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Evaluating the impact of different incentive schemes on time window selection.

An empirical study within the B2C logistics sector.

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Abstract

The rapid growth of e-commerce, particularly in grocery delivery, presents significant logistical challenges that impact both cost-efficiency and environmental sustainability. Encouraging customers to select wider delivery time windows is critical for optimizing delivery efficiency, ultimately contributing to a more sustainable delivery process.

This study investigates the influence of different types of incentives—green, financial, and social norms—used in nine unique combinations, on customers' selection of multiple delivery time windows. It further explores how these incentives interact with personality traits and environmental consciousness to shape behaviour.

A survey of 181 participants was conducted, with respondents randomly assigned to one of nine incentive schemes. Each scheme incorporated green incentives alongside variations of financial incentives and social norms. Statistical analyses, including chi-squared tests, linear regression, ordinal regression, and binary logistic regression, were employed to evaluate the effectiveness of these schemes. The addition of financial incentives had a significant overall effect on the number of time windows selected. However, for customers scoring high on the personality trait Openness, a motivation crowding effect was observed, suggesting that financial incentives should be applied cautiously for this group. Social norms also influenced time window selection. While social norms paired with green incentives had limited impact when used alone, combining financial incentives with neutral social norms proved most effective, significantly increasing the number of time windows selected. This combination was particularly effective for customers scoring high on the personality trait Neuroticism.

This research provides valuable insights into the design of incentive strategies that enhance both logistical efficiency and environmental sustainability in e-grocery delivery.

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1 Introduction

The current era of advanced technology and convenience has led to a significant surge in e-commerce, as a Forbes Advisor article states that by 2027 23% of all retail purchases are expected to take place online [AB23]. Consequently, industries are evolving and new markets are emerging to keep pace with customer expectations. One such market is e-grocery, where customers order groceries online for delivery to their homes. This market has been developing enormously in recent years. In 2022, in Netherlands alone, the turnover was 3.7 billion [Gel24]. Most major supermarket chains now offer home delivery services, bringing groceries directly to customers' doorsteps for a small fee and at a chosen time.

However, this convenience does raise concerns around the economical and environmental sustainability. E-grocery, especially when fulfilled through the most common delivery method known as Attended Home Delivery, presents substantial challenges. This sector operates on tight profit margins, and the perishable nature of groceries demands sophisticated logistics considerations in the last-mile delivery [Aga09, ACF+13].

In today's context, sustainability considerations are becoming increasingly important, necessitating that delivery processes are not only cost-efficient but also strive to be as environmentally sustainable as possible. Sustainability can be achieved when customers provide a wide range of available delivery times, enabling the logistics system to plan routes more efficiently [MMZ18]. However, customers may be reluctant to provide a wider range of time windows, as this requires them to remain at home for extended periods, which many perceive as inconvenient.

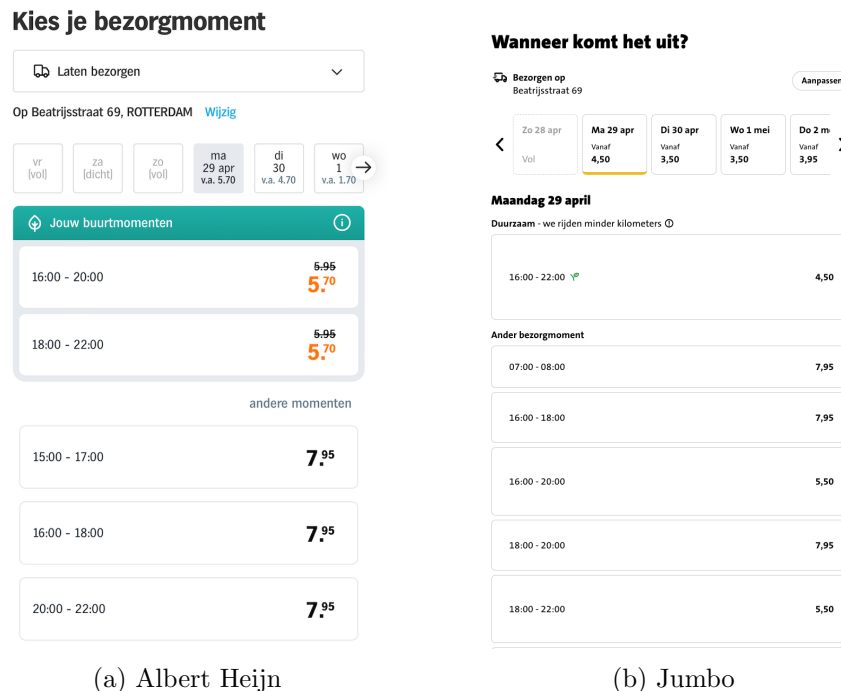


Figure 1: Screenshots of time window selection interfaces for Albert Heijn and Jumbo.

To encourage customers to provide a wider range of time windows, incentive schemes can be employed [CS06]. These schemes can guide consumer behaviour by encouraging sustainable choices, which in turn can reduce delivery costs for home delivery services and alleviate logistical challenges for companies. As illustrated in Figure 1, Dutch supermarkets such as Albert Heijn and Jumbo are already promoting wider time windows to optimize delivery planning. This research builds on these efforts by investigating which incentives are most effective in encouraging customers to select wider time windows, ultimately contributing to more sustainable and efficient delivery practices.

