Will consumers use biodiesel?
Assessing the potential for reducing CO2 emissions from transport in Spain

Azucena Gracia Royo
(CITA-Aragón)
Jesús Barreiro-Hurle
(DG Enterprise and Industry – European Commission)
Luis Pérez y Pérez
(CITA-Aragón)

Presentation outline

- Introduction
- Theoretical framework – *the theory of planned behaviour*
- Methodology
  - Sample & questionnaire
  - Statistical analysis
- Results
- Conclusions

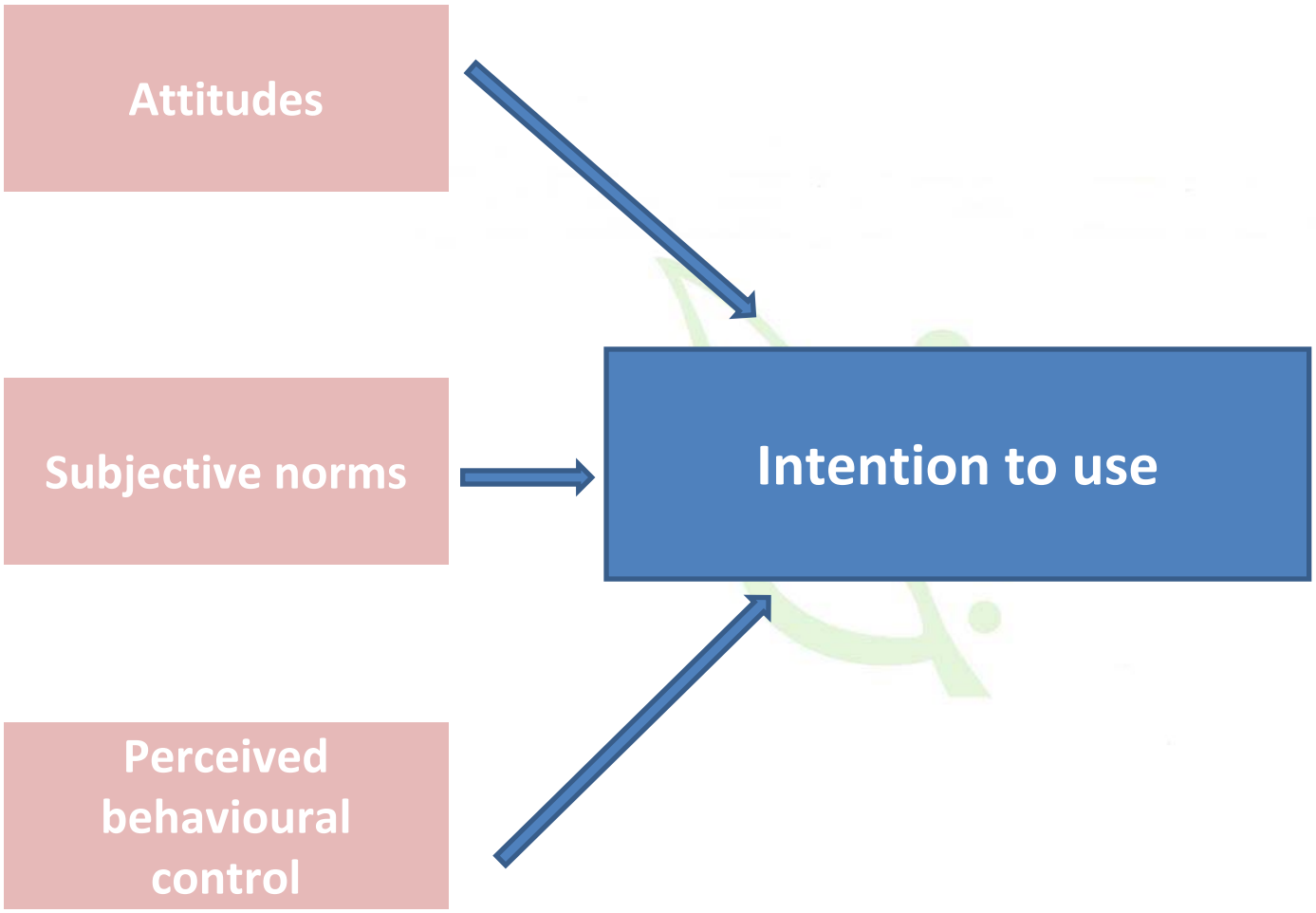
1. Introduction

- Biodiesel as part of EU Climate change mitigation policy for transport
- Stagnation of consumption – crisis and policy uncertainty
- Prior research – people willing to pay for biodiesel => not happening
- Complementary approach - Is there still a role for biodiesel in the EU Climate Change policy mix?
  - Price
  - Convenience

