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ANALYZING HETEROGENEITY AMONG RESIDENTIAL ENERGY CONSUMERS IN SLOVENIA: IS THERE ROOM FOR ENERGY EFFICIENCY?

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Objectives of the study

Objectives:

- To investigate preference heterogeneity among Slovenian consumers
- To establish how different consumer groups value different attributes of energy products and services

Our **hypotheses** are:

1. Consumer preferences for energy services are heterogeneous, so more than one consumer segment could be identified based on the range of preferences for energy services.
2. A consumer segment could be identified that shows pro energy-efficient behaviour and higher preferences and attitudes towards energy efficiency and green energy.

Approach

To verify the two hypothesis, a latent class analysis (LCA) has been augmented by a latent class regression (LCR) model

1. For the first hypothesis, the **LCA** has been used to identify a range of preferences for energy services that may cluster consumers into different segments (latent classes)

2. For the second hypothesis, the **LCR** model is employed to provide empirical verification of correlates with identified consumer segments in order to determine the consumer profile of each segment.

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Background I:
Transition of energy markets

- Energy markets are undergoing a major transition
- The transition started with the deregulation of energy markets
- Energy suppliers expanded their portfolio with additional products and services
- Their main goal is to establish effective relationships with consumers

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Background II:
Consumer preferences

- Consumer preferences are becoming more diverse with expanded supplier offers
- Understanding consumer preferences and identifying their potential heterogeneity is crucial for effectively addressing their needs
- Energy suppliers are therefore forced to transform into active, consumer-oriented utilities
- The residential sector accounts for considerable share of energy use and thus represents an important potential for energy savings

Background III:
Energy sector

- Consumer base will become even more heterogeneous
- Especially in the energy sector, the primary goal for utilities is to understand which energy services and which attributes consumer prefer.
- Ideally, the energy market should focus on the development and the awareness of efficient energy use and the use of green energy
- Consumer preferences, attitudes, and energy consumption along with consumer heterogeneity may also be country-specific

Theoretical framework

Model:

- **Method:** Latent class regression
  - Classification variables
    - Consumer preferences for energy services
  - Explanatory variables
    - Consumer satisfaction
    - The level of energy consumption
    - Socio-economic characteristics
    - Attitude and behavior toward energy efficiency and green energy
- **Data:**
  - Supplier's database
  - Survey data

Data I:
General information

- **Supplier's database**
  - Electricity purchasing contractors or bill payers
    - Initial sample of 5,466 electricity consumers
    - Electricity bill information, Geographical location (region), Settlement (city, town, village), Age

- **Survey data** (research on behavioral and attitudinal factors)
  - Online survey (self-administered questionnaire)
  - Carried out in February 2016 (research agency)
  - Final sample of 984 consumers

Data II:
Consumer preferences

- **Core service quality**
  - Offering reliable, uninterrupted services
- **Service process quality**
  - Organizing a network of firms providing repair of HH appliances
  - Company is a consumer friendly company
  - Rewarding consumer loyalty
  - Free of charge help to the consumers
  - Offering advice on reducing electricity consumption
- **Competitive and transparent pricing**
  - Offering the lowest price
  - Company's bill is clear and transparent
- **Brand reputation**
  - Company has great reputation
- **Offer of additional services**
  - Offering multiple tariff billing systems
  - Offering household's specifications tailored offer
  - Opening online electricity bill payment
  - Opening an online consumption monitoring system
  - Opening a specialized shop offering electric appliances
  - Offering energy card
- **Offer of green energy**
  - Offering green energy

Data III:
Consumer characteristics

- Gender
- Age
- Number of household members
- Household income
  - Low income
  - High income
  - Unknown income
- Education
- Satisfaction with the energy supplier
- Usage of additional services
- Usage of additional energy fuels
- Average monthly consumption
- Interested in EE and in green energy
- Environmental concern is important
- Prepared to pay a 10% higher premium for green energy
- Using EE home appliances
- Seeking ways to reduce energy costs
- Number of household's investments in EE
- Number of household's EE activities

Methodology I:
Latent class analysis

- Probabilistic approach for determining the unobserved (i.e. latent) class membership of individuals
- One of the most often used approaches for analysing consumer heterogeneity in the literature
- The importance of preferences for energy services may differ across underlying consumer classes
- LCA allows cluster consumers into different classes on the basis of their expressed preferences,
- LCA assumes there exists a finite number of subgroups of individuals (i.e. classes of residential energy consumers)

