Behavioural models and willingness to pay

Deliverable D2.4

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Change Log

Version	Description of change
V0.1	Initial version preparation
V0.2	Internal review
V0.3	Version ready for review
V0.5	Final version. Revising the deliverable according to all input provided
V1.0	Submitted

List of abbreviations

Abbreviation/Term	Description
ASC	Alternative-Specific Constants
CA	Consortium Agreement
CBC	Choice-based Conjoint
D	Deliverable
DOA	Description of Action
EC	European Commission
EU	European Union
GA	Grant Agreement
KPI	Key Performance Indicator
MMNL	Mixed Multinomial Logit
MS	Milestone
PC	Project Coordinator
PO	Project Officer
PSC	Project Steering Committee
RP	Revealed Preference
SAB	Stakeholders Advisory Board
SP	Stated Preference
WP	Work Package
WTP	Willingness-to-pay
WPL	Work Package Leader
VOT	Value-of-time

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Table of contents

List of tables

List of figures

Executive Summary

This deliverable presents the development of behavioural models that quantify consumer preferences and willingness to pay (WTP) for eco-friendly delivery and return solutions in e-commerce. The analysis covers the five GreenTurn pilot countries: Greece, Poland, France, Spain, and Austria.

The models build upon the findings of Deliverable D2.3 *E-commerce customer journeys*, in which consumer personas were validated, customer journeys were mapped, and stated preference data were collected. By applying advanced choice modelling techniques, consumer trade-offs between cost, convenience, and environmental impact have been measured, together with the influence of behavioural interventions such as incentives, nudges, and eco-labelling.

Mixed Multinomial Logit models with error components were estimated using the Apollo software in R. The models incorporate socio-demographic characteristics, product type, and behavioural indicators to capture heterogeneity in consumer preferences. The analysis also estimated how much consumers are willing to pay for different aspects of delivery and returns. Specifically, the value of time reflects how much they would pay to save time when traveling to parcel lockers or pick-up points, considering their environmental concerns and how the delivery cost relates to the product price. The willingness to pay to reduce return distance captures how much they value shorter and easier trips when returning Items, with differences depending on the type of product and the cost–product price balance. Finally, the willingness to pay for a seven-day return period shows how much consumers value greater flexibility in the return process, relative to delivery cost and product price.

The results highlight that cost, travel time, and convenience are the most influential factors shaping consumer decisions for both delivery and return methods. Environmental aspects, while less dominant, play a measurable role, particularly for out-of-home delivery options such as Parcel Lockers and Pick-up Points, where clear environmental information can slightly increase their attractiveness.

For return choices, the analysis shows that the introduction of incentives (e.g. discounts, refunds, loyalty rewards) and nudging strategies can positively influence consumer behaviour. These measures increase the likelihood of selecting more sustainable return practices, including extended return windows or, in some cases, the choice not to return low-value items.

The cross-country analysis confirms notable differences across markets. For instance, Parcel Lockers are highly preferred in Poland, reflecting the well-developed infrastructure and consumer familiarity with this option. In contrast, other countries display more varied patterns, with price sensitivity being particularly pronounced in Greece and Spain.

Overall, these findings provide evidence-based insights into how consumers balance cost, convenience, and sustainability considerations. This knowledge will guide the design of targeted communication strategies (D2.5) and the implementation of pilot interventions (WP3), ensuring that proposed measures align with local behaviours and support the transition toward more sustainable e-commerce practices with measurable environmental benefits.

1. Introduction and Objectives

The transition towards sustainable e-commerce practices has become an essential component of European climate and mobility strategies (European Commission, 2025). Online retail has been growing rapidly, leading to significant challenges for urban freight systems, particularly with respect to the environmental impacts of last-mile deliveries and product returns (Eurostat, 2025). Addressing these challenges requires a comprehensive understanding of consumer behaviour, including the drivers of choice and the potential for behavioural interventions to promote more sustainable alternatives (Sharma et al., 2025).

Within the framework of the GreenTurn project, Work Package 2 (WP2) has been designed to investigate consumer preferences, behavioural drivers, and acceptance of sustainable delivery and return options. Earlier tasks focused on the identification of relevant stakeholders and the creation of consumer personas (D2.2), followed by the mapping of e-commerce customer journeys and the collection of stated preference (SP) survey data across five pilot countries: Greece, Poland, France, Spain, and Austria (D2.3).

Deliverable D2.4 builds directly on these results by applying behavioural modelling techniques to the data collected. The objective of this deliverable is to quantify consumer preferences, to estimate willingness to pay (WTP) for eco-friendly delivery and return attributes, and to assess the effectiveness of behavioural interventions such as incentives and nudging strategies. The modelling results are intended to provide an evidence base for the design of communication strategies (D2.5) and for the planning and implementation of pilot activities in WP3.

The analysis is structured around the development of advanced Mixed Multinomial Logit (MMNL) models with error components, which allow for the incorporation of consumer heterogeneity and correlation between alternatives (Ben-Akiva, McFadden and Train, 2019). The models are estimated separately for each of the five pilot countries to capture contextual differences in consumer behaviour. Socio-demographic and behavioural variables, along with product categories and past choices, are included as covariates to enrich the interpretation of model outcomes.

The rest of the deliverable is structured as follows: Section 2 outlines the research methodology, including the data sources, model specification, data preparation, and estimation process. Section 3 presents the model estimation results for both delivery and return choices. Section 4 focuses on the willingness-to-pay (WTP) analysis, translating model outputs into monetary values. Finally, Section 5 provides conclusions and recommendations for future research and policy directions.

2. Methodology

2.1. Data sources

The empirical basis of the behavioural models was provided by the large-scale consumer survey conducted in Task 2.2 (GreenTurn project, 2025). The survey was implemented in five pilot countries (i.e. Greece, Poland, France, Spain, and Austria), reaching 1,000 respondents per country for a total sample of 5,000 individuals. A stratified sampling approach was applied to ensure representativeness across gender and age.

The survey instrument consisted of three main parts:

- **Sociodemographic and actual e-shopping choices**, including age, gender, education, income, employment status, digital literacy, and online shopping frequency.
- **Attitudinal indicators**, captured through Likert-scale questions addressing trust, convenience, sustainability concerns, and engagement with digital services.
- **Choice-based conjoint (CBC) experiments**, which provided the core data for behavioural modelling. Two experiments were included:
  - **CBC1: Delivery choice**, where respondents chose between four delivery options (Home Delivery, Parcel Locker, Pick-up Point, Click & Collect) varying in cost, delivery time, travel time to pick-up points, and environmental impact.
  - **CBC2: Return choice**, where respondents chose between four return options (Home Pick-up, Parcel Locker, Return to Store, No Return) varying in cost, return period, travel distance, environmental impact, and the inclusion of incentives or nudging strategies.

The survey also included questions on actual purchasing and return behaviour in the two weeks preceding participation, providing the basis for the Revealed Preference (RP) models estimations.

2.2. Modelling Framework

The modelling approach was based on the Mixed Multinomial Logit (MMNL) framework, estimated using the Apollo package in R. This framework was selected due to its ability to (Ben-Akiva, McFadden and Train, 2019):

- Account for panel effects, as each respondent completed multiple choice tasks.
- Introduce error components to model correlation between alternatives with similar unobserved attributes (e.g., Home Delivery and Click & Collect as attended options).

The specification of the utility functions included both alternative-specific constants (ASCs) and attribute-level parameters. For the delivery models, the key attributes included delivery cost, delivery speed (e.g., same-day delivery), and travel time to collection points, along with interaction terms such as travel time with environmental concern. For the return models, the attributes comprised return cost, return period, distance to return locations, environmental impact weighted by return cost, as well as incentives and nudging strategies encouraging consumers to avoid returns. In addition, socio-demographic characteristics such as age, income

level, education, employment status, and household composition were incorporated, alongside behavioural indicators such as preferred payment methods, types of products purchased, and recent delivery or return experiences.

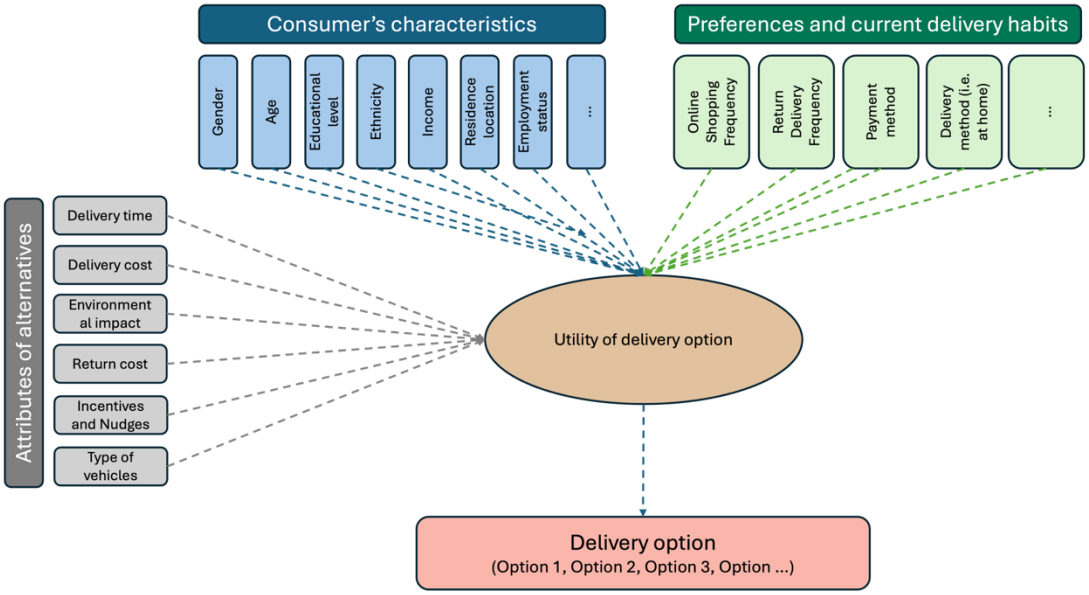

Figure 1. Behavioural Framework

Finally, to account for heterogeneity in consumer responses, Halton draws were employed for simulation-based estimation. Random coefficients were assumed to follow normal distributions, while error components were included to capture unobserved correlations between groups of alternatives.

2.3. Modelling Assumptions and Data Preparation

To ensure consistency and comparability between the Revealed Preference (RP) and Stated Preference (SP) models, several assumptions and data preparation steps were applied. These were necessary to align the datasets, structure the input for model estimation, and maintain a clear focus on the delivery and return methods under investigation. The main assumptions are summarized below.

Revealed Preference (RP) models:

- Behavioural variables used in the RP models were based on actual purchasing and return behaviour reported for the two weeks preceding survey participation, ensuring that real-world decisions informed the modelling process.
- Each row in the RP dataset represents a single purchase event, reflecting the structure of the trip diary data.
- Purchase and return cases involving delivery or return methods not included in the SP experiment were excluded to maintain consistency across model estimations.

- It was assumed that all delivery and return methods were available to the respondent at the time of their purchase or return decision.

Stated Preference (SP) models:

- The SP models combined the experimental choice scenarios with information about the type of product involved in each scenario (e.g., electronics, second-hand goods, fashion items, non-prescription pharmaceuticals). This ensured that choices were analysed in a realistic context reflecting the nature of the purchased product.
- Each row in the SP dataset corresponds to a single scenario, capturing the full set of alternatives presented to the respondent.
- All entries associated with the following product categories were removed, as they were outside the study's focus:
  - Fresh groceries, food, or beverages (e.g., fresh produce, packaged food),
  - Prepared meals (e.g., pizzas, delicatessen products, drinks).
- Binary variables were created based on the RP data to indicate whether respondents had previously used each delivery or return method, integrating recent behavioural experience into the SP models.

2.4. Estimation and Willingness-to-Pay (WTP)

The willingness-to-pay (WTP) analysis was conducted to convert the estimated preferences from the choice models into monetary terms. Using the Mixed Multinomial Logit (MMNL) framework, random taste variation and unobserved correlations between alternatives were captured through simulation with Halton draws and error components.

WTP values were calculated as the marginal rate of substitution between each attribute coefficient and the cost coefficient, reflecting how much consumers are willing to pay—or need to be compensated—for changes in delivery or return characteristics. This approach was applied separately for delivery and return models, considering key attributes such as travel time, delivery speed, return flexibility, and environmental impact, with costs scaled relative to product value.

The purpose of this analysis is to provide a clear monetary interpretation of consumer preferences, preparing the ground for Section 4, where WTP results are presented and discussed in relation to different product categories and service options.

3. Model Estimation Results

3.1. Revealed Preference (RP) - Deliveries

This section presents the results of the model estimations for both delivery and return behaviours, based on the Revealed Preference (RP) and Stated Preference (SP) datasets. It provides detailed insights into the factors influencing consumers' choices, combining real-world behavioural data with hypothetical scenario-based experiments.

3.1.1. RP Descriptive Statistics for Deliveries

Understanding the composition of deliveries across product categories provides context for consumer demand and highlights which sectors dominate e-commerce flows. Table 1 reports the distribution of 13,312 deliveries by category within each country. The total of 13,312 deliveries represents the combined number of online purchases reported by respondents across all five countries in response to the survey question: "How many online purchases did you make in the last two weeks?". Fashion represents the largest share of deliveries in most cases, followed by electronics, while categories such as pharmaceuticals, fresh groceries, and toys vary in relative importance across countries. The presence of a substantial "Other" category also reflects the diversity of items being ordered. These results underline both common trends, such as the strong role of fashion, and national differences that may guide retailers and logistics providers in tailoring their strategies to country-specific demand structures.

Table 1. Distribution of 13312 deliveries to Product Categories by Country (% of total per country)

Country	Electronics	Resales	Fashion	Pharmaceuticals	Fresh Groceries	Prepared Meals	Toys
Austria	12.6	8.7	29.3	14.9	8.9	7.2	18.4
Spain	15.3	7.6	35.2	11.8	9.6	6.9	13.6
France	12.5	14.2	36.3	7.7	8.8	7.0	13.5
Greece	16.8	4.9	28.1	14.8	8.1	14.9	12.3
Poland	12.2	11.5	27.8	15.3	7.4	7.4	18.4

3.1.2. Utility Functions

This subsection outlines the utility functions specified for each delivery method. The models include sociodemographic characteristics, payment preferences, product types, and accessibility factors, allowing the estimation to capture both consumer attributes and contextual influences on last-mile delivery choices.

It is noted that the selection of variables included in the utility functions was based on the specific characteristics of the dataset. Variables were added iteratively and evaluated based on a combination of their statistical significance, the R^2 value of the model, and the log-likelihood (LL). This process ensured that only variables with meaningful behavioural interpretation and sufficient variation in the data were retained.

In general, the utility (V) represents the relative attractiveness of each (delivery) option. A higher V indicates a greater likelihood that the option will be chosen. For example, if V for Home Delivery

is 3 and V for Parcel Locker is 1, Home Delivery is more likely to be selected because it provides greater perceived value to the consumer. However, these values are on a relative scale, meaning they are most useful when comparing one option to another rather than interpreting them in absolute terms.

After the Utility Functions' section a table summarizes the estimation results for each choice model. The table is organized by delivery method, with each row representing a model variable. The first column shows the estimated coefficient (ESTIMATE), indicating the direction and strength of the variable's effect on the likelihood of choosing that delivery option. A positive value means the variable increases the probability of selecting that option, while a negative value means it decreases it. The second column reports the t-ratio (T-RATIO), which reflects the statistical significance of each estimate (values above |1.96| are typically considered significant at the 5% level). The bottom rows present overall model fit statistics, including the adjusted rho-squared, log-likelihood (LL), and the number of observations.

Home Deliveries (HD)

$$V_{HD} = ASC_{HD} + \beta_{age50plusHD} \cdot Age50Plus + \beta_{urbanhighdensityHD} \cdot UrbanHighDensity + \beta_{loweduHD} \cdot LowEdu + \beta_{unemployedHD} \cdot Unemployed + \beta_{paypaluserHD} \cdot PayPalUser + \varepsilon_{panel}$$

where:
ASC_{HD} = Alternative Specific Constant for Home Delivery (reference)
Age50Plus = Age 50 years or older
UrbanHighDensity = Lives in high-density urban area (>3,000 residents/km^2)
LowEdu = Highest education level is high school or below
Unemployed = Employment status is unemployed
PayPalUser = PayPal selected as one of the preferred payment methods
ε_{panel} = Error component capturing random taste variation

Parcel Lockers (PL)

$$V_{PL} = ASC_{PL} + \beta_{fashionPL} \cdot Fashion + \beta_{resalePL} \cdot Resale + \beta_{pharmPL} \cdot Pharm + \beta_{freshPL} \cdot Fresh + \beta_{mealPL} \cdot Meal + \beta_{toysPL} \cdot Toys + \beta_{shortdistancePL} \cdot ShortDistance + \beta_{walkingaccessPL} \cdot WalkingAccess + \beta_{midhighincPL} \cdot MidHighIncome + \beta_{noincomeresponse} \cdot NoIncomeResponse + \varepsilon_{panel}$$

where:
ASC_{PL} = Alternative Specific Constant for Parcel Locker
Fashion = Item ordered is fashion/clothing
Resale = Item ordered is from resale/second-hand platforms
Pharm = Item ordered is non-prescription pharmaceutical or vitamins
Fresh = Item ordered is fresh grocery/food
Meal = Item ordered is ready-made meals or beverages
Toys = Item ordered is toys, books, or other household consumables
ShortDistance = Travel time to nearest locker or pick-up point is less than 10 minutes
WalkingAccess = Usual mode of access to delivery point is walking
MidHighIncome = Self-reported monthly personal income is above €2,000
NoIncomeResponse = Respondent preferred not to disclose income
ε_{panel} = Error component capturing random taste variation

Pick-up Point (PP)

$V_{PP} = ASC_{PP} + \beta_{FashionPP} \cdot Fashion + \beta_{ResalePP} \cdot Resale + \beta_{PharmPP} \cdot Pharm + \beta_{FreshPP} \cdot Fresh + \beta_{MealPP} \cdot Meal + \beta_{ToysPP} \cdot Toys + \beta_{MidHighIncomePP} \cdot MidHighIncome + \beta_{NoIncomeResponse} \cdot NoIncomeResponse + \beta_{ShortDistancePP} \cdot ShortDistance + \varepsilon_{panel}$

where:
ASC_{PP} = Alternative Specific Constant for Pick-up Point
Fashion = Item ordered is fashion/clothing
Resale = Item ordered is from resale/second-hand platforms
Pharm = Item ordered is non-prescription pharmaceutical or vitamins
Fresh = Item ordered is fresh grocery/food
Meal = Item ordered is ready-made meals or beverages
Toys = Item ordered is toys, books, or other household consumables
MidHighIncome = Self-reported monthly personal income is above €2,000
NoIncomeResponse = Respondent preferred not to disclose income
ShortDistance = Travel time to nearest locker or pick-up point is less than 10 minutes
ε_{panel} = Error component capturing random taste variation

Click-and-Collect (CC)

$V_{CC} = ASC_{CC} + \beta_{FashionCC} \cdot Fashion + \beta_{ResaleItemCC} \cdot Resale + \beta_{PharmCC} \cdot Pharm + \beta_{FreshCC} \cdot Fresh + \beta_{MealCC} \cdot Meal + \beta_{ToysCC} \cdot Toys + \beta_{MidHighIncomeCC} \cdot MidHighIncome + \beta_{NoIncomeResponse} \cdot NoIncomeResponse + \beta_{CashOnDeliveryCC} \cdot CashOnDelivery + \varepsilon_{panel}$

where:
ASC_{CC}= Alternative Specific Constant for Click & Collect
Fashion = The purchased product is fashion-related (clothing, accessories, footwear)
Resale = Item ordered is from resale/second-hand platforms
Pharm = Item ordered is non-prescription pharmaceutical or vitamins
Fresh = Item ordered is fresh grocery/food
Meal = Item ordered is ready-made meals or beverages
Toys = Item ordered is toys, books, or other household consumables
MidHighIncome = Self-reported monthly personal income is above €2,000
NoIncomeResponse = Respondent preferred not to disclose income
CashOnDelivery = Respondent reports using Cash on Delivery as a usual payment method
ε_{panel} = Error component capturing random taste variation

3.1.3. Modeling results: Pooled Model

This subsection presents the pooled estimation results across all five countries. By combining the data, the model highlights common behavioral patterns and significant factors influencing the choice of last-mile delivery methods in the overall sample.

Table 2. Model Estimation Results RP Deliveries: Pooled Data

	ESTIMATE	T-RATIO
Home Delivery		
ASC_{HD}	0	NA
Age50Plus	0.290	2.58
UrbanHighDensity	-0.724	-6.65
LowEdu	0.727	6.54
Unemployed	0.447	2.24
PayPalUser	0.331	3.12
Parcel Locker		
ASC_{PL}	-1.716	-8.56
Fashion	0.528	4.56
Resale	1.679	10.99
Pharm	0.225	1.68
Toys	0.635	4.88
Fresh	-1.385	-8.40
Meal	-3.462	-16.74
ShortDistance	0.582	3.95
WalkingAccess	0.397	3.31
NoIncomeResponse (Generic)	-0.524	-2.12
MidHighIncome	-1.469	-10.39
Pick-up Point		
ASC_{PP}	-2.936	-13.75
Fashion	0.350	2.68
Resale	1.882	11.28
Pharm	0.012	0.08
Toys	0.016	0.11
Fresh	-1.316	-6.99
Meal	-2.890	-12.30
ShortDistance	0.476	3.10
MidHighIncome	0.387	2.67
NoIncomeResponse (Generic)	-0.524	-2.12
Click & Collect		
ASC_{CC}	-3.266	-16.10
Fashion	-0.342	-2.11
Resale	0.234	1.05
Pharm	0.218	1.21
Toys	-0.295	-1.57
Fresh	-0.455	-2.30
Meal	-2.155	-9.21
MidHighIncome	-0.418	-2.45
CashOnDelivery	0.568	3.52
NoIncomeResponse (Generic)	-0.524	-2.12
Panel-level variation		
ε_{panel}	2.115	41.64
Summary statistics		

	ESTIMATE	T-RATIO
Adj.Rho-squared vs equal shares	0.3714	
LL at equal shares, LL(0)	-18454.35	
LL(final)	-11565.07	
Observations	13312	

Home Delivery: For home delivery, several sociodemographic and behavioural factors showed statistically significant effects in the pooled sample. Older respondents (β = 0.290, t = 2.58) were more likely to prefer home delivery, reflecting a stronger reliance on convenience among this group. Living in high-density urban areas significantly reduced the likelihood of choosing home delivery (β = -0.724, t = -6.65), pointing to lower adoption in compact city environments where alternative options are more accessible. Lower education levels were strongly associated with higher preference for this mode (β = 0.727, t = 6.54), suggesting that individuals with less formal education favour the simplicity of home delivery. Unemployment also showed a positive and significant relationship (β = 0.447, t = 2.24). Finally, payment behaviour mattered: PayPal users were more likely to select home delivery (β = 0.331, t = 3.12), indicating alignment of this service with digital payment practices.

Parcel Lockers: Parcel lockers carried a negative constant (β = -1.716, t = -8.56), indicating lower baseline preference compared to home delivery. However, product-related and accessibility factors strongly influenced their use. Positive associations were observed for fashion (β = 0.528, t = 4.56), resale items (β = 1.679, t = 10.99), pharmaceuticals (β = 0.225, t = 1.68), and toys/books (β = 0.635, t = 4.88), highlighting suitability of lockers for durable and non-perishable goods. By contrast, fresh groceries (β = -1.385, t = -8.40) and ready meals (β = -3.462, t = -16.74) were strongly negative, confirming that lockers are not appropriate for perishable or time-sensitive products. Accessibility played a key role: shorter distance (β = 0.582, t = 3.95) and walking access (β = 0.397, t = 3.31) significantly increased the likelihood of locker use. Income effects were also visible: respondents unwilling to disclose income were less likely to use lockers (β = -0.524, t = -2.12), while higher-income households showed a strong negative effect (β = -1.469, t = -10.39), suggesting lockers are more attractive to mid- and lower-income groups.

Pick-up Point: Pick-up points were generally less favoured, as shown by the negative constant (β = -2.936, t = -13.75). Still, product and accessibility factors shaped their adoption. Resale items were strongly and positively associated with this mode (β = 1.882, t = 11.28), and fashion products also had a positive and significant effect (β = 0.350, t = 2.68). Conversely, fresh groceries (β = -1.316, t = -6.99) and ready meals (β = -2.890, t = -12.30) were negatively associated, confirming limited suitability of pick-up points for perishable or urgent goods. Distance influenced choices positively (β = 0.476, t = 3.10), showing that proximity plays an important role in adoption. Income also mattered: respondents with higher household income were more likely to favour pick-up points (β = 0.387, t = 2.67).

