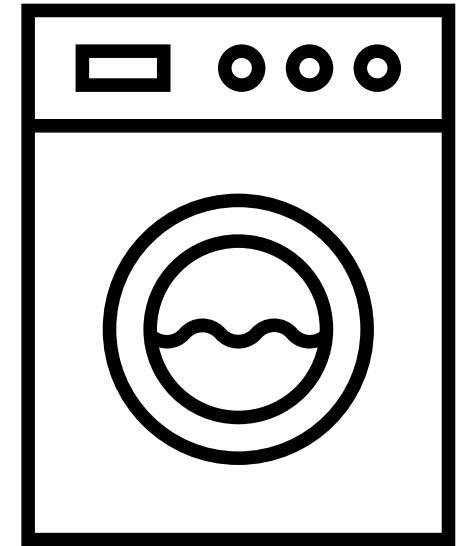


Ethiopia Poverty Measurement Training

Day 4. Durable Goods

Characteristics of Durable Goods

- Durable goods “deliver useful services to a consumer through repeated use over an extended period of time.”
- Lumpy/valuable enough to make practical to ask respondent about current stock and value
 - In a way that it wouldn't be to ask about pairs of shoes or cooking pots.
- Physical goods for which the use year after year can be realistically modeled using depreciation



Items to Exclude

- Make sure to only include consumer durable goods, not farm implements or productive assets for a household business
 - Sewing machines are often included in this list, in many contexts they are productive assets for a business, not a consumer good for a hobby
- Goods that are used as a store of wealth (silver and gold) rather than for use should also be excluded
- Some durable goods may also be included in the non-food expenditure section, make sure not to double count
 - For most things, it's better to take use value than expenditure if you have both
- Some questionnaires include houses and land in this list
 - Value of housing actually used is included elsewhere
 - Farmland is productive asset
 - Other dwellings / land might be a source of savings or income but are not consumption

Consumption Flow

- How much of the value / purchase price of the durable good is “used up” for the year that is the reference period for the survey?
- Three methods:
 - Acquisition approach
 - Rental equivalence approach
 - User cost approach
- If you are interested, see M&V 4.4 for discussion of 1 & 2. M&V and most practitioners agree that 3 is to be used.

User Cost Approach (1/2)

- Consider that for each durable good, at the beginning of the year, a household can either:
 - Sell the durable good and invest the revenue on the financial market
 - Use the durable good and sell at the end of the year for its value then
- Define
 - p_t = market value at the beginning of the year
 - i_t = general nominal interest rate
 - π_t = inflation rate
 - δ = depreciation rate

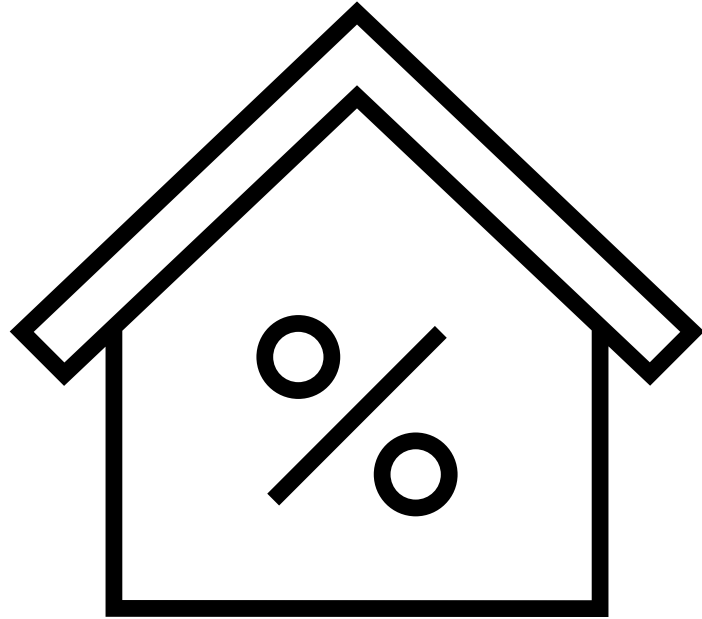
User Cost Approach (2/2)

- Sell: at the end of the year the hh has $p_t(1 + i_t)$
- Use: at the end of the year the hh has $p_t(1 + \pi_t)(1 - \delta_t)$
- Difference between these two is the cost the household is willing to pay to use the durable for the year:
$$p_t(1 + i_t) - p_t(1 + \pi_t)(1 - \delta_t)$$
- Assume that $\pi_t \delta_t \approx 0$ then the cost can be written as $p_t(r_t + \delta_t)$ where $r_t = i_t - \pi_t$ is the real interest rate

