INSPIRING IDEAS AND TALENT

Beyond energy efficiency: do consumers care about life-cycle properties of household appliances?

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www.briskee-cheetah.eu

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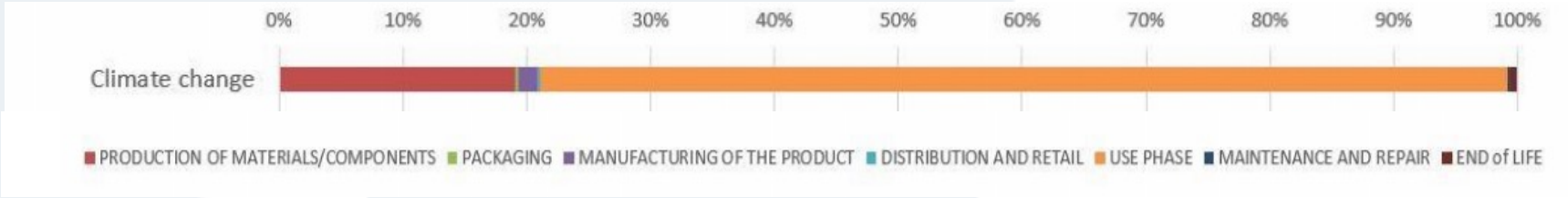
Outline

- Motivation
- Methodology
- Results
- Summary and policy implications

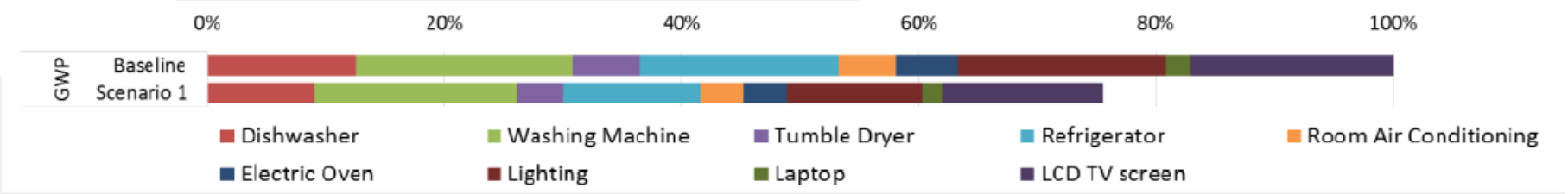
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Motivation

- GHG emission footprint of appliances (from the typical EU basket of products):



- Large potential for improvements (with efficiency and renewable energy)



Source: Reale et al. . 2019

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Motivation

- EU regulation on household appliances has long focused on energy consumption during usage:
  - MEPS (see Ecodesign Directive 20/30/EU)
  - Energy Labelling (see (EU) 2017/1369)
- Green Deal ➔ EU framework covers lifecycle environmental impact (e.g., GHG emissions) and circular economy:
  - EU Circular Economy Action Plan (CEAP) from 2020
  - Proposal for the Battery Directive from 12.2020 (incl. carbon footprint declaration in 2024)
  - Proposal for the Ecodesign for Sustainable Product Regulation from 03.2022 (major update of the Ecodesign Directive)

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Objective

- Empirically elicit individual preferences for life-cycle properties of large household appliances, in particular for production-related energy consumption

- Explore heterogeneity in preferences for life-cycle properties

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Empirical methodology

- CAWI survey of households in Germany (N= 450)
- Representative samples in terms of gender, age, income, and regional population dispersion.
- Stated preference discrete choice experiment (DCE) on refrigerator purchase decisions
  - Mixed logit analysis
- Rating of life-cycle purchasing criteria
  - Descriptive statistics (relevance)
  - Ordered logit models (relation with socio-demographics, environmental and economic preferences, energy literacy)

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Framing of DCE

Imagine that **your refrigerator has broken down and you need to buy a new one.** On the following pages, we will show you different refrigerator purchase options. We would like to know **which refrigerator you would choose, if these were your only options.**

Please assume that all refrigerator options fit properly in your kitchen and are currently available in colour and finish of your choice.

The refrigerators only differ on the following attributes:

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Attributes

1. Size: The total internal space of each refrigerator is 220, 240, 260, 280, 300, or 320 liters. 20 liters corresponds to one small compartment. The picture below shows a 320-litre and a 220-litre refrigerator.



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Attributes

2. Energy class: Refrigerators come with a label that looks like the following:



The colour **"green"** indicates a lower energy consumption while the colour **"red"** indicates a higher energy consumption compared to refrigerators with the same volume and features. You will choose among refrigerators with energy class **A+++, A++, or A+**.

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Attributes

3. Energy consumption for production and distribution: The energy consumption necessary to produce and distribute each refrigerator is either **much higher, average, or much lower** compared to similar refrigerators.

4. Warranty: The **warranty** for each refrigerator is 2, 4, or 6 years.

5. Customer rating: Ratings are provided by customers who have bought the same refrigerator. You may assume that the refrigerators you can choose from have **average ratings** of 3.5, 4.0, or 4.5 stars out of 5 stars.