Latent class analysis:
Results I

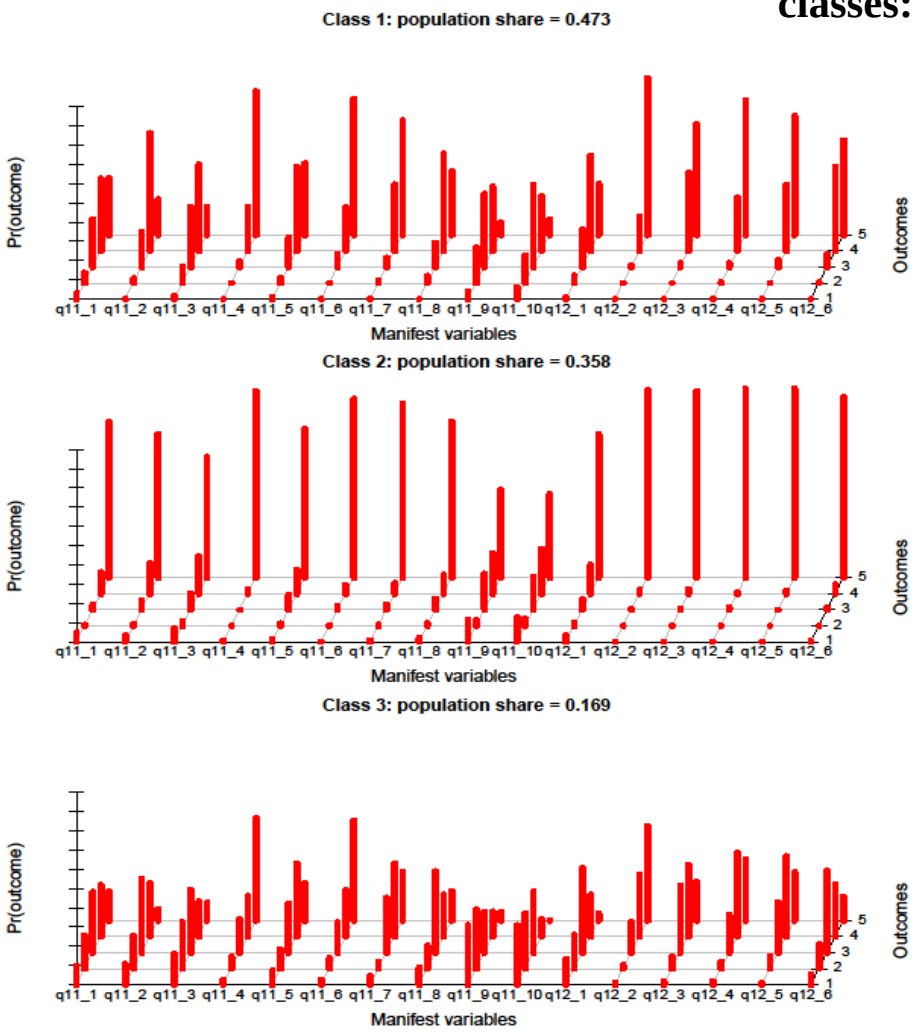
Determing number of classes:

Number of classes	Npar	LL	AIC	BIC	Entropy
1	64	-17243.14	34614.28	34927.34	
2	143	-15770.29	31798.59	32429.61	0.86
3	222	-14924.09	30366.18	31633.11	**0.88**
4	301	-14688.29	30024.57	**31609.46**	0.85
5	324	-14509.04	**29796.08**	31698.92	0.84

Note: Npar = number of free parameters; LL = log likelihood; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion.

	Assigned class probability to each class		
Assigned class membership*	Class 1	Class 2	Class 3
Class 1	0.95	0.04	0.07
Class 2	0.03	0.96	0.00
Class 3	0.02	0.00	0.93

Distribution of classification variables across classes:



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Latent class analysis:
Results II

Explanatory variables	Energy efficient vs. regular		Dissatisfied vs. regular	
Coefficient and Standard Error				
Intercept	-7.99***	1.591	3.850*	2.127
Gender	-.310	.233	.471	.369
Age	-.001	.010	-.010	.014
Number of household members	-.142	.107	-.091	.140
Household income				
Low income	-.126	.345	.172	.550
High income	-.017	.445	.762	.537
Unknown income	-.012	.291	.419	.408
Education	**-.282*** **	.107	.196	.160
Satisfaction with the energy supplier	**.848*** **	.205	**-.782*** **	.249
Usage of additional services	-.017	.105	-.084	.137
Usage of additional energy fuels	-.346	.249	.540	.351
Average monthly consumption	.130	.116	.183	.188
Interested in EE and in green energy	**.285** **	.113	-.127	.172
Environmental concern is important	**.811*** **	.166	-.158	.220
Prepared to pay a 10% higher premium for green energy	**.128***	.078	.023	.135
Using EE home appliances	**.302***	.169	**-.402***	.230
Seeking ways to reduce energy costs	-.022	.098	-.171	.163
Number of household's investments in EE	-.098	.102	-.209	.142
Number of household's EE activities	**.224** **	.106	-.073	.162

Conclusions I:
General conclusions

- Heterogeneity in residential consumer preferences for energy supplier offer **is present**

- When accounting for residential energy consumers attitudes and behavior toward green energy and energy efficiency, socio-demographic and socio-economic characteristics, our research establishes that energy consumers can be effectively segmented into three different groups:
  - Regular consumers
  - Energy efficient consumers
  - Dissatisfied consumers

The findings of our study thus support both hypotheses.

Conclusions II:
Consumer classes

Energy efficient class:

- These consumers are interested in green energy programs and willing to pay a higher premium for green energy
- No gap between stated aand revealed preferences as their actions follow their intentions

Regular class:

- These consumers support energy efficiency and green energy, however their actions do not follow their intentions
- Consumer retention programs should also focus more intensively on these two segments of consumers, as it was found that regular consumers tend to be less satisfied with the supplier compared to the energy efficiency group.

Conclusions III:
Managerial implications

- Suppliers should carefully analyse consumer preferences in order to design appropriate marketing strategies
- They should be based on non-traditional criteria
- Differentiated marketing campaigns and service offers are needed to maximise revenues and achieve mandatory energy saving targets at consumer sites at the lowest costand acquisition strategy.

Conclusions IV
Policy implications

- This study clearly reveals that the same policy measures may achieve different effectiveness in different consumer segments.

- If the suppliers get to know their consumers through customer relationship management involving for example loyalty programs, they may help policy makers in more effective implementation of energy policy measures.
- Energy saving offers may be immediately directed to enhance the involvement of the most energy efficient consumers, while publicly designed information campaigns may be primarily targeted to consumers that are less inclined toward energy efficient behaviour.

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THANK YOU FOR YOUR ATTENTION

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