Click-and-collect: Click-and-collect was the least preferred option overall, as reflected in the strongly negative constant (β = -3.266, t = -16.09). Product effects were generally negative: fashion (β = -0.342, t = -2.10), fresh groceries (β = -0.455, t = -2.30), and ready meals (β = -2.155, t = -9.21) all reduced the likelihood of choosing this mode. Resale (β = 0.234, t = 1.05) and pharmaceuticals (β = 0.218, t = 1.21) showed weak, non-significant tendencies. Payment and income variables were more decisive: higher household income was negatively associated with

click-and-collect (β = -0.418, t = -2.45), while preference for cash-on-delivery increased the likelihood of choosing this option (β = 0.568, t = 3.52). These results suggest that click-and-collect remains less attractive overall, with limited suitability for perishable goods, but may appeal to consumers who value in-store cash payment options.

3.1.4. Modelling results per country

This section presents the estimation results separately for each country. The models capture country-specific factors that shape consumer preferences for last-mile delivery methods, allowing for a more detailed understanding of national-level behaviours.

Poland

Table 3. Model Estimation Results RP Deliveries: Poland

	ESTIMATE	T-RATIO
Home Delivery		
ASC_{HD}	0	NA
Age50Plus	0.049	0.21
UrbanHighDensity	-0.445	-2.05
LowEdu	0.858	3.96
Unemployed	0.122	0.27
PayPalUser	-0.276	-1.21
Parcel Locker		
ASC_{PL}	-0.192	-0.51
Fashion	1.150	5.39
Resale	1.673	6.32
Pharm	0.476	2.00
Toys	1.168	5.07
Fresh	-1.079	-3.75
Meal	-4.158	-10.32
ShortDistance	1.026	3.43
WalkingAccess	0.174	0.77
NoIncomeResponse (Generic)	0.248	0.53
MidHighIncome	-0.222	-0.69
Pick-up Point		
ASC_{PP}	-2.497	-5.13
Fashion	0.477	1.41
Resale	1.082	2.65
Pharm	0.466	1.28
Toys	0.345	0.90
Fresh	-0.867	-1.91
Meal	-2.305	-4.54
ShortDistance	0.018	0.05
MidHighIncome	0.355	0.87
NoIncomeResponse (Generic)	0.248	0.527
Click & Collect		
ASC_{CC}	-2.625	-6.80

	ESTIMATE	T-RATIO
Fashion	0.511	1.46
Resale	-0.123	-0.24
Pharm	1.597	4.58
Toys	0.853	2.31
Fresh	0.056	0.13
Meal	-2.144	-4.22
MidHighIncome	-0.775	-1.84
CashOnDelivery	0.593	2.14
NoIncomeResponse (Generic)	0.248	0.53
Panel-level variation		
ε_{panel}	-1.727	-19.68
Summary statistics		
Adj.Rho-squared vs equal shares	0.4073	
LL at equal shares, LL(0)	-4412.57	
LL(final)	-2580.14	
Observations	3183	

Home Delivery: For home delivery, most sociodemographic variables did not exert a strong influence on preferences in Poland. Age (β = 0.049, t = 0.21) and unemployment (β = 0.122, t = 0.27) were not statistically significant, while use of PayPal as a preferred payment method (β = -0.276, t = -1.21) showed a negative but non-significant relationship with home delivery choice. The results indicate that living in high-density urban areas significantly reduced the likelihood of choosing home delivery (β = -0.445, t = -2.05), suggesting that residents in compact city environments may favor alternative delivery modes with more flexible access. Conversely, individuals with lower education levels (high school or below) displayed a strong positive association with home delivery (β = 0.858, t = 3.96), highlighting that this group places higher reliance on the convenience of direct-to-home service.

Parcel Lockers: Parcel lockers exhibited several statistically significant associations with product type and delivery conditions. Fashion (β = 1.150, t = 5.39), resale/second-hand items (β = 1.673, t = 6.32), pharmaceutical products (β = 0.476, t = 2.00), and toys/books (β = 1.168, t = 5.07) were all positively linked with locker use, indicating strong suitability of this channel for non-perishable, compact, and frequently ordered goods. In contrast, fresh grocery purchases (β = -1.079, t = -3.75) and ready-made meals (β = -4.158, t = -10.32) were negatively associated, confirming that lockers are poorly matched with perishable or time-sensitive items. Accessibility was also a key factor: shorter distances to lockers significantly increased their selection (β = 1.026, t = 3.43), reinforcing the importance of location density in consumer uptake. Walking access and income categories showed no meaningful effect.

Pick-up Point: Pick-up points were generally less favoured, as reflected in the large negative and statistically significant alternative-specific constant (β = -2.497, t = -5.13). Nonetheless, product-related effects influenced preferences. Resale items showed a significant positive association (β = 1.082, t = 2.65), suggesting that consumers may accept greater effort to collect second-hand purchases. Fresh groceries (β = -0.867, t = -1.91) and ready-made meals (β = -2.305, t = -4.54) had negative associations, indicating limited suitability of this mode for perishable or urgent goods. Other product categories (fashion, pharmaceuticals, toys) did not reach significance, while

distance and income effects were negligible. Overall, the results highlight that pick-up points are not a widely preferred option in Poland, except for niche cases such as resale goods.

Click-and-collect: Click-and-collect also displayed a strong negative constant (β = -2.625, t = -6.80), indicating that, on average, it was less preferred compared to home delivery. However, specific product and payment factors shaped choices. Pharmaceutical items (β = 1.597, t = 4.58) and toys/books (β = 0.853, t = 2.31) significantly increased the likelihood of selecting click-and-collect, suggesting suitability for small but valuable purchases that benefit from secure collection at retail outlets. Ready-made meals were strongly and negatively associated (β = -2.144, t = -4.22), confirming unsuitability of this mode for time-sensitive food deliveries. Finally, payment preferences influenced adoption: cash-on-delivery users were more likely to choose click-and-collect (β = 0.593, t = 2.14), reflecting alignment with traditional in-store payment habits.

Greece

Table 4. Model Estimation Results RP Deliveries: Greece

	ESTIMATE	T-RATIO
Home Delivery		
ASC_{HD}	0	NA
Age50Plus	-0.030	-0.15
UrbanHighDensity	-0.290	-1.41
LowEdu	0.113	0.53
Unemployed	0.439	1.34
PayPalUser	-0.304	-1.62
Parcel Locker		
ASC_{PL}	-0.874	-2.65
Fashion	0.248	1.21
Resale	0.721	2.03
Pharm	0.328	1.38
Toys	0.564	2.28
Fresh	-3.970	-9.31
Meal	-5.374	-12.10
ShortDistance	0.756	3.33
WalkingAccess	0.466	2.47
NoIncomeResponse (Generic)	1.185	2.39
MidHighIncome	-0.113	-0.40
Pick-up Point		
ASC_{PP}	-3.148	-7.12
Fashion	-0.33	-0.91
Resale	0.542	0.96
Pharm	0.486	1.27
Toys	0.124	0.29
Fresh	-1.434	-2.96
Meal	-3.132	-5.71
ShortDistance	0.192	0.58

	ESTIMATE	T-RATIO
MidHighIncome	0.413	1.11
NoIncomeResponse (Generic)	1.185	2.39
Click & Collect		
ASC_{CC}	-1.936	-5.53
Fashion	-1.115	-3.65
Resale	-1.045	-1.80
Pharm	-0.392	-1.18
Toys	-0.790	-2.12
Fresh	-2.456	-5.64
Meal	-4.118	-8.12
MidHighIncome	-0.391	-1.05
CashOnDelivery	0.352	1.37
NoIncomeResponse (Generic)	1.185	2.39
Panel-level variation		
ε_{panel}	1.495	16.50
Summary statistics		
Adj.Rho-squared vs equal shares	0.3933	
LL at equal shares, LL(0)	-3375.63	
LL(final)	-2012.96	
Observations	2435	

Home Delivery: For home delivery in Greece, most sociodemographic variables did not significantly influence consumer choices. Age (β = -0.030, t = -0.15), urban density (β = -0.290, t = -1.41), education (β = 0.113, t = 0.53), and unemployment (β = 0.439, t = 1.34) showed no meaningful effects. The only variable approaching statistical relevance was PayPal usage (β = -0.304, t = -1.62), indicating a potential but weak tendency for PayPal users to avoid home delivery in favour of alternatives. Overall, the results suggest that home delivery is broadly used across different groups, with no strong differentiation by sociodemographics in the Greek sample.

Parcel Lockers: Parcel lockers in Greece displayed clear patterns in terms of product type and accessibility. Consumers showed strong positive associations for second-hand goods (β = 0.721, t = 2.03) and toys/books (β = 0.564, t = 2.28), suggesting suitability of lockers for durable, non-perishable items. In contrast, fresh groceries (β = -3.970, t = -9.31) and ready meals (β = -5.374, t = -12.10) were strongly and negatively related, underlining the unsuitability of lockers for perishable or time-sensitive products. Accessibility was also important: short distance significantly increased the probability of using lockers (β = 0.756, t = 3.33), while walking access also played a positive role (β = 0.466, t = 2.47). Notably, respondents who did not disclose their income were more likely to favour lockers (β = 1.185, t = 2.39), possibly reflecting privacy-related preferences. The negative constant (β = -0.874, t = -2.65) shows that lockers are less preferred overall, but specific product and access conditions can increase their adoption.

Pick-up Point: Pick-up points in Greece were characterized by a strong negative constant (β = -3.148, t = -7.12), confirming that this mode is generally less favoured compared to home delivery. Nevertheless, product type effects were evident. Fresh groceries (β = -1.434, t = -2.96) and ready meals (β = -3.132, t = -5.71) were both significantly negative, suggesting that consumers find pick-up points unsuitable for food and perishable items. Other categories, such as pharmaceuticals (β

= 0.486, t = 1.27) and resale products (β = 0.542, t = 0.96), showed no significant influence. Distance (β = 0.192, t = 0.58) and income (β = 0.413, t = 1.11) did not affect choices. Overall, pick-up points are not a widely preferred option in Greece, particularly for time-sensitive goods.

Click-and-collect: Click-and-collect showed a generally negative perception, as indicated by the large negative constant (β = -1.936, t = -5.53). Several product categories were significantly associated with reduced likelihood of using this mode, including fashion (β = -1.115, t = -3.65), toys/books (β = -0.790, t = -2.12), fresh groceries (β = -2.456, t = -5.64), and ready meals (β = -4.118, t = -8.12). These results suggest that Greek consumers do not strongly associate click-and-collect with convenient or reliable handling of either non-perishable or perishable goods. Income (β = -0.391, t = -1.05) was not significant, while cash-on-delivery preference showed a positive but non-significant effect (β = 0.352, t = 1.37). Overall, the findings highlight that click-and-collect is the least attractive option in Greece, particularly for food-related purchases.

France

Table 5. Model Estimation Results RP Deliveries: France

	ESTIMATE	T-RATIO
Home Delivery		
ASC_{HD}	0	NA
Age50Plus	0.024	0.11
UrbanHighDensity	-0.506	-2.51
LowEdu	-0.064	-0.29
Unemployed	0.688	1.78
PayPalUser	-0.096	-0.48
Parcel Locker		
ASC_{PL}	-4.095	-8.44
Fashion	0.564	1.63
Resale	2.585	6.68
Pharm	0.121	0.25
Toys	0.357	0.88
Fresh	-0.301	-0.59
Meal	-1.704	-2.77
ShortDistance	0.174	0.57
WalkingAccess	0.309	1.15
NoIncomeResponse (Generic)	1.796	2.50
MidHighIncome	0.525	1.75
Pick-up Point		
ASC_{PP}	-2.399	-6.38
Fashion	0.659	2.72
Resale	2.268	7.65
Pharm	0.576	1.73
Toys	0.057	0.20
Fresh	-0.501	-1.38
Meal	-2.783	-5.35
ShortDistance	0.636	2.62

	ESTIMATE	T-RATIO
MidHighIncome	0.274	1.12
NoIncomeResponse (Generic)	1.796	2.50
Click & Collect		
ASC_{CC}	-3.060	-7.79
Fashion	-0.066	-0.214
Resale	0.761	1.98
Pharm	0.660	1.69
Toys	-0.195	-0.54
Fresh	1.217	3.40
Meal	-0.869	-2.04
MidHighIncome	0.116	0.40
CashOnDelivery	0.652	2.02
NoIncomeResponse (Generic)	1.796	2.50
Panel-level variation		
ε_{panel}	1.65	18.21
Summary statistics		
Adj.Rho-squared vs equal shares	0.3071	
LL at equal shares, LL(0)	-3396.42	
LL(final)	-2318.21	
Observations	2450	

Home Delivery: For home delivery in France, most sociodemographic variables were not statistically significant. Age (β = 0.024, t = 0.11), education (β = -0.064, t = -0.29), and PayPal use (β = -0.096, t = -0.48) showed no notable impact. Living in high-density urban areas was associated with a significantly lower likelihood of selecting home delivery (β = -0.506, t = -2.51), suggesting that French consumers in compact urban environments rely more on alternative modes. Unemployment had a positive coefficient (β = 0.688, t = 1.78), indicating some tendency for unemployed individuals to prefer home delivery, although the effect was only marginally significant.

Parcel Lockers: Parcel lockers in France were strongly disfavoured overall, as reflected by the large negative constant (β = -4.095, t = -8.44). Nevertheless, product type effects were evident. Resale items were strongly and positively associated with parcel locker use (β = 2.585, t = 6.68), highlighting this option's suitability for second-hand platforms. Fashion products also showed a positive but less robust effect (β = 0.564, t = 1.63). In contrast, ready meals were significantly negative (β = -1.704, t = -2.77), confirming limited use of lockers for time-sensitive deliveries. Fresh groceries (β = -0.301, t = -0.59) and pharmaceuticals (β = 0.121, t = 0.25) had no significant effect. Income played a role: respondents who did not disclose their income were more likely to prefer lockers (β = 1.796, t = 2.50), while higher-income households also showed a weakly positive association (β = 0.525, t = 1.75). Distance and walking access were not significant factors.

Pick-up Point: Pick-up points in France showed mixed results. The negative and significant constant (β = -2.399, t = -6.38) reflects a generally lower preference compared to home delivery. However, several product categories were positively linked to this option. Resale goods had the strongest association (β = 2.268, t = 7.65), followed by fashion items (β = 0.659, t = 2.72), and

pharmaceuticals (β = 0.576, t = 1.73), indicating that pick-up points are particularly attractive for durable and non-perishable products. Ready meals were strongly negative (β = -2.783, t = -5.35), and fresh groceries were also unfavourable, though not significant (β = -0.501, t = -1.38). Accessibility mattered: shorter distances significantly increased the likelihood of choosing pick-up points (β = 0.636, t = 2.62). Income did not show a strong effect (β = 0.274, t = 1.12).

Click-and-collect: Click-and-collect also carried a negative constant (β = -3.060, t = -7.79), showing that it was less preferred overall. Still, product and payment-related factors shaped its adoption. Fresh groceries were positively and significantly associated with click-and-collect (β = 1.217, t = 3.40), suggesting suitability for food shopping in retail outlets. Resale goods (β = 0.761, t = 1.98) and pharmaceuticals (β = 0.660, t = 1.69) also showed positive tendencies, though with weaker significance. Conversely, ready meals were significantly negative (β = -0.869, t = -2.04), reflecting the unsuitability of this mode for immediate food orders. Payment preferences mattered: cash-on-delivery users were more likely to choose click-and-collect (β = 0.652, t = 2.02), highlighting the alignment of this channel with in-store payment practices. Income did not significantly influence choices.

Spain

Table 6. Model Estimation Results RP Deliveries: Spain

	ESTIMATE	T-RATIO
Home Delivery		
ASC_{HD}	0	NA
Age50Plus	0.022	0.08
UrbanHighDensity	-0.215	-0.82
LowEdu	0.142	0.50
Unemployed	-0.380	-0.92
PayPalUser	-0.304	-1.19
Parcel Locker		
ASC_{PL}	-5.070	-8.80
Fashion	0.552	1.50
Resale	3.040	6.33
Pharm	0.392	0.88
Toys	0.856	1.96
Fresh	-0.937	-1.87
Meal	-2.740	-3.13
ShortDistance	0.150	0.35
WalkingAccess	-0.242	-0.63
NoIncomeResponse (Generic)	0.155	0.26
MidHighIncome	0.417	1.10
Pick-up Point		
ASC_{PP}	-3.836	-7.94
Fashion	0.641	2.41
Resale	3.077	7.71
Pharm	0.008	0.02
Toys	0.377	1.17

	ESTIMATE	T-RATIO
Fresh	-1.859	-4.28
Meal	-3.285	-4.83
ShortDistance	0.930	2.59
MidHighIncome	0.132	0.41
NoIncomeResponse (Generic)	0.155	0.26
Click & Collect		
ASC_{CC}	-5.847	-9.76
Fashion	0.358	0.74
Resale	1.885	2.98
Pharm	-0.219	-0.35
Toys	-0.003	-0.01
Fresh	-0.614	-0.95
Meal	-0.409	-0.62
MidHighIncome	0.346	0.77
CashOnDelivery	-0.481	-0.88
NoIncomeResponse (Generic)	0.155	0.26
Panel-level variation		
ε_{panel}	2.1871	16.35
Summary statistics		
Adj.Rho-squared vs equal shares	0.4737	
LL at equal shares, LL(0)	-3404.74	
LL(final)	-1756.76	
Observations	2456	

Home Delivery: For home delivery in Spain, none of the sociodemographic or payment-related variables showed statistical significance. Age (β = 0.022, t = 0.08), urban density (β = -0.215, t = -0.82), education (β = 0.142, t = 0.50), and unemployment (β = -0.380, t = -0.92) all had negligible effects. Preference for PayPal payment was negatively associated with home delivery (β = -0.304, t = -1.19), but not at a statistically meaningful level. Overall, these results suggest that home delivery in Spain is widely adopted across different population groups, without strong differentiation by demographic or income characteristics.

Parcel Lockers: Parcel lockers in Spain carried a large and strongly negative constant (β = -5.070, t = -8.80), showing that this option is generally disfavoured compared to home delivery. However, certain product categories were significantly associated with locker use. Resale items had the strongest positive effect (β = 3.040, t = 6.33), while toys/books also showed a positive and borderline significant effect (β = 0.856, t = 1.96). Ready meals were negatively and significantly related (β = -2.740, t = -3.13), underlining the unsuitability of lockers for time-sensitive deliveries. Fresh groceries (β = -0.937, t = -1.87) also tended to reduce locker use, though with weaker significance. Fashion and pharmaceutical products showed no meaningful influence, and accessibility factors (distance and walking) were not significant.

Pick-up Point: Pick-up points in Spain were also characterized by a strong negative constant (β = -3.836, t = -7.94), but product and accessibility factors shaped their adoption. Resale goods had the strongest positive association (β = 3.077, t = 7.71), confirming that pick-up points are widely used for second-hand platforms. Fashion items also showed a significant positive effect (β =

0.641, t = 2.41), while toys/books displayed a weaker positive tendency (β = 0.377, t = 1.17). In contrast, fresh groceries (β = -1.859, t = -4.28) and ready meals (β = -3.285, t = -4.83) were both significantly negative, highlighting the limitations of pick-up points for perishable or urgent goods. Accessibility mattered: shorter distances strongly increased the probability of using this option (β = 0.930, t = 2.59).

Click-and-collect: Click-and-collect in Spain was the least favoured delivery mode, as shown by the large negative constant (β = -5.847, t = -9.76). Still, some product-related factors influenced its use. Resale goods had a significant positive effect (β = 1.885, t = 2.98), suggesting alignment of click-and-collect with second-hand purchases. Other categories, including fashion, pharmaceuticals, toys, fresh groceries, and ready meals, showed no meaningful impact. Income was not significant (β = 0.346, t = 0.77), while cash-on-delivery preference had a negative but non-significant coefficient (β = -0.481, t = -0.88). These results suggest that click-and-collect in Spain remains a niche option, primarily relevant for resale items, while broadly disfavoured for food-related deliveries.

Austria

Table 7. Model Estimation Results RP Deliveries: Austria

	ESTIMATE	T-RATIO
Home Delivery		
ASC_{HD}	0	NA
Age50Plus	0.955	3.52
UrbanHighDensity	-1.03	-3.97
LowEdu	1.153	4.33
Unemployed	0.834	1.47
PayPalUser	0.401	1.57
Parcel Locker		
ASC_{PL}	-2.980	-5.56
Fashion	0.582	1.61
Resale	1.045	2.37
Pharm	-0.202	-0.51
Toys	0.002	0.01
Fresh	0.290	0.71
Meal	-0.171	-0.39
ShortDistance	-1.522	-4.51
WalkingAccess	0.055	0.16
NoIncomeResponse (Generic)	-1.76	-3.00
MidHighIncome	0.361	1.00
Pick-up Point		
ASC_{PP}	-2.222	-4.28
Fashion	-0.465	-1.59
Resale	0.914	2.59
Pharm	-1.034	-3.08
Toys	-0.838	-2.54
Fresh	-1.357	-3.54

	ESTIMATE	T-RATIO
Meal	-2.016	-4.58
ShortDistance	0.010	0.03
MidHighIncome	0.053	0.15
NoIncomeResponse (Generic)	-1.761	-3.00
Click & Collect		
ASC_{CC}	-4.149	-7.32
Fashion	-0.564	-1.33
Resale	0.054	0.10
Pharm	-1.362	-2.62
Toys	-1.320	-2.56
Fresh	-1.228	-2.28
Meal	-1.501	-2.583
MidHighIncome	0.484	1.07
CashOnDelivery	0.908	1.74
NoIncomeResponse (Generic)	-1.761	-3.00
Panel-level variation		
ε_{panel}	-1.978	-15.42
Summary statistics		
Adj.Rho-squared vs equal shares	0.5401	
LL at equal shares, LL(0)	-3864.99	
LL(final)	-1742.44	
Observations	2788	

Home Delivery: In Austria, home delivery was strongly influenced by sociodemographic characteristics. Older respondents (50 years and above) were significantly more likely to select this mode (β = 0.955, t = 3.52), suggesting that age plays an important role in reinforcing preference for home delivery. Living in high-density urban areas, however, reduced the likelihood of choosing this option (β = -1.033, t = -3.97), pointing to stronger adoption of alternative modes in compact cities. Lower education level was positively and strongly associated with home delivery (β = 1.153, t = 4.33), reflecting its importance for less formally educated groups. Unemployment (β = 0.834, t = 1.47) and PayPal usage (β = 0.401, t = 1.57) both showed positive but not statistically significant relationships. Overall, home delivery is widely favoured in Austria, especially among older and less-educated individuals, while urban residents are less likely to rely on it.

Parcel Lockers: Parcel lockers in Austria were generally disfavoured, as reflected in the negative constant (β = -2.980, t = -5.56). Still, specific product and income-related factors shaped their use. Resale items showed a positive and statistically significant effect (β = 1.045, t = 2.37), confirming that lockers are viewed as suitable for second-hand purchases. Other product types, such as fashion, pharmaceuticals, toys, fresh groceries, and ready meals, showed no significant influence. Distance plays a counterintuitive role: having a locker within 10 minutes reduces adoption (β = –1.522, t = –4.51), suggesting that very close lockers may not necessarily encourage use. This may reflect that individuals living near lockers still prefer alternatives such as Home Delivery, warranting further investigation into their characteristics and motivations. Income responses were also important: respondents who chose not to disclose income were

significantly less likely to favour lockers (β = -1.761, t = -3.00), suggesting a level of reluctance or mistrust within this group.

Pick-up Point: Pick-up points carried a negative constant (β = -2.222, t = -4.28), indicating lower baseline preference. However, resale items were positively associated with their use (β = 0.914, t = 2.59), aligning with patterns observed for parcel lockers. By contrast, several product categories showed negative and statistically significant effects: pharmaceuticals (β = -1.034, t = -3.08), toys/books (β = -0.838, t = -2.54), fresh groceries (β = -1.357, t = -3.54), and ready meals (β = -2.016, t = -4.58). These results emphasize that Austrian consumers view pick-up points as poorly suited for both perishable and everyday consumable items. Distance and income were not significant, suggesting that product type is the primary determinant of pick-up point use.

Click-and-collect: Click-and-collect in Austria showed the strongest disfavour, with a large negative constant (β = -4.149, t = -7.32). Product effects were predominantly negative: pharmaceuticals (β = -1.362, t = -2.62), toys/books (β = -1.320, t = -2.56), fresh groceries (β = -1.228, t = -2.28), and ready meals (β = -1.501, t = -2.58) all significantly reduced the likelihood of choosing this mode. Fashion items and resale products showed no meaningful impact. Payment preferences, however, played a role: cash-on-delivery users were somewhat more likely to select click-and-collect (β = 0.908, t = 1.74), although the effect was only marginally significant. Income had no strong effect (β = 0.484, t = 1.07). Overall, click-and-collect is the least attractive option in Austria, with particularly low suitability for both food-related and pharmaceutical products.

3.2. Revealed Preference (RP) - Returns

3.2.1. RP Descriptive Statistics for Returns

To better understand consumer behaviour, it is important to examine how product returns are distributed across different categories and countries. Table 8 presents the relative share of returns by product type within each country, offering insights into which sectors are more prone to return activity. Fashion clearly dominates return patterns across all countries, followed by electronics, while categories such as fresh groceries and pharmaceuticals show lower shares, consistent with their typically perishable or regulated nature. These patterns highlight both cross-country similarities and differences that may inform retailers and logistics providers about where return management efforts should be concentrated.