6. Purchase price: Each **refrigerator costs €250, €350, €450, €550, €700, or €850**.

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Levels of different attributes considered in the choice experiment

Attribute	Levels
Size	220 L, 240 L, 260 L, 280 L, 300 L, 320 L
Energy class	A+, A++, A+++
Energy consumption for production and distribution	Much higher, average, much lower
Warranty	2 years, 4 years, 6 years
Customer rating	3.5/5 stars, 4/5 stars, 4.5/5 stars
Price	250 €, 350 €, 450 €, 550 €, 700 €, 850 €

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Typical choice card

Which refrigerator would you choose?

	Refrigerator A	Refrigerator B
Size	320 L	220 L
Energy class	A++	A+++
Energy consumption for production and distribution	Much higher	Average
Warranty	6 years	2 years
Customer rating	4.5 stars	3.5 stars
Purchase price	350€	700€

	Refrigerator A	Refrigerator B
I choose:	○	○

Results of mixed logit models (10% "speeders" excluded)

	Estimated mean	p-value
Attributes		
price	-0.008***	0.000
size	0.012***	0.001
top_energy_class	1.947***	0.000
prod_label_average	0.292	0.418
prod_label_much_higher	-1.611***	0.000
warranty	0.226***	0.000
star4	0.201	0.306
star45	0.366**	0.042

*** p<0.01, ** p<0.05, * p<0.1

On average, participants prefer a refrigerator with a

- **top energy class (A+++),** larger volume (size), longer warranty, and top customer rating

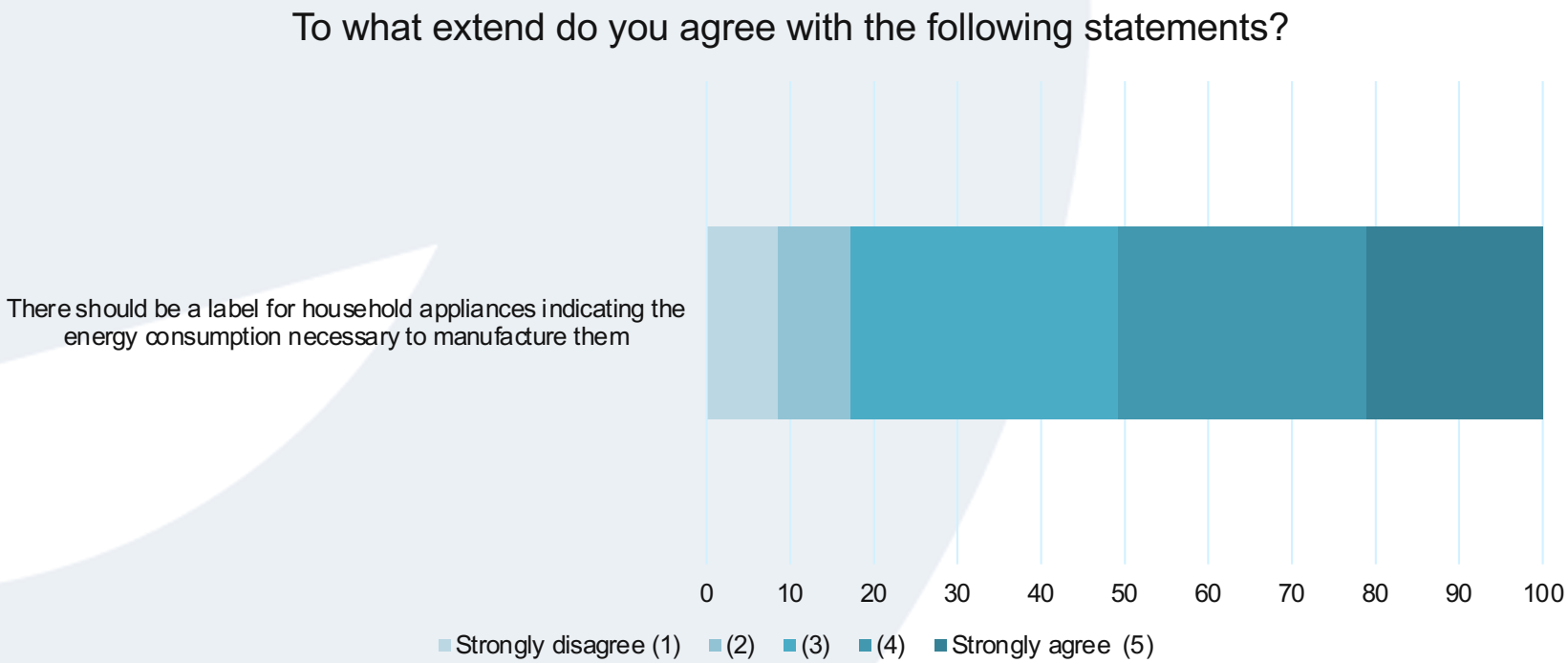
On average, participants dislike a refrigerator with a

- higher price, and much higher production-related energy consumption

There is also significant heterogeneity across respondents.