2. Theoretical framework – the theory of planned behaviour

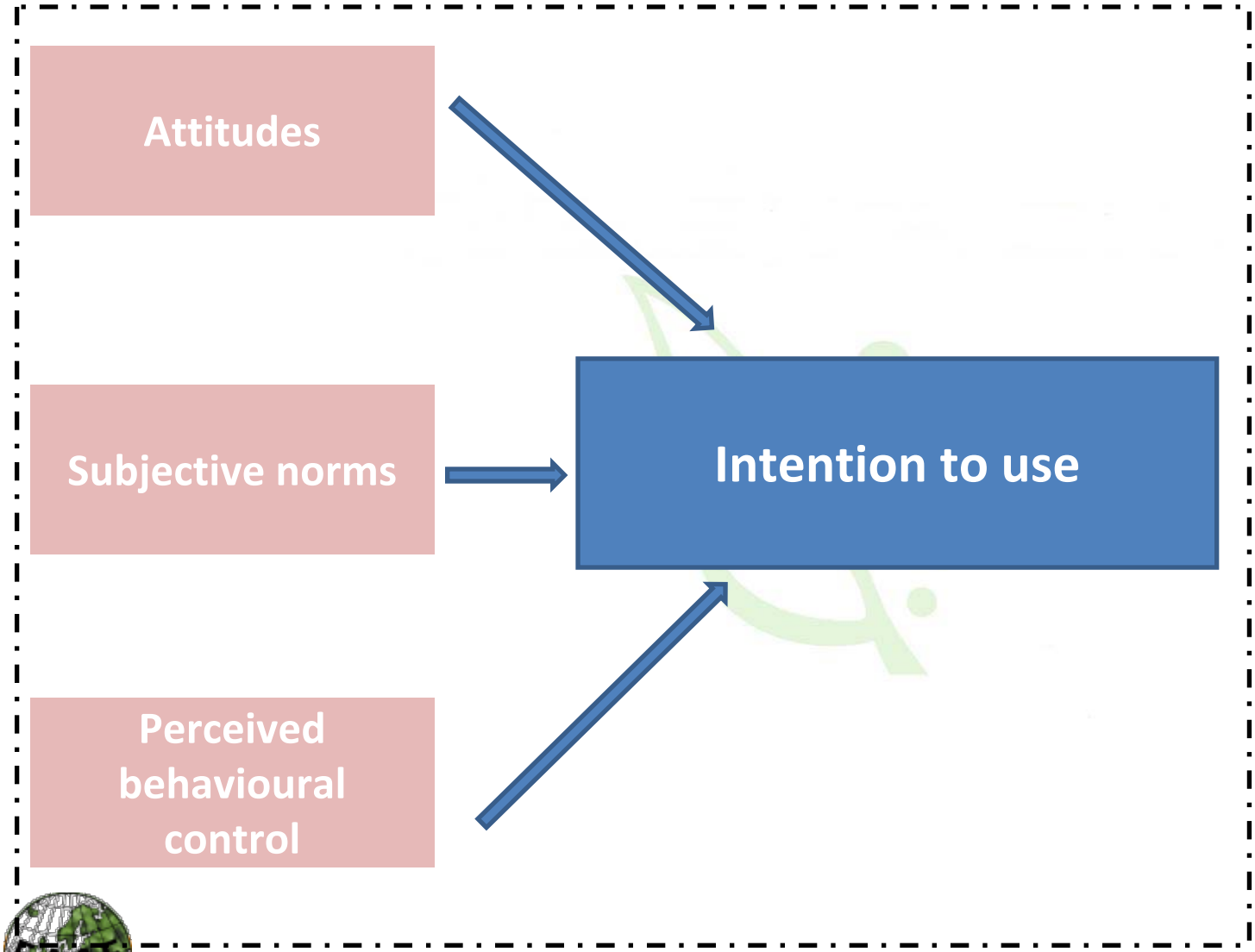
- Intention *versus* actual consumption
- **Consumption** – economic theory - f(*price, income, availability*)
- **Intention** – social psychology - f(*attitudes, norms, behavioral control*)
- TPB (Azjen, 1991)
  - Intentions as predictors of behaviour for non-available in the market or behaviour currently not undertaken