Table 8. Distribution of 1234 returns to Product Categories by Country (% of total per country)

Country	Electronics	Resales	Fashion	Pharmaceuticals	Fresh Groceries	Toys	Other
Austria	10.3	9.8	50.3	8.7	8.4	10.9	1.6
Spain	13.8	10.6	55.3	7.4	3.2	7.4	2.3
France	13.8	14.2	49.8	7.1	4.6	8.0	2.5
Greece	15.8	5.5	45.7	15.0	7.9	7.9	2.4
Poland	10.3	9.9	63.7	3.6	1.4	8.1	3.1

3.2.2. Utility Functions

This subsection introduces the utility functions specified for the different return methods. The models incorporate sociodemographic factors, household characteristics, product categories,

return reasons, payment preferences, and accessibility conditions, enabling the estimation to reflect both individual attributes and contextual drivers of return behaviour.

Home Returns (HR)

$$V_{HR}^{PerCountry} = ASC_{HR} + \beta_{Children} \cdot Children + \beta_{RecentReturns} \cdot RecentReturns + \beta_{CashOnDelivery} \cdot CashOnDelivery + \varepsilon_{panel}$$

where:
ASC_{HR} = Alternative Specific Constant for the Home Return method (reference alternative)
Children = Total number of children in the household
RecentReturns = Number of product returns made in the last two weeks
CashOnDelivery = preferable payment method during online purchases
ε_{panel} = Error component capturing random taste variation

A second specification of the Home Returns utility function is included to account for cross-country analysis. While the first model is applied separately for each country, the pooled version incorporates country-specific dummies (Poland, Greece, France, Spain) to capture national differences within a single framework, allowing consistent estimation across the full sample.

$$V_{HR}^{AcrossCountries} = V_{HR}^{PerCountry} + \beta_{Poland} \cdot Poland + \beta_{Greece} \cdot Greece + \beta_{France} \cdot France + \beta_{Spain} \cdot Spain$$

where:
Poland, Greece, France, Spain = Country dummies indicating the respondent's country of residence (Austria is the reference category for these dummies)

Parcel Lockers

$$V_{PLR} = ASC_{PLR} + \beta_{fashionPLR} \cdot Fashion + \beta_{midhighincomePLR} \cdot MidHighIncome + \beta_{ShortDistancePLR} \cdot ShortDistance + \beta_{WalkingAccessPLR} \cdot WalkingAccess + \beta_{ElectronicsPLR} \cdot Electronics + \beta_{ReturnReasonMismatch} \cdot ReturnReasonMismatch + \beta_{PrefersLiveSupportPLR} \cdot PrefersLiveSupport + \varepsilon_{panel}$$

where:
ASC_{PLR}= Alternative Specific Constant for choosing Parcel Locker as the return method
Fashion = The returned product belongs to the Fashion category (clothing, shoes, accessories)
MidHighIncome = Self-reported monthly personal income is above €2,000
ShortDistance = Travel time to nearest locker or pick-up point is less than 10 minutes
WalkingAccess = Usual mode of access to delivery point is walking
Electronics = The returned product belongs to the Electronics category
ReturnReasonMismatch = The reason for return was that the product did not match its description or images (generic)
PrefersLiveSupport = Respondent prefers live chat with a customer representative for online shopping support
ε_{panel} = Error component capturing random taste variation

Store

$V_{SR} = ASC_{SR} + \beta_{Age50PlusSR} \cdot Age50Plus + \beta_{MidHighIncomeSR} \cdot MidHighIncome + \beta_{FashionSR} \cdot Fashion + \beta_{ElectronicsSR} \cdot Electronics + \beta_{ReturnReasonMismatch} \cdot ReturnReasonMismatch + \varepsilon_{panel}$

where:

ASC_{SR}= Alternative Specific Constant for choosing return via physical store

Age50Plus = Age 50 years or older

MidHighIncome = Respondent's monthly personal income exceeds €2,000

Fashion = The returned product belongs to the Fashion category (clothing, shoes, accessories)

Electronics = The returned product belongs to the Electronics category

ReturnReasonMismatch = The reason for return was that the product did not match its description or images (generic)

ε_{panel} = Error component capturing random taste variation

3.2.3. Modelling results pooled data

This subsection presents the pooled estimation results across all five countries. By combining the data, the model highlights common behavioral patterns and significant factors influencing the choice of last-mile delivery methods in the overall sample.

Table 9. Model Estimation Results RP Returns: Pooled Data

	ESTIMATE	T-RATIO
Home Return		
ASC_{HR}	0.00	NA
RecentReturns	0.21	2.47
Children	0.43	1.73
CashOnDelivery	0.55	1.30
Poland	0.04	0.07
Greece	1.80	2.61
France	0.59	1.03
Spain	2.61	4.39
Parcel Lockers		
ASC_{PLR}	3.02	4.34
Fashion	0.96	3.12
Electronics	-0.69	-1.60
ShortDistance	0.60	1.64
WalkingAccess	0.38	1.11
MidHighIncome	-0.83	-1.87
ReturnReasonMismatch (Generic)	0.41	1.15
PrefersLiveSupport	0.77	2.11
Store		
ASC_{SR}	1.91	2.96
Fashion	0.88	2.53
Electronics	0.05	0.10
Age50Plus	1.42	3.38
MidHighIncome	-0.75	-1.59
ReturnReasonMismatch (Generic)	0.41	1.15
Panel-level variation		

	ESTIMATE	T-RATIO
ε_{panel}	-2.42	-9.93
Summary statistics		
Adj.Rho-squared vs equal shares	0.2115	
LL at equal shares, LL(0)	-1363.38	
LL(final)	-1054.0000	
Observations	1241.0000	

Home Return: The Alternative Specific Constant (ASC) for Home Return is fixed at zero as the reference option. Among the explanatory factors, the number of recent returns ($\beta = 0.21$, $t = 2.47$) is significant and positive, indicating that respondents who had recently returned products were more likely to prefer home collection as their return method. The number of children in the household also shows a positive effect ($\beta = 0.43$, $t = 1.73$), suggesting that households with more children tend to value the convenience of home returns, although the statistical evidence is somewhat weaker. Preference for cash on delivery is positively associated with home return ($\beta = 0.55$, $t = 1.30$), but the effect is not statistically significant.

Country-specific effects show meaningful differences: respondents in Greece ($\beta = 1.80$, $t = 2.61$) and Spain ($\beta = 2.61$, $t = 4.39$) are significantly more likely to prefer home return compared to the reference group (Austria). The coefficients for France ($\beta = 0.59$, $t = 1.03$) and Poland ($\beta = 0.04$, $t = 0.07$) are not statistically significant, suggesting no distinct country effect for these cases.

Parcel Lockers: The ASC for Parcel Lockers is strongly positive and significant ($\beta = 3.02$, $t = 4.34$), indicating a high baseline preference for this option. Several product- and context-related variables shape this choice. Returning fashion products ($\beta = 0.96$, $t = 3.12$) significantly increases the likelihood of using lockers, confirming the suitability of lockers for handling clothing and accessories. A preference for live support during online shopping is also positively related ($\beta = 0.77$, $t = 2.11$), suggesting that users who value interaction may still choose lockers, possibly due to complementary services or reliability.

Other variables show weaker or negative effects. Electronics returns are less likely to be directed to lockers ($\beta = -0.69$, $t = -1.60$), which may reflect concerns about packaging or product safety, though the effect is not statistically strong. Mid- to high-income respondents are somewhat less likely to use lockers ($\beta = -0.83$, $t = -1.87$), hinting at socioeconomic differences in return preferences. Shorter travel distance ($\beta = 0.60$, $t = 1.64$) is positive and significant at the 90% level, while walking access ($\beta = 0.38$, $t = 1.11$) is positive but not significant. Similarly, returns due to product mismatch show no robust effect ($\beta = 0.41$, $t = 1.15$).

Store: The ASC for Store returns is positive and statistically significant ($\beta = 1.91$, $t = 2.96$), indicating that physical stores are valued as a return channel even without accounting for other attributes. Among explanatory variables, returning fashion items strongly favours this option ($\beta = 0.88$, $t = 2.53$), confirming the alignment of fashion returns with physical store infrastructure. Age also plays an important role: respondents aged 50 and above are significantly more likely to return items in-store ($\beta = 1.42$, $t = 3.38$), highlighting a generational dimension in return behaviour.

Other factors do not exhibit strong effects. Electronics returns have no meaningful association with in-store preferences ($\beta = 0.05$, $t = 0.10$). Higher income shows a negative but not significant relationship ($\beta = -0.75$, $t = -1.59$), suggesting that income does not strongly determine store return

preferences. Finally, returns motivated by product mismatch show a small, non-significant positive effect (β = 0.41, t = 1.15).

3.2.4. Modelling results per country

Poland

Table 10. Model Estimation Results RP Returns: Poland

	ESTIMATE	T-RATIO
Home Return		
ASC_{HR}	0.00	NA
RecentReturns	1.45	1.85
Children	0.91	0.90
CashOnDelivery	0.60	0.37
Parcel Lockers		
ASC_{PLR}	6.06	1.81
$Fashion_{PLR}$	0.74	0.63
$Electronics_{PLR}$	-0.93	-0.58
ShortDistance	3.98	2.02
WalkingAccess	-0.05	-0.03
MidHighIncome	0.11	0.05
ReturnReasonMismatch (Generic)	0.53	0.42
PrefersLiveSupport	0.41	0.31
Store		
ASC_{SR}	0.96	0.37
$Fashion_{SR}$	3.16	1.57
$Electronics_{SR}$	2.97	1.10
Age50Plus	2.47	1.34
MidHighIncome	2.53	1.02
ReturnReasonMismatch (Generic)	0.53	0.42
Panel-level variation		
ε_{panel}	-3.96	-2.53
Summary statistics		
Adj.Rho-squared vs equal shares	0.3686	
LL at equal shares, LL(0)	-244.99	
LL(final)	-137.69	
Observations	223	

Home Return: The Alternative Specific Constant (ASC) for Home Return is fixed at zero as the reference option. Recent returns show a positive and relatively strong effect (β = 1.45, t = 1.85), indicating that Polish respondents who had recently returned products are more likely to prefer home collection as their method of return. The number of children in the household (β = 0.91, t = 0.90) and a preference for cash on delivery (β = 0.60, t = 0.37) both show positive coefficients, but these effects are not statistically significant, implying limited influence on home return preferences.

Parcel Lockers: The ASC for Parcel Lockers is large and positive (β = 6.06, t = 1.81), suggesting a strong baseline inclination toward this method, although the statistical support is modest. Accessibility plays a key role: shorter travel distance to a locker significantly increases the probability of using this option (β = 3.98, t = 2.02), confirming that proximity is a decisive factor in the Polish context. Other variables, such as fashion (β = 0.74, t = 0.63) and electronics (β = –0.93, t = –0.58), do not reach significance, indicating no consistent product-related pattern. Similarly, income (β = 0.11, t = 0.05), walking access (β = –0.05, t = –0.03), product mismatch as a return reason (β = 0.53, t = 0.42), and preference for live support (β = 0.41, t = 0.31) do not show meaningful effects on locker choice.

Store: The ASC for Store returns is positive but not statistically significant (β = 0.96, t = 0.37), suggesting no clear baseline inclination toward this channel. Several explanatory variables have positive coefficients but lack strong statistical support. Returning fashion items (β = 3.16, t = 1.57) and electronics (β = 2.97, t = 1.10) both indicate potential alignment with physical store returns, but the evidence is not conclusive. Older respondents (50+) show a positive tendency toward in-store returns (β = 2.47, t = 1.34), though not at conventional significance levels. Similarly, higher-income respondents also exhibit a positive but non-significant association with store returns (β = 2.53, t = 1.02). Finally, returns due to product mismatch show no clear influence (β = 0.53, t = 0.42).

Greece

Table 11. Model Estimation Results RP Returns: Greece

	ESTIMATE	T-RATIO
Home Return		
ASC_{HR}	0.00	NA
RecentReturns	0.61	2.38
Children	0.20	0.44
CashOnDelivery	1.39	1.62
Parcel Lockers		
ASC_{PLR}	1.61	1.31
$Fashion_{PLR}$	1.17	1.28
$Electronics_{PLR}$	0.56	0.50
ShortDistance	-0.04	-0.06
WalkingAccess	0.40	0.56
MidHighIncome	-0.12	-0.13
ReturnReasonMismatch (Generic)	0.44	0.48
PrefersLiveSupport	1.94	2.22
Store		
ASC_{SR}	1.43	1.20
$Fashion_{SR}$	0.40	0.48
$Electronics_{SR}$	0.68	0.60
Age50Plus	1.31	1.53
MidHighIncome	0.40	0.42
ReturnReasonMismatch (Generic)	0.44	0.48
Panel-level variation		

	ESTIMATE	T-RATIO
ε_{panel}	1.44	2.43
Summary statistics		
Adj.Rho-squared vs equal shares	0.0382	
LL at equal shares, LL(0)	-139.52	
LL(final)	-117.19	
Observations	127	

Home Return: The Alternative Specific Constant (ASC) for Home Return is fixed at zero as the reference option. Recent returns have a positive and statistically significant influence (β = 0.61, t = 2.38), indicating that Greek respondents with recent return experience are more inclined to choose home collection. A preference for cash on delivery also increases the likelihood of home return (β = 1.39, t = 1.62), though the evidence is somewhat weaker. The number of children in the household shows a small positive effect (β = 0.20, t = 0.44), but this result is not statistically significant.

Parcel Lockers: The ASC for Parcel Lockers is positive but not statistically significant (β = 1.61, t = 1.31), suggesting no inherent strong preference for lockers once explanatory factors are considered. Among the explanatory variables, a preference for live support stands out as significant (β = 1.94, t = 2.22), showing that even respondents who value personal assistance may still favour parcel lockers, potentially due to convenience or reliability. Other product- and access-related factors, such as fashion (β = 1.17, t = 1.28), electronics (β = 0.56, t = 0.50), short travel distance (β = –0.04, t = –0.06), and walking access (β = 0.40, t = 0.56), do not demonstrate strong effects. Household income (β = –0.12, t = –0.13) and product mismatch returns (β = 0.44, t = 0.48) are also not significant.

Store: The ASC for Store returns is positive but not statistically significant (β = 1.43, t = 1.20), indicating no strong baseline preference for this option. Fashion (β = 0.40, t = 0.48) and electronics (β = 0.68, t = 0.60) returns both show positive but non-significant associations with in-store returns. Older respondents (50+) demonstrate a positive tendency toward store returns (β = 1.31, t = 1.53), suggesting that age may play a role, although the statistical support remains below conventional thresholds. Income (β = 0.40, t = 0.42) and product mismatch as a return reason (β = 0.44, t = 0.48) show no meaningful effects.

France

Table 12. Model Estimation Results RP Returns: France

	ESTIMATE	T-RATIO
Home Return		
ASC_{HR}	0.00	NA
RecentReturns	0.15	1.02
Children	-1.24	-2.09
CashOnDelivery	0.03	0.04
Parcel Lockers		
ASC_{PLR}	2.20	1.84
$Fashion_{PLR}$	0.42	0.62
$Electronics_{PLR}$	-0.78	-0.93

	ESTIMATE	T-RATIO
ShortDistance	0.42	0.59
WalkingAccess	-0.27	-0.38
MidHighIncome	-2.06	-2.20
ReturnReasonMismatch (Generic)	-0.57	-0.78
PrefersLiveSupport	0.51	0.71
Store		
ASC_{SR}	1.73	1.66
$Fashion_{SR}$	-0.07	-0.10
$Electronics_{SR}$	-0.96	-1.08
Age50Plus	0.67	0.65
MidHighIncome	-2.55	-2.57
ReturnReasonMismatch (Generic)	-0.57	-0.78
Panel-level variation		
ε_{panel}	2.08	4.30
Summary statistics		
Adj.Rho-squared vs equal shares	0.1691	
LL at equal shares, LL(0)	-262.57	
LL(final)	-201.16	
Observations	239	

Home Return: The Alternative Specific Constant (ASC) for Home Return is fixed at zero as the reference option. Among the explanatory variables, the number of children in the household has a negative and statistically significant effect ($\beta = -1.24$, $t = -2.09$), indicating that households with more children are less likely to prefer home collection as a return method. Recent return activity shows a small positive but non-significant influence ($\beta = 0.15$, $t = 1.02$), while preference for cash on delivery has no meaningful impact ($\beta = 0.03$, $t = 0.04$).

Parcel Lockers: The ASC for Parcel Lockers is positive ($\beta = 2.20$, $t = 1.84$), pointing to a baseline inclination toward this option, although statistical support is modest. Household income plays a key role: respondents in the mid- to high-income category are significantly less likely to choose lockers ($\beta = -2.06$, $t = -2.20$). Other product and access-related variables do not show significant effects. Fashion returns ($\beta = 0.42$, $t = 0.62$), electronics returns ($\beta = -0.78$, $t = -0.93$), short travel distance ($\beta = 0.42$, $t = 0.59$), and walking access ($\beta = -0.27$, $t = -0.38$) all lack statistical strength. Return due to product mismatch ($\beta = -0.57$, $t = -0.78$) and preference for live support ($\beta = 0.51$, $t = 0.71$) also do not significantly shape locker preferences.

Store: The ASC for Store returns is positive ($\beta = 1.73$, $t = 1.66$), suggesting a modest baseline preference for in-store returns, although just below conventional significance thresholds. Income is again a decisive factor: mid- to high-income respondents are significantly less likely to return products in-store ($\beta = -2.55$, $t = -2.57$). Other variables are not statistically significant. Fashion returns ($\beta = -0.07$, $t = -0.10$) and electronics returns ($\beta = -0.96$, $t = -1.08$) show weak negative associations. Older respondents (50+) display a positive but non-significant tendency toward store returns ($\beta = 0.67$, $t = 0.65$). Product mismatch as a reason for return also has no meaningful effect ($\beta = -0.57$, $t = -0.78$).

Spain

Table 13. Model Estimation Results RP Returns: Spain

	ESTIMATE	T-RATIO
Home Return		
ASC_{HR}	0.00	NA
RecentReturns	-0.11	-0.31
Children	1.77	2.14
CashOnDelivery	2.90	2.08
Parcel Lockers		
ASC_{PLR}	2.37	1.30
$Fashion_{PLR}$	0.08	0.09
$Electronics_{PLR}$	-2.00	-1.34
ShortDistance	0.49	0.36
WalkingAccess	0.35	0.29
MidHighIncome	-0.80	-0.64
ReturnReasonMismatch (Generic)	0.99	1.03
PrefersLiveSupport	1.31	1.17
Store		
ASC_{SR}	0.47	0.31
$Fashion_{SR}$	1.36	1.22
$Electronics_{SR}$	-0.63	-0.39
Age50Plus	-0.60	-0.44
MidHighIncome	-0.90	-0.64
ReturnReasonMismatch (Generic)	0.99	1.03
Panel-level variation		
ε_{panel}	3.46	3.40
Summary statistics		
Adj.Rho-squared vs equal shares	0.1432	
LL at equal shares, LL(0)	-238.4	
LL(final)	-187.26	
Observations	217	

Home Return: The Alternative Specific Constant (ASC) for Home Return is fixed at zero as the reference. Two variables stand out as significant drivers of this option. The number of children in the household has a positive and statistically significant effect ($\beta = 1.77$, $t = 2.14$), showing that larger families are more likely to prefer home collection for returns, likely due to convenience needs. Similarly, a preference for cash on delivery is strongly associated with home returns ($\beta = 2.90$, $t = 2.08$), suggesting that households accustomed to this payment method also favor the simplicity of home-based return solutions. Recent return experience has a small negative but non-significant effect ($\beta = -0.11$, $t = -0.31$).

Parcel Lockers: The ASC for Parcel Lockers is positive ($\beta = 2.37$, $t = 1.30$), pointing toward a baseline inclination, though not statistically significant. Explanatory variables do not show strong effects, but some patterns are notable. Electronics returns are negatively associated with locker use ($\beta = -2.00$, $t = -1.34$), which may reflect concerns about size or fragility. A preference for live support has a positive but non-significant relationship ($\beta = 1.31$, $t = 1.17$), while product mismatch as a return reason also points positively but without statistical strength ($\beta = 0.99$, $t = 1.03$). Other

factors, including fashion returns (β = 0.08, t = 0.09), short travel distance (β = 0.49, t = 0.36), walking access (β = 0.35, t = 0.29), and income (β = –0.80, t = –0.64), do not meaningfully influence locker preferences.

Store: The ASC for Store returns is small and not significant (β = 0.47, t = 0.31), indicating no strong baseline inclination toward this method. Fashion returns are positively associated with in-store returns (β = 1.36, t = 1.22), though the effect is not statistically significant. Electronics returns show a weak negative influence (β = –0.63, t = –0.39). Age 50+ has a negative coefficient (β = –0.60, t = –0.44), suggesting that older respondents are somewhat less likely to return products in stores, but again without statistical significance. Higher income (β = –0.90, t = –0.64) and product mismatch returns (β = 0.99, t = 1.03) also show no conclusive effects.

Austria

Table 14. Model Estimation Results RP Returns: Austria

	ESTIMATE	T-RATIO
Home Return		
ASC_{HR}	0.00	NA
RecentReturns	0.19	1.80
Children	0.59	1.40
CashOnDelivery	-0.92	-0.98
Parcel Lockers		
ASC_{PLR}	1.99	2.21
$Fashion_{PLR}$	1.51	3.17
$Electronics_{PLR}$	-0.78	-1.10
ShortDistance	0.10	0.18
WalkingAccess	-0.16	-0.27
MidHighIncome	0.02	0.03
ReturnReasonMismatch (Generic)	0.13	0.21
PrefersLiveSupport	0.27	0.43
Store		
ASC_{SR}	1.55	1.87
$Fashion_{SR}$	1.28	2.46
$Electronics_{SR}$	0.38	0.52
Age50Plus	1.80	2.99
MidHighIncome	-0.75	-1.01
ReturnReasonMismatch (Generic)	0.13	0.21
Panel-level variation		
ε_{panel}	-1.96	-6.63
Summary statistics		
Adj.Rho-squared vs equal shares	0.2079	
LL at equal shares, LL(0)	-477.9	
LL(final)	-361.53	
Observations	435	

Home Return: The Alternative Specific Constant (ASC) for Home Return is set to zero as the reference. Recent return experience has a positive and nearly significant effect (β = 0.19, t = 1.80),

suggesting that respondents who had recently returned items are more likely to favor home collection. The number of children in the household also points positively (β = 0.59, t = 1.40), though the evidence is weaker. In contrast, a preference for cash on delivery shows a negative but non-significant relationship (β = –0.92, t = –0.98), indicating that this payment habit does not align with choosing home return in the Austrian context.

Parcel Lockers: The ASC for Parcel Lockers is positive and statistically significant (β = 1.99, t = 2.21), reflecting a general inclination toward this return channel. Product type plays a decisive role: fashion returns strongly favor lockers (β = 1.51, t = 3.17), confirming that lockers are considered a suitable and convenient channel for clothing and accessory returns. Other factors do not significantly affect preferences. Electronics returns show a negative tendency (β = –0.78, t = –1.10), while travel distance (β = 0.10, t = 0.18), walking access (β = –0.16, t = –0.27), income (β = 0.02, t = 0.03), product mismatch (β = 0.13, t = 0.21), and preference for live support (β = 0.27, t = 0.43) all remain statistically weak.

Store: The ASC for Store returns is positive and close to conventional significance (β = 1.55, t = 1.87), suggesting a moderate baseline preference for this option. Product type and age emerge as key drivers. Fashion returns significantly favor in-store returns (β = 1.28, t = 2.46), highlighting the role of physical stores in handling clothing and accessory returns. Older respondents (50+) are also significantly more likely to choose this method (β = 1.80, t = 2.99), pointing to generational differences in return behaviour. Other variables show weaker effects: electronics returns (β = 0.38, t = 0.52) and product mismatch (β = 0.13, t = 0.21) are not significant, while higher income has a negative but non-significant influence (β = –0.75, t = –1.01).

3.3. Stated Preference (SP) - Deliveries

3.3.1. SP Descriptive Statistics for Deliveries

Understanding the distribution of product categories across scenarios provides valuable insights into consumer demand patterns and highlights which sectors dominate e-commerce flows. Table 15 presents the share of 20,045 scenarios by product category within each country. Fashion consistently emerges as the leading category, particularly in Spain (49.8%) and France (49.6%), followed by electronics, which account for around one-fifth of deliveries across all markets. Pharmaceuticals represent a notable share in Austria (20.3%) and Greece (21.5%), while resales are more prominent in France (16.0%) and Poland (13.9%). Toys, though a smaller category overall, maintain a relatively stable presence across countries.