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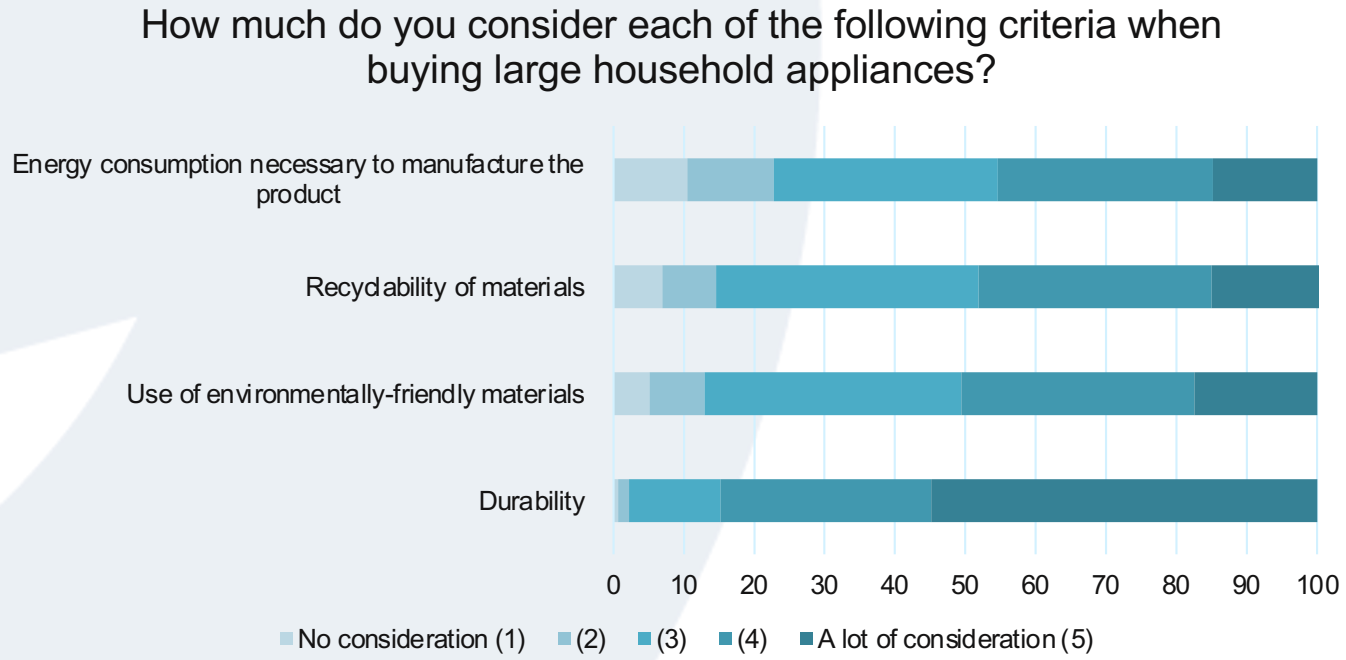
Interest in information about energy use related to manufacturing of appliances



Interest in information about energy use related to manufacturing of appliances is rather modest

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Relevance of life-cycle purchasing criteria



Compared to durability, relevance of energy use related to manufacturing of appliances is not an important purchasing criteria

→ Financial/quality criteria more important than environmental criteria

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Results of multivariate analysis (ordered logit models)

VARIABLES	Durability	Environmentally friendly material	Recyclability	Energy use to manufacture product
Male	-0.430**	-0.513***	-0.283	-0.397**
	(0.211)	(0.195)	(0.189)	(0.185)
Age	0.014*	-0.005	-0.004	0.002
	(0.008)	(0.009)	(0.008)	(0.007)
High income	0.008	0.052	-0.236	0.043
	(0.211)	(0.215)	(0.192)	(0.203)
High education	-0.260	-0.600***	-0.375*	-0.408**
	(0.215)	(0.200)	(0.193)	(0.199)
Urban	0.176	0.312	0.351*	0.575***
	(0.198)	(0.190)	(0.181)	(0.189)
Owner	-0.238	0.088	0.169	-0.061
	(0.206)	(0.201)	(0.186)	(0.190)
High environmental ID	0.621***	1.780***	1.489***	1.476***
	(0.195)	(0.211)	(0.207)	(0.199)
Patience	0.165***	0.285***	0.204***	0.181***
	(0.053)	(0.058)	(0.058)	(0.061)
Energy literacy	0.401***	0.017	0.054	-0.044
	(0.137)	(0.129)	(0.131)	(0.133)
Observations	447	447	447	447

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

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Summary and policy implications

- On average, individual interest in production-related energy use is modest, and may be limited to significant differences → so a label may need few categories only
- Label on life-cycle properties should include not only information on usage and production-related energy use but also on durability, recyclability etc. → support for EU draft on Ecodesign regulation (or French reparability index)
- Information about life-cycle properties of appliances should target women, older people, people with below average education, and urban households.
- Improving energy literacy would lead to a higher share of the adult population to strongly consider durability when purchasing an appliance.

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Thank you!



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