2. Theoretical framework – the theory of planned behaviour



2. Theoretical framework – the theory of planned behaviour

Basic TPB



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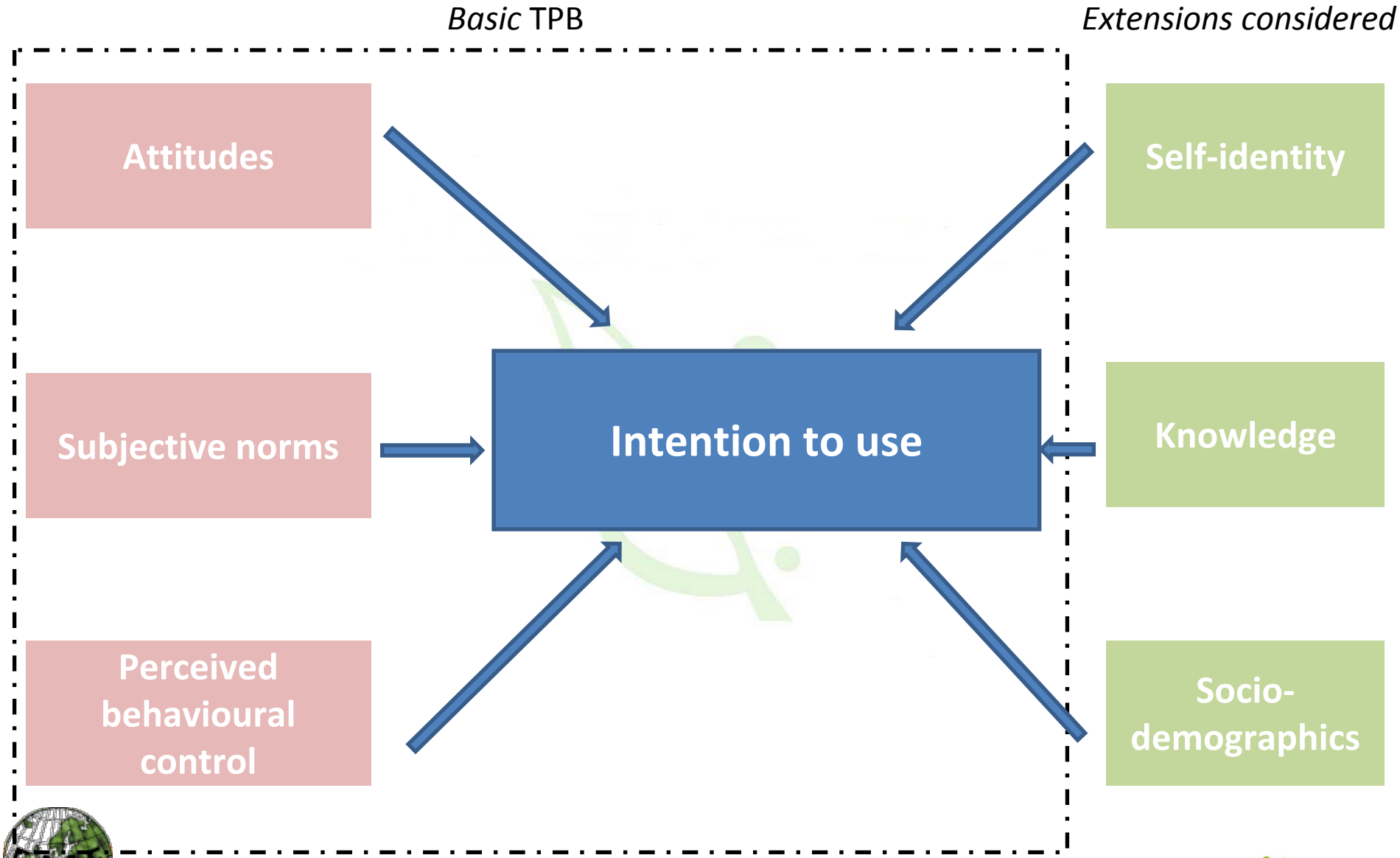