Table 15. Distribution of **20045** scenarios to Product Categories by Country (% of total per country)

Country	Electronics	Resales	Fashion	Pharmaceuticals	Toys
Austria	21.4	7.4	43.1	20.3	7.8
Spain	23.3	5.9	49.8	14.7	6.3
France	20.9	16.0	49.6	6.4	7.1
Greece	27.4	5.1	42.8	21.5	3.3
Poland	20.6	13.9	41.0	18.4	6.1

3.3.2. Utility Functions

This subsection introduces the utility functions specified for the different delivery methods in the SP experiment. The models combine cost - and service-related attributes with sociodemographic characteristics, household composition, payment preferences, product types, and stated behavioural intentions. This design allows the estimations to capture both economic trade-offs and contextual influences on delivery choice. The inclusion of interaction terms, such as travel time with environmental concern, further reflects the role of personal attitudes in shaping preferences.

Home Deliveries (HD)

$$V_{HD} = ASC_{HD} + \beta_{Cost} \cdot RelCost_{HD} + \beta_{UnknownDistanceHD} \cdot UnknownDistance + \beta_{ChooseDeliveryDayHD} \cdot ChooseDeliveryDay + \beta_{SameDayDeliveryHD} \cdot SameDayDelivery + \beta_{OrderNowHD} \cdot OrderNow_{HD} + \beta_{FemaleHD} \cdot Female + \beta_{HigherEduHD} \cdot HigherEducation + \beta_{KidsUnder13HD} \cdot KidsUnder13 + \beta_{Age50PlusHD} \cdot Age50Plus + \beta dontknowdist \cdot DontKnowDist + \varepsilon_{panel} + \varepsilon_{comp}$$

where:

ASC_{HD} = Alternative Specific Constant for selecting the Home Delivery option.

$RelCost_{HD}$ = Delivery cost for Home Delivery, expressed relative to the value of the most recent online purchase.

UnknownDistance = Dummy variable indicating whether the respondent did not know the travel time to the nearest pick-up/locker point

ChooseDeliveryDay = Whether the respondent had the option to select the delivery date for the Home Delivery option

SameDayDelivery = delivery time for Home Delivery within the same day

$OrderNow_{HD}$ = Indicates whether the respondent reported choosing Home Delivery as the delivery method for at least one of their online purchases made in the last two weeks.

Female = Female respondent or not

HigherEducation = completed higher education (bachelor's degree or higher)

KidsUnder13 = Total number of children in the household under 13 years of age

Age50Plus = Age 50 years or older

ε_{panel} = Error component capturing random taste variation

ε_{comp} = Error component capturing random taste variation between Home Delivery and Click-and-Collect options, reflecting their similarity in unobserved preferences.

Parcel Lockers (PL)

$$V_{PL} = ASC_{PL} + \beta_{cost} \cdot RelCost_{PL} + \beta_{tt} \cdot TravelTime_{PL} + \beta_{ttPL} \cdot (TravelTime_{PL} \cdot EnvConcern_{PL}) + \beta_{type\_resale} \cdot Resale + \beta_{type\_toys} \cdot Toys + \beta_{deldaypl} \cdot SameDay_{PL} + \beta_{FashionPL} \cdot Fashion_{PL} + \beta_{Pharm} \cdot Pharm + \beta_{ordernowpl} \cdot OrderNow_{PL} + \varepsilon_{PL}$$

where:

ASC_{PL} = Alternative specific constant for the Parcel Locker delivery method.

$RelCost_{PL}$= Delivery cost for parcel locker, expressed relative to the value of the most recent online purchase.

$TravelTime_{PL}$ = Reported travel time required to reach the nearest parcel locker collection point.

$EnvConcern_{PL}$ = Stated importance of environmental impact as a factor in delivery preferences.
Resale = Type of most recent online purchase: resaled items, such as second-hand products from online platforms.
Toys = Type of most recent online purchase : toys, books, or other small household and consumable items.
$SameDay_{PL}$ = Availability of same-day delivery for the parcel locker option.
$Fashion_{PL}$= Type of most recent online purchase :fashion-related items, including clothing, accessories, and footwear.
Pharm = Type of most recent online purchase : non-prescription pharmaceutical products, such as vitamins and supplements.
$DontKnowDist_{PL}$ = People that don't know the distance of the nearest locker/pick up point
$OrderNow_{PL}$ = Indicates whether the respondent reported choosing Parcel Lockers as the delivery method for at least one of their online purchases made in the last two weeks.
ε_{panel} = Error component capturing random taste variation

Pick-up Point (PP)

$$V_{PP} = ASC_{PP} + \beta_{cost} \cdot RelCost_{PP} + \beta_{tt} \cdot TravelTime_{PP} + \beta_{ttPP} \cdot (TravelTime_{PP} \cdot EnvConcern_{PP}) + \beta_{resales} \cdot Resale + \beta_{toys} \cdot Toys + \beta_{deldayPP} \cdot SameDayDelivery_{PP} + \beta_{OrderNowPP} \cdot OrderNow_{PP} + \beta_{fashionPP} \cdot Fashion_{PP} + \beta_{pharm} \cdot Pharm + \beta_{numprod} \cdot RecentOrders + \varepsilon_{panel}$$

where:
ASC_{PP} = Alternative Specific Constant for Pick up Point
$RelCost_{PP}$ = Delivery cost for pick-up point return relative to product price.
$TravelTime_{PP}$ = Reported time to reach the pick-up point or designated return location.
$EnvConcern_{PP}$ = Self-assessed environmental impact of using the pick-up point.
Resale = Type of most recent Purchase from re-commerce platforms such as Vinted or eBay.
Toys = Toys, books, or consumables such as diapers, stationery, or household small items.
$SameDayDelivery_{PP}$ = Ability to receive delivery from pick-up point within the same day.
$OrderNow_{PP}$ = Indicates whether the respondent reported choosing Pick-up Points as the delivery method for at least one of their online purchases made in the last two weeks.
$Fashion_{PP}$ = Clothing, accessories, or footwear.
Pharm = Over-the-counter pharmaceutical products and vitamins (excluding cosmetics and personal care).
$DontKnowDist_{PP}$ = People that don't know the distance of the nearest locker/pick up point
RecentOrders = Number of online purchases in the last two weeks.
ε_{panel} = Error component capturing random taste variation

Click-and-Collect (CC)

$$V_{CC} = ASC_{CC} + \beta_{cost} \cdot RelCost_{CC} + \beta_{ordernowCC} \cdot OrderNow_{CC} + \beta_{cash} \cdot CashPreference + \beta_{gender} \cdot Female + \beta_{adultsinhousehold} \cdot AdultsInHousehold + \beta_{resale} \cdot Resale + \beta_{toys} \cdot Toys + \beta_{fashionCC} \cdot Fashion_{CC} + \beta_{pharm} \cdot Pharm + \varepsilon_{panel} + \varepsilon_{comp}$$

where:
ASC_{CC} = Alternative Specific Constant for Click-and-Collect

$RelCost_{CC}$ = Relative cost of Click & Collect compared to the price range of the last online purchase
$OrderNow_{CC}$ = Indicates whether the respondent reported choosing Click-and-Collect as the delivery method for at least one of their online purchases made in the last two weeks.
CashPreference = Respondent uses cash on delivery as a preferred online payment method
Female = Respondent's gender is female
AdultsInHousehold = Number of adults in the household
Resale = Product purchased in the last online order was a resale item (e.g., second-hand from platforms like Vinted or eBay)
Toys = Product purchased in the last online order was from the toys, books, or consumables category
$Fashion_{CC}$ = Product purchased in the last online order was a fashion item (e.g., clothing, accessories, shoes)
Pharm = Product purchased in the last online order was a pharmaceutical product (non-prescription) or vitamins
ε_{panel} = Error component capturing random taste variation
ε_{comp} = Error component capturing random taste variation between Home Delivery and Click-and-Collect options, reflecting their similarity in unobserved preferences.

3.3.3. Modelling pooled data

This subsection presents the pooled estimation results across all five countries. By combining the data, the model highlights common behavioural patterns and significant factors influencing the choice of last-mile delivery methods in the overall sample.

Table 16. Model Estimation Results SP Deliveries: Pooled Data

	ESTIMATE	T-RATIO
Home Deliveries		
ASC_{HD}	0	NA
$RelCost_{HD}$	-0.088	-1.75
Age50Plus	0.097	2.27
ChooseDeliveryDay	0.050	1.53
SameDayDelivery	0.069	2.01
OrderNowHome	0.600	14.69
Female	-0.102	-2.41
HigherEducation	-0.272	-6.92
KidsUnder13	0.013	0.44
DontKnowDist	0.874	5.21
Parcel Lockers		
ASC_{PL}	-0.212	-3.01
$RelCost_{PL}$	-0.088	-1.75
$TravelTime_{PL}$	-0.007	-2.84
$TravelTime_{PL}$ * $EnvConcern_{PL}$	0.002	2.32
Resale	0.384	4.96
Toys	0.098	1.10
$Fashion_{PL}$	0.097	1.67
Pharm	0.127	1.99

	ESTIMATE	T-RATIO
$Sameday_{PL}$	0.192	4.03
$OrderNow_{PL}$	0.278	6.43
Pick-up Points		
ASC_{PP}	-0.066	-0.93
$RelCost_{PP}$	-0.088	-1.75
$TravelTime_{PP}$	-0.007	-2.84
$TravelTime_{PP}$ * $EnvConcern_{PP}$	0.002	2.68
Resales	0.384	4.96
Toys	0.098	1.10
$Fashion_{PP}$	0.087	1.49
Pharm	0.127	1.99
RecentOrders	-0.003	-0.37
$SameDayDelivery_{PP}$	-0.115	-2.32
PickUpNow	0.075	1.51
Click-and-Collect		
ASC_{CC}	-0.457	-5.74
$RelCost_{CC}$	-0.088	-1.75
Resales	0.384	4.96
Toys	0.098	1.10
$Fashion_{CC}$	0.084	1.39
Pharm	0.127	1.99
CashPreference	0.105	2.08
ClickCollectNow	0.343	5.27
Female	-0.109	-2.32
AdultsInHousehold	0.027	1.24
Variation		
ε_{panel}	0.556	27.69
ε_{comp}	-0.223	-2.37
Summary statistics		
Adj.Rho-squared vs equal shares	0.0346	
LL at equal shares, LL(0)	-27788.27	
LL(final)	-26827.86	
Observations	20045	

Home Delivery: The Alternative Specific Constant (ASC) for Home Delivery is fixed to zero as the reference alternative. Several factors significantly influence the choice of this delivery method. The relative cost of home delivery has a negative coefficient ($\beta = -0.088$, $t = -1.75$), suggesting that higher delivery costs reduce the likelihood of selecting this option, although the effect is only marginally significant. Same-day delivery availability positively affects preferences ($\beta = 0.069$, $t = 2.01$), indicating that faster service increases the attractiveness of home delivery. Similarly, the ability to choose the delivery day shows a positive but weaker effect ($\beta = 0.050$, $t = 1.53$). Sociodemographic characteristics play an important role. Respondents aged 50 and above are more likely to prefer home delivery ($\beta = 0.097$, $t = 2.27$). The presence of children under 13 years in the household has a positive but non-significant effect ($\beta = 0.013$, $t = 0.44$). Female respondents are significantly less likely to select home delivery ($\beta = -0.102$, $t = -2.41$), while individuals with

higher education are also less inclined toward this method (β = –0.272, t = –6.92). The OrderNowHD variable is highly significant (β = 0.600, t = 14.69), highlighting that recent actual behaviour — choosing home delivery for at least one order in the last two weeks — is a strong predictor of stated preference for this method. Respondents who do not know the distance to the nearest locker are significantly more likely to choose this method (β = 0.874, t = 5.21), potentially reflecting reliance on the default option when lockers are unfamiliar.

Parcel Lockers: The ASC for Parcel Lockers is negative and statistically significant (β = –0.212, t = –3.01), indicating that, all else being equal, this method is less preferred compared to home delivery. The cost-to-price ratio has a negative effect (β = –0.088, t = –1.75), showing that higher relative costs decrease the attractiveness of lockers. Travel time to the locker significantly reduces its selection (β = –0.007, t = –2.84). However, this effect is moderated by environmental concern through an interaction term (β = 0.00168, t = 2.32), meaning that respondents with stronger environmental awareness are less sensitive to longer travel times. Regarding product types, resale items strongly increase the likelihood of using lockers (β = 0.384, t = 4.96). Pharmaceutical products also have a significant positive association (β = 0.127, t = 1.99). Fashion (β = 0.097, t = 1.67) and toys (β = 0.098, t = 1.10) are positively related but not strongly significant. Contextual factors are also relevant. Same-day delivery availability positively influences locker selection (β = 0.192, t = 4.03). Finally, OrderNowPL is a strong predictor (β = 0.278, t = 6.43), linking recent locker use with future stated preference.

Pick-up Point: The ASC for Pick-up Points is negative but not statistically significant (β = –0.066, t = –0.93), indicating no clear inherent preference or aversion to this method. Delivery cost and travel time both negatively affect choice (β = –0.088, t = –1.75 and β = –0.0068, t = –2.84, respectively). As with lockers, the negative impact of travel time is mitigated by environmental concern (β = 0.00198, t = 2.68), showing that environmentally conscious individuals are more willing to travel further to use this method. Product-related factors show similar patterns to lockers. Resale items significantly increase the probability of selecting pick-up points (β = 0.384, t = 4.96), while pharmaceutical products are also positively associated (β = 0.127, t = 1.99). Toys (β = 0.098, t = 1.10) and fashion (β = 0.087, t = 1.49) have weaker, non-significant effects. Among service attributes, same-day delivery availability has a negative and significant effect (β = –0.115, t = –2.32), suggesting that respondents do not expect or require same-day options for pick-up points. RecentOrders, representing the number of online purchases in the past two weeks, has no meaningful impact (β = –0.0027, t = –0.37). OrderNowPP shows a positive but non-significant association (β = 0.075, t = 1.51).

Click-and-collect: The ASC for Click-and-Collect is negative and highly significant (β = –0.457, t = –5.74), indicating a general preference against this method relative to home delivery. Delivery cost has a negative effect (β = –0.088, t = –1.75), as expected. Among product categories, resale items strongly increase the likelihood of using Click-and-Collect (β = 0.384, t = 4.96), while pharmaceutical products also have a positive and significant relationship (β = 0.127, t = 1.99). Toys (β = 0.098, t = 1.10) and fashion (β = 0.084, t = 1.39) are positively related but not significant. Among sociodemographic and behavioural factors, cash preference is significant (β = 0.105, t = 2.08), suggesting that respondents favouring cash-on-delivery payments are more inclined toward Click-and-Collect services. Female respondents are less likely to choose this option (β = –0.109, t = –2.32), while the number of adults in the household has a small, non-significant positive effect

(β = 0.027, t = 1.24). $OrderNow_{CC}$ strongly predicts this choice (β = 0.343, t = 5.27), showing a clear link between recent experience with Click-and-Collect and future stated preference.

3.3.4. Modelling results per country

Poland

Table 17. Model Estimation Results SP Deliveries: Poland

	ESTIMATE	T-RATIO
Home Deliveries		
ASC_{HD}	0	NA
$RelCost_{HD}$	-0.148	-1.69
Age50Plus	0.295	2.98
ChooseDeliveryDay	-0.007	-0.09
SameDayDelivery	0.108	1.32
OrderNowHome	0.529	6.04
Female	-0.186	-1.98
HigherEducation	-0.130	-1.49
KidsUnder13	0.106	1.86
DontKnowDist	1.487	3.64
Parcel Lockers		
ASC_{PL}	0.140	0.86
$RelCost_{PL}$	-0.148	-1.69
$TravelTime_{PL}$	-0.012	-2.35
$TravelTime_{PL}$ * $EnvConcern_{PL}$	0.003	1.99
Resale	0.191	1.27
Toys	0.264	1.29
$Fashion_{PL}$	0.252	1.97
Pharm	0.071	0.53
$Sameday_{PL}$	0.250	2.57
$OrderNow_{PL}$	0.238	2.68
Pick-up Points		
ASC_{PP}	0.437	2.86
$RelCost_{PP}$	-0.148	-1.69
$TravelTime_{PP}$	-0.012	-2.35
$TravelTime_{PP}$ * $EnvConcern_{PP}$	0.003	2.11
Resales	0.191	1.27
Toys	0.264	1.29
$Fashion_{PP}$	0.184	1.45
Pharm	0.071	0.53
RecentOrders	0.005	0.38
$SameDayDelivery_{PP}$	-0.129	-1.25
PickUpNow	-0.040	-0.34
Click-and-Collect		
ASC_{CC}	-0.284	-1.56

	ESTIMATE	T-RATIO
$RelCost_{CC}$	-0.148	-1.69
Resales	0.191	1.27
Toys	0.264	1.29
$Fashion_{CC}$	0.224	1.69
Pharm	0.071	0.53
CashPreference	-0.002	-0.02
ClickCollectNow	0.334	2.69
Female	-0.244	-2.44
AdultsInHousehold	0.066	1.32
Variation		
ε_{panel}	-0.28826	-4.58033
ε_{comp}	-0.4519	-5.07958
Summary statistics		
Adj.Rho-squared vs equal shares	0.0273	
LL at equal shares, LL(0)	-5475.86	
LL(final)	-5294.25	
Observations	3950	

Home Delivery: The Alternative Specific Constant (ASC) for Home Delivery is fixed at zero as the reference option. The cost-to-price ratio has a negative effect (β = –0.148, t = –1.69), indicating that higher costs discourage respondents from selecting this method, although the effect is only marginally significant. Same-day delivery availability shows a positive but non-significant influence (β = 0.108, t = 1.32), suggesting a potential preference for faster services without clear statistical evidence. The ability to choose the delivery day has no impact (β = –0.007, t = –0.09). Among sociodemographic factors, age 50 and above strongly increases the likelihood of choosing home delivery (β = 0.295, t = 2.98). The presence of children under 13 also has a positive effect (β = 0.106, t = 1.86), though slightly below conventional significance thresholds, reflecting a tendency for families to prefer the convenience of home delivery. Female respondents are less likely to select this method (β = –0.186, t = –1.98). Respondents with higher education also show a negative, though not significant, association (β = –0.130, t = –1.49). The OrderNowHD variable is a strong predictor (β = 0.529, t = 6.04), demonstrating that respondents who have recently used home delivery are significantly more likely to state a preference for this method. Respondents who do not know the distance to the nearest locker are much more likely to select this method (β = 1.487, t = 3.64), potentially indicating a lack of awareness of alternative methods.

Parcel Lockers: The ASC for Parcel Lockers is positive but not statistically significant (β = 0.140, t = 0.86), indicating no clear baseline preference compared to home delivery. Higher delivery costs reduce the attractiveness of lockers (β = –0.148, t = –1.69). Travel time to the locker significantly decreases its selection (β = –0.0117, t = –2.35). However, this negative effect is moderated by environmental concern (β = 0.00305, t = 1.99), suggesting that environmentally conscious respondents are more willing to tolerate longer travel times. Regarding product types, fashion items positively and significantly influence locker use (β = 0.252, t = 1.97). Resale products (β = 0.191, t = 1.27) and toys (β = 0.264, t = 1.29) are also positively associated, but not statistically significant. Pharmaceutical products have a small and non-significant effect (β = 0.071, t = 0.53).

Other contextual factors play a strong role. Same-day delivery availability strongly increases locker preference (β = 0.250, t = 2.57). Finally, OrderNowPL is significant (β = 0.238, t = 2.68), confirming that recent locker use predicts a higher stated preference for this option.

Pick-up Point: The ASC for Pick-up Points is positive and significant (β = 0.437, t = 2.86), indicating a baseline preference for this method relative to home delivery. Delivery cost (β = –0.148, t = –1.69) and travel time (β = –0.012, t = –2.35) negatively affect pick-up point selection. Similar to lockers, this negative effect of travel time is moderated by environmental concern (β = 0.00324, t = 2.11), indicating that environmentally conscious respondents are more accepting of longer travel distances. For product types, fashion items (β = 0.184, t = 1.45), resale products (β = 0.191, t = 1.27), and toys (β = 0.264, t = 1.29) all show positive but non-significant relationships. Pharmaceutical products are weakly related (β = 0.071, t = 0.53). Service-related factors reveal interesting patterns. Same-day delivery availability has a negative but not strongly significant effect (β = –0.129, t = –1.25), suggesting that this speed is less relevant for pick-up point users. RecentOrders, representing the number of online purchases in the past two weeks, has no meaningful influence (β = 0.005, t = 0.38). Similarly, OrderNowPP is slightly negative and non-significant (β = –0.040, t = –0.34), indicating that past use of pick-up points does not strongly predict future stated preference.

Click-and-collect: The ASC for Click-and-Collect is negative but not significant (β = –0.284, t = –1.56), indicating a weak baseline aversion relative to home delivery. Higher delivery costs decrease preference for this method (β = –0.148, t = –1.69). Among product types, fashion items are positively associated with Click-and-Collect and approach significance (β = 0.224, t = 1.69), while resale products (β = 0.191, t = 1.27), toys (β = 0.264, t = 1.29), and pharmaceuticals (β = 0.071, t = 0.53) are not significant. Cash preference has no meaningful effect on this choice (β = –0.002, t = –0.02). Female respondents are significantly less likely to choose Click-and-Collect (β = –0.244, t = –2.44). The number of adults in the household has a small positive but non-significant effect (β = 0.066, t = 1.32). OrderNowCC is a strong positive predictor (β = 0.334, t = 2.69), showing that recent experience with Click-and-Collect strongly influences future stated preference.

Greece

Table 18. Model Estimation Results SP Deliveries: Greece

	ESTIMATE	T-RATIO
Home Deliveries		
ASC_{HD}	0	NA
$RelCost_{HD}$	-0.006	-0.05
Age50Plus	0.028	0.30
ChooseDeliveryDay	0.131	1.77
SameDayDelivery	0.133	1.70
OrderNowHome	0.518	5.81
Female	-0.228	-2.41
HigherEducation	-0.218	-2.39
KidsUnder13	0.063	0.99
DontKnowDist	1.507	3.71
Parcel Lockers		

	ESTIMATE	T-RATIO
ASC_{PL}	-0.037	-0.24
$RelCost_{PL}$	-0.006	-0.05
$TravelTime_{PL}$	-0.014	-2.71
$TravelTime_{PL}$ * $EnvConcern_{PL}$	0.003	1.76
Resale	0.423	1.97
Toys	-0.063	-0.25
$Fashion_{PL}$	0.045	0.36
Pharm	0.206	1.64
$Sameday_{PL}$	0.173	1.69
$OrderNow_{PL}$	0.237	2.71
Pick-up Points		
ASC_{PP}	0.018	0.12
$RelCost_{PP}$	-0.006	-0.05
$TravelTime_{PP}$	-0.014	-2.71
$TravelTime_{PP}$ * $EnvConcern_{PP}$	0.003	1.96
Resales	0.423	1.97
Toys	-0.063	-0.25
$Fashion_{PP}$	0.191	1.55
Pharm	0.206	1.64
RecentOrders	0.022	1.12
$SameDayDelivery_{PP}$	0.021	0.20
PickUpNow	-0.144	-0.96
Click-and-Collect		
ASC_{CC}	-0.060	-0.35
$RelCost_{CC}$	-0.006	-0.05
Resales	0.423	1.97
Toys	-0.063	-0.25
$Fashion_{CC}$	0.093	0.72
Pharm	0.206	1.64
CashPreference	0.116	1.28
ClickCollectNow	0.416	3.30
Female	-0.275	-2.83
AdultsInHousehold	-0.038	-0.90
Variation		
ε_{panel}	0.519	14.46
ε_{comp}	-0.017	-0.08
Summary statistics		
Adj.Rho-squared vs equal shares	0.0161	
LL at equal shares, LL(0)	-5718.46	
LL(final)	-5594.1	
Observations	4125	

Home Delivery: The Alternative Specific Constant (ASC) for Home Delivery is fixed at zero as the reference alternative. The cost-to-price ratio has virtually no effect on home delivery choice (β = –0.006, t = –0.05), indicating that Greek consumers do not consider cost differences to be a

decisive factor for this method. Service attributes play a more prominent role. Both the ability to choose the delivery day (β = 0.131, t = 1.77) and same-day delivery availability (β = 0.133, t = 1.70) positively influence preferences, showing that flexibility and speed increase the attractiveness of home delivery, although the effects are slightly below conventional significance thresholds. Sociodemographic factors reveal some distinct patterns. Female respondents are significantly less likely to choose home delivery (β = –0.228, t = –2.41), while individuals with higher education also show a negative and significant association (β = –0.218, t = –2.39). Respondents aged 50 and above and those with children under 13 years exhibit positive but non-significant effects (β = 0.028, t = 0.30 and β = 0.063, t = 0.99, respectively). The OrderNowHD variable is highly significant (β = 0.518, t = 5.81), indicating that respondents who have recently chosen home delivery for at least one purchase are much more likely to express a stated preference for this method. Respondents who do not know the distance to the nearest locker are much more likely to select this method (β = 1.507, t = 3.71), which underlines the role of spatial awareness in shaping delivery preferences.

