Empower the consumer! Energy-related financial literacy and its socio-economic determinants

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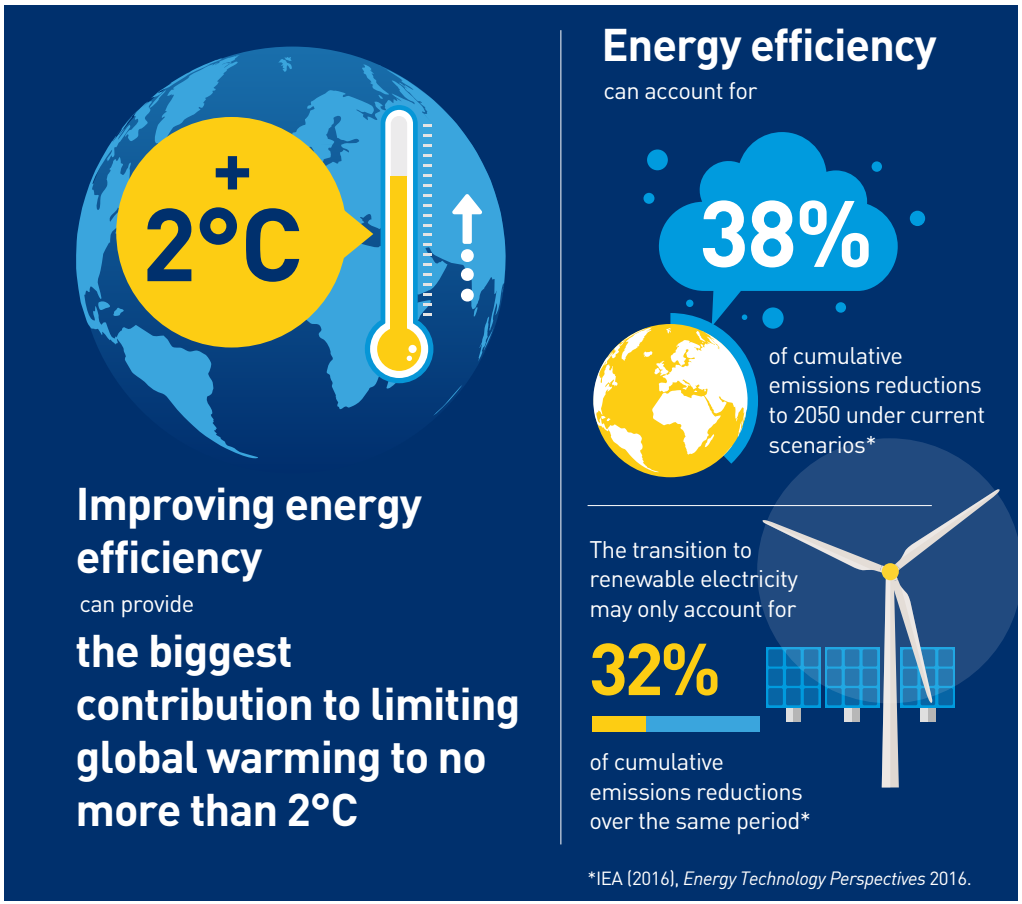
Motivation



Source: Carbon Trust

ENERGY EFFICIENCY GAP:

Individual decision-makers do not choose the most energy-efficient technology

EVEN if this technology is also the most cost-efficient choice (minimizing lifetime costs)

Motivation

Possible explanations for the energy efficiency gap:

- Market failures
  - Negative externalities
  - Lack of information
  - Asymmetric information
  - ...
- Behavioural failures
  - Bounded rationality
  - Status-quo bias
  - Bounded willpower (self-control)
  - ...

Motivation

- Energy-related decisions: Benefits and costs over a long period of time $\Rightarrow$ imply an inter-temporal optimisation
- Individuals need to
  - collect information,
  - make assumption regarding price and usage over the lifetime,
  - perform an investment analysis or calculate the lifetime cost
- Different decision-making strategies:
  - **Rational consumer**: make decisions using information and cognitive skills to calculate the lifetime cost
  - **Bounded-rational consumer**: make decisions using limited information and with cognitive constraints (uses heuristics)
- Factors such as age, income, gender, education, attitudes, ... but also *financial literacy* and *energy-related knowledge* play a role for what decision-making strategy an individual uses.

Literacy

- Basic definition of literacy: abilities to read and write text
- UNICEF: ability to use reading, writing and numeracy skills for effective functioning and development of the individual and the community
- In the last decades the word “literacy” has been used in a much broader way, metaphorical way: information literacy, media literacy, scientific literacy, financial literacy, environmental literacy...