1.1 Thesis overview

The remainder of this thesis is structured as follows: Chapter 2 sets out the Research Objective, including the main research question and the hypotheses this study seeks to answer. Chapter 3 provides the Theoretical Background, discussing relevant literature on various types of incentives and the role of personality traits in influencing consumer behaviour. Chapter 4 describes the Methodology, detailing the survey design, incentive structures, and data collection process, as well as the statistical methods used to analyse the data. In Chapter 5, the Results of the statistical analyses are presented, including chi-squared tests, ordinal regression, and logistic regression, to evaluate the effectiveness of different incentive schemes and their interactions with personality traits. Then Chapter 6, the Discussion, interprets the results in the context of the hypotheses. Chapter 7 will form a Conclusion regarding the main research question, summarizes key findings, and provides recommendations for implementing effective incentive schemes in grocery delivery logistics. Finally, Chapter 8 will highlight the Limitations of this study, such as potential biases and generalizability, and suggests directions for future research.

2 Research Objective

The objective of this research is to explore the influence of various incentive schemes on consumer behaviour in the context of time window selection. This research addresses a gap in the existing literature, which often limited respondents to choosing only one time window, as the focus was on having respondents select a specific time window. In contrast, this study is interested in understanding the number of time windows selected, emphasizing flexibility in delivery route planning. Specifically, this study aims to examine two key aspects:

- The effect of different types of incentives on the number of time windows chosen for delivery. This study will try to understand how incentives, like discounts (financial) or social norms (non-financial), encourage respondents to select wider time windows.
- The potential cumulative value of combining multiple incentives. This study will investigate whether combining multiple types of incentives creates a compounded effect, further increasing the number of time windows selected.

In addition, this study seeks to identify differences in how specific customer groups respond to incentives. By understanding whether certain incentives are more effective for particular demographics or personality traits, this study will provide insights into how best to use different incentive schemes and apply them as efficiently as possible to encourage customers to select more flexible time windows, ultimately contributing to more sustainable and cost-effective delivery solutions.

2.1 Research Question and Hypotheses

Main research question:

How do incentives influence the number of time windows chosen by customers for grocery delivery?

Hypotheses:

- Hypothesis 1: *The combination of a financial incentive (low or high) with a green incentive will not significantly increase the number of time windows selected for grocery delivery compared to using only a green incentive*
- Hypothesis 2: *The combination of a social norm incentive with a green incentive will result in a higher number of time windows chosen for grocery delivery compared to using only a green incentive.*
- Hypothesis 3: *Higher levels of social norm incentives will result in a greater number of time windows chosen for grocery delivery compared to lower levels of social norm incentives.*
- Hypothesis 4: *The combination of green, financial, and social norm incentives will result in a greater number of time windows chosen for grocery delivery compared to using only a green incentive combined with either financial or social norm incentive alone.*
- Hypothesis 5: *Higher scores for personality traits Conscientiousness and Openness will be positively associated with greater environmental consciousness.*
- Hypothesis 6: *Higher scores in Conscientiousness and Openness will be positively associated with selecting a higher number of delivery time windows for grocery delivery.*

The basis for each hypothesis is given in the theoretical background, which outlines the relevant research supporting these proposed relationships.

3 Theoretical Background

A distinctive feature of e-grocery services is their reliance on Attended Home Delivery. Unlike standard parcel services, where packages can be left with neighbours or at designated pickup points, groceries—especially perishables—require the recipient to be present at the time of delivery. This necessity makes effective delivery planning crucial in ensuring both customer satisfaction and operational efficiency. Furthermore, attended deliveries introduce additional costs; a study found that fully flexible unattended delivery options are approximately 30% cheaper than attended deliveries with a 2-hour time window [AFN06]

It is also important to differentiate e-grocery services from flash delivery services, also referred to as “flitsbezorgers” or dark stores. The e-grocery model discussed in this paper typically requires a minimum order value of around 50 euros, catering to larger deliveries such as weekly groceries. In contrast, flash delivery services focus on smaller, immediate purchases, with orders starting from just a few euros and deliveries sometimes completed within minutes. While flash delivery emphasises speed, e-grocery prioritises precision by delivering within a specific time window that customers can select several days in advance.

Figure 1 illustrates the time window selection interface used by e-grocers in the Netherlands. These time windows vary in length and price, these variables are continuously updated during the ordering process based on factors such as previously selected windows by other customers, and customer locations. This approach is known in literature as dynamic time slot management, which adjusts the availability of delivery time windows in real-time. An alternative approach is static time slot management, where customers are presented with a set of predetermined time windows that remain fixed throughout the ordering process. The dynamic approach accommodates real-time fluctuations in demand and resource availability, providing greater flexibility compared to static methods. However, it requires significant computational power and may lead to longer waiting times for customers on the website [Vis19].

Continuous research efforts are aimed at enhancing the efficiency of time slot management. Research by Gülmez, Emmerich, and Fan highlights the benefits of allowing customers to rank their top three preferred 1-hour time windows. Their study concludes that requesting multiple time windows provides greater adaptability in routing, which facilitates eco-friendly, cost-efficient, and consumer-satisfactory delivery solutions. [BGF24] Additionally, other research has shown that when more customers are willing to accept long time windows, this can help maintain flexibility and increase time window availability for later customers. This approach is especially effective when long time windows are offered in the beginning of the selection process, before a lot of other windows are chosen. [KEC19]

3.1 Incentives

This section explains the different types of incentives used in the study’s incentive schemes. These incentives—green, financial, and social norm—are grounded in both theoretical and practical research aimed at enhancing operational efficiency and promoting sustainable consumer behaviours.