Parcel Lockers: The ASC for Parcel Lockers is negative but not significant (β = –0.037, t = –0.24), indicating no inherent baseline preference or aversion compared to home delivery. Travel time to the nearest locker significantly decreases its attractiveness (β = –0.014, t = –2.71). However, this negative effect is partially moderated by environmental concern through a positive interaction term (β = 0.00276, t = 1.76), meaning that environmentally conscious respondents are more tolerant of longer travel times. Among product types, resale items strongly increase the likelihood of choosing parcel lockers (β = 0.423, t = 1.97). Pharmaceutical products are also positively associated (β = 0.206, t = 1.64), though slightly below conventional significance levels. Fashion (β = 0.045, t = 0.36) and toys (β = –0.063, t = –0.25) have no meaningful effect. Other contextual factors play a crucial role. The availability of same-day delivery positively affects locker use (β = 0.173, t = 1.69). Finally, OrderNowPL is a strong predictor (β = 0.237, t = 2.71), showing that recent locker use strongly influences future stated preference.

Pick-up Point: The ASC for Pick-up Points is close to zero and non-significant (β = 0.018, t = 0.12), indicating no inherent preference relative to home delivery. Travel time has a significant negative effect (β = –0.014, t = –2.71), similar to parcel lockers. This effect is moderated by environmental concern (β = 0.00311, t = 1.96), suggesting that environmentally aware respondents are more willing to travel further for this option. Product-related variables show mixed results. Resale items are strongly associated with pick-up point use (β = 0.423, t = 1.97), while pharmaceutical products are positively related (β = 0.206, t = 1.64). Fashion (β = 0.191, t = 1.55) is positive but not significant, and toys (β = –0.063, t = –0.25) are negligible. Service characteristics reveal limited effects. Same-day delivery availability has virtually no influence (β = 0.021, t = 0.20). RecentOrders, representing the number of online purchases in the past two weeks, has a small, positive but non-significant effect (β = 0.022, t = 1.12). OrderNowPP is slightly negative and non-significant (β = –0.144, t = –0.96), indicating that past pick-up point usage does not strongly predict future stated preferences.

Click-and-collect: The ASC for Click-and-Collect is negative but not significant (β = –0.060, t = –0.35), indicating no strong baseline aversion compared to home delivery. Delivery cost has no effect (β = –0.006, t = –0.05). Among product types, resale items are positively associated with Click-and-Collect usage (β = 0.423, t = 1.97), while pharmaceutical products also have a positive

but slightly weaker association (β = 0.206, t = 1.64). Fashion (β = 0.093, t = 0.72) and toys (β = –0.063, t = –0.25) show no significant effects. Among user characteristics, female respondents are significantly less likely to choose Click-and-Collect (β = –0.275, t = –2.83). Cash preference has a positive but non-significant effect (β = 0.116, t = 1.28). The number of adults in the household has a small negative and non-significant effect (β = –0.038, t = –0.90). Behavioural patterns are clear: OrderNowCC is a strong predictor (β = 0.416, t = 3.30), showing that recent use of Click-and-Collect strongly predicts future stated preference for this method.

France

Table 19. Model Estimation Results SP Deliveries: France

	ESTIMATE	T-RATIO
Home Deliveries		
ASC_{HD}	0	NA
$RelCost_{HD}$	-0.082	-0.71
Age50Plus	-0.009	-0.09
ChooseDeliveryDay	0.124	1.68
SameDayDelivery	0.133	1.71
OrderNowHome	0.531	5.81
Female	0.127	1.34
HigherEducation	-0.263	-2.94
KidsUnder13	-0.056	-0.89
DontKnowDist	-0.186	-0.34
Parcel Lockers		
ASC_{PL}	-0.146	-0.919
$RelCost_{PL}$	-0.082	-0.71
$TravelTime_{PL}$	0.001	0.24
$TravelTime_{PL}$ * $EnvConcern_{PL}$	0.000	0.26
Resale	0.417	2.78
Toys	0.038	0.20
$Fashion_{PL}$	0.180	1.38
Pharm	0.110	0.55
$Sameday_{PL}$	0.199	1.86
$OrderNow_{PL}$	0.290	2.43
Pick-up Points		
ASC_{PP}	-0.068	-0.41
$RelCost_{PP}$	-0.082	-0.71
$TravelTime_{PP}$	0.001	0.24
$TravelTime_{PP}$ * $EnvConcern_{PP}$	-0.000	-0.16
Resales	0.417	2.78
Toys	0.038	0.20
$Fashion_{PP}$	0.206	1.59
Pharm	0.110	0.55
RecentOrders	-0.033	-2.05
$SameDayDelivery_{PP}$	-0.061	-0.55

	ESTIMATE	T-RATIO
PickUpNow	0.265	2.76
Click-and-Collect		
ASC_{CC}	-0.344	-1.91
$RelCost_{CC}$	-0.082	-0.71
Resales	0.417	2.78
Toys	0.038	0.20
$Fashion_{CC}$	0.088	0.65
Pharm	0.110	0.55
CashPreference	0.071	0.48
ClickCollectNow	0.170	1.30
Female	-0.034	-0.33
AdultsInHousehold	0.028	0.52
Variation		
ε_{panel}	-0.542	-12.59
ε_{comp}	-0.173	-0.77
Summary statistics		
Adj.Rho-squared vs equal shares	0.0237	
LL at equal shares, LL(0)	-5448.14	
LL(final)	-5286.85	
Observations	3930	

Home Delivery: The Alternative Specific Constant (ASC) for Home Delivery is fixed at zero as the reference alternative. The cost-to-price ratio has a negative but non-significant effect (β = –0.082, t = –0.71), showing that price is not a key determinant for home delivery choices among French respondents. Service-related attributes are more relevant. The ability to choose the delivery day (β = 0.124, t = 1.68) and same-day delivery availability (β = 0.133, t = 1.71) both positively influence preference, indicating that flexibility and speed make this option more appealing, though these effects are slightly below conventional significance thresholds. Regarding sociodemographic factors, female respondents tend to prefer home delivery (β = 0.127, t = 1.34), but the effect is not statistically significant. Respondents with higher education are significantly less likely to select home delivery (β = –0.263, t = –2.94). Age (β = –0.009, t = –0.09) and the presence of children under 13 (β = –0.056, t = –0.89) show no significant influence. The OrderNowHD variable is highly significant and strongly positive (β = 0.531, t = 5.81), indicating that respondents who recently used home delivery are much more likely to state a preference for this method. In Greece, unawareness of the distance to the nearest locker does not appear to influence the choice of this option (β = –0.186, t = –0.34).

Parcel Lockers: The ASC for Parcel Lockers is negative but non-significant (β = –0.146, t = –0.92), suggesting no inherent baseline preference or aversion compared to home delivery. Neither the cost-to-price ratio (β = –0.082, t = –0.71) nor travel time (β = 0.001, t = 0.24) significantly impact preferences for parcel lockers. Additionally, the interaction between travel time and environmental concern is negligible (β = 0.00042, t = 0.26). Product-related factors play a more meaningful role. Resale items significantly increase the likelihood of selecting parcel lockers (β = 0.417, t = 2.78), while fashion products have a positive but non-significant association (β = 0.180, t = 1.38). Toys (β = 0.038, t = 0.20) and pharmaceuticals (β = 0.110, t = 0.55) show no substantial

effects. Service attributes also matter. Same-day delivery availability positively affects parcel locker preference (β = 0.199, t = 1.86). The OrderNowPL variable is statistically significant (β = 0.290, t = 2.43), indicating that recent experience with parcel lockers strongly predicts future stated preference.

Pick-up Point: The ASC for Pick-up Points is negative and non-significant (β = –0.068, t = –0.41), showing no inherent baseline preference relative to home delivery. As with parcel lockers, cost-to-price ratio (β = –0.082, t = –0.71) and travel time (β = 0.001, t = 0.24) are not influential factors. The interaction with environmental concern is also negligible (β = –0.00027, t = –0.16). Product-related factors align with locker findings: resale items significantly increase preference for pick-up points (β = 0.417, t = 2.78), while fashion (β = 0.206, t = 1.59), toys (β = 0.038, t = 0.20), and pharmaceuticals (β = 0.110, t = 0.55) remain non-significant. Behavioural and service-related factors are more relevant. RecentOrders, indicating the number of online purchases in the last two weeks, negatively influences this choice (β = –0.033, t = –2.05), suggesting that frequent online shoppers are less likely to favor pick-up points. Same-day delivery availability has no significant effect (β = –0.061, t = –0.55). In contrast, OrderNowPP is highly significant and positive (β = 0.265, t = 2.76), demonstrating that recent use of pick-up points strongly predicts future preference.

Click-and-collect: The ASC for Click-and-Collect is negative and approaches significance (β = –0.344, t = –1.91), indicating a slight baseline aversion relative to home delivery.Cost-to-price ratio is not a decisive factor (β = –0.082, t = –0.71). Among product types, resale items significantly increase the likelihood of selecting Click-and-Collect (β = 0.417, t = 2.78). Fashion (β = 0.088, t = 0.65), toys (β = 0.038, t = 0.20), and pharmaceuticals (β = 0.110, t = 0.55) have no significant effect. Behavioural variables highlight the role of past experience. OrderNowCC is positive but not significant (β = 0.170, t = 1.30). Cash preference is also non-significant (β = 0.071, t = 0.48). Female respondents show no clear differences in preference (β = –0.034, t = –0.33). Similarly, the number of adults in the household has no influence (β = 0.028, t = 0.52).

Spain

Table 20. Model Estimation Results SP Deliveries: Spain

	ESTIMATE	T-RATIO
Home Deliveries		
ASC_{HD}	0	NA
$RelCost_{HD}$	-0.063	-0.53
Age50Plus	-0.106	-1.17
ChooseDeliveryDay	-0.028	-0.41
SameDayDelivery	-0.004	-0.06
OrderNowHome	0.419	4.48
Female	-0.281	-3.08
HigherEducation	-0.138	-1.62
KidsUnder13	0.058	0.92
DontKnowDist	0.754	2.87
Parcel Lockers		
ASC_{PL}	-0.593	-3.78

	ESTIMATE	T-RATIO
$RelCost_{PL}$	-0.063	-0.53
$TravelTime_{PL}$	-0.003	-0.48
$TravelTime_{PL}$ * $EnvConcern_{PL}$	0.001	0.83
Resale	0.463	2.30
Toys	-0.019	-0.10
$Fashion_{PL}$	0.136	1.09
Pharm	0.056	0.40
$Sameday_{PL}$	0.050	0.46
$OrderNow_{PL}$	0.203	1.47
Pick-up Points		
ASC_{PP}	-0.505	-3.11
$RelCost_{PP}$	-0.063	-0.53
$TravelTime_{PP}$	-0.003	-0.48
$TravelTime_{PP}$ * $EnvConcern_{PP}$	0.001	0.88
Resales	0.463	2.30
Toys	-0.019	-0.10
$Fashion_{PP}$	0.073	0.58
Pharm	0.056	0.40
RecentOrders	-0.019	-1.00
$SameDayDelivery_{PP}$	-0.213	-1.88
PickUpNow	0.288	2.85
Click-and-Collect		
ASC_{CC}	-0.708	-3.85
$RelCost_{CC}$	-0.063	-0.53
Resales	0.463	2.30
Toys	-0.019	-0.10
$Fashion_{CC}$	0.065	0.51
Pharm	0.056	0.40
CashPreference	0.000	0.00
ClickCollectNow	0.378	2.12
Female	-0.079	-0.77
AdultsInHousehold	0.019	0.40
Variation		
ε_{panel}	0.554	15.65
ε_{comp}	-0.030	-0.090
Summary statistics		
Adj.Rho-squared vs equal shares	0.0343	
LL at equal shares, LL(0)	-5711.53	
LL(final)	-5483.44	
Observations	4120	

Home Delivery: The Alternative Specific Constant (ASC) for Home Delivery is fixed at zero as the reference alternative. The relative delivery cost has a small, negative, and non-significant effect ($\beta = -0.063$, $t = -0.53$), showing that price is not a determining factor for Spanish consumers when selecting home delivery. Service-related attributes such as the ability to choose the delivery day

(β = –0.028, t = –0.41) and same-day delivery availability (β = –0.004, t = –0.06) show no meaningful impact on preferences. This indicates that flexibility and speed are not major drivers for choosing home delivery in Spain. Sociodemographic effects reveal notable patterns. Female respondents are significantly less likely to prefer home delivery (β = –0.281, t = –3.08). Respondents with higher education also display a negative tendency toward this method, though not strongly significant (β = –0.138, t = –1.62). Age 50+ (β = –0.106, t = –1.17) and the presence of children under 13 years old (β = 0.058, t = 0.92) do not have meaningful effects. The OrderNowHD variable is highly significant and strongly positive (β = 0.419, t = 4.48), showing that recent use of home delivery strongly predicts future stated preferences for this option. Among service factors, respondents unaware of the distance to the nearest locker are more likely to select this option (β = 0.754, t = 2.87), reflecting a perception of convenience or uncertainty about accessibility.

Parcel Lockers: The ASC for Parcel Lockers is negative and highly significant (β = –0.593, t = –3.78), indicating a general baseline aversion to this method compared to home delivery. Neither relative delivery cost (β = –0.063, t = –0.53) nor travel time to lockers (β = –0.003, t = –0.48) significantly influence preferences. Likewise, the interaction between travel time and environmental concern shows no effect (β = 0.00136, t = 0.83). Product types play a more critical role. Resale items significantly increase the likelihood of using parcel lockers (β = 0.463, t = 2.30). Fashion (β = 0.136, t = 1.09), toys (β = –0.019, t = –0.10), and pharmaceuticals (β = 0.056, t = 0.40) do not have significant effects. In contrast, same-day delivery availability has no meaningful impact (β = 0.050, t = 0.46). Behavioural patterns are important. OrderNowPL is positive but not significant (β = 0.203, t = 1.47), suggesting that recent locker use has some, but not decisive, influence on future stated preferences.

Pick-up Point: The ASC for Pick-up Points is strongly negative and significant (β = –0.505, t = –3.11), showing a baseline aversion compared to home delivery. Neither cost (β = –0.063, t = –0.53) nor travel time (β = –0.003, t = –0.48) significantly affect preferences, and the interaction with environmental concern remains insignificant (β = 0.00145, t = 0.88). Product-related factors again highlight the importance of resale items, which significantly increase the likelihood of using pick-up points (β = 0.463, t = 2.30). Fashion (β = 0.073, t = 0.58), toys (β = –0.019, t = –0.10), and pharmaceuticals (β = 0.056, t = 0.40) are non-significant. Service and behavioural variables play mixed roles. Same-day delivery availability negatively influences preference and approaches significance (β = –0.213, t = –1.88), suggesting that consumers may associate pick-up points with slower or less convenient service. RecentOrders, representing the number of online purchases in the past two weeks, is slightly negative but non-significant (β = –0.019, t = –1.00). In contrast, OrderNowPP is strongly significant and positive (β = 0.288, t = 2.85), showing that recent use of pick-up points is a strong predictor of future preference.

Click-and-collect: The ASC for Click-and-Collect is negative and highly significant (β = –0.708, t = –3.85), indicating a general baseline aversion relative to home delivery. Cost plays no role in shaping preferences (β = –0.063, t = –0.53). Among product types, resale items significantly increase the likelihood of selecting this method (β = 0.463, t = 2.30). Fashion (β = 0.065, t = 0.51), toys (β = –0.019, t = –0.10), and pharmaceuticals (β = 0.056, t = 0.40) remain non-significant. Behavioural factors are important. OrderNowCC is significant and positive (β = 0.378, t = 2.12), showing that recent experience with Click-and-Collect predicts future stated preferences. Cash

preference is neutral and non-significant (β = 0.000, t = 0.00). Neither gender (β = –0.079, t = –0.77) nor number of adults in the household (β = 0.019, t = 0.40) show meaningful effects.

Austria

Table 21. Model Estimation Results SP Deliveries: Austria

	ESTIMATE	T-RATIO
Home Deliveries		
ASC_{HD}	0	NA
$RelCost_{HD}$	-0.091	-0.63
Age50Plus	0.203	2.06
ChooseDeliveryDay	0.036	0.50
SameDayDelivery	-0.001	-0.02
OrderNowHome	0.396	3.66
Female	0.130	1.28
HigherEducation	-0.232	-2.36
KidsUnder13	-0.074	-1.02
DontKnowDist	0.515	1.17
Parcel Lockers		
ASC_{PL}	-0.509	-3.11
$RelCost_{PL}$	-0.091	-0.63
$TravelTime_{PL}$	-0.005	-0.90
$TravelTime_{PL}$ * $EnvConcern_{PL}$	0.000	0.17
Resale	0.349	1.76
Toys	0.263	1.36
$Fashion_{PL}$	-0.030	-0.20
Pharm	0.209	1.43
$Sameday_{PL}$	0.272	2.35
$OrderNow_{PL}$	0.077	0.49
Pick-up Points		
ASC_{PP}	-0.437	-2.58
$RelCost_{PP}$	-0.091	-0.63
$TravelTime_{PP}$	-0.005	-0.90
$TravelTime_{PP}$ * $EnvConcern_{PP}$	0.002	0.93
Resales	0.349	1.76
Toys	0.263	1.36
$Fashion_{PP}$	-0.135	-0.92
Pharm	0.209	1.43
RecentOrders	-0.030	-1.69
$SameDayDelivery_{PP}$	-0.249	-1.93
PickUpNow	0.238	1.72
Click-and-Collect		
ASC_{CC}	-1.012	-5.53
$RelCost_{CC}$	-0.091	-0.63
Resales	0.349	1.76

	ESTIMATE	T-RATIO
Toys	0.263	1.36
$Fashion_{CC}$	0.009	0.06
Pharm	0.209	1.43
CashPreference	0.135	0.73
ClickCollectNow	0.574	2.75
Female	0.229	1.92
AdultsInHousehold	0.032	0.59
Variation		
ε_{panel}	-0.682	-18.45
ε_{comp}	0.057	0.19
Summary statistics		
Adj.Rho-squared vs equal shares	0.0759	
LL at equal shares, LL(0)	-5434.27	
LL(final)	-4989.86	
Observations	3920	

Home Delivery: The Alternative Specific Constant (ASC) for Home Delivery is fixed at zero as the baseline reference. The relative delivery cost has a negative but non-significant effect (β = –0.091, t = –0.63), showing that price does not strongly influence Austrian consumers when selecting home delivery. Among service-related factors, the ability to choose the delivery day (β = 0.036, t = 0.50) and same-day delivery availability (β = –0.001, t = –0.02) are both non-significant, indicating that delivery flexibility and speed do not significantly affect home delivery preference. Sociodemographic variables show some significant effects. Respondents aged 50 years or older are more likely to prefer home delivery (β = 0.203, t = 2.06). Conversely, those with higher education are less likely to favor this method (β = –0.232, t = –2.36). Gender (β = 0.130, t = 1.28) and households with children under 13 (β = –0.074, t = –1.02) are not significant. The OrderNowHome variable is strongly significant and positive (β = 0.396, t = 3.66), showing that recent experience with home delivery is a key predictor of future stated preference for this option. Finaly, distance awareness is positive but non-significant (β = 0.515, t = 1.17).

Parcel Lockers: The ASC for Parcel Lockers is negative and highly significant (β = –0.509, t = –3.11), indicating a strong baseline aversion to parcel lockers compared to home delivery. Neither relative delivery cost (β = –0.091, t = –0.63) nor travel time to lockers (β = –0.005, t = –0.90) have meaningful impacts. The interaction between travel time and environmental concern is also negligible (β = 0.0003, t = 0.17). Product categories influence preferences to a certain degree. Resale items positively affect locker usage (β = 0.349, t = 1.76), approaching significance, while toys also have a positive but non-significant effect (β = 0.263, t = 1.36). Fashion items are slightly negative (β = –0.030, t = –0.20), while pharmaceutical products show a moderate positive association (β = 0.209, t = 1.43). Service-related attributes matter more here. Same-day delivery availability is a significant positive driver (β = 0.272, t = 2.35), highlighting the importance of speed for Austrian consumers using parcel lockers. Recent locker usage (OrderNowPL) is positive but not influential (β = 0.077, t = 0.49).

Pick-up Point: The ASC for Pick-up Points is negative and significant (β = –0.437, t = –2.58), showing a baseline aversion compared to home delivery. As with parcel lockers, neither relative

cost (β = –0.091, t = –0.63) nor travel time (β = –0.005, t = –0.90) significantly affect preferences. The interaction between travel time and environmental concern is slightly positive but not significant (β = 0.0017, t = 0.93). Product-related influences are similar to parcel lockers. Resale items have a near-significant positive effect (β = 0.349, t = 1.76), while toys are positive but non-significant (β = 0.263, t = 1.36). Fashion items are negative (β = –0.135, t = –0.92), and pharmaceutical products remain moderately positive (β = 0.209, t = 1.43). Service and behavioural aspects play a more substantial role:

- Same-day delivery availability has a negative effect and approaches significance (β = –0.249, t = –1.93), indicating potential concerns about reliability or speed for this method.
- RecentOrders, representing the number of online purchases in the past two weeks, is negative and close to significance (β = –0.030, t = –1.69), suggesting that frequent online shoppers may avoid pick-up points.
- OrderNowPP is positive and approaches significance (β = 0.238, t = 1.72), indicating that recent use predicts future preference.

Click-and-collect: The ASC for Click-and-Collect is strongly negative and highly significant (β = –1.012, t = –5.53), reflecting a general baseline aversion to this method compared to home delivery. Cost has no meaningful effect (β = –0.091, t = –0.63). Product type effects are similar to other non-home delivery options:

- Resale items are positively associated with this method (β = 0.349, t = 1.76), nearing significance.
- Toys also have a positive but non-significant effect (β = 0.263, t = 1.36).
- Fashion (β = 0.009, t = 0.06) and pharmaceuticals (β = 0.209, t = 1.43) do not significantly influence preferences.

Behavioural factors strongly shape click-and-collect use. OrderNow_{CC} is highly significant and positive (β = 0.574, t = 2.75), showing that recent experience with this method strongly predicts future choice. Female respondents are more likely to prefer click-and-collect, with a positive and near-significant effect (β = 0.229, t = 1.92). Neither cash payment preference (β = 0.135, t = 0.73) nor number of adults in the household (β = 0.032, t = 0.59) are significant.

3.4. Stated Preference (SP) - Returns

3.4.1. Utility Functions

This subsection introduces the utility functions specified for the different return methods in the SP experiment. The models integrate cost-related factors, service characteristics, and sociodemographic attributes, along with product categories and stated behavioural intentions. This comprehensive design enables the analysis to capture both economic trade-offs and contextual influences shaping return choices. The specification also includes policy-relevant elements, such as incentives and nudging messages, which allow the assessment of strategies aimed at reducing return rates and promoting sustainable behaviour. Interaction terms, such as environmental concern weighted by return cost, are incorporated to reflect the role of personal attitudes and environmental awareness.

Home Return (HR)

$$V_{HR} = ASC_{HR} + \beta_{costHR} \cdot RelCost_{HR} + \beta_{returnperiod} \cdot ReturnPeriod_{HR} + \beta_{env} \cdot (Env_{HR} \cdot Cost_{HR}) + \beta_{returnnowHR} \cdot ReturnNow_{HR} + \beta_{MidHighIncome} \cdot MidHighIncome + \beta_{unemployed} \cdot Unemployed + \beta_{resale} \cdot Resale + \beta_{toys} \cdot Toys + \beta_{fashion} \cdot Fashion + \beta_{pharm} \cdot Pharm + \varepsilon_{panel} + \varepsilon_{comp}$$

where:

ASC_{HR} = Alternative-specific constant for the Home Return method

$RelCost_{HR}$ = Relative cost of returning an item via home pick-up, scaled by purchase price

$ReturnPeriod_{HR}$ = Return period is limited to 7 days

$Env_{HR} \cdot Cost_{HR}$ = Environmental friendliness weighted by the cost of return

$ReturnNow_{HR}$ = Indicates whether the respondent reported choosing Home Return as return method for at least one of their online purchases made in the last two weeks.

MidHighIncome = Monthly net personal income over €2,000

Unemployed = Respondent is unemployed

Resale = Type of most recent online purchase: resaled items, such as second-hand products from online platforms

Toys = Type of most recent online purchase : toys, books, or other small household and consumable items

Fashion = Type of most recent online purchase :fashion-related items, including clothing, accessories, and footwear

Pharm = Type of most recent online purchase : non-prescription pharmaceutical products, such as vitamins and supplements

ε_{panel} = Error component capturing random taste variation

ε_{comp} = Error component capturing random taste variation among Home Return, Parcel lockers / Pick-up Points and Store options, reflecting their similarity in unobserved preferences.