Validity of Assumptions

- Poor households in low-income countries may sell assets to raise cash, but in many contexts, it is not a very common practice (pawning of assets may be common in some contexts)
 - But: a rich market for second-hand consumer durables does exist which would help households be able to estimate the value of their goods
- Poor households in many contexts don't actually have the opportunity to save their money at the official interest rate
 - But: there is still a benefit of having money now as opposed to later
- Bottom line:
 - we taking use value as a fraction of the current value of the item, usually between 10 and 40%
 - the utility/value a household gets from the durable good declines over time as the good ages / wears out

Source of Variables for Use Value Formula



- We want to construct use value as $p_t(r_t + \delta_t)$
- Current value of the item is almost always asked on questionnaire
- Real interest rate (or nominal interest rate and inflation) is fairly easy to find from official sources
- Depreciation rates (usually specific to the type of durable good) can be calculated from data often collected in the survey: purchase price, current value and length of time the hh has owned the item

Construction of Depreciation Rates

- We assume **constant geometric depreciation**: the **real** value of durable good (P) declines at a constant rate δ every year: $P_t = P_{t-1}(1 - \delta)$ or $P_t = P_{t-a}(1 - \delta)^a$ for any a
- The **nominal** value of the durable good (p) changes due to depreciation and inflation:

$$\bullet \quad p_t = p_{t-1}(1 - \delta)(1 + \pi) \text{ or } p_t = p_{t-a}(1 - \delta)^a(1 + \pi)^a$$

- If a household purchased the item a years ago for p_{t-a} , we solve this equation for δ and get

$$\delta = 1 - \left(\frac{p_t}{p_{t-a}(1 + \pi)^a} \right)^{1/a} = 1 - \frac{1}{1 + \pi} \left(\frac{p_t}{p_{t-a}} \right)^{1/a} \approx 1 - \left(\frac{p_t}{p_{t-a}} \right)^{1/a} + \pi$$

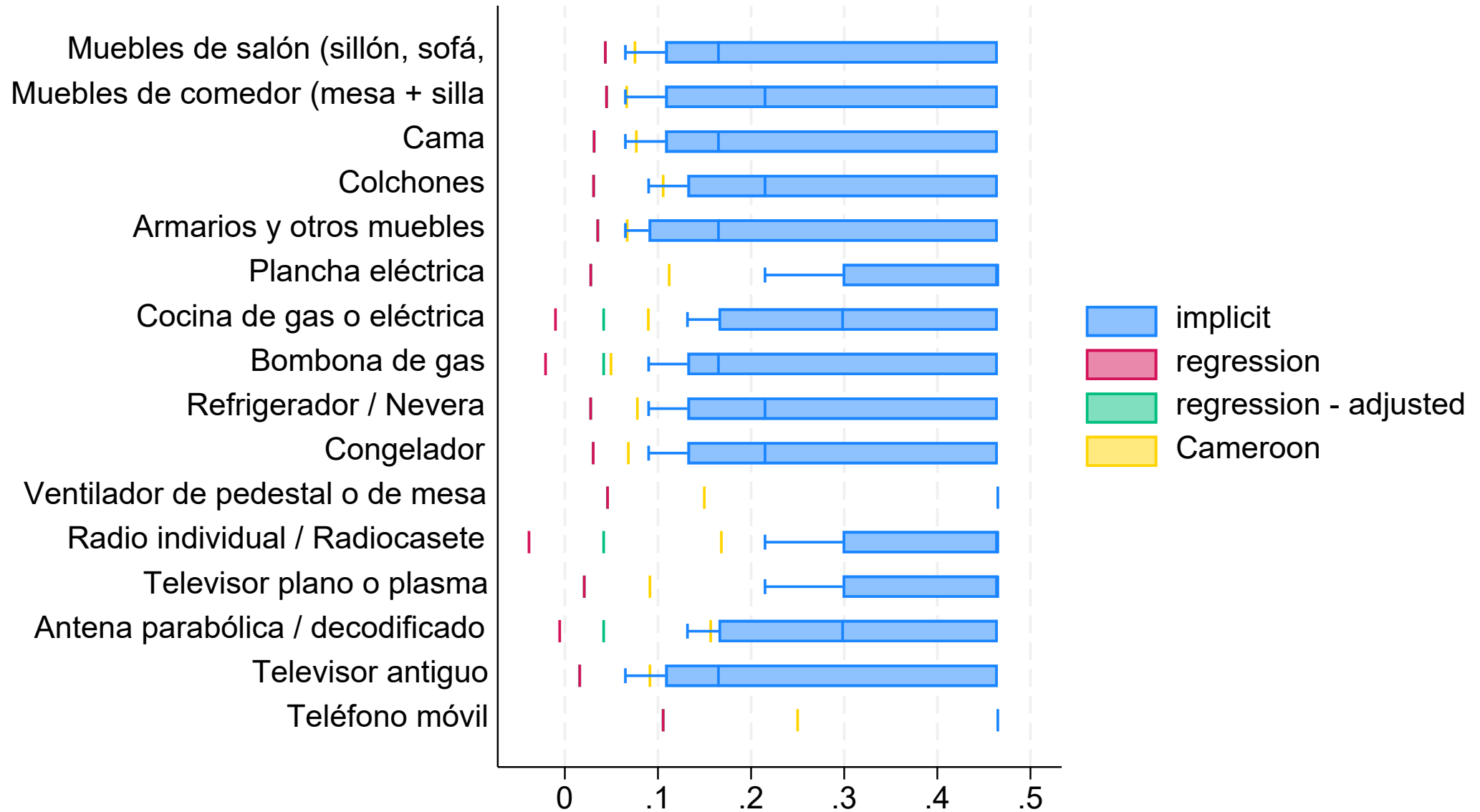
- The term $p_{t-a}(1 + \pi)^a$ is sometimes referred to as the **replacement cost**: the cost today of an item identical to the one the household originally bought