Title	Incentives	Research aim	Results
The Impact of Green Labels on Time Slot Choice and Operational Sustainability [AFS21]	a) Green time window with text "In the green time windows a delivery van will already in your zip-code area; booking will help save fuel and reduce emissions." b) Three discount conditions offering a price incentive on the deliver fee of \$2, \$5, or \$8.	This study examines the effectiveness of green labels that specify time slot as environmentally friendly and how this motivates customers to choose a specific delivery time slot in lieu of price incentives.	Steering individuals to select delivery time windows through intrinsic motivation via green labels may be a promising, no-cost direction for (online) retailers.
Making the E-grocery Attended Home Delivery more efficient:An empirical research on the impact of green incentives and discounts on customer’s delivery-window choice [Kon18]	a) Green time window with text "Delivery fee is 6 euros for every time-window. By selecting a green coloured time window, you make an environmentally-friendly decision as the delivery truck will travel less kilometres on read, which means less emissions." b) All time windows are valued at €6, except from those in the conditions that are incentivized with €1 discount	This study examines the effect of different number of incentivized time windows offered in a weekly time slot timetable.	(1) When the offered incentives - either green or discounts - are increased from 1 to 3, the likelihood that a customer chooses an incentivized time slot grows. (2) The potential increase of the incentivized time windows offered in a weekly time slot has a lessening impact on increasing the incentivized time windows selection rate, as can be inferred from the relevant chart – which depicts the lessening marginal increase.
The Effectiveness of Donation incentive as an Intrinsic Motivation for Consumers within the Context of Online Grocery [Zho19]	a) Donation logo, 2 euros will be donate to a tree-planting project; b) Green Leaf logo, the delivery truck of this time slot will reduce its polluted emission to the environment; c) Discount logo, you receive a 2 RMB discount on delivery fee	This study examines the effectiveness of a donation incentive as a way of stimulating consumers to choose certain delivery time slot when doing online grocery.	Although it turns out that donation incentive is effective in motivating consumers, it is less impactful than green incentive or financial incentive.

Table 1: Summary of prior research on use of incentives in context of time windows selection.

Green Incentive

Green incentives appeal to customers’ environmental consciousness by emphasising the sustainability benefits of certain choices [RBVM21]. Supermarkets such as Albert Heijn and Jumbo have implemented green incentives, known as “buurtmomenten,” to encourage customers to choose more sustainable delivery time windows. These retailers inform customers that delivery vehicles will already be in the neighbourhood, and by selecting one of these specified time windows, fewer kilometres will be driven, reducing the environmental impact.

Previous research has demonstrated the effectiveness of green labels in shaping customer choices, particularly in online retail environments. For instance, one study in the context of last-mile deliveries found that highlighting the environmental and social impacts of such deliveries can encourage customers to opt for more sustainable delivery options [IC20]. The effectiveness of green incentives has also been tested in the context of time window selection, as shown in Table 1. Research has shown that green labels can be as effective as financial incentives in encouraging customers to make more sustainable time window choices. Some studies have even found that green labels are more effective than price incentives in prompting customers to select longer and more flexible delivery time windows [AFS21] [AFS21].

Financial Incentive

Financial incentives, such as price discounts, have long been recognised as effective tools for influencing consumer behaviour [CM14]. Even small (dis-)incentives can significantly impact customers’ time window choices [YSCE14]. Discounts used in previous research typically range between 1 to 8 euros, as seen in the studies presented in Table 1. While this accurately reflects the discounts offered by retailers like Albert Heijn and Jumbo, recent studies suggest that the actual cost savings from providing more flexible delivery planning are often lower than these discounts. The percentage by which operational costs are reduced ranges from 1% to 8%, depending on the number of instances [BGF24].

Social Norm

Social norms have been shown to effectively promote pro-environmental behaviour [GCG08]. The social norm incentive used in this research is a *descriptive* social norm, which influences behaviour by shaping perceptions of how most others behave [CKR91]. A study investigating customers’ sustainable decision-making on a web-shop’s checkout page found a significant increase in the selection of sustainable delivery options when a descriptive social norm was implemented [RBVM21]. That is why this study proposes that adding a social norm incentive to the green incentive will increase the number of selected time windows (H2).

Research also shows that social norm incentives can significantly influence consumer behaviour, even when modest in scale. This is relevant because, in reality, the percentage of customers selecting multiple delivery time windows may not always be high. It is essential to present these incentives truthfully, as exaggerating norms can backfire, leading to mistrust and reducing the effectiveness of the incentive. [DCHW15]. However, it is hypothesized that higher levels of social norm incentives may yield a stronger effect than lower levels (H3).

Combining Incentives

At first glance, applying multiple incentives may seem like the most effective strategy to encourage sustainable choices. However, research consistently shows that this approach is not always successful. The reason behind this is the so-called motivation crowding effect. This effect states that extrinsic incentives, such as financial rewards, diminish the influence of intrinsic motivations, such as environmental consciousness. This suggests that offering too many or the wrong combination of incentives can backfire, reducing their overall effectiveness [HLLL14].

This effect has also been observed by several studies in the context of time window selection. For example, in the research by Agatz, Fan, and Stam, it was found that combining green labels with price incentives provided only a little added benefit compared to using green labels alone in motivating customers to choose incentivised time windows [AFS21]. Similarly, another study demonstrated that when a donation incentive was paired with a financial incentive, customers were less likely to select the incentivised time windows than when only the donation incentive was offered [Zho19]. These studies both illustrate how financial incentives can undermine the impact of intrinsic incentives, reducing their overall effectiveness. That is why this study hypothesizes that adding financial incentives to the green incentive alone may not significantly increase selected time windows (H1).

It has been found that green incentives work better for eco-conscious consumers [AFS21] and financial incentives are more effective for people who are more price-sensitive. Based on this precipice and based on the findings from previous research, it might be more effective to identify the different type of consumers and tailor incentives to these types—either offering green or financial incentives—rather than providing a combination of both to all customers.

The combination of multiple non-monetary incentives has not been extensively researched in the context of time window selection. However, one study on the effectiveness of different non-financial incentives concluded that combining approaches—in this particular study, social norms was combined with social media sharing—showed promise for future research and practice [RBVM21]. Hence, exploring the combination of a green incentive with social norms could provide valuable insights into whether combining non-monetary incentives has a greater impact on behaviour change than using them individually.