Financial Literacy

- (Lusardi and Mitchell, 2008): "*Knowledge of basic financial concepts, such as the working of interest compounding, the difference between nominal and real values, and the basics of risk diversification.*"
- Financial literacy is usually measured using three questions:
  - Compound interest
  - Inflation
  - Risk diversification
- Gender gap in financial literacy (Fonseca et al., 2012; Lusardi and Mitchell, 2014; Almenberg and Dreber, 2015)

Energy Literacy

- DeWaters and Powers (2011, 2013): established stream of literature uses a definition of "energy literacy" that focuses on an individual's energy-related knowledge, attitudes and behaviour.
- Brounen et al. (2013); Kalmi et al. (2017): recent empirical literature measures "energy literacy" as an individual's ability to calculate and compare lifetime costs of energy consuming durables.
- Blasch et al. (2017a,b,c): consider two separate literacy indicators, one for energy-related knowledge and another for investment literacy.

Energy-related financial literacy

- We combine and extend these above measures to the measure of *energy-related financial literacy*.
- We define energy-related financial literacy as *the combination of*

  (1) energy-related knowledge and

  (2) cognitive abilities that are needed in order to take decisions with respect to the investment for the production of energy services and their consumption.

Energy-related financial literacy

We elicit the respondents level of energy-related financial literacy using eight questions:

- Energy-related knowledge (4 questions)
  - knowledge of the average electricity price
  - operating costs of appliances
  - savings potential of LED technology
- Financial literacy (3 questions, Lusardi and Mitchell (2014))
  - compound interest
  - inflation
  - risk diversification
- Energy-related investment (1 question)
  - lifetime cost calculation

Lifetime cost calculation

Suppose you own your home, your fridge breaks down and you need to replace it. As a replacement, you can choose between two alternatives that are identical in terms of design, capacity and quality of the cooling system. Fridge A sells for **400 CH** and consumes electricity for the amount of **300 kWh per year**. Fridge B has a retail price of **500 CHF** and consumes electricity for the amount of **280 kWh per year**.

Assume the average cost of energy is **0.20 CHF per kWh**, the two models have both a **lifespan of 15 years** and that you would get a return of 0 percent from any alternative investment of your money. Which choice of purchase minimizes the total costs of the fridge over its lifespan?

- Fridge A
- Fridge B
- Fridge A and B are equivalent in terms of total costs
- Don't know

