1 - \left(\frac{p_{v,t}}{p_{0,t}}\right)^{\frac{1}{v}}$
- Bottom line: δ can be easily estimated, at least in theory: it only requires information on the market values of homogeneous durable goods of different age, $p_{v,t}$ and $p_{0,t}$.

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*The straight line model

- Finite economic life. After T years CF falls down to zero. Linear pattern

$$\frac{p_{v,t}}{p_{0,t}} = \begin{cases} \frac{T-v}{T} & if\ v \le T \\ 0 & otherwise \end{cases}$$

- The depreciation rate increases over time

$$\delta_i = \begin{cases} \frac{1}{T-i} & if\ i < T \\ 1 & otherwise \end{cases}$$

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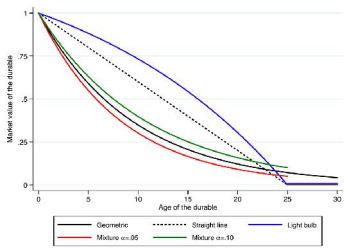
*Depreciation models compared



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Recap

- User cost is the more appropriate concept to evaluate the consumption flow from durables
- In terms of data requirements, the geometric depreciation model is a good compromise
- We need to estimate:

1) Current market value of the durable: $p_{v,t}$
2) Current real interest rate: $r_t = i_t - \pi_t$
3) Depreciation rate: δ

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Data requirements: first best

- Current market value of item of vintage v: $p_{v,t}$
- Current market value of a new item: $p_{0,t}$
- Age v of the durable
- Current nominal interest rate: i_t
- Current yearly inflation rate: π_t

$$CF = (i_t - \pi_t + \delta)p_{v,t} \qquad \delta = 1 - \left(\frac{p_{v,t}}{p_{0,t}}\right)^{\frac{1}{v}}$$

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Data requirements: approximating the first best

- Current market value of the item purchased year $t-s$: $p_{t-s,t}$
- Price paid in year $t-s$: p_{t-s}
- Current nominal interest rate: i_t
- Current yearly inflation rate: π_t
- Average yearly inflation rate: $\bar{\pi}$

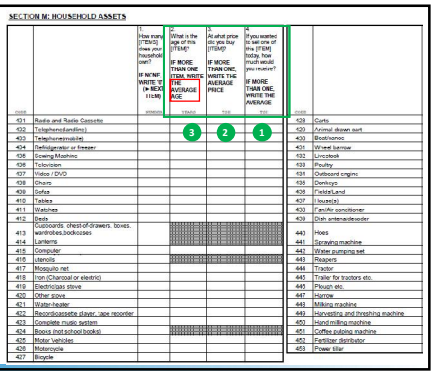
$$CF = (i_t - \pi_t + \hat{\delta})p_{t-s,t} \qquad \hat{\delta} = 1 - \frac{1}{1+\bar{\pi}}\left(\frac{p_{t-s,t}}{p_{t-s}}\right)^{\frac{1}{s}}$$

4. How to design a dedicated module in the questionnaire?

Tanzania, 2014/15

National Panel Survey

- 1) Current market value of item ($p_{t-s,t}$)
- 2) Price paid in year t-s (p_{t-s})
- Age of the durable (**v**)
- Data requirements for a (practical) first best are met


SECTION M: HOUSEHOLD ASSETS

		1 How many [ITEMS] does your household own? IF NONE WRITE '0' (→ NEXT ITEM)	2 What is the age of this [ITEM]? IF MORE THAN ONE ITEM, NOTE THE AVERAGE AGE	3 At what price do you buy [ITEM]? IF MORE THAN ONE, WRITE THE AVERAGE PRICE	4 If you wanted to sell one of the [ITEM] today, how much would you receive? IF MORE THAN ONE, WRITE THE AVERAGE		
CODE		NUMBER	YEARS	TSH	TSH	CODE	
401	Radio and Radio Cassette					428	Cots
402	Telephone(landline)		3	2	1	429	Animal drawn cart
403	Telephone(mobile)					430	Boat/canoe
404	Refrigerator or freezer					431	Wheel barrow
405	Sewing Machine					432	Livestock
406	Television					433	Poultry
407	Video / DVD					434	Outboard engine
408	Chairs					435	Donkeys
409	Sofas					436	Fields/Land
410	Tables					437	House(s)
411	Watches					438	Fan/Air conditioner
412	Beds					439	Dish antenna/decoder
413	Cupboards, chest-of-drawers, boxes, wardrobes,bookcases					440	Hoes
414	Lanterns					441	Spraying machine
415	Computer					442	Water pumping set
416	Utensils					443	Reapers
417	Mosquito net					444	Tractor
418	Iron (Charcoal or electric)					445	Trailer for tractors etc.
419	Electric(gas) stove					446	Plough etc.
420	Other stove					447	Harrow
421	Water-heater					448	Milking machine
422	Record/cassette player, tape recorder					449	Harvesting and threshing machine
423	Complete music system					450	Hand milling machine
424	Books (not school books)					451	Coffee pulping machine
425	Motor Vehicles					452	Fertilizer distributor
426	Motorcycle					453	Power tiller
427	Bicycle						