This study suggests that the combination of all three incentives will result in more selected time windows compared to a two-incentive scheme (H4). Since there is limited existing research specifically exploring the combination of these three incentive types, this expectation is based on the broader idea that combining incentives of different types can target a wider range of motivations and personality traits. Green incentives may appeal to environmentally conscious customers, financial incentives to those driven by cost savings or practicality, and social norms to those who value social approval.

3.2 Big Five Inventory: Personality domains

The Big Five Inventory (BFI), first introduced in 1991, is a widely recognised tool for assessing personality traits [JDK91]. It is based on the Five-Factor Model of personality, which captures the key dimensions of human personality across five domains: Openness to Experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism. While some argue that the BFI may oversimplify complex personality constructs or be influenced by cultural biases [Nae23], it remains a reliable and valid method for assessing personality types. [FBMM11]

The Big Five Inventory, while rooted in psychology, is also widely applicable in other fields, such as understanding consumer behaviours like time window selection and the role of incentives in decision-making contexts. Previous research has demonstrated that certain personality traits significantly influence consumer behaviour, as highlighted in Table 2. For instance, traits like Conscientiousness and Openness have been shown to correlate with environmentally friendly decision-making [FAM06] [Duo21]. That is why this study proposes that higher scores in Conscientiousness and Openness are positively associated with greater eco-consciousness (H5) and thereby with a higher number of time windows selected (H6)

While Conscientiousness, Openness, Extraversion, and Agreeableness are generally associated with environmentally friendly behaviour, research findings on Neuroticism’s influence are mixed. Some studies link higher Neuroticism to increased environmental concern [Kva15], while others find little to no effect on eco-friendly actions [FAM06] [SWGL18].

Title	Research Aim	Methodology	Results
Influence of Personality on Ecological Consumer Behavior [FAM06]	To explore how personality traits influence green product purchasing behaviour	Big Five traits measured via Likert scale, SEM used for analysis. Traits categorised into high/low scorers on each trait.	Conscientiousness and Openness had significant positive effects on ecological behaviour. Personality traits are strong predictors of green purchasing.
The Role of Personality Traits in Green Decision-Making [Duo21]	To assess how personality traits influence the decision-making process in sustainability contexts	Big Five traits measured and categorised by percentile ranks. Multiple regression analysis performed.	Openness and Conscientiousness were the most influential traits in green decision-making. Broad environmental consciousness influenced by these traits.
Unearthing the Effects of Personality Traits on Consumer’s Attitude and Intention to Buy Green Products [SWGL18]	To explore how personality traits influence attitudes and intentions toward buying green products	Big Five traits measured using a Likert scale. Multi-group SEM used. Traits grouped into high/low scorers.	Conscientiousness , Extraversion , and Openness had strong effects on green buying intentions. Agreeableness was not significant in this context.

Table 2: Summary of research linking Big Five traits to sustainable behaviours.

4 Methodology

This study aims to evaluate how different incentive schemes, as presented in nine different survey versions, influence the number of time windows selected by customers for grocery delivery. In addition, the study explores the role of environmental consciousness and personality traits in this decision-making process. This chapter provides a detailed description of the survey structure. The specific incentives chosen for the study are explained and how they were grouped and tested in different incentive schemes across the nine survey versions. Finally, the structure of the dataset used in this study is then outlined.

4.1 Survey Design

The survey consists of five distinct sections: General Demographic Information, Shopping Habits, Time-Window Selection, Big Five Questions, and Environmental Consciousness. When developing the survey, the number of questions per section was kept as low as possible while still ensuring reliable results. Research has shown that longer questionnaires often lead to lower response rates and increased participant dropout [LW18]. For a complete list of the survey questions, refer to Appendix A.

General demographic information

The survey begins with general demographic questions, which are the same for each respondent. This data will be used for segmentation and analysis purposes, as well as to ensure that the sample is not biased toward certain characteristics, allowing for a more accurate and representative analysis.

Shopping habits

The survey also included two questions about respondents' shopping habits, specifically focusing on their general online shopping frequency and their frequency of ordering groceries online.

Time window selection

The time window selection segment of the survey serves as the focal point where respondents participate in the decision-making process regarding the delivery of their groceries. This section is designed to mirror the real-life scenario of scheduling grocery deliveries, thereby eliciting responses that closely resemble respondents' actual preferences and behaviours.

Firstly, respondents are introduced to a hypothetical scenario where they find themselves ordering groceries from an (fictional) online supermarket, NetGroceries. The respondents are tasked with selecting time windows for the delivery of their groceries for the upcoming week, and they are instructed to consider their actual agenda to provide responses that reflect real-life decision-making. It is emphasised that someone must be present to receive the delivery during the chosen time window(s). The standard delivery fee is € 8.50 regardless of the number and choice of time windows selected. This fee is based on the highest possible delivery fee of Albert Heijn and Jumbo.

To examine the impact of various incentive schemes, respondents are randomly assigned to one of nine different survey versions. After being introduced to the hypothetical scenario, each group is presented with their assigned incentive or combination of incentives, after which they go on to the time window selection part of the survey.

The nine different incentive schemes are:

1. Green Incentive
2. Green incentive + Low Financial incentives
3. Green incentive + High Financial incentives
4. Green incentive + High Financial incentives + Low Social Norm
5. Green incentive + High Financial incentives + Neutral Social Norm
6. Green incentive + High Financial incentives + High Social Norm
7. Green incentive + Low Social Norm
8. Green incentive + Neutral Social Norm
9. Green incentive + High Social Norm

After having received their incentive(s), respondents are asked to select the day they would like to receive the delivery. Then, a screen is provided with a comprehensive overview of delivery time windows, see Figure 2 allowing them to select time windows that align with their schedules and preferences. The 1-hour time windows range from 07:00 am to 22:00 pm. Respondents have the flexibility to choose multiple time windows but must select at least one time window. It was also not a requirement for the selected time windows to be consecutive.