3. Methodology – sample and questionnaire

- Stratified random sample based on district and age of 400 owners or users of motor vehicles in Zaragoza (Spain)

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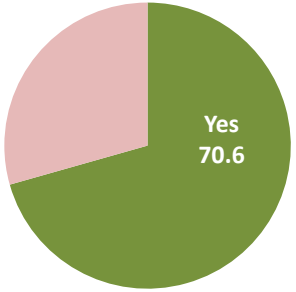
- Stratified random sample based on district and age of 400 owners or users of motor vehicles in Zaragoza (Spain)
- Face to face survey carried out in 2010
- Questionnaire includes questions on
  - Fuel purchase habits
  - Knowledge about biodiesel
  - Attitudes
  - Biodiesel consumption and intention

3. Methodology – variables

Intention to use

Variables	Name	Value
Intention to use biodiesel if sold at the same price than conventional and available in the same fuelling station.		
Definitely not		3.0%
Probably not		5.3%
Indifferent	IU1	15.2%
Probably yes		30.3%
Definitely yes		46.2%



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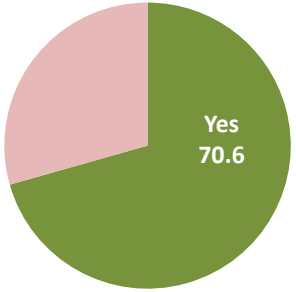
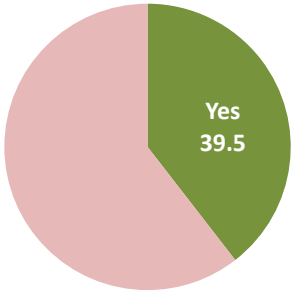
Intention to use biodiesel if sold at a higher price than the conventional but available in the same fuelling station.		
Definitely not		19.7%
Probably not		18.3%
Indifferent	IU2	22.5%
Probably yes		19.5%
Definitely yes		20.0%





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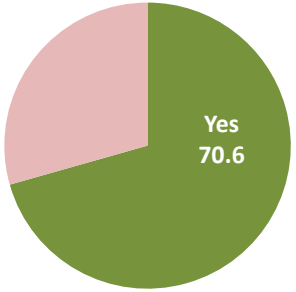
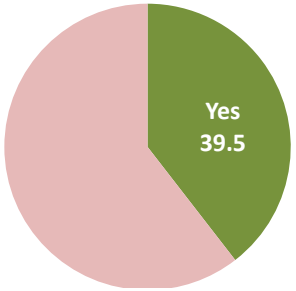
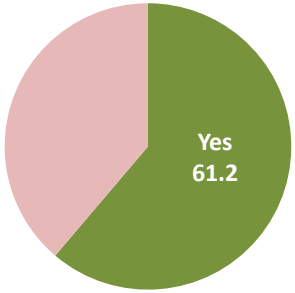
Probably not		18.3%
Indifferent		22.5%
Probably yes		19.5%
Definitely yes		20.0%
Intention to use biodiesel if sold at the same price than conventional but not available in the same fuelling station.		
Definitely not	IU3	8.8%
Probably not		11.5%
Indifferent		18.5%
Probably yes		31.0%
Definitely yes		30.2%







3. Methodology – variables

Attitudes

Attitudes towards biodiesel		
Biodiesel can be produced from raw material from my region	REGIONAL	4.1 (0.67)
Biodiesel may increase the price of food products	FOOD	3.4 (1.03)
Biodiesel may diminish import oil dependence	DEPENDENCE	4.0 (0.77)
Biodiesel is a renewable fuel	RENEWABLE	3.6 (0.99)
The use of biodiesel may diminish the climate change	CLIMATE	3.9 (0.82)
Biodiesel may help the increase of farmer' incomes	FARMERS	4.0 (0.84)
The use of biodiesel decreases the greenhouse gas emissions	GHGEMISSIONS	4.0 (0.81)
Attitudes towards using biodiesel		
I believe that using biodiesel is good	GOOD	3.8 (0.70)

Subjective norms

People close to me think that I should use biodiesel	SNORM	3.0 (0.87)