Namibia, 2015/16

Household Income and Expenditure Survey (NHIES)

1) Current market value of item ($p_{t-s,t}$)

~~2) Price paid in year t-s (p_{t-s})~~

~~3) Years of ownership (s) or Age of the durable (v)~~

- We only have the current market value of the item
- Standard methods cannot be applied

Section 5: Durable Assets

DURABLE GOOD CODE	5.01 Does this household or any of its members own any of the following items? ASK YES/NO FOR EACH ITEM FIRST. IF 'YES' ASK QUESTIONS 5.02 and 5.03 FOR EACH OF THE ITEMS IF 'NO' ASK 5.04	5.02 How many does your household own of [ITEM]?	5.03 If you were to sell this [ITEM] today, how much would you charge?	5.04 INTERVIEWER: FOR ITEMS NOT OWNED, ASK: Although your household does not own, does your household have access to [ITEM]?
	DESCRIPTION	NUMBER	N$	
01	Motor car, station wagon			
02	Buses & Mini-buses			
03	bakkies and 4-wheel drives			
04	Motor scoter scooter			
05	Bicycle			
06	Electric stove			
07	Gas or paraffin stove			
08	Microwave oven			
09	refrigerator			
10	Freezer			
11	Washing machine			
12	Sewing/ knitting machine			
13	Radio			
14	Stereo/HiFi			
15	Tape recorder			
16	Television			
17	Internet server dish			
18	Video cassette recorder/DVD			
19	Telephone handset/corded			
20	Cell telephone			
21	Computer: laptop or desktop			
22	Tablet - iPad, etc.			
23	Camera			
24	Generator			
25	Living room furniture set			
26	Bedroom furniture set			
27	Dining room/ kitchen furniture			
28	Donkey cart/ox cart			
29	Plough			
30	Tractor			
31	Harvesterror			

1

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Some practical considerations

- The years of ownership can be used as a substitute for the age of the durable
- It is uncommon for surveys to collect information on the current market value of item of vintage v, and most of the time, what we have instead is the price paid in t-s. In all these cases, we will need to apply an inflation rate
- When the first best criteria are not fulfilled, alternative methods may exist to achieve a reliable estimation of the durables
- But not always.

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Palestine

Expenditure and Consumption Survey, PECS 2011

- Palestine is an extreme case
- We only have information about the amount of durables (number of units)
- In those cases, a wise choice is to ignore consumer durable goods and exclude them from the welfare aggregate

Durable Goods

Group No	Description of item	Item No.	Total amount last 12 months
50	**Furniture**		
	Wooden bed	5001	
	Metal bed	5002	
	Wooden tables	5003	
	Wooden chairs	5004	
	Plastic tables	5005	
	Plastic chairs	5006	
	Wooden cupboard	5007	
	Dining room, complete set	5008	
	Living room, complete set	5009	
	Bed room, complete set	5010	

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Lessons learned

- We are interested in the use (consumption) of a durable good, and not in its value (purchase).
- The recommended approach to estimate the value of use is called "the user cost method".
- Data requirements depend on the specific method chosen for estimating the so-called consumption flow from durable goods.
- The questionnaire should contain a specific module on ownership of durables.

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References

Required readings

Amendola, N. and G. Vecchi (2014), "Durable goods and poverty measurement", World Bank Policy Research Working Paper no. 7105.

Deaton, A., & Zaidi, S. (2002). Guidelines for constructing consumption aggregates for welfare analysis (Vol. 135). World Bank Publications. p. 33-35

Suggested readings

Diewert, W. E. (2004), "Durables and User Costs" in ILO, Consumer Price Index Manual: Theory and Practice, chapter 23, ILO / IMF / OECD / UNECE / Eurostat / World Bank.

Diewert, W. E. (2009), "Durables and Owner-Occupied Housing in a Consumer Price Index" in W. E. Diewert , J.S. Greenlees and C.R. Hulten (eds.), Price Index Concepts and Measurements, University of Chicago Press.

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Thank you for your attention

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Homework

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Exercise 1 – The durable goods module

- Comment on whether the following modules are suitable for estimating the CF, as needed by a welfare analyst.