Alternative Construction of Depreciation Rates (1/2)

- If we don't have purchase price or replacement cost, we can still construct depreciation rates
- $p_t = p_{t-a}(1 - \delta)^a(1 + \pi)^a = P_{t-a}(1 - \delta)^a$
- Assume the real value of items of a certain type when acquired is drawn from a normal distribution with mean P_0
- Taking the natural log of both sides, we get
- $\log p_t^i = \log P_0 + \log(1 - \delta) \times a^i + \varepsilon^i$
- If we regress the log of the current value on the age of the item, the coefficient on the age is $\log(1 - \delta)$ thus $\delta = 1 - e^\beta$
- Issue: not guaranteed to return a strictly positive depreciation rate.

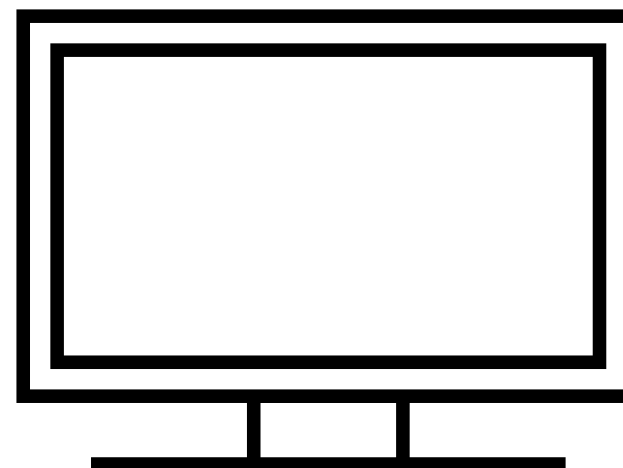
Alternative Construction of Depreciation Rates (2/2)

- Assume instead linear depreciation, so we will divide the current value by the number of years of useful life left
- Estimate maximum useful life based on the distribution of observed ages for each kind of item
 - Twice median
 - 95th or 99th percentile
- Every item is assumed to have at least two years useful life left, so we take a fraction of the current value that is less than or equal to 0.5
- Produces a different depreciation “rate” at different points in the life cycle
- Not generally recommended



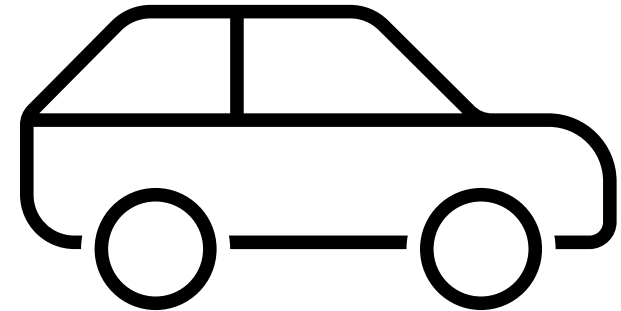
All You Really Need is Current Value

- In $p_t(r_t + \delta_t)$ the term that provides the variation in household wellbeing is p_t
- If you have this, you should include use value of durable goods in your NCA even if you can't construct depreciation rates from the data
- Use depreciation rates from a similar country
 - Similar types and qualities of durable goods available
 - Similar climate / lifestyles
 - Similar quality of electricity supply or other factors that impact depreciation
- Or just use a rule-of-thumb value like 0.2