Select time-window(s) for delivery

07:00 - 08:00
08:00 - 09:00
09:00 - 10:00
10:00 - 11:00
11:00 - 12:00
12:00 - 13:00
13:00 - 14:00
14:00 - 15:00
15:00 - 16:00
16:00 - 17:00
17:00 - 18:00
18:00 - 19:00
19:00 - 20:00
20:00 - 21:00
21:00 - 22:00

Figure 2: Example of the delivery time selection screen used in the survey.

Personality assessment

This section of the survey is designed to assess the personality traits of the respondents. To achieve this, a shorter version of the Big Five Inventory is used, specifically the Ten-Item Personality Inventory (TIPI) [GRS03]. The TIPI is recommended for research contexts where time is limited and personality assessment is not the primary focus, as it significantly reduces the complexity and completion time compared to the full 44-item Big Five Inventory (BFI). This inventory measures five broad personality domains: extraversion, agreeableness, conscientiousness, neuroticism (emotional stability), and openness to experience. The TIPI consists two items per personality trait.

Despite being a shorter measure, the TIPI has been tested for reliability and validity and is considered a reasonable alternative to longer inventories [CBP⁺15]. Furthermore, the TIPI has been validated across multiple languages and cultural settings, demonstrating its robustness and applicability in diverse populations [MHG07] [IY18].

Environmental Attitudes Inventory

To measure a respondents environmental consciousness the Environmental Attitudes Inventory (EAI) [MD10] is used. EAI consist of 12 unidimensional scales each containing 10 questions. However, similar to the Personality Questions section, a shorter version was chosen due to limited time and it not being the primary focus of the research. The survey only focuses on Scale 8, Personal Conservation Behaviour. This scale measures an individual's actions towards conserving resources and protecting the environment in their daily lives. This aligns closely with the research aim, as choosing multiple delivery time windows can also be seen as a form of Personal Conservation Behaviour.

4.2 Incentives

A description of the incentives has already been given in the theoretical background and previous research has been discussed. In this section, it will be explained how the incentives were applied in this study.

Green Incentive

Respondents assigned the green incentive are shown the following:

At NetGroceries, we care a great deal about the environment and strive to be as sustainable as possible. Did you know that by selecting multiple time windows, you are contributing to a more sustainable delivery process. Your choice allows us to optimise our delivery routes, reducing the amount of time our trucks spend on the road and thus minimising polluting emissions. Let's protect our planet together!

Besides the information provided to the respondents about the environmental benefits of choosing multiple time windows a green leaf logo is also shown. Given the proven effectiveness of green incentives and their use in real-life applications, we have included this incentive in every survey.

Financial Incentive

Respondents assigned the financial incentive are shown the following message:

*NetGroceries is currently offering a special discount! For each additional time window you select, a discount of *50 cents* / *1 euro* will be applied, up to a maximum discount of 6 euros.*

As described in the theoretical background the current discounts used do not reflect the actual cost saved. Therefore, we aim to investigate whether a lower financial incentive, which more accurately reflects the real cost savings, is still effective. The lower financial incentive will be tested, next to the "normal" financial incentive. The maximum discount of €6 is chosen to reflect the current pricing of Albert Heijn and Jumbo, as their cheapest delivery windows don't go below an average of around €2,50.

Social Norm

Respondents assigned the social norm incentive are shown the following message:

**20%* / *50%* / *80%* of our customers choose 3 or more time windows!*

In this research we use varying percentages to see if the level of social norm has an effect on the impact of the incentive. In other words, does a low percentage still have a positive effect on the number of time windows chosen. The reasoning behind choosing 3 time windows for the standard is because from the paper by Gülmez, Emmerich, and Fan we know that if 3 windows are chosen this is better for efficient planning. Besides, the chosen number should not be too high, this would make it harder to meet this threshold in real life scenarios. As retailers will only implement the statement if the statement is true, so the threshold is reached.

4.3 Data Analysis

The data used in this study was obtained through a survey designed specifically for this experiment in the online survey platform Qualtrics and was distributed through various channels, including the internet (Prolific), social media platforms, and personal contacts. This multi-channel approach was aimed to reach a diverse sample of potential e-grocery customers, there was no specific target demographic.

The data was cleaned to ensure quality. Some respondents did not complete the Personality Assessment and/or the Environmental Attitudes Inventory sections. This was anticipated, which is why these sections were placed at the end of the survey. However, if the rest of the survey was filled in, resulting in a progress rate of 95 % or higher, the survey was included in the dataset. For surveys that met the inclusion criteria but had missing values in the personality or EAI sections, the mean was used to fill these gaps. Out of the total number of completed surveys a total of 181 surveys met this criteria.

The study’s dependent variable is a count of the number of time windows selected for grocery delivery, ranging from 1 to 15. The dataset also includes several independent variables such as demographic information, shopping habits, personality traits, environmental consciousness, and the incentive scheme received.

The general demographic information section include mostly categorical questions, with a few integer responses that could later be categorised for analysis. Both the TIPI and Environmental Attitudes Inventory questions consist of 10 questions, all answered using a 7-point Likert scale where 1 = Strongly disagree and 7 = Strongly agree. Half of the questions are reverse-coded items to prevent response bias [WO01]. The questions in section Shopping Habits were also answered using a 7-point Likert scale.

To address the study’s hypotheses, various statistical tests were conducted:

Chi-squared Test

This test assessed whether there were significant differences in time window selection behaviour across different incentive schemes, specifically to evaluate Hypotheses 1-4. The number of time windows selected was categorized as “Low” (1 time window), “Medium” (2-3 time windows), and “High” (4 or more time windows), this was done to reflect practical ranges for grocery delivery as time windows are typically 2 hours long, with 4 hours being the longer option. Additionally, this grouping strengthens the chi-squared test results, allowing for a clearer distinction between incentive effects.