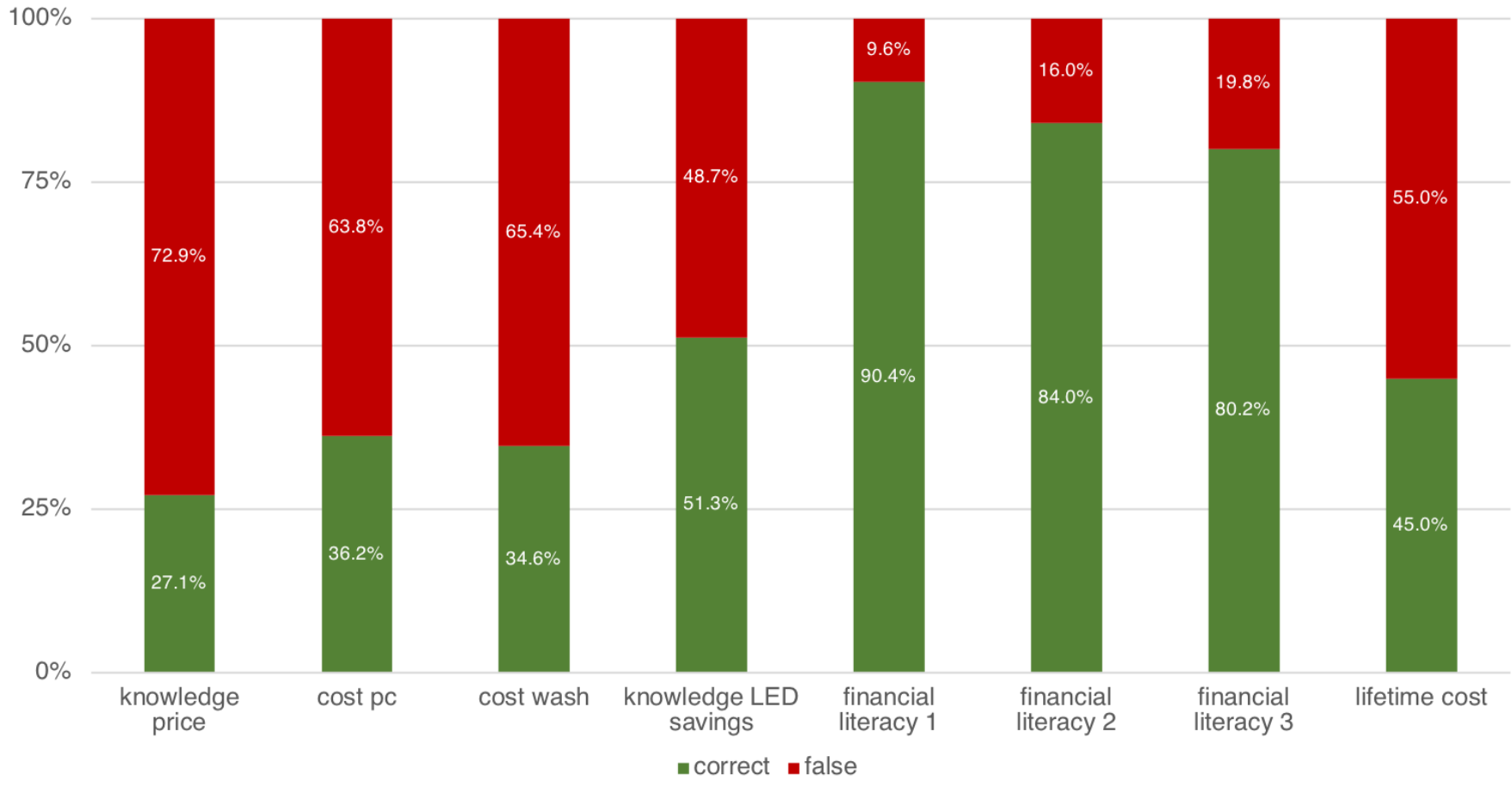
Contributions

- Summarize and clarify the various concepts and definitions of "energy literacy".
- Propose new concept of "energy-related financial literacy" that captures the bounded rationality of individuals associated with energy- related decision-making in a more comprehensive way.
- Identify the most relevant socio-economic characteristics that can explain the differences in the level of "energy-related financial literacy" among a large sample of European households using an econometric analysis.
- Analyse the role of gender in the context of energy-related investment decisions.

Data

- Large-scale household survey collected within the EU H2020 Project "PENNY" in Italy, the Netherlands and Switzerland
- Survey organization:
  - In collaboration with national utility companies.
  - Online survey in 2017
  - Invitation via postal letters (Switzerland) or via e-mail (Netherlands and Italy)
- Survey information on:
  - Household composition and socio-economic attributes
  - Dwelling characteristics
  - Energy services and appliance stock
  - Energy-related financial literacy (N=2,823)

Descriptive statistics



Estimation method

- Literacy indicators can be considered ordinal outcome variables.
- Latent variable can be described as a linear function of several explanatory variables: $y_i^* = X_i\beta + \varepsilon_i$
- Where X_i is a vector of socio-economic characteristics of household i such as:
  - age and age^2
  - income groups
  - educational attainment
  - owned dwelling
  - country of residence
  - employment status and
  - gender (and interactions of gender with e.g. country)
- We use ordered probit to estimate:
  1. energy-related financial literacy index (0 to 8)
  2. financial literacy index (0 to 3)
  3. indicator for whether respondents could carry out the lifetime cost calculation correctly

Results - Average marginal effects

	energy-related financial index			
	5		6	
Owned dwelling	0.0054	***	0.0204	***
Female	-0.0170	***	-0.0635	***
IT	-0.0173	***	-0.0647	***
Not working*female	0.0037	*	0.0138	*
Partner has university degree	0.0027	**	0.0102	**
Partner is not working	0.0022	*	0.0081	*

Note: * p<0.10, ** p<0.05, *** p<0.01.

For dummy variables the effects are obtained from probability differences.

Results - Average marginal effects

	energy-related financial index			
	7		8	
Owned dwelling	0.0277	***	0.0284	***
Female	-0.0862	***	-0.0884	***
IT	-0.0879	***	-0.0901	***
Not working*female	0.0187	*	0.0192	*
Partner has university degree	0.0139	**	0.0142	**
Partner is not working	0.0111	*	0.0113	*

Note: * p<0.10, ** p<0.05, *** p<0.01.

For dummy variables the effects are obtained from probability differences.

Conclusions

- New concept of "energy-related financial literacy" is more appropriate, as it considers two important elements (knowledge and skills).
- The majority of the respondents in our sample perform well in the standard financial literacy questions.
- However, substantial lack of knowledge in the field of energy-related knowledge and in the ability to compute the lifetime cost of appliances.
- In the econometric analysis we find a significant gender gap for our measure of energy-related financial literacy.

  $\Rightarrow$ Confirms previous findings (gender gap in financial literacy)
- Specifically educate women in energy-related investment decisions???

QUESTIONS?

Thank you for your attention...

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