Mix of Items Acquired New and Used

- In many countries, some of the durable goods may have been purchased used
- This doesn't matter for main method of constructing depreciation rates
- Because we are assuming constant geometric depreciation $p_t = p_{t-a}(1 - \delta)^a(1 + \pi)^a$ for any a , whether the item is new or used at time $t - a$
- In the alternative method (regression), this increases the variance in the purchase prices and makes our regression less precise, but not biased



Code Example

- d0 is item code, d2 is length of time hh has owned, d3 is current value, d4 is purchase price
- // depreciation for each item
- gen age = d2
- replace age = 0.5 if d2 == 0
- gen delta = 1 - (1/(1+`pi'))(d3/d4)^(1/age)
- // median depreciation by item type
- bys d0: egen delta_med = pctlile(delta), p(50)
- table d0, stat(mean delta_med)
- // use value
- gen useval = d3 * (`r' + delta_med)

Robust Data Processing

- Distribution of time the household has owned the item should be checked and high values should be top coded or considered missing
 - `flagout` program does **not** work well on this kind of discrete variable
- Check for any invalid values in purchase price and current value
- Excluding invalid values, check distribution of these variables and exclude outliers from the construction of the depreciation rates
- Check deprecation rates: must be between 0 and 1, almost always 0.05 to 0.5
- Check distribution of constructed use value
 - Assume it is log-normally distributed
 - Winsorize upper and lower outliers

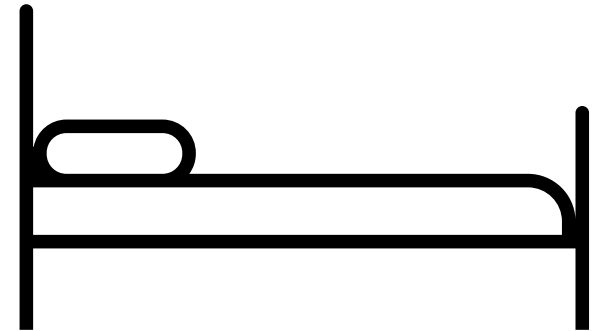
Reporting Depreciation Rates

Appendix B: Durable Goods and Depreciation Rates

Code	Items	Median Depreciation Rate
2	Antenne parabolique/numerique	15.66
3	Armoires et autres meubles	6.70
4	Aspirateur	15.48
5	Bouteille de gaz	4.96
6	Chaine musicale	10.49
9	Climatiseur	8.18
10	Congelateur	6.82
11	Cuisiniere	8.97
13	Fer a repasser a charbon	9.14
14	Fer a repasser a lectrique	11.21
15	Four a micro-onde ou a lectrique	9.14
16	Frigo	7.79
17	Groupe electrogene	9.22
18	Lave-linge, seche linge	10.58
19	Lecteur DVD/VCD	11.16
20	Lit	7.68
21	Matelas simple	10.56
22	Mixeur/Presse-fruits non electrique	10.61
23	Ordinateur fixe	9.09
24	Piano et appareil de musique	10.30
25	Poste radio	16.91
26	Rechaud a gaz	11.09
27	Rechaud a petrole	16.74
28	Refrigerateur	7.17
29	Robot de cuisine electrique (Moulinex)	10.56
30	Salon (Fauteuils et table basse)	7.53

Multiple Items

- Households can own **multiple items** of the same kind
- Questionnaires often only collect information on one, sometimes the newest
- Some questionnaires collect information on 2 or 3
- If households own more items than we have information on, usually just **assume all of them have the same value**
- If **newest** is specifically asked about, could assume others have only a **fraction of the value**




Cross Reference to Manchini and Vecchi

Concept	Question	Our notation	M&V's notation
Purchase price	How much did the household actually pay for the item when they bought it? (a years ago)	p_{t-a}	$p_{v,t-v}$
Current value	How much could the household get for the item now if they sold it?	p_t	p_t through eq 4.7, then $p_{v,t}$
Replacement cost	What would it cost now to buy an item identical to the one the household bought?	$p_{t-a}(1 + \pi)^a$	$p_{0,t}$