To ensure reliable results, a Benjamini-Hochberg (BH) correction is applied to account for the multiple comparisons, as running many tests increases the risk of false positives. The BH method adjusts significance thresholds by sorting p-values and comparing each to an adjusted threshold; if a p-value is smaller than its threshold, it is marked as significant after correction. Unlike stricter methods, the BH correction allows for more flexibility in identifying significant results. A p-value

below 0.05 indicates statistically significant differences, suggesting that the incentive schemes influenced respondents' choices.

Linear Regression Analysis

Linear regression was used for multiple analyses in this study. First, it examined the direct impact of different incentive schemes on the number of time windows selected, using the green incentive as the reference category. This analysis provided insights into how each incentive scheme influenced consumer behaviour relative to only the green incentive.

Additionally, linear regression was applied to explore the relationship between personality traits and environmental consciousness, as relevant for Hypothesis 5. This analysis assessed how individual personality traits correlate with environmental attitudes, measured by EAI scores, with coefficients indicating each trait's relative impact on environmental attitudes.

Finally, linear regression was used to investigate interaction effects between personality traits, environmental consciousness, and incentives on the number of time windows chosen. This analysis, relevant to Hypothesis 6, revealed specific personality-incentive combinations that were particularly effective, offering a more personalized approach to influencing consumer behaviour.

Ordinal Regression Analysis

Given the count nature of the dependent variable, ordinal regression was used to assess the impact of incentives on the number of time windows selected. Time windows were categorized consistently with the Chi-Squared test, allowing for a more nuanced understanding of incentive effects. Several models were designed to evaluate the effect sizes of incentives (Hypotheses 1-4). Coefficients indicate the direction and strength of each variable's impact, with significance tested at the 0.05 level.

Binary Logistic Regression Analysis

This test focused on the influence of incentives at specific thresholds (1, 2, and 3). By transforming the time window count into binary variables, it assessed whether specific incentive schemes increased the likelihood of selecting additional time windows, thereby surpassing each threshold, and provided additional insights into Hypotheses 1–4. The analysis extracted model coefficients, calculated standard errors, and determined p-values using a Wald z-test. Each coefficient represents the change in the log-odds of selecting more time windows than the threshold for a given incentive scheme. A positive coefficient indicates an increased likelihood of exceeding the threshold, while a negative coefficient suggests a reduced likelihood.

5 Results

5.1 Sample Characteristics

Once the data has been cleaned, a descriptive analysis is applied, giving a clear overview of the characteristics of the dataset collected. Table 3 summarises the numerical variables, displaying the mean and standard deviation for age, environmental consciousness (EAI score) and each of the personality traits across each survey version. Table 4 presents a summary of the categorical variables for each survey version, highlighting the two most prevalent groups within each variable and the corresponding percentage of responses in those categories. Additionally, both tables include the overall distribution of variables across the entire dataset, shown in the “Total” column.

The distribution of the numerical variables across the survey versions appears to be fairly consistent, with only small variations in standard deviation. For categorical variables, the data indicates that respondents are predominantly from the UK or the Netherlands and generally well-educated. Employment status shows that most respondents work either full- or part-time, with no survey version displaying a notably higher rate of unemployment, which might otherwise introduce a bias due to greater availability at home. Gender distribution reveals a higher proportion of female respondents; however, this is consistent across all versions, thus minimizing potential gender-related variations in the results. Households with three or more members represent the largest category across all versions, and income levels are generally skewed toward the higher categories.

	1		2		3		4		5	
	Mean	Std	Mean	Std	Mean	Std	Mean	Std	Mean	Std
Age	36.45	14.70	37.26	14.55	36.81	12.92	47.26	16.92	42.95	17.77
EAI	4.25	1.33	3.95	1.45	4.10	1.40	4.50	1.60	4.30	1.55
Extraversion	4.39	1.56	3.47	1.18	4.19	1.4	3.74	1.82	4.05	1.14
Agreeableness	5.16	1.03	5.06	1.19	5.0	1.17	5.0	1.37	4.9	1.01
Conscientiousness	5.53	1.24	4.56	1.17	5.22	1.32	5.16	1.4	5.48	1.13
Neuroticism	4.76	1.1	3.81	1.28	4.67	1.41	5.24	1.23	4.81	1.25
Openness to experience	5.45	0.98	4.83	1.11	5.42	0.71	4.68	1.15	4.95	0.84

	6		7		8		9		Total	
	Mean	Std	Mean	Std	Mean	Std	Mean	Std	Mean	Std
Age	41.25	15.60	39.78	14.30	38.55	13.25	40.15	14.60	39.95	14.20
EAI	4.05	1.50	4.00	1.48	3.95	1.47	4.10	1.53	4.05	1.49
Extraversion	4.0	1.52	4.18	1.56	4.05	1.41	4.52	1.38	4.08	1.55
Agreeableness	5.1	0.85	5.19	1.00	4.79	0.9	5.14	1.15	5.05	1.07
Conscientiousness	4.92	1.4	5.26	1.16	5.29	1.45	4.83	1.5	5.14	1.32
Neuroticism	4.83	1.24	4.42	1.49	4.26	1.66	5.0	1.3	4.66	1.36
Openness to experience	5.12	1.2	4.92	0.75	5.26	1.06	4.95	1.06	5.07	1.01

Table 3: Mean and standard deviation of variables such as age, environmental consciousness, and personality traits.