Parcel Lockers/ Pick Up Point (P)

$$V_P = ASC_P + \beta_{costP} \cdot RelCost_P + \beta_{returnperiod} \cdot ReturnPeriod_P + \beta_{urban} \cdot UrbanArea + \beta_{env} \cdot (Env_P \cdot Cost_P) + \beta_{returnnowP} \cdot ReturnNow_P + \beta_{noincomeresponse} \cdot NoIncomeResponse + \beta_{age50Plus} \cdot Age50plus + \beta_{distance} \cdot Distance_P + \beta_{resale} \cdot Resale + \beta_{toys} \cdot Toys + \beta_{fashion} \cdot Fashion + \beta_{pharm} \cdot Pharm + \varepsilon_{panel} + \varepsilon_{comp}$$

where:

ASC_P = Alternative-specific constant for the Parcel Locker return method

$RelCost_P$ = Relative cost of returning via parcel/pick-up point, scaled by product value

$ReturnPeriod_P$ = Return period is limited to 7 days

UrbanArea = Respondent resides in a high-density urban area (>3000 residents/km^2)

$Env_P \cdot Cost_P$ = Environmental friendliness weighted by return cost

$ReturnNow_P$ = Indicates whether the respondent reported choosing Parcel Lockers/Pick-up Point as return method for at least one of their online purchases made in the last two weeks.

NoIncomeResponse = Respondent preferred not to disclose income

Age50Plus = Age 50 years or older

$Distance_P$ = Distance to the nearest parcel locker or pick-up return point

Resale = Type of most recent online purchase: resaled items, such as second-hand products from online platforms

Toys = Type of most recent online purchase : toys, books, or other small household and consumable items
Fashion = Type of most recent online purchase :fashion-related items, including clothing, accessories, and footwear
Pharm = Type of most recent online purchase : non-prescription pharmaceutical products, such as vitamins and supplements
ε_{panel} = Error component capturing random taste variation
ε_{comp} = Error component capturing random taste variation among Home Return, Parcel lockers / Pick-up Points and Store options, reflecting their similarity in unobserved preferences

Store (S)

$$V_S = ASC_S + \beta_{returnperiodS} \cdot ReturnPeriod_S + \beta_{returnnowS} \cdot ReturnNow_S + \beta_{noincomeresponse} \cdot NoIncomeResponse + \beta_{distanceS} \cdot Distance_S + \beta_{resale} \cdot Resale + \beta_{toys} \cdot Toys + \beta_{fashion} \cdot Fashion + \beta_{pharm} \cdot Pharm + \varepsilon_{panel} + \varepsilon_{comp}$$

where:
ASC_{Store}= Alternative Specific Constant for Store return method
ReturnPeriodS = Return period is limited to 7 days
$ReturnNow_S$ = Indicates whether the respondent reported choosing Store as return method for at least one of their online purchases made in the last two weeks
NoIncomeResponse = Respondent preferred not to disclose income
$Distance_S$ = Distance to the nearest store used for returning products
Resale = Type of most recent online purchase: resaled items, such as second-hand products from online platforms
Toys = Type of most recent online purchase : toys, books, or other small household and consumable items
Fashion= Type of most recent online purchase :fashion-related items, including clothing, accessories, and footwear
Pharm = Type of most recent online purchase : non-prescription pharmaceutical products, such as vitamins and supplements
ε_{panel} = Error component capturing random taste variation
ε_{comp} = Error component capturing random taste variation among Home Return, Parcel lockers / Pick-up Points and Store options, reflecting their similarity in unobserved preferences

No Return (NR)

$$V_{NR}^{Percountry} = ASC_{NR} + \beta_{recentreturns} \cdot RecentReturns + \beta_{Refund2.5Per} \cdot Refund2.5Percent + \beta_{Loyaltyreward} \cdot LoyaltyReward + \beta_{Nextpurchasediscount} \cdot NextPurchaseDiscount + \beta_{CO2message} \cdot CO_2Message + \beta_{Airqualitymessage} \cdot AirQualityMessage + \varepsilon_{panel}$$

where:
ASC_{NR} = Alternative Specific Constant for No return
RecentReturns = Number of product returns made in the past two weeks
Refund2.5Percent = Incentive offering 2.5% refund of the purchase amount if the item is not returned
LoyaltyReward = Reward incentive offering €5 or 100 loyalty points if fewer than 2 returns occur annually

NextPurchaseDiscount = Incentive providing 25% discount on the next purchase for not returning the item
CO_2Message = Nudging message: "By not returning, you reduce CO_2 emissions and contribute to the environment."
AirQualityMessage = Nudging message: "Thank you for not returning! You reduce your carbon footprint and improve air quality."
ε_{panel} = Error component capturing random taste variation

A second specification of the No Returns utility function is included to account for cross-country analysis. While the first model is applied separately for each country, the pooled version incorporates country-specific dummies (Poland, Greece, France, Spain) to capture national differences within a single framework, allowing consistent estimation across the full sample.

$$V_{NR}^{AcrossCountries} = V_{NR}^{Percountry} + \beta_{Poland} \cdot Poland + \beta_{Greece} \cdot Greece + \beta_{France} \cdot France + \beta_{Spain} \cdot Spain$$

where:
Poland, Greece, France, Spain = Country dummies indicating the respondent's country of residence (Austria is the reference category for these dummies)

3.4.2. Modelling pooled data

This subsection presents the pooled estimation results across all five countries. By combining the data, the model highlights common behavioural patterns and significant factors influencing the choice of last-mile delivery methods in the overall sample.

Table 22. Model Estimation Results SP Returns: Pooled Data

	ESTIMATE	T-RATIO
Home Returns		
ASC_{HR}	0.119	0.71
$RelCost_{HR}$	-0.733	-4.29
$ReturnPeriod_{HR}$	0.025	0.96
Fashion	-0.190	-1.47
Pharm	-0.326	-2.02
Resale	-0.670	-3.46
Toys	-0.557	-2.42
Env	0.001	0.51
$ReturnNow_{HR}$	1.302	7.19
MidHighIcome	0.071	0.85
Unemployed	0.037	0.26
Parcel Lockers / Pick-up Points		
ASC_P	0.306	1.76
$RelCost_P$	-0.240	-1.51
$ReturnPeriod_P$	0.025	0.96
$Distance_P$	-0.009	-1.36
Fashion	-0.190	-1.47
Pharm	-0.326	-2.02

	ESTIMATE	T-RATIO
UrbanArea	-0.059	-0.76
Resale	-0.670	-3.46
Toys	-0.557	-2.42
Env	0.001	0.51
$ReturnNow_P$	0.570	4.44
NoIncomeResponse	0.191	1.23
Age50Plus	-0.253	-3.09
Store		
ASC_S	1.738	10.90
$ReturnPeriod_S$	0.025	0.96
$Distance_S$	-0.004	-0.72
Fashion	-0.190	-1.47
Resale	-0.670	-3.46
Toys	-0.557	-2.42
Pharm	-0.326	-2.02
$ReturnNow_S$	0.029	0.18
NoIncomeResponse	0.191	1.23
No Return		
ASC_{NR}	0	NA
Refund2.5Percent	0.147	1.89
LoyaltyReward	0.204	2.63
NextPurchaseDiscount	0.176	2.26
RecentReturns	-0.124	-2.83
CO_2Message	0.167	2.14
AirQualityMessage	0.212	2.76
Poland	-1.270	-7.52
Greece	0.826	5.31
France	-0.138	-0.86
Spain	-0.185	-1.16
Variation		
ε_{panel}	-1.383	-49.51
ε_{comp}	1.906	21.07
Summary Statistics		
Adj.Rho-squared vs equal shares	0.2396	
LL at equal shares, LL(0)	-27788.27	
LL(final)	-21096.92	
Observations	20045	

Home Returns: For the Home Return option, the model highlights several influential factors shaping respondent preferences. The cost-to-price ratio of returning an item via home pick-up has a strong and highly significant negative effect ($\beta = -0.733$, $t = -4.29$), indicating that higher costs greatly reduce the likelihood of selecting this method. Product type also plays a key role, as resale items ($\beta = -0.670$, $t = -3.46$), toys ($\beta = -0.557$, $t = -2.42$), and pharmaceuticals ($\beta = -0.326$, $t = -2.02$) are all significantly less likely to be returned through home collection. In contrast, recent behaviour strongly influences future choices, with respondents who had used home return for at

least one of their recent purchases showing a markedly higher probability of choosing it again (β = 1.302, t = 7.19). Sociodemographic factors, such as mid-to-high income (β = 0.071, t = 0.85) and unemployment (β = 0.037, t = 0.27), do not show a meaningful effect in this pooled model. These findings suggest that while home return is highly convenient, it is primarily constrained by cost sensitivity and product characteristics.

Parcel Lockers / Pick-up Points: For Parcel Lockers and Pick-up Points, the relative cost of returns is again negative (β = −0.306, t = −1.76), reflecting moderate sensitivity to price. Accessibility factors are also important, as distance to the nearest return point has a negative impact (β = −0.009, t = −1.36), indicating that longer travel distances reduce the appeal of this method. Similar to home returns, certain product categories are less likely to be associated with this method, including resale items (β = −0.670, t = −3.46), toys (β = −0.557, t = −2.42), and pharmaceuticals (β = −0.326, t = −2.02). Past behaviour strongly predicts future use, with recent experience of returning through lockers or pick-up points positively affecting the likelihood of selecting this option again (β = 0.570, t = 4.44). Age also plays a significant role, as respondents aged 50 or above are less inclined to use this method (β = −0.253, t = −3.09). Living in a high-density urban area has a negative but statistically insignificant effect (β = −0.059, t = −0.76). Overall, this suggests that parcel locker and pick-up point returns are driven by familiarity and accessibility, with distance and demographic factors shaping preferences.

Store Returns: The Store Return option stands out with a strong and highly significant alternative-specific constant (β = 1.738, t = 10.90), showing that, when all other factors are equal, respondents strongly favor returning items directly to a store. Product categories again play a role, with resale items (β = −0.670, t = −3.46) and toys (β = −0.557, t = −2.42) being less commonly returned through stores. Interestingly, neither distance to the store (β = −0.004, t = −0.72) nor recent store return behaviour (β = 0.029, t = 0.18) have a significant effect, suggesting that store returns are perceived as a default, reliable option regardless of convenience or past experience. Respondents who chose not to disclose their income exhibit a slight, non-significant positive association with store returns (β = 0.191, t = 1.23). These results indicate that stores maintain a stable role in the returns ecosystem, driven by habit and trust rather than situational factors.

No Return: For the No Return alternative, several behavioural and policy-related factors are important. Respondents who had made more recent returns are significantly less likely to choose not returning items (β = −0.124, t = −2.83), suggesting a persistent pattern of return behaviour. Incentives play a critical role in encouraging no-return decisions: loyalty rewards, such as a €5 voucher or 100 loyalty points, have the strongest positive influence (β = 0.204, t = 2.63), followed by a 25% discount on the next purchase (β = 0.176, t = 2.26) and a 2.5% refund of the purchase amount (β = 0.147, t = 1.89). Nudging messages are also effective, with the Air Quality message (β = 0.212, t = 2.76) slightly outperforming the CO_2 message (β = 0.167, t = 2.14). Significant cross-country differences are evident: respondents in Greece are much more inclined toward no-return behaviour (β = 0.826, t = 5.31), while those in Poland are far less likely to choose this option (β = −1.271, t = −7.52). France and Spain show small, non-significant negative effects. These findings highlight the potential of targeted incentives and nudging strategies to reduce return volumes, particularly in countries with higher baseline return tendencies.

3.4.3. Modeling results per country

Poland

Table 23. Model Estimation Results SP Returns: Poland

	ESTIMATE	T-RATIO
Home Returns		
ASC_{HR}	0.490	1.52
$RelCost_{HR}$	-0.893	-2.44
$ReturnPeriod_{HR}$	-0.018	-0.29
Fashion	-0.213	-0.72
Pharm	-0.103	-0.29
Resale	-0.721	-1.94
Toys	-0.278	-0.54
Env	0.001	0.18
$ReturnNow_{HR}$	1.320	2.08
MidHighIcome	0.262	0.97
Unemployed	0.474	1.16
Parcel Lockers / Pick-up Points		
ASC_{P}	1.191	3.47
$RelCost_{P}$	0.126	0.41
$ReturnPeriod_{P}$	-0.018	-0.29
$Distance_{P}$	-0.008	-0.54
Fashion	-0.213	-0.72
Pharm	-0.103	-0.29
UrbanArea	0.007	0.04
Resale	-0.721	-1.94
Toys	-0.278	-0.54
Env	0.001	0.18
$ReturnNow_{P}$	0.379	1.37
NoIncomeResponse	0.823	2.00
Age50Plus	-0.647	-3.06
Store		
ASC_{S}	2.663	9.02
$ReturnPeriod_{S}$	-0.018	-0.29
$Distance_{S}$	0.005	0.42
Fashion	-0.213	-0.72
Pharm	-0.103	-0.29
Resale	-0.721	-1.94
Toys	-0.278	-0.54
$ReturnNow_{S}$	0.303	0.63
NoIncomeResponse	0.823	2.00
No Return		
ASC_{NR}	0	NA
Refund2.5Percent	0.138	0.67

	ESTIMATE	T-RATIO
LoyaltyReward	0.430	2.27
NextPurchaseDiscount	0.037	0.19
RecentReturns	-0.331	-1.97
CO_2Message	0.272	1.43
AirQualityMessage	0.205	1.01
Variation		
ε_{panel}	1.609	21.75
ε_{comp}	0.893	2.04
Summary Statistics		
Adj.Rho-squared vs equal shares	0.2921	
LL at equal shares, LL(0)	-5475.86	
LL(final)	-3847.58	
Observations	3950	

Home Returns: For the Home Return option in Poland, the model reveals a moderate sensitivity to the cost-price ration of returning an item via home pick-up, which has a significant negative effect (β = –0.490, t = –1.52). This indicates that higher return costs considerably reduce the likelihood of choosing this method. Among product categories, resale items are significantly less likely to be returned through home collection (β = –0.721, t = –1.94), suggesting that consumers may view these products as less suitable or worth the cost of home returns. Other product categories, such as fashion (β = –0.213, t = –0.72), pharmaceuticals (β = –0.103, t = –0.29), and toys (β = –0.278, t = –0.54), are negative but not statistically significant. Past behaviour plays a pivotal role, as respondents who had previously chosen home return for at least one purchase in the past two weeks are much more likely to select it again (β = 1.320, t = 2.08). Sociodemographic factors such as mid-to-high income (β = 0.262, t = 0.97) and unemployment (β = 0.474, t = 1.16) are positive but not significant, indicating only weak associations. Overall, the home return method in Poland is primarily shaped by cost considerations and habitual use, with product type playing a secondary role.

Parcel Lockers / Pick-up Points: For Parcel Lockers and Pick-up Points, the alternative-specific constant is strongly positive and highly significant (β = 1.191, t = 3.47), indicating a strong underlying preference for this return method compared to home return when all other factors are equal. Interestingly, the relative to price delivery cost of return shows a small, positive, and non-significant coefficient (β = 0.126, t = 0.41), suggesting that cost is not a key determinant for this option. The distance to the nearest return point has a negative but non-significant effect (β = –0.008, t = –0.54), meaning that accessibility does not play a decisive role in this context. Product effects mirror those seen for home return, with resale items being significantly less associated with locker or pick-up returns (β = –0.721, t = –1.94). Age has a strong influence: respondents aged 50 or older are significantly less likely to use lockers or pick-up points (β = –0.647, t = –3.06). Those who did not disclose their income show a strong and significant positive relationship with this method (β = 0.823, t = 2.00), indicating a potential link between privacy concerns and preference for this return option. Familiarity also matters, as prior experience with this method positively influences current choice (β = 0.379, t = 1.37), though the effect is not highly significant. These findings suggest that parcel lockers and pick-up points are popular in Poland, driven largely by habit and demographic preferences rather than economic or accessibility factors.

Store Returns: The Store Return method emerges as the most strongly preferred option, reflected in a very high and highly significant alternative-specific constant (β = 2.663, t = 9.02). This shows that, when all other factors are equal, consumers overwhelmingly favor returning items directly to physical stores. Product-specific effects remain consistent, with resale items (β = –0.721, t = –1.94) less frequently returned through stores, while fashion and toys have negative but non-significant associations. Neither distance to the store (β = 0.005, t = 0.42) nor recent return behaviour through stores (β = 0.303, t = 0.63) significantly influence this choice, suggesting that store returns are considered a default, reliable option irrespective of convenience or past use. Respondents who did not disclose their income are significantly more likely to choose store returns (β = 0.823, t = 2.00), reflecting a potential preference for face-to-face interactions in situations where financial privacy is valued.

No Return: For the No Return alternative, several behavioural and incentive-related factors are relevant. Respondents who had made more recent returns are significantly less likely to choose not returning items (β = –0.331, t = –1.97), highlighting a consistent return behaviour pattern. Among the tested incentives, loyalty rewards, such as a €5 voucher or equivalent loyalty points, have a strong and significant positive effect (β = 0.430, t = 2.27), making them the most effective strategy for encouraging no-return behaviour. In contrast, the 2.5% refund (β = 0.138, t = 0.67) and 25% next purchase discount (β = 0.037, t = 0.19) are positive but not statistically significant, indicating limited motivational power. Nudging strategies show moderate effects, with the CO_2 message (β = 0.272, t = 1.43) and Air Quality message (β = 0.205, t = 1.01) trending positively but not reaching statistical significance. These results suggest that, in Poland, reducing returns through non-monetary messages alone may be insufficient, whereas tangible loyalty-based incentives offer a more promising approach.

Greece

Table 24. Model Estimation Results SP Returns: Greece

	ESTIMATE	T-RATIO
Home Returns		
ASC_{HR}	-0.291	-1.19
$RelCost_{HR}$	-0.593	-1.54
ReturnPeriod	0.061	1.03
Fashion	-0.671	-2.63
Pharm	-0.653	-2.22
Resale	-1.170	-2.32
Toys	-1.653	-2.69
Env	-0.001	-0.31
$ReturnNow_{HR}$	1.064	2.58
MidHighIcome	0.077	0.35
Unemployed	0.058	0.19
Parcel Lockers / Pick-up Points		
ASC_{P}	-0.376	-1.31
$RelCost_{P}$	-0.085	-0.23
ReturnPeriod	0.061	1.03
$Distance_{P}$	-0.009	-0.60

	ESTIMATE	T-RATIO
Fashion	-0.671	-2.63
Pharm	-0.653	-2.22
UrbanArea	-0.017	-0.09
Resale	-1.170	-2.32
Toys	-1.653	-2.69
Env	-0.001	-0.31
$ReturnNow_P$	0.804	2.30
NoIncomeResponse	0.003	0.01
Age50Plus	0.042	0.24
Store		
ASC_S	1.111	5.01
ReturnPeriod	0.061	1.03
$Distance_S$	0.004	0.33
Fashion	-0.671	-2.63
Pharm	-0.653	-2.22
Resale	-1.170	-2.32
Toys	-1.653	-2.69
$ReturnNow_S$	-0.803	-2.02
NoIncomeResponse	0.003	0.01
No Return		
ASC_{NR}	0	NA
Refund2.5Percent	0.043	0.28
LoyaltyReward	-0.040	-0.26
NextPurchaseDiscount	0.194	1.24
RecentReturns	-0.426	-3.12
CO_2Message	0.313	2.06
AirQualityMessage	0.017	0.11
Variation		
ε_{panel}	1.250	20.97
ε_{comp}	-1.980	-11.99
Summary Statistics		
Adj.Rho-squared vs equal shares	0.2193	
LL at equal shares, LL(0)	-5718.46	
LL(final)	-4435.22	
Observations	4125	

Home Returns: For the Home Return option in Greece, the relative cost of returning an item via home pick-up has a strong negative effect ($\beta = -0.291$, $t = -1.19$), indicating that higher return costs significantly reduce the likelihood of selecting this method. Product type plays a major role: resale items ($\beta = -1.170$, $t = -2.32$), fashion items ($\beta = -0.671$, $t = -2.63$), pharmaceutical products ($\beta = -0.653$, $t = -2.22$), and especially toys and small household consumables ($\beta = -1.653$, $t = -2.69$) are all strongly and significantly associated with a lower probability of being returned via home collection. This pattern suggests that consumers in Greece prefer alternative return methods for these product categories, potentially due to lower perceived value or higher convenience of other return channels. On the other hand, respondents with recent experience using home returns are

much more likely to select this option again (β = 1.064, t = 2.58), highlighting the importance of habit and familiarity. Sociodemographic factors such as mid-to-high income (β = 0.077, t = 0.35) and unemployment (β = 0.058, t = 0.19) are positive but not statistically significant, showing no strong evidence of influence. Overall, the results suggest that for Greek consumers, home return is primarily chosen by those with prior experience, but its use is strongly limited for certain product categories and sensitive to cost.

Parcel Lockers / Pick-up Points: For Parcel Lockers and Pick-up Points, the alternative-specific constant is negative and non-significant (β = −0.376, t = −1.31), indicating a lack of inherent preference for this method compared to home return. The relative to price cost of return has a small negative but non-significant effect (β = −0.085, t = −0.23), showing that cost is not a decisive factor for this channel. Similarly, distance to the nearest locker or pick-up point is negative and non-significant (β = −0.009, t = −0.60), suggesting that accessibility does not strongly influence choice. The product effects are consistent with those observed for home return: resale items (β = −1.170, t = −2.32), fashion (β = −0.671, t = −2.63), pharmaceutical products (β = −0.653, t = −2.22), and toys (β = −1.653, t = −2.69) are all significantly less likely to be returned through lockers or pick-up points. A key driver of this method is recent usage, with a strong positive effect of prior experience (β = 0.804, t = 2.30), indicating that habit plays a critical role in encouraging this return option. Other demographic factors, such as urban residence (β = −0.017, t = −0.09), age 50+ (β = 0.042, t = 0.24), and undisclosed income (β = 0.003, t = 0.01), are negligible and non-significant. These findings suggest that while lockers and pick-up points are not inherently preferred, familiarity strongly encourages their use, whereas product type remains a strong deterrent.

Store Returns: The Store Return method shows a strong and highly significant alternative-specific constant (β = 1.111, t = 5.01), indicating that Greek consumers display a strong underlying preference for returning items directly to physical stores. Product type again has a significant negative influence, with resale items (β = −1.170, t = −2.32), fashion products (β = −0.671, t = −2.63), and toys (β = −1.653, t = −2.70) less likely to be returned in-store. Unlike other return methods, recent use of store returns shows a significant negative effect (β = −0.803, t = −2.02), suggesting that repeated use may lead to decreased satisfaction or a tendency to explore other return channels. Factors such as distance to the store (β = 0.004, t = 0.33) and undisclosed income (β = 0.003, t = 0.01) are non-significant, indicating that convenience and privacy concerns do not play a major role in store returns. Overall, this method emerges as the default preferred option, but its dominance is moderated by product type and declining satisfaction among frequent users.

No Return: For the No Return alternative, behavioural and nudging factors play a key role. Respondents who had more recent return experiences are significantly less likely to choose not returning items (β = −0.426, t = −3.12), indicating that habitual returners are unlikely to shift toward a no-return behaviour. Among the tested incentives, only the 25% next purchase discount shows a positive trend (β = 0.194, t = 1.24), though it is not statistically significant, while loyalty rewards (β = −0.040, t = −0.26) and the 2.5% refund (β = 0.043, t = 0.28) appear ineffective. The CO_2 nudging message, emphasizing environmental benefits of avoiding returns, has a significant positive impact (β = 0.313, t = 2.06), showing that environmental awareness can successfully encourage no-return decisions. In contrast, the air quality message is positive but not significant (β = 0.017, t = 0.11). These findings highlight that, in Greece, promoting no-return behaviour is most effective

through environmental nudging rather than financial incentives, with recent return habits being the main barrier to change.