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Ghana, 2017

Ghana Living Standards Survey

SECTION 12: CREDIT, ASSETS AND SAVINGS

PART B: ASSETS AND DURABLE CONSUMER GOODS

ITEM	CODE	1 Does any member of the household own ... Yes, working ...1; Yes, not working ...2; No ...3 (>> Next Item)	1a Who owns it? ID	2 How long ago was ... obtained? LESS THAN ONE YEAR: CODE 00 ITEM	3 What was its purchase price? (IF GIFT PUT ZERO) C = CURRENCY CODE Cedi ...1; Naira ...2; CFA ...3; Pound ...4; US Dollar ...5; Euro ...6; Yen ...7; Other (specify) ...8	4 How much could you sell it now in Ghana cedis?
		A B C	A B C	A B C	ITEM - A C ITEM - B C ITEM - C C	A B C
				YEARS	AMOUNT	VALUE (GHc)
Furniture (stuffed)	301					
Furniture (not stuffed)	302					
Sewing machine	303					
Stove (kerosene)	304					
Stove (electric)	305					
Stove (gas)	306					
Refrigerator	307					
Freezer	308					
Air conditioner	309					
Fan	310					
Radio	311					

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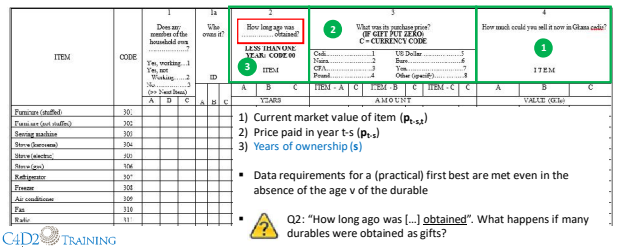
Ghana, 2017

Ghana Living Standards Survey



1) Current market value of item ($p_{t-s,t}$)
2) Price paid in year t-s (p_{t-s})
3) Years of ownership (s)

- Data requirements for a (practical) first best are met even in the absence of the age v of the durable
- Q2: "How long ago was [...] obtained". What happens if many durables were obtained as gifts?

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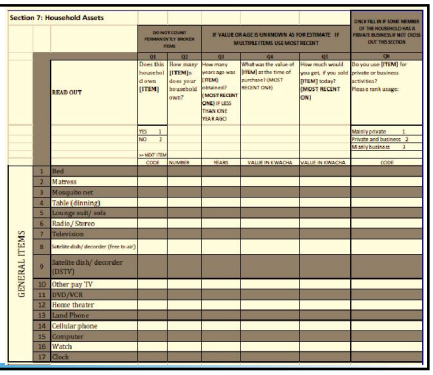
Zambia, 2015

Living Conditions Monitoring Survey



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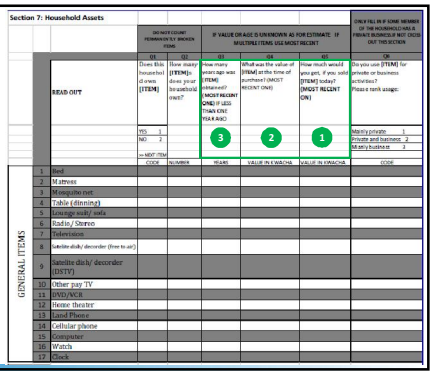
Zambia, 2015

Living Conditions Monitoring Survey

1) Current market value of item ($p_{t-s,t}$)
2) Price paid in year t-s (p_{t-s})
3) Years of ownership (s)

- **Same case as Ghana**
- Here, information is collected on the "most recent" durable. How does this affect the resulting estimate (think about cases in which the household owns more than one durable good for each type)?



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Nigeria, 2015/16
General Household Survey

SECTION 5: HOUSEHOLD ASSETS

DATA ENTRY LINE NUMBER	ITEM CODE	ITEM	1. How many of the following items does your household own? WRITE THE TOTAL NUMBER OF ITEMS THAT THE HOUSEHOLD POSSESSES. IF NONE PUT '0'	2. Who is the person that owns this item? WRITE THE ID OF THE PERSON WHO OWNS THIS ITEM. IF THIS ITEM IS OWNED BY THE HOUSEHOLD IN COMMON, WRITE "38".	ID CODE	3. How long ago was [ITEM] acquired? (IF LESS THAN ONE YEAR, PUT '0') IF MORE THAN ONE, REFER TO NEWEST	4. If you wanted to sell one of this [ITEM] today, how much would you receive? IF MORE THAN ONE, REFER TO NEWEST	DATA ENTRY LINE NUMBER
			NUMBER OF ITEMS	ID CODE		NUMBER OF YEARS	NAIRA	
1	301	Furniture (s/4 piece so'a set)						1
2	302	Furniture (chairs)						2
3	303	Furniture (table)						3
4	304	Mattress						4
5	305	Bed						5
6	306	Mat						6