$p_{v,t}$ is the price of a good of vintage v (v years old as of the survey) at time t

NHIS 2024 - question

WMS-FORM 8														
FIXED ASSETS OF THE HOUSEHOLD														
8202	8203	8204	8205	8206	8207									
Type of Assets	Does the household currently own [ASSET TYPE]?	If the household owns atleast one asset type or if atleast one code 1 is recorded in Q8203												
	1 = Yes	How many [ASSET TYPE] does the household own?	How long ago was [ITEM] obtained? LESS THAN ONE YEAR: CODE 00. IF MORE THAN ONE, REFER TO MOST RECENTLY PURCHASED/OBTAINED	What was the purchase price of <u>one</u> [ITEM] at the time while the asset had been purchased? (IF NOT PURCHASED PUT ZERO). IF MORE THAN ONE, REFER TO MOST RECENTLY PURCHASED	If the household want to sell one/set [ASSET TYPE] the what would be the expected current price in BIRR? IF MORE THAN ONE, REFER TO MOST RECENTLY PURCHASED/OBTAINED									
	2 = No  NEXT ASSET													
	If the household doesn't have any type of the assets listed in Q8202 or if code 2 is recorded for all asset types													
↓ Q9103														
modern)														

NHIS 2024

ITEM LIST

1 PLOUGH (MODERN)

2 Water pump

3 Electric stove

4 Mattress and/or Bed

5 Wrist watch/clock

6 Electric Iron

7 Fixed line telephone

8 Wireless Telephone

9 Mobile Telephone/ Tablet

0 Desktop/ Laptop Computer

1 Radio /tape / Radio and tape

2 Television (Or with Dish/set)

3 SPEAKER/ G-PASS

4 Sofa set

5 Chair and table (excluding stool and bench)

6 Bicycle

7 Motor cycle

8 Cart (Hand pushed)

9 Cart (animal drawn)- for transporting people & goods

2 0 SEWING MACHINE

2 1 Weaving equipment

2 2 Builder's equipment

2 3 Carpenter's equipment

2 4 Welding equipment

2 5 Wood cutting equipment

2 6 Block production equipment

2 7 Mitad-Electrical

2 8 Mitad-power saving (modified)

2 9 Refrigerator

3 0 Private car

3 1 Car-Commercial

3 2 Bajaj

3 3 Jewels (Gold and silver)

3 4 Wardrobe

3 5 Shelf for storing goods

3 6 Biogas stove (pit)

3 7 Water storage pit

9 8 Others (specify)

WMS 2021

DURABLE GOOD LIST

1	Mofer and Kember?	26	Chair and table (excluding stool and bench)
2	Sickle (Machid)/'Mencha'	27	Bicycle
3	Axe (Gejera)	28	Motor cycle
4	Pick axe (Geso)	29	Cart (Hand pushed)
5	Plough (traditional)	30	Cart (animal drawn)- for transporting people
6	Plough (modern)	31	Sewing machine
7	Water pump	32	Weaving equipment
8	Kerosene stove	33	Builder?s equipment
9	Butane Gas stove	34	Carpenter?s equipment
10	Electric stove	35	Welding equipment
11	Blanket/Gabi	36	Wood cutting equipment
12	Mattress and/or Bed	37	Block production equipment
13	Wrist watch/clock	38	Mitad-Electrical
14	Iron (coal)	39	Mitad-power saving (modified)
15	Electric Iron	40	Refrigerator
16	Fixed line telephone	41	Private car
17	Wireless Telephone	42	Car-Commercial
18	Mobile Telephone/Tablet	43	Bajaj
19	Desktop/Laptop Computer	44	Jewels (Gold and silver)
20	Radio/tape/Radio and tape	45	Wardrobe
21	Television	46	Shelf for storing goods
22	Video Deck	47	Biogas stove (pit)
23	VCD/DVD/G-PASS	48	Water storage pit
24	Dish	49	Others (specify)

Experience in WMS2022

WMS2022 household-level data is available

- 8201*, 8203*: asset types
- 8204: how many owns
- 8205: length of the ownership
- 8206: purchase price
- 8207: resale price

Some issue:

- Extreme price: 99999 birr
- Over 25 years of purchase
- Higher resale values than purchase values
- High inflation (35%) led to a negative consumption flow