	1	2	3	4	5
Country	United Kingdom of Great Britain and Northern Ireland (55.0%) Netherlands (40.0%)	United Kingdom of Great Britain and Northern Ireland (57.89%) Netherlands (31.58%)	United Kingdom of Great Britain and Northern Ireland (66.67%) Netherlands (33.33%)	United Kingdom of Great Britain and Northern Ireland (63.16%) Netherlands (31.58%)	United Kingdom of Great Britain and Northern Ireland (57.14%) Netherlands (33.33%)
Education	4 year degree (35.0%) Professional degree (20.0%)	Some college (31.58%) High school graduate (21.05%)	Professional degree (33.33%) 4 year degree (28.57%)	High school graduate (26.32%) Some college (21.05%)	4 year degree (33.33%) Professional degree (23.81%)
Employment	Full-time (40.0%) Part-time (25.0%)	Full-time (36.84%) Part-time (21.05%)	Full-time (38.1%) Part-time (33.33%)	Full-time (36.84%) Part-time (26.32%)	Full-time (23.81%) Retired (23.81%)
Gender	Female (65.0%) Male (30.0%)	Female (68.42%) Male (31.58%)	Female (61.9%) Male (33.33%)	Male (52.63%) Female (47.37%)	Female (61.9%) Male (38.1%)
Household	3 or more (65.0%) 2 (20.0%)	3 or more (52.63%) 2 (31.58%)	3 or more (57.14%) 2 (28.57%)	3 or more (42.11%) 2 (36.84%)	3 or more (38.1%) 2 (33.33%)
Income	€20,000 - €40,000 (30.0%) More than €100,000 (25.0%)	€0 - €20,000 (31.58%) €20,000 - €40,000 (21.05%)	€20,000 - €40,000 (33.33%) €0 - €20,000 (23.81%)	€20,000 - €40,000 (36.84%) €60,000 - €80,000 (21.05%)	€20,000 - €40,000 (33.33%) €40,000 - €60,000 (23.81%)

	6	7	8	9	Total
Country	United Kingdom of Great Britain and Northern Ireland (57.14%) Netherlands (33.33%)	United Kingdom of Great Britain and Northern Ireland (55.0%) Netherlands (35.0%)	United Kingdom of Great Britain and Northern Ireland (68.42%) Netherlands (26.32%)	United Kingdom of Great Britain and Northern Ireland (61.9%) Netherlands (33.33%)	United Kingdom of Great Britain and Northern Ireland (60.22%) Netherlands (33.15%)
Education	Some college (28.57%) Professional degree (23.81%)	Some college (35.0%) Professional degree (25.0%)	Professional degree (26.32%) High school graduate (21.05%)	Professional degree (28.57%) Some college (28.57%)	Some college (25.41%) Professional degree (24.31%)
Employment	Full-time (42.86%) Student (28.57%)	Full-time (35.0%) Part-time (20.0%)	Full-time (36.84%) Part-time (36.84%)	Full-time (52.38%) Part-time (19.05%)	Full-time (38.12%) Part-time (24.31%)
Gender	Female (66.67%) Male (33.33%)	Female (75.0%) Male (25.0%)	Female (57.89%) Male (36.84%)	Female (71.43%) Male (23.81%)	Female (64.09%) Male (33.7%)
Household	3 or more (57.14%) 2 (23.81%)	3 or more (65.0%) 2 (25.0%)	3 or more (57.89%) 2 (31.58%)	3 or more (42.86%) 2 (33.33%)	3 or more (53.04%) 2 (29.28%)
Income	€0 - €20,000 (23.81%) €20,000 - €40,000 (23.81%)	€40,000 - €60,000 (40.0%) €20,000 - €40,000 (25.0%)	€20,000 - €40,000 (31.58%) €40,000 - €60,000 (21.05%)	€0 - €20,000 (23.81%) More than €100,000 (19.05%)	€20,000 - €40,000 (27.07%) €40,000 - €60,000 (19.89%)

Table 4: Distribution of demographic and categorical variables across different incentive schemes.

5.2 Data Overview

Figure 3 provides a visual comparison of the the distribution of the number of chosen time windows across different incentive schemes. It displays the median number of time windows chosen for each scheme, represented by the horizontal line within each box, while the average is reflected by the small marker inside the box. The interquartile range is depicted by the height of the boxes, while the whiskers extend to the most extreme data points that are not considered outliers. Outliers, represented as individual points, show observations where respondents selected a number of time windows significantly different from the rest of the results.

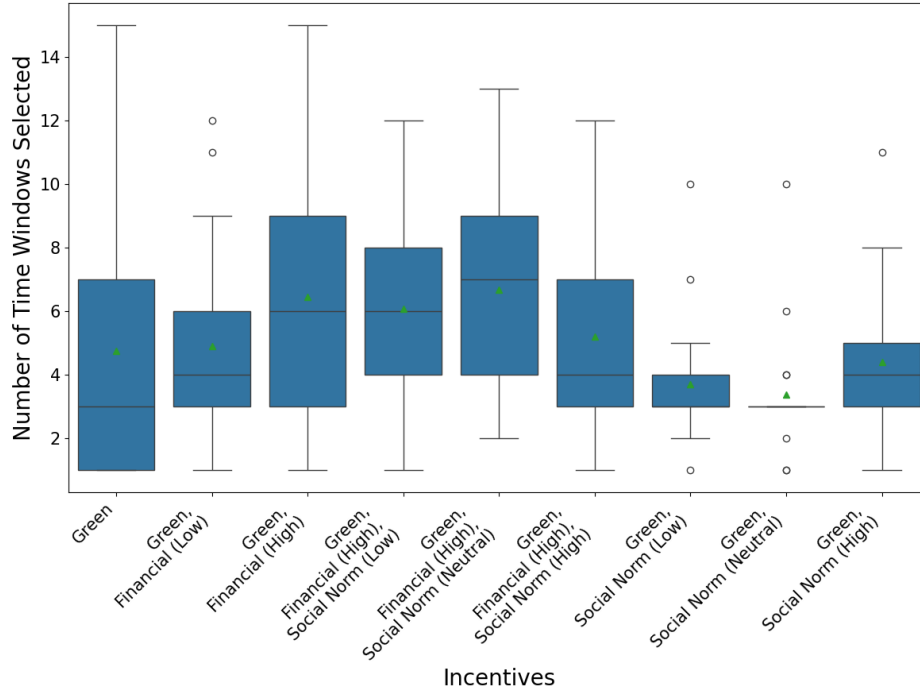


Figure 3: Visual distribution of time windows selected across different incentive schemes.