France

Table 25. Model Estimation Results SP Returns: France

	ESTIMATE	T-RATIO
Home Returns		
ASC_{HR}	0.467	1.47
$RelCost_{HR}$	-0.372	-1.03
ReturnPeriod	0.037	0.64
Fashion	0.112	0.37
Pharm	-0.236	-0.47
Resale	-0.220	-0.57
Toys	-0.556	-1.13
Env	-0.005	-1.57
$ReturnNow_{HR}$	0.536	1.36
MidHighIcome	-0.131	-0.78
Unemployed	-0.406	-1.41
Parcel Lockers / Pick-up Points		
ASC_{P}	0.596	1.88
$RelCost_{P}$	-0.011	-0.03
ReturnPeriod	0.037	0.64
$Distance_{P}$	-0.011	-0.80
Fashion	0.112	0.37
Pharm	-0.236	-0.47
UrbanArea	-0.073	-0.46
Resale	-0.220	-0.57
Toys	-0.556	-1.13
Env	-0.005	-1.57
$ReturnNow_{P}$	0.774	2.87
Resale	-0.220	-0.57
NoIncomeResponse	0.195	0.41
Age50Plus	-0.260	-1.55
Store		
ASC_{S}	1.802	6.30
ReturnPeriod	0.037	0.64
$Distance_{S}$	-0.012	-1.04
Fashion	0.112	0.37
Pharm	-0.236	-0.47
Resale	-0.220	-0.57
Toys	-0.556	-1.13
$ReturnNow_{S}$	-0.317	-0.94
Resale	-0.220	-0.57
NoIncomeResponse	0.195	0.41

	ESTIMATE	T-RATIO
No Return		
ASC_{NR}	0	NA
Refund2.5Percent	0.229	1.29
LoyaltyReward	0.467	2.74
NextPurchaseDiscount	0.324	1.86
RecentReturns	-0.051	-0.55
CO_2Message	0.082	0.46
AirQualityMessage	0.251	1.48
Variation		
ε_{panel}	-1.216	-21.19
ε_{comp}	2.111	11.50
Summary Statistics		
Adj.Rho-squared vs equal shares	0.2072	
LL at equal shares, LL(0)	-5448.14	
LL(final)	-4290.21	
Observations	3930	

Home Returns: For the Home Return method in France, the relative cost of return has a negative effect ($\beta = -0.467$, $t = -1.47$), suggesting that higher costs discourage the use of home collection, though the effect is not statistically significant. Among product categories, toys and small household consumables show a notable negative relationship ($\beta = -0.556$, $t = -1.13$), indicating that these items are less likely to be returned through home collection. In contrast, fashion products show a small, non-significant positive effect ($\beta = 0.112$, $t = 0.37$), while pharmaceutical products ($\beta = -0.236$, $t = -0.47$) and resale items ($\beta = -0.220$, $t = -0.57$) are slightly less likely to be returned via this method. Environmental concern, when weighted by return cost, shows a negative trend ($\beta = -0.005$, $t = -1.57$), indicating that environmentally conscious individuals may be less inclined to choose home returns, though the evidence is not statistically strong. The recent experience of using home return positively influences the likelihood of choosing this option again ($\beta = 0.536$, $t = 1.36$), highlighting the role of habit, though this effect is only moderately significant. Sociodemographic factors such as mid-to-high income ($\beta = -0.131$, $t = -0.78$) and unemployment ($\beta = -0.406$, $t = -1.41$) are negative but not significant, showing limited influence. Overall, while home return is influenced by cost sensitivity and certain product types, habitual use remains a key driver.

Parcel Lockers / Pick-up Points: For Parcel Lockers and Pick-up Points, the alternative-specific constant is positive ($\beta = 0.596$, $t = 1.88$), suggesting a modest inherent preference for this return method. Cost-related effects are minimal, as relative to price cost of return ($\beta = -0.011$, $t = -0.03$) and distance to the nearest point ($\beta = -0.011$, $t = -0.80$) are negligible and not statistically significant. Product-level effects mirror those of home return: toys ($\beta = -0.556$, $t = -1.13$) are the least likely to be returned via this channel, while fashion products ($\beta = 0.112$, $t = 0.37$) and pharmaceutical items ($\beta = -0.236$, $t = -0.47$) have no meaningful impact. Resale products also show a negative association ($\beta = -0.220$, $t = -0.57$). Environmental concern again trends negatively ($\beta = -0.005$, $t = -1.57$), suggesting that eco-conscious respondents may be less inclined to use this method, though the effect is only marginal. The strongest predictor is recent use, with a significant positive effect ($\beta = 0.774$, $t = 2.87$), indicating that familiarity greatly increases the

likelihood of choosing parcel lockers or pick-up points. Demographic factors, such as urban residence (β = –0.073, t = –0.46), age 50+ (β = –0.260, t = –1.55), and undisclosed income (β = 0.195, t = 0.41), have no significant influence. This highlights that habit is the dominant factor driving preference for this method.

Store Returns: The Store Return method stands out as the most preferred option, with a very strong and highly significant alternative-specific constant (β = 1.802, t = 6.30). This suggests a strong baseline preference among French consumers for returning items directly to physical stores. While the distance to the store has a small negative effect (β = –0.012, t = –1.04), it is not statistically significant, indicating that proximity plays only a minor role. Product types follow similar trends as other methods, with toys again less likely to be returned (β = –0.556, t = –1.13), while fashion (β = 0.112, t = 0.37) and resale items (β = –0.220, t = –0.57) show no meaningful effect. Interestingly, recent experience with store returns has a negative but non-significant impact (β = –0.317, t = –0.94), suggesting that frequent use may slightly decrease preference, though not decisively. Overall, store returns remain the dominant choice due to strong consumer familiarity and trust.

No Return: For the No Return alternative, several behavioural drivers emerge. Loyalty rewards, such as receiving points or vouchers for reduced returns, have the strongest and most significant positive effect (β = 0.467, t = 2.74), making them the most effective strategy to encourage no-return behaviour. The 25% discount on a future purchase also shows a positive effect (β = 0.324, t = 1.86), though at a slightly lower level of significance, while the 2.5% refund is positive but not significant (β = 0.229, t = 1.29). Among the nudging strategies, the air quality message encouraging environmental responsibility shows a positive relationship (β = 0.251, t = 1.48), whereas the CO_2 reduction message has a smaller and non-significant effect (β = 0.082, t = 0.46). Recent return behaviour is negative but not significant (β = –0.051, t = –0.55), indicating only a weak tendency for habitual returners to resist shifting to a no-return approach. These results indicate that in France, behavioural incentives—particularly loyalty rewards—are the most promising avenue to promote sustainable return practices, while nudging messages play a secondary role.

Spain

Table 26. Model Estimation Results SP Returns: Spain

	ESTIMATE	T-RATIO
Home Returns		
ASC_{HR}	0.429	1.51
$RelCost_{HR}$	-0.777	-1.98
ReturnPeriod	0.003	0.06
Fashion	-0.060	-0.22
Pharm	0.012	0.03
Resale	0.330	0.67
Toys	0.026	0.06
Env	0.001	0.47
$ReturnNow_{HR}$	1.427	4.21
MidHighIcome	-0.244	-1.35

	ESTIMATE	T-RATIO
Unemployed	-0.123	-0.46
Parcel Lockers / Pick-up Points		
ASC_P	0.287	0.92
$RelCost_P$	-0.981	-2.34
ReturnPeriod	0.003	0.06
$Distance_P$	-0.013	-0.82
Fashion	-0.060	-0.22
Pharm	0.012	0.03
UrbanArea	-0.178	-0.99
Resale	0.330	0.67
Toys	0.026	0.06
Env	0.001	0.47
$ReturnNow_P$	0.795	2.47
NoIncomeResponse	-0.405	-1.15
Age50Plus	-0.178	-0.97
Store		
ASC_S	1.795	6.93
ReturnPeriod	0.003	0.06
$Distance_S$	-0.015	-1.29
Fashion	-0.060	-0.22
Pharm	0.012	0.03
Resale	0.330	0.67
Toys	0.026	0.06
$ReturnNow_S$	0.242	0.61
NoIncomeResponse	-0.405	-1.15
No Return		
ASC_{NR}	0	NA
Refund2.5Percent	0.145	0.86
LoyaltyReward	0.139	0.79
NextPurchaseDiscount	0.153	0.89
RecentReturns	0.016	0.12
CO_2Message	0.224	1.29
AirQualityMessage	0.281	1.70
Variation		
ε_{panel}	1.394	21.92
ε_{comp}	-1.847	-9.18
Summary Statistics		
Adj.Rho-squared vs equal shares	0.2332	
LL at equal shares, LL(0)	-5711.53	
LL(final)	-4350.72	
Observations	4120	

Home Returns: For the Home Return method in Spain, the relative cost of return has a negative and significant effect (β = –0.429, t = –1.51), indicating that higher costs strongly discourage consumers from selecting home collection for returns. Product categories show no statistically

significant influence: fashion items (β = –0.060, t = –0.22), toys and small household goods (β = 0.026, t = 0.06), resale items (β = 0.330, t = 0.67), and pharmaceutical products (β = 0.012, t = 0.03) all exhibit negligible effects. Environmental concern, when weighted by return cost, is also insignificant (β = 0.001, t = 0.47). The strongest driver of home return usage is recent behaviour, as respondents who had previously used home return in the past two weeks were much more likely to select it again (β = 1.427, t = 4.21). Socioeconomic factors such as mid-to-high income (β = –0.244, t = –1.35) and unemployment (β = –0.123, t = –0.46) are negative but not statistically significant. Overall, while cost is a key deterrent, the habitual use of home return emerges as the most consistent factor influencing this choice.

Parcel Lockers / Pick-up Points: For Parcel Lockers and Pick-up Points, the relative cost of return is a strong negative predictor (β = –0.981, t = –2.34), highlighting cost sensitivity for this method. The distance to the nearest return point has a small negative but non-significant effect (β = –0.013, t = –0.82), indicating that distance plays a minor role in Spain. Demographic factors such as urban residence (β = –0.178, t = –0.97), age 50+ (β = –0.179, t = –0.98), and undisclosed income (β = –0.405, t = –1.15) do not significantly influence preferences. As with home return, product categories including fashion (β = –0.060, t = –0.22),, pharmaceuticals (β = 0.012, t = 0.03), resale items (β = 0.330, t = 0.67), and toys (β = 0.026, t = 0.06) have no significant impact. The strongest predictor is recent use, where respondents with prior experience using lockers or pick-up points were significantly more likely to select this method again (β = 0.795, t = 2.47). These results suggest that cost remains the dominant factor, while habit reinforces continued use.

Store Returns: The Store Return method is clearly favored, as shown by its very strong and highly significant alternative-specific constant (β = 1.795, t = 6.93). This reflects a strong inherent consumer preference for returning items directly to physical stores. The distance to the store has a negative but non-significant effect (β = –0.015, t = –1.29), suggesting that proximity has only a minor influence on choice. Product categories again show no significant effects, including fashion (β = –0.060, t = –0.22), resale (β = 0.330, t = 0.67), and toys (β = 0.026, t = 0.06). The effect of recent return experience is small and non-significant (β = 0.242, t = 0.61), indicating that even first-time or infrequent users strongly prefer this method. Collectively, these findings highlight store returns as the default, trusted option for Spanish consumers, largely independent of other factors.

No Return: For the No Return alternative, none of the tested strategies show strong statistical significance, though some positive trends are present. Among the incentive-based approaches, the 2.5% refund (β = 0.145, t = 0.86), loyalty rewards (β = 0.139, t = 0.79), and 25% next purchase discount (β = 0.153, t = 0.89) all have positive but non-significant effects, suggesting a weak influence on behaviour. Environmental nudging shows slightly stronger effects, with the air quality message producing the highest positive response (β = 0.281, t = 1.70), followed by the CO_2 reduction message (β = 0.224, t = 1.29, though neither reaches full significance. The number of recent returns has no meaningful impact (β = 0.016, t = 0.12). Overall, while environmental messaging appears somewhat more effective than financial incentives, no single factor strongly drives no-return behaviour in Spain, indicating a need for more compelling strategies to encourage this sustainable practice.

Austria

Table 27. Model Estimation Results SP Returns: Austria

	ESTIMATE	T-RATIO
Home Returns		
ASC_{HR}	-0.080	-0.24
$RelCost_{HR}$	-0.222	-0.49
ReturnPeriod	0.043	0.71
Fashion	-0.055	-0.17
Pharm	-0.592	-1.60
Resale	-1.370	-2.71
Toys	-0.495	-0.97
Env	0.006	2.02
$ReturnNow_{HR}$	1.688	4.21
MidHighIcome	0.228	1.18
Unemployed	-0.034	-0.09
Parcel Lockers / Pick-up Points		
ASC_{P}	0.303	0.91
$RelCost_{P}$	-0.738	-1.65
ReturnPeriod	0.043	0.71
$Distance_{P}$	-0.004	-0.26
Fashion	-0.055	-0.17
Pharm	-0.592	-1.60
UrbanArea	-0.020	-0.11
Resale	-1.370	-2.71
Toys	-0.495	-0.97
Env	0.006	2.02
$ReturnNow_{P}$	0.268	0.99
NoIncomeResponse	0.455	1.56
Age50Plus	-0.247	-1.31
Store		
ASC_{S}	1.798	6.04
ReturnPeriod	0.043	0.71
$Distance_{S}$	-0.000	-0.01
Fashion	-0.055	-0.17
Pharm	-0.592	-1.60
Resale	-1.370	-2.71
Toys	-0.495	-0.97
$ReturnNow_{S}$	0.390	1.36
NoIncomeResponse	0.455	1.56
No Return		
ASC_{NR}	0	NA
Refund2.5Percent	0.207	1.17
LoyaltyReward	0.075	0.411
NextPurchaseDiscount	0.145	0.79

	ESTIMATE	T-RATIO
RecentReturns	-0.105	-1.41
CO_2Message	-0.092	-0.50
AirQualityMessage	0.326	1.86
Variation		
ε_{panel}	1.432	21.71
ε_{comp}	2.069	9.62
Summary Statistics		
Adj.Rho-squared vs equal shares	0.2436	
LL at equal shares, LL(0)	-5434.27	
LL(final)	-4081.73	
Observations	3920	

Home Returns: For Home Returns in Austria, the relative cost of return has a negative but non-significant effect (β = –0.080, t = –0.24), suggesting that higher costs slightly discourage the selection of this method, though without strong evidence. Product type effects vary, with resale items showing a strong and significant negative relationship (β = –1.370, t = –2.71), indicating that consumers are considerably less likely to use home returns for second-hand products. Pharmaceuticals also have a negative but weaker effect (β = –0.592, t = –1.60), while fashion items (β = –0.055, t = –0.17) and toys or other small household goods (β = –0.495, t = –0.97) are not significant. Environmental concern, when weighted by return cost, is positive and statistically significant (β = 0.006, t = 2.02), showing as environmental concern increases, the negative impact of return cost is reduced. The strongest driver of home returns is previous behaviour, with respondents who recently used home returns being highly likely to choose it again (β = 1.688, t = 4.21). Socioeconomic factors such as mid-to-high income (β = 0.228, t = 1.18) and unemployment (β = –0.034, t = –0.09) are not significant. Overall, habitual behaviour and environmental awareness are key motivators, while resale products and certain categories strongly deter home return selection.

Parcel Lockers / Pick-up Points: For Parcel Lockers and Pick-up Points, the relative to price cost of return plays a major role, showing a negative and statistically significant effect at the 90% level (β = –0.738, t = –1.65), indicating that higher costs reduce the likelihood of choosing this method. The distance to the nearest return point is slightly negative but insignificant (β = –0.004, t = –0.26). As with home returns, resale products strongly discourage the use of lockers and pick-up points (β = –1.370, t = –2.71), while pharmaceuticals have a moderate negative effect (β = –0.592, t = –1.60). Other product categories, such as fashion (β = –0.055, t = –0.17) and toys (β = –0.495, t = –0.97), show no significant influence. The interaction between environmental concern and return relative to price cost is positive and significant (β = 0.006, t = 2.02), indicating that environmentally conscious consumers are less deterred by higher return costs. The effect of previous use is positive but not significant (β = 0.268, t = 0.99), showing a weaker habitual component compared to home returns. Demographic factors like urban residence (β = –0.020, t = –0.11), age 50+ (β = –0.247, t = –1.31), and undisclosed income (β = 0.455, t = 1.56) do not play a significant role.

Store Returns: The Store Return method demonstrates the strongest overall appeal, with a highly significant and positive alternative-specific constant (β = 1.798, t = 6.04). This indicates a strong

inherent preference for returning products to physical stores, independent of other factors. The distance to the store has virtually no effect (β = –0.000, t = –0.01), suggesting that consumers are willing to travel to return items. Product categories again mirror the earlier patterns: resale products strongly discourage store returns (β = –1.370, t = –2.71), while fashion items (β = –0.055, t = –0.17) and toys (β = –0.495, t = –0.97) are non-significant. The influence of recent store return use is positive but not strongly significant (β = 0.390, t = 1.36). Consumers who preferred not to disclose their income show a positive but moderate relationship with this return option (β = 0.455, t = 1.56). Overall, the findings highlight store returns as a highly trusted and dominant return method for Austrian consumers.

No Return: For the No Return alternative, environmental and financial incentives have mixed effects. The air quality message has the strongest positive influence (β = 0.326, t = 1.86), indicating that environmental nudges can encourage consumers to forgo returns. In contrast, the CO_2 message has a small negative and insignificant effect (β = –0.092, t = –0.50). Financial incentives such as a 2.5% refund (β = 0.207, t = 1.17), loyalty rewards (β = 0.075, t = 0.41), and a 25% discount on the next purchase (β = 0.143, t = 0.78) all show positive but non-significant effects. The number of recent returns has a negative and nearly significant effect (β = –0.105, t = –1.41), suggesting that frequent returners are less likely to be persuaded to adopt a no-return option. These results indicate that environmental messaging—particularly emphasizing air quality—is somewhat more effective than financial incentives in promoting no-return behaviour, though the overall impact remains limited.

3.5. Cross-Cutting Observations

The combined analysis of delivery and return preferences reveals a consistent hierarchy of decision drivers across countries and product categories. Cost remains the dominant factor, with higher delivery or return fees significantly reducing the likelihood of selecting a given option. Convenience, expressed through shorter travel distances and faster delivery times, also plays a central role, especially for urgent product types such as pharmaceuticals, where consumers show the highest willingness to pay for time savings.

For return behaviours, consumers place clear value on flexibility. The availability of a seven-day return window significantly increases the attractiveness of both Home Return and Parcel Locker Return, while incentives such as discounts or loyalty rewards can nudge consumers toward more sustainable behaviours. These include choosing to not return low-value items, which has potential environmental and operational benefits for retailers and logistics providers.

Across countries, notable contextual differences were observed:

- In Poland, Parcel Lockers dominate as the preferred delivery and return method, reflecting a mature, widespread network and strong consumer familiarity.
- Greece and Spain exhibit high price sensitivity, with cost being the decisive factor for both delivery and return choices.
- Austria and France display more balanced preferences, with moderate responsiveness to convenience attributes and environmental information.

Environmental considerations play a secondary but substantial role. While they are not the primary drivers of choice, integrating environmental information—particularly when linked to cost—can subtly shift preferences toward greener options, especially for out-of-home returns.

These findings demonstrate the need for tailored strategies when promoting sustainable e-commerce practices. Policies and interventions must account for national contexts, product types, and the trade-offs consumers face between cost, convenience, and sustainability. This ensures that behavioural measures and pilot interventions are both locally relevant and scalable across different markets.

4. Willingness-to-pay

The willingness-to-pay (WTP) estimates provide valuable insights into how much consumers are prepared to pay for changes in delivery attributes such as travel time, delivery speed, and environmental impact. These values were calculated using the marginal rate of substitution between the attribute coefficients and the cost coefficient in the utility functions.

4.1. Deliveries

To calculate willingness-to-pay (WTP) measures, the model specification was adjusted to explicitly link attributes with cost. In particular, the utility functions for each delivery option were formulated to include delivery cost, scaled by the self-reported product price, alongside relevant service attributes. For parcel lockers and pick-up points, travel time to the collection location was introduced, with additional interaction terms capturing (i) the effect of environmental concerns on the disutility of travel time, and (ii) the differences in sensitivity to travel time across delivery types. The new modified utilities are presented below:

Home Deliveries (HD)

$$V_{HD} = ASC_{HD} + \beta_{Cost} \cdot RelCost_{HD} + \beta_{UnknownDistanceHD} \cdot UnknownDistance + \beta_{ChooseDeliveryDayHD} \cdot ChooseDeliveryDay + \beta_{SameDayDeliveryHD} \cdot SameDayDelivery + \beta_{OrderNowHD} \cdot OrderNow_{HD} + \beta_{FemaleHD} \cdot Female + \beta_{HigherEduHD} \cdot HigherEducation + \beta_{KidsUnder13HD} \cdot KidsUnder13 + \beta_{Age50PlusHD} \cdot Age50Plus + \beta dontknowdist \cdot DontKnowDist + \beta_{Poland} \cdot Poland + \beta_{Greece} \cdot Greece + \beta_{France} \cdot France + \beta_{Spain} \cdot Spain + \varepsilon_{panel} + \varepsilon_{comp}$$

where:

ASC_{HD} = Alternative Specific Constant for selecting the Home Delivery option.

$RelCost_{HD}$ = Delivery cost for Home Delivery, expressed relative to the value of the most recent online purchase.

UnknownDistance = Dummy variable indicating whether the respondent did not know the travel time to the nearest pick-up/locker point

ChooseDeliveryDay = Whether the respondent had the option to select the delivery date for the Home Delivery option

SameDayDelivery = delivery time for Home Delivery within the same day

$OrderNow_{HD}$ = Indicates whether the respondent reported choosing Home Delivery as the delivery method for at least one of their online purchases made in the last two weeks.

Female = Female respondent or not

HigherEducation = completed higher education (bachelor's degree or higher)
KidsUnder13 = Total number of children in the household under 13 years of age
Age50Plus = Age 50 years or older
Poland, Greece, France, Spain = Country dummies indicating the respondent's country of residence (Austria is the reference category for these dummies)
ε_{panel} = Error component capturing random taste variation
ε_{comp} = Error component capturing random taste variation between Home Delivery and Click-and-Collect options, reflecting their similarity in unobserved preferences.

Parcel Lockers (PL)

$$V_{PL} = ASC_{PL} + \beta_{cost} \cdot RelCost_{PL} + \beta_{tt} \cdot TravelTime_{PL} \cdot ProductType + \beta_{ttPL} \cdot (TravelTime_{PL} \cdot EnvConcern_{PL}) + \beta_{deldaypl} \cdot SameDay_{PL} + \beta_{ordernowpl} \cdot OrderNow_{PL} + \varepsilon_{PL}$$

where:
ASC_{PL} = Alternative specific constant for the Parcel Locker delivery method.
$RelCost_{PL}$= Delivery cost for parcel locker, expressed relative to the value of the most recent online purchase.
$TravelTime_{PL}$ = Reported travel time required to reach the nearest parcel locker collection point.
ProductType=Electronics or Pharmaceuticals
$EnvConcern_{PL}$ = Stated importance of environmental impact as a factor in delivery preferences.
$SameDay_{PL}$ = Availability of same-day delivery for the parcel locker option.
$DontKnowDist_{PL}$ = People that don't know the distance of the nearest locker/pick up point
$OrderNow_{PL}$ = Indicates whether the respondent reported choosing Parcel Lockers as the delivery method for at least one of their online purchases made in the last two weeks.
ε_{panel} = Error component capturing random taste variation

Pick-up Point (PP)

$$V_{PP} = ASC_{PP} + \beta_{cost} \cdot RelCost_{PP} + \beta_{tt} \cdot TravelTime_{PP} \cdot ProductType + \beta_{ttPP} \cdot (TravelTime_{PP} \cdot EnvConcern_{PP}) + \beta_{deldayPP} \cdot SameDayDelivery_{PP} + \beta_{OrderNowPP} \cdot OrderNow_{PP} + \beta_{numprod} \cdot RecentOrders + \varepsilon_{panel}$$

where:
ASC_{PP} = Alternative Specific Constant for Pick up Point
$RelCost_{PP}$ = Delivery cost for pick-up point return relative to product price.
$TravelTime_{PP}$ = Reported time to reach the pick-up point or designated return location.
ProductType=Electronics or Pharmaceuticals
$EnvConcern_{PP}$ = Self-assessed environmental impact of using the pick-up point.
$SameDayDelivery_{PP}$ = Ability to receive delivery from pick-up point within the same day.
$OrderNow_{PP}$ = Indicates whether the respondent reported choosing Pick-up Points as the delivery method for at least one of their online purchases made in the last two weeks.
$DontKnowDist_{PP}$ = People that don't know the distance of the nearest locker/pick up point
RecentOrders = Number of online purchases in the last two weeks.
ε_{panel} = Error component capturing random taste variation

Click-and-Collect (CC)

$V_{CC} = ASC_{CC} + \beta_{cost} \cdot RelCost_{CC} + \beta_{ordernowCC} \cdot OrderNow_{CC} + \beta_{cash} \cdot CashPreference + \beta_{gender} \cdot Female + \beta_{adultsinhousehold} \cdot AdultsInHousehold + \varepsilon_{panel} + \varepsilon_{comp}$

where:
ASC_{CC} = Alternative Specific Constant for Click-and-Collect
$RelCost_{CC}$ = Relative cost of Click & Collect compared to the price range of the last online purchase
$OrderNow_{CC}$ = Indicates whether the respondent reported choosing Click-and-Collect as the delivery method for at least one of their online purchases made in the last two weeks.
CashPreference = Respondent uses cash on delivery as a preferred online payment method
Female = Respondent's gender is female
AdultsInHousehold = Number of adults in the household
ε_{panel} = Error component capturing random taste variation
ε_{comp} = Error component capturing random taste variation between Home Delivery and Click-and-Collect options, reflecting their similarity in unobserved preferences.

Results are presented for key product categories (electronics, resale items, fashion, and pharmaceuticals) and for different delivery methods, including Home Delivery, Parcel Lockers, and Pick-Up Points. The WTP varies significantly across product categories, reflecting differences in consumer priorities. For instance, pharmaceuticals show the highest WTP for reduced travel time, indicating urgency and perceived importance, whereas resale items exhibit lower WTP, suggesting cost sensitivity.