Nigeria, 2015/16
General Household Survey

1) Current market value of item ($p_{t-s,t}$)
2) ~~Price paid in year t-s (p_{t-s})~~
3) Years of ownership (**s**)

- ⚠ Standard methods cannot be applied
- Alternative methods exist when we only have the current market value of the durable and an estimation of the **maximum economic life of the durable.**

SECTION 5: HOUSEHOLD ASSETS

DATA ENTRY LINE NUMBER	ITEM CODE	ITEM	1. How many of the following items does your household own? WRITE THE TOTAL NUMBER OF ITEMS THAT THE HOUSEHOLD POSSESSES. IF NONE PUT '0'	2. Who is the person that owns this item? WRITE THE ID OF THE PERSON WHO OWNS THIS ITEM. IF THIS ITEM IS OWNED BY THE HOUSEHOLD IN COMMON, WRITE "38".	ID CODE	3. How long ago was [ITEM] acquired? (IF LESS THAN ONE YEAR, PUT '0') IF MORE THAN ONE, REFER TO NEWEST	4. If you wanted to sell one of this [ITEM] today, how much would you receive? IF MORE THAN ONE, REFER TO NEWEST	DATA ENTRY LINE NUMBER
			NUMBER OF ITEMS	ID CODE		NUMBER OF YEARS	NAIRA	
2	302	Furniture (chairs)						2
3	303	Furniture (table)						3
4	304	Mattress						4
5	305	Bed						5
6	306	Mat						6

Malawi, 2016/17
Integrated household survey

MODULE L: DURABLE GOODS

ENUMERATOR: RECORD START DATE & TIME FOR MODULE L

ITEM	L01 Does your household own a ITEM? YES=1 NO=2 >> NEXT ITEM	L02 How many ITEMS do you own?	L03 How many [ITEM]s do you own?	L04 What is the age of this [ITEM]? IF MORE THAN ONE, REFER TO AVERAGE AGE.	L05 If you wanted to sell one of this [ITEM] today, how much would you receive? IF MORE THAN ONE, AVERAGE VALUE.	L06 Did you purchase or pay for any [ITEM] in the last 12 months? YES=1 NO=2 >> NEXT ITEM	L07 How much in total did you pay for [ITEM] in the last 12 months?
	CODE		NUMBER	YEARS	MK		MK
Mortar/pestle (mtondo)		801					
Bed		802					
Table		803					
Chair		804					
Fan		805					
Air conditioner		806					
Radio ('wireless')		807					
Radio with flash drive/micro CD		8801					
Tape or CD/DVD player; HiFi		808					
Television		809					
VCR		810					
Sewing machine		811					
Kerosene/paraffin stove		812					
Electric or gas stove; not plate		813					
Refrigerator		814					

C4D2 TRAINING

Malawi, 2016/17

Integrated household survey

1) Current market value of item ($p_{t-s,t}$)
2) Price paid in year t (p_t)
3) Age of the durable (**v**)

- the questionnaire only collects information about the price paid if the durable was acquired ***in the last 12 months*** (in year t!).
- We don't have the price paid in year t-s.
- Note that, in this case, p_t and $p_{t-s,t}$ will probably be very similar
- **Same case as Nigeria** but a bit better because we have the vintage

C4D2 TRAINING

MODULE L: DURABLE GOODS

ENUMERATOR: RECORD START DATE & TIME FOR MODULE L

ITEM	L01 Does your household own a [ITEM]? YES...1 NO...2 >> NEXT ITEM	L02 HOW MANY CODE	L03 How many [ITEM]s do you own?	L04 What is the age of this [ITEM]? IF MORE THAN ONE ITEM, AVERAGE AGE. YEARS	L05 If you wanted to sell one of this [ITEM] today, how much would you receive? IF MORE THAN ONE, AVERAGE VALUE.	L06 Did you purchase or acquire any [ITEM] in the last 12 months? YES...1 NO...2 >> NEXT ITEM	L07 How much in total did you pay for [ITEM] in the last 12 months?
		LINE	NUMBER	YEARS	MK		MK
Mortar/pestle (mtondo)		551					
Bed		552					
Table		553					
Chair		554					
Fan		555					
Air conditioner		556					
Radio ('wireless')		557					
Radio with flash drive/micro CD		5551					
Tape or CD/DVD player; HiFi		558					
Television		559					
VCR		510					
Sewing machine		511					
Kerosene/paraffin stove		512					
Electric or gas stove; hot plate		513					
Refrigerator		514					