Perceived behavioural control

Whether I will eventually use biodiesel is entirely up to me	CONTROL	3.4 (1.08)
If biodiesel was available all fuelling stations, I do not think I would ever be able to use	ABILITY	3.0 (1.00)

3. Methodology – variables

Self-identity

Self-identity: Membership of an environmental association
Dummy 1=yes; 0=otherwise

SELF-IDENTITY 10.0%

Knowledge

Knowledge
Dummy 1=correct answer to the three statements; 0=otherwise

KNOWLEDGE 19.2%

Socio-demographics

Variable definition	*Name (type)*	*Value*
Gender		
Male	FEMALE (dummy: 1=female)	51.2
Female		48.8
Age (Average from total sample)	AGE (continuous)	44.0
Education of respondent		
Primary School	UNIVERSITY (dummy:	12.2
Secondary School	1=university)	30.0
University or higher		57.8
Average monthly household income		
Less than 1,500 €		13.8
Between 1,501 and 2,500 €	HIGH_INCOME (dummy:	31.2
Between 2,501 and 3,500 €	1=higher than 3,500 €)	29.5
Between 3,501 and 4,500 €		14.0
More than 4,500 €		11.5
Household Size (Average from total sample)	HSIZE (continuous)	3.2

- Three independent ordered probits

$$IU_i^* = \beta X_i + u_i \begin{cases} IU_i = 1 \quad if \quad IU_i^* \le \tau_1 \\ IU_i = 2 \quad if \quad \tau_1 \le IU_i^* \le \tau_2 \\ IU_i = 3 \quad if \quad \tau_2 \le IU_i^* \le \tau_3 \\ IU_i = 4 \quad if \quad \tau_3 \le IU_i^* \le \tau_4 \\ IU_i = 5 \quad if \quad \tau_4 \le IU_i^* \end{cases}$$

4. Results

Variables	Same price Same place		Higher price Same place		Same price Different place	
Coefficients	Estimates	t-ratio	Estimates	t-ratio	Estimates	t-ratio
Socio-demographic characteristics						
FEMALE	0.2592	2.18	0.2805	2.50	0.2319	2.09
HIGHINCOME	0.2892	2.01	0.3826	2.73	0.2441	1.89
Knowledge about biodiesel						
KNOWLEDGE	0.4709	3.08	0.4181	2.93	---	---
Self-identity						
SELF-IDENTITY	0.6803	2.96	0.7422	3.47	0.5508	2.48
Attitudes towards the biodiesel and the use						
REGIONAL	---	---	---	---	0.2886	3.18
FOOD	---	---	-0.1583	-2.65	-0.1339	-2.20
DEPENDENCE	0.2250	2.74	0.2636	3.27	0.2809	3.44
FARMERS	0.1480	1.85	0.1897	2.63	---	---
GHGEMISSIONS	0.1725	2.11	---	---	0.2310	2.74
GOOD	0.6605	5.51	0.6793	5.84	0.5677	5.46
Subjective norms						
SNORMS	0.1720	1.87	0.2314	2.79	0.2131	2.94
Perceived behavioral control						
ABILITY	-0.1512	-2.38	---	---	---	---
Threshold parameters						
μ_1	2.5610	4.39	3.7753	6.80	3.9450	6.78
μ_2	3.2117	5.61	4.5088	7.88	4.6624	8.00
μ_3	4.1270	6.81	5.3171	9.03	5.4163	9.15
μ_4	5.2500	8.26	6.1628	10.2	6.5326	10.65
N	400		400		400	
Log Likelihood	-407.14		-521.79		-488.69	

IU1: biodiesel at same price and location; IU2: biodiesel at higher price and same location; IU3: biodiesel at same price and different location.

Basic TPB

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Extensions considered

5. Conclusions

- Biodiesel can still play a role as GHG mitigation - however, price and convenience matter
- Increasing knowledge is key to increase consumption – BUT will not change habits
- TPB performs well (*attitudes – norms – behavioural control*)
- Policy actions are needed if we want to increase their potential
  - Higher prices will be accepted if:
    - Farmers benefit from biodiesel
    - Energy security is enhanced
  - Habits will be changed if:
    - Biodiesel if procured domestically
    - Biodiesel actually reduces GHG (sustainability)
    - Energy security is enhanced

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