Table 28. WTP Estimates for Delivery Methods by Product Category and Price

Product Price (€)	Pick-up Point (PP) WTP (€)	Parcel Locker (PL) WTP (€)
Electronics		
10	0.16	0.25
20	0.32	0.49
30	0.48	0.74
40	0.65	0.99
50	0.81	1.23
Pharmaceuticals		
10	0.46	0.67
20	0.92	1.34
30	1.39	2.01
40	1.85	2.67
50	2.31	3.34

Notes for the table:

1) WTP interpretation: WTP values are expressed in euros and represent the additional amount respondents are willing to pay for an improvement in the specified attribute (e.g., faster delivery or reduced travel time).

- Positive WTP: Respondents are willing to pay extra.

2) Baseline delivery method: Home Delivery serves as the reference alternative for comparison.

3) Cost scaling: Delivery costs are scaled relative to the product purchase price, ensuring comparability across different price levels.

4) Product categories analysed:

- Electronics;
- Pharmaceuticals (non-prescription items such as vitamins and supplements).

5) Travel time interpretation: WTP reflects the value of reducing travel time to the collection point (e.g., Parcel Lockers or Pick-up Points).

6) Environmental concern interaction: The WTP calculations account for environmental impact as an additional factor influencing preferences. To calculate the value of time (VoT), we assumed a mid-point level of environmental concern (3 on a 5-point scale), which was used when computing the interaction term between travel time and environmental concern

7) Exclusions: Fresh groceries and ready-meal deliveries were excluded to maintain consistency with the stated preference experiment design.

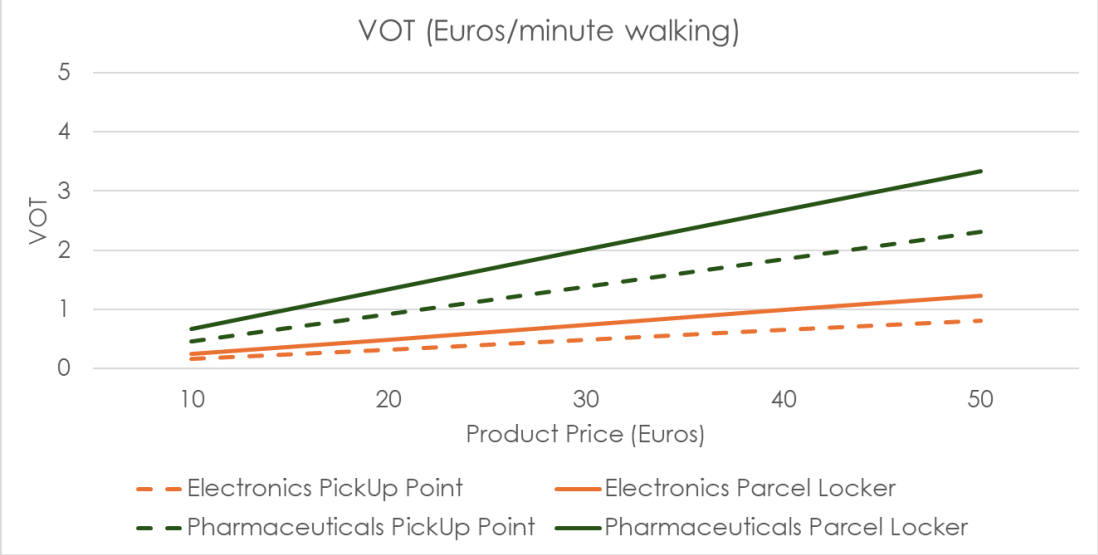

Figure 2. Value of Time

4.2. Returns

This section presents the willingness to pay (WTP) estimates for different return methods, segmented by product category and purchase price. The analysis focuses on three return options: Home Return, where items are collected directly from the customer's address; Parcel Locker Return, where customers drop off items at designated lockers or collection points; and an additional seven-day return window, which captures the added value consumers place on extended return flexibility.

To calculate willingness-to-pay (WTP) for reducing return distance by one unit, the model specification was adjusted to explicitly link return attributes with cost. In particular, the utility functions for each return option were formulated to include return cost, scaled by the self-

reported product price, and distance to the return point interacted with product type. The new modified utilities are presented below.

Home Return (HR)

$V_{HR} = ASC_{HR} + \beta_{costHR} \cdot RelCost_{HR} + \beta_{returnperiod} \cdot ReturnPeriod_{HR} + \beta_{returnnowHR} \cdot ReturnNow_{HR} + \beta_{MidHighIncome} \cdot MidHighIncome + \beta_{unemployed} \cdot Unemployed + b_{typeHR} \cdot ProductType + \varepsilon_{panel} + \varepsilon_{comp}$

where:
ASC_{HR} = Alternative-specific constant for the Home Return method
$RelCost_{HR}$ = Relative cost of returning an item via home pick-up, scaled by purchase price
$ReturnPeriod_{HR}$ = Return period is limited to 7 days
$Env_{HR} \cdot Cost_{HR}$ = Environmental friendliness weighted by the cost of return
$ReturnNow_{HR}$ = Indicates whether the respondent reported choosing Home Return as return method for at least one of their online purchases made in the last two weeks.
MidHighIncome = Monthly net personal income over €2,000
Unemployed = Respondent is unemployed
ProductType=Electronics or Pharmaceuticals or Fashion
ε_{panel} = Error component capturing random taste variation
ε_{comp} = Error component capturing random taste variation among Home Return, Parcel lockers / Pick-up Points and Store options, reflecting their similarity in unobserved preferences.

Parcel Lockers/ Pick Up Point (P)

$V_P = ASC_P + \beta_{costP} \cdot RelCost_P + \beta_{returnperiod} \cdot ReturnPeriod_P + \beta_{urban} \cdot UrbanArea + \beta_{returnnowP} \cdot ReturnNow_P + \beta_{noincomeresponse} \cdot NoIncomeResponse + \beta_{age50Plus} \cdot Age50plus + \beta_{distance} \cdot Distance_P + \beta_{distancetype} \cdot Distance_P \cdot ProductType + \varepsilon_{panel} + \varepsilon_{comp}$

where:
ASC_P = Alternative-specific constant for the Parcel Locker return method
$RelCost_P$ = Relative cost of returning via parcel/pick-up point, scaled by product value
$ReturnPeriod_P$ = Return period is limited to 7 days
UrbanArea = Respondent resides in a high-density urban area (>3000 residents/km^2)
$Env_P \cdot Cost_P$ = Environmental friendliness weighted by return cost
$ReturnNow_P$ = Indicates whether the respondent reported choosing Parcel Lockers/Pick-up Point as return method for at least one of their online purchases made in the last two weeks.
NoIncomeResponse = Respondent preferred not to disclose income
Age50Plus = Age 50 years or older
$Distance_P$ = Distance to the nearest parcel locker or pick-up return point
ProductType=Electronics or Pharmaceuticals or Fashion
ε_{panel} = Error component capturing random taste variation
ε_{comp} = Error component capturing random taste variation among Home Return, Parcel lockers / Pick-up Points and Store options, reflecting their similarity in unobserved preferences

Store (S)

$V_S = ASC_S + \beta_{returnperiodS} \cdot ReturnPeriod_S + \beta_{returnnowS} \cdot ReturnNow_S + \beta_{noincomeresponse} \cdot NoIncomeResponse + \beta_{distanceS} \cdot Distance_S + \beta_{type} \cdot ProductType + \varepsilon_{panel} + \varepsilon_{comp}$

where:
ASC_{Store}= Alternative Specific Constant for Store return method
ReturnPeriodS = Return period is limited to 7 days
$ReturnNow_S$ = Indicates whether the respondent reported choosing Store as return method for at least one of their online purchases made in the last two weeks
NoIncomeResponse = Respondent preferred not to disclose income
$Distance_S$ = Distance to the nearest store used for returning products
ProductType=Electronics or Pharmaceuticals or Fashion
ε_{panel} = Error component capturing random taste variation
ε_{comp} = Error component capturing random taste variation among Home Return, Parcel lockers / Pick-up Points and Store options, reflecting their similarity in unobserved preferences

No Return (NR)

$$V_{NR}^{Percountry} = ASC_{NR} + \beta_{recentreturns} \cdot RecentReturns + \beta_{Refund2.5Per} \cdot Refund2.5Percent + \beta_{Loyaltyreward} \cdot LoyaltyReward + \beta_{Nextpurchasediscount} \cdot NextPurchaseDiscount + \beta_{CO2message} \cdot CO_2Message + \beta_{Airqualitymessage} \cdot AirQualityMessage + \varepsilon_{panel}$$

where:
ASC_{NR} = Alternative Specific Constant for No return
RecentReturns = Number of product returns made in the past two weeks
Refund2.5Percent = Incentive offering 2.5% refund of the purchase amount if the item is not returned
LoyaltyReward = Reward incentive offering €5 or 100 loyalty points if fewer than 2 returns occur annually
NextPurchaseDiscount = Incentive providing 25% discount on the next purchase for not returning the item
CO_2Message = Nudging message: "By not returning, you reduce CO_2 emissions and contribute to the environment."
AirQualityMessage = Nudging message: "Thank you for not returning! You reduce your carbon footprint and improve air quality."
ε_{panel} = Error component capturing random taste variation

The results illustrate how WTP varies across product types—Electronics, Resales, Fashion, and Pharmaceuticals—and at different product price levels. Positive WTP values indicate a willingness to pay extra for a specific return method or service, while negative values suggest that customers would require compensation or discounts to choose that option. This provides valuable insights for e-commerce platforms and logistics providers aiming to design cost-effective and customer-centric return policies.

Table 29. WTP Estimates for Return Methods by Product Category and Price

Product Price (€)	Parcel Locker-PickUp Point (PL-PP) WTP (€)	Home Return – 7-Day Window (€)	Parcel Locker – 7-Day Window (€)
Electronics			
10	0.20	0.41	1.37
20	0.41	0.83	2.73

Product Price (€)	Parcel Locker-PickUp Point (PL-PP) WTP (€)	Home Return – 7-Day Window (€)	Parcel Locker – 7-Day Window (€)
30	0.61	1.24	4.1
40	0.82	1.66	5.46
50	1.02	2.07	6.83
Fashion			
10	0.09	0.38	1.01
20	0.17	0.77	2.02
30	0.26	1.15	3.02
40	0.34	1.54	4.03
50	0.43	1.92	5.04
Pharmaceuticals			
10	1.83	0.39	0.98
20	3.65	0.78	1.95
30	5.48	1.16	2.93
40	7.3	1.55	3.91
50	9.13	1.94	4.89

Notes for the table:

1) WTP interpretation:

- Positive WTP: Respondents are willing to pay extra for the corresponding return option.
- Negative WTP: Indicates that respondents need compensation or discounts to choose the option.

2) Return methods analyzed:

- Home Return: The courier collects the item directly from the customer's address.
- Parcel Locker Return: The customer delivers the item to a parcel locker or designated collection point.
- Store Return: Excluded from the table since WTP values are negligible in this context.

3) Seven-day return window: The second and third columns represent the additional WTP for having a seven-day window for returns, either through Home Return or Parcel Locker services.

4) Product categories:

- Electronics: Laptops, phones, gadgets.
- Fashion: Clothing, footwear, and accessories.
- Pharmaceuticals: Non-prescription medicines, vitamins, supplements.

5) Scaling of costs: Return costs are scaled relative to product value, ensuring WTP comparability across different price levels.

6) Highest WTP values: Highest WTP: €18.25 for Pharmaceuticals using Parcel Lockers at a product price of €100.

7) Exclusions: Fresh groceries and ready-made meals are excluded from the analysis to maintain consistency with the SP experiment.

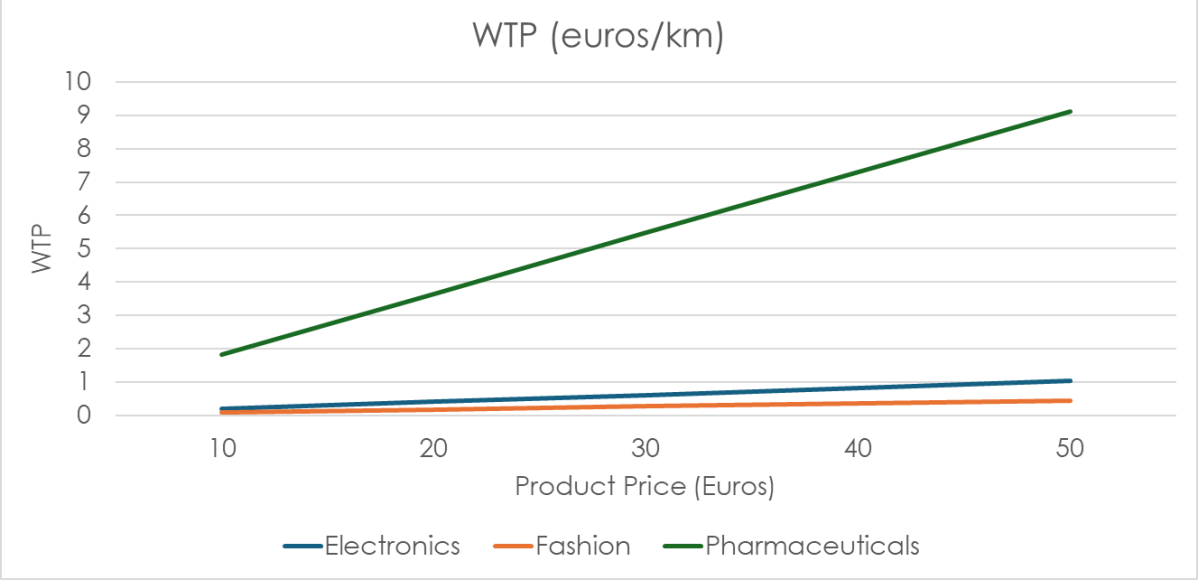

Figure 3. Willingness to pay to reduce distance 1km

In an attempt to explain the figure, the results indicate a very high WTP to reduce travel distance when returning e.g. pharmaceutical products. For instance, a WTP of 10 €/km suggests that a consumer would, in theory, be willing to pay 20€ to avoid walking 2 km to make a return. This likely reflects the perceived urgency and sensitivity associated with pharmaceutical items, where consumers place a high value on convenience and speed. It may also relate to concerns about product integrity or personal comfort. However, this finding should be interpreted with caution. Since all product types were presented within similar price ranges, respondents may have assigned extra non-monetary importance to pharmaceuticals, which the model captures as a higher WTP. This highlights both a strong behavioural pattern and a limitation of the experimental design.

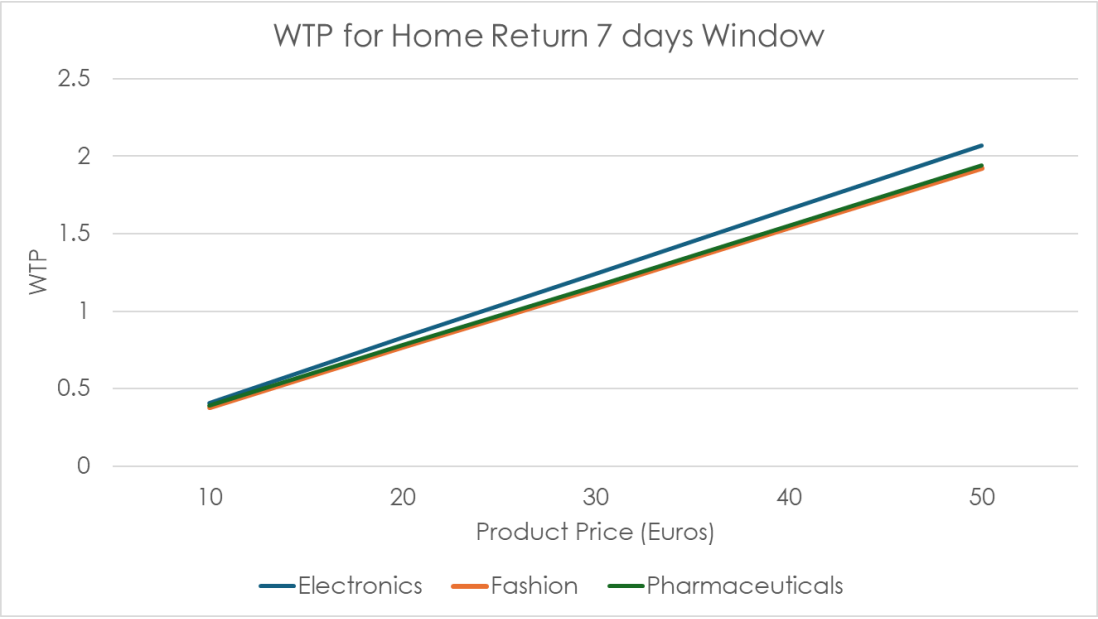

Figure 4. Willingness to pay for home returns 7 days window

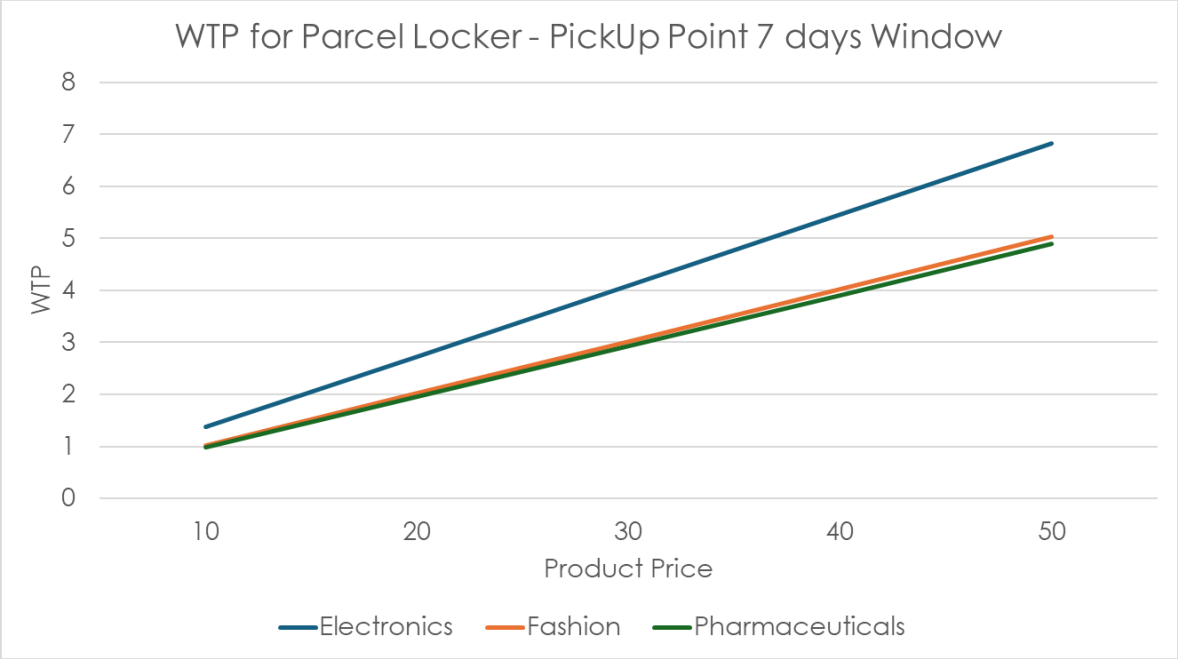

Figure 5. Willingness to pay for Parcel Locker – PickUp point returns 7 days window

4.3. VOT comparisons with other studies

Existing studies across different countries provide a broad spectrum of consumers' willingness-to-pay (WTP) for delivery and return services. Reported values range from only a few cents in Italy and Norway for sustainability-related surcharges, up to several euros in Germany for sustainable last-mile solutions, and more than €5–6 per delivery in the USA for flexible return-enabled delivery services. Asian case studies (Vietnam, China) show lower but still significant WTP, typically between €0.20 and €0.40 for speed or reliability attributes. In Ukraine, crowd-shipping options remain the cheapest, with WTP below €0.10 per delivery.

Table 30. Overview of International Willingness-to-Pay (WTP) Estimates

(Rossolov & Susilo, 2024)	Ukraine	e-grocery deliveries	Crowd-Shipping: 4.64 UAH (0.096 €) | Commercial carriers: 2.07 UAH (0.043 €)
(Biancolin et al., 2025)	Italy & Norway	Sustainability fee	Average: 12 cents (0.12€) | 18-29 years old: 13 cents (0.13€) | 29+ years old: 9 cents (0.09€) | Frequent online shoppers: 16 cents (0.16€) | Second-hand products: 25 cents (0.25€) | Frequent returners: 25 cents (0.25€) | Shop online because it is cheaper: 3 cents (0.03€)
(Doan & Pham, 2023)	Vietnam	Grocery Retailing	Home delivery (vs. in-store pickup): average VND 11,700 (0, 38€) | Same-day delivery (vs. next-day): VND 10,000 (0,32€) | Guaranteed on-time delivery: VND 7,150 (0,23€)

(Engelhardt, 2023)	Germany	Sustainable last mile innovations	Average: 2.22€/delivery | "Willing-to-pay professionals": 5€/delivery | "Old conservative shoppers": 1.65€/delivery | "Rich heavy users" 1.76€/delivery | "Young demanders" 1.77€/delivery
(Hagen & Scheel-Kopeinig, 2021)	Germany	Customer-driven central last mile micro depot (CMD)	Average: 1.15€–1.20€/parcel | Young consumers (18–29 years): 1.17€/parcel | In cities ≥1,000,000 inhabitants: 1.20€/parcel
(Rossolov et al., 2025)	USA	Pay more for delivery to enable free return	Females: 7.42$/delivery (6.33€) | Males 6.65 $/delivery (5.67€)
(Pan et al., 2021)	China	Delay compensation service	99% of orders arrive on time: +0.49 Yuan (0.059€) | 1% delay probability: +0.13 Yuan (0.016€) | Progressive compensation for delays: +0.40 Yuan (0.048€)
(Forsythe et al., 2024)	USA	Grocery shopping	Human same-day delivery (to doorstep): Average $6.70/delivery (5.73€) | Autonomous delivery: –$1.90 (-1.63€) | Delivery delay: –$2.30/day (-1.97€/day) | Curbside or locker delivery: –$3.10 (-2.65€) to –$7.90 (-6.76€)

Against this background, our study differs from prior literature by modelling both the delivery and the return stage in a single framework and reporting price- and product-category WTP for each. On the delivery side, we quantify the premiums for pick-up points and parcel lockers and show how these scale with basket value across categories (electronics, pharmaceuticals), rather than giving one average figure. On the return side, we value not only return location (home vs. locker/pick-up) but also the option value of an extended 7-day window. This joint, category-by-price approach uncovers heterogeneity that single-average WTP studies miss and, in our five-country setting, enables cross-country comparisons for both deliveries and returns.

5. Conclusions

This deliverable explored the behavioural drivers of consumer decisions regarding last-mile deliveries and product returns in e-commerce, combining revealed and stated preference data from five European countries. The models provide a comprehensive understanding of how cost, convenience, product type, and socio-demographic factors influence the choice among home delivery, parcel lockers, pick-up points, and click-and-collect services, as well as return methods and policies.

The results confirm that cost and convenience remain the strongest determinants of both delivery and return behaviours. Home delivery is the preferred option for most consumers, especially among older individuals, households with lower education levels, and families with young children, due to its perceived ease and reliability. Conversely, urban density and proximity to alternative collection points increase the attractiveness of out-of-home options, particularly parcel lockers. These findings show that promoting sustainable delivery methods requires more than just better infrastructure. Strategies must also address demographic differences such as

age, household type, and local context to make sustainable options both accessible and appealing to consumers.

Product characteristics strongly influence delivery choices. Parcel lockers are most suitable for durable and non-perishable goods, such as fashion, toys, and second-hand items, while fresh groceries and ready-made meals remain strongly associated with home delivery. Similar patterns are evident in return behaviours: fashion items dominate locker-based returns, while store-based returns remain relevant for older demographics and for products where tactile verification provides reassurance.

While environmental concerns alone do not dominate decision-making, eco-information and behavioural interventions significantly shape consumer choices when combined with convenience and affordability. The models demonstrate that incentives (e.g., discounts or loyalty rewards) and nudges (e.g., extended return windows) can encourage consumers to adopt more sustainable practices, including reducing unnecessary returns or selecting lower-emission delivery methods. This suggests that well-designed communication strategies and policy frameworks can play a critical role in steering behaviour without imposing rigid restrictions.

From a cross-country perspective, contextual differences are evident. For instance, Poland demonstrates strong baseline preference for parcel lockers due to its mature infrastructure, while in countries like Spain and Greece, home delivery remains dominant, reflecting cultural and logistical factors. These differences imply that policy interventions must be tailored to local market conditions, combining common European-level guidance with country-specific measures to maximize impact.

5.1. Limitations

A key limitation of this study is that, for consistency across scenarios, all product types were presented with similar price ranges. While this ensured comparability between categories in the stated preference experiments, it does not fully reflect real-world variations where some products, such as electronics, can have much higher values. This simplification may have influenced preferences for delivery and return options, as higher-value items are often associated with different perceptions of risk, convenience, and return behavior.

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