	Incentive(s)	Mean	Std	Observations
1	Green	4.7500	4.5408	20
2	Green, Financial (Low)	4.8947	3.1072	19
3	Green, Financial (High)	6.4286	3.7091	21
4	Green, Financial (High), Social Norm (Low)	6.0526	3.1176	19
5	Green, Financial (High), Social Norm (Neutral)	6.6667	3.2301	21
6	Green, Financial (High), Social Norm (High)	5.1905	3.2957	21
7	Green, Social Norm (Low)	3.7000	1.9762	20
8	Green, Social Norm (Neutral)	3.3684	1.9210	19
9	Green, Social Norm (High)	4.3810	2.1325	21
<i>Total</i>		<i>5.0663</i>	<i>3.2397</i>	<i>181</i>

Table 5: Mean and standard deviation for the number of time windows chosen per incentive scheme.

Table 5 presents several observations regarding the effect of different incentive schemes. Compared to the base model, only the Green Incentive, all combinations that included a financial incentive resulted in a higher average number of time windows selected, with the highest average observed for the combination of Green, high financial, and neutral social norm incentives.

In contrast, the Green incentive combined with social norms alone resulted in the lowest overall scores, however these combinations do show the lowest standard deviation, indicating more consistent choices across respondents. The highest variability in behaviour was observed when only the Green incentive was used. Figure 3, illustrate this variability, particularly for the Green incentive alone and its combination with the high financial incentive, where a wider spread of selections was seen. Additionally, the combinations of the Green incentive with the low financial incentive and with social norms produced outliers, suggesting some respondents might have been especially motivated by these incentives, selecting significantly more time windows than the majority.

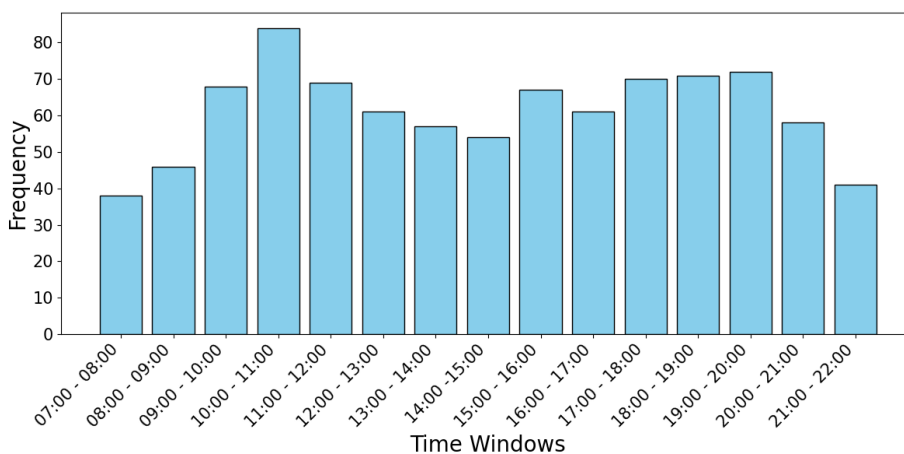


Figure 4: A chart showing when respondents most frequently selected time windows.

Figure 4 shows the distribution of selected time windows, with a clear peak in late morning (around 11:00–12:00) and steady preferences observed during the late afternoon and evening (16:00–21:00). Respondents in this study were free to choose non-consecutive time windows, unlike the predefined time windows typically offered by most e-grocers. Despite this flexibility, approximately half of the participants opted for consecutive time windows, suggesting a preference for closely grouped selections.

Further analysis reveals that most respondents selected consecutive time windows, with either no gaps or a single gap between their choices. Only a small number chose up to two non-consecutive time windows. For those who did choose non-consecutive time windows, the middle 50% had maximum gaps ranging between 1 and 3 time time windows. Only a small fraction of respondents selected time windows spread across the entire day, such as one in the morning and another in the evening. The average number of time windows chosen was nearly the same for respondents who selected non-consecutive time windows and those who chose consecutive ones, with both groups averaging around five selected time windows. This finding may explain why real-life supermarkets typically restrict choices to consecutive slots, prioritizing logistical simplicity.

5.3 Chi-Squared test

Incentive Scheme	χ^2	p-Value	*p-Value
1 vs. 2	3.2940	0.1926	0.241
1 vs. 3	6.0903	0.0476	0.119
1 vs. 2+3	7.3179	0.0258	0.086
1 vs. 4	4.9220	0.0853	0.142
1 vs. 5	9.4428	0.0089	0.031
1 vs. 6	2.9622	0.2274	0.272
1 vs. 7	7.8255	0.0200	0.067
1 vs. 8	9.4461	0.0089	0.031
1 vs. 9	6.2412	0.0441	0.110
1 vs. 7+8+9	12.5522	0.0019	0.013

Incentive Scheme	χ^2	p-Value	p-Value*
3 vs. 4	1.5229	0.4670	0.467
3 vs. 5	1.2361	0.5390	0.539
3 vs. 6	3.0857	0.2138	0.272
3 vs. 4+5+6	1.6635	0.4353	0.467
4 vs. 7	8.6746	0.0131	0.041
5 vs. 8	14.7492	0.0006	0.004
6 vs. 9	5.7333	0.0569	0.110

Table 6: Statistical significance of differences between incentive schemes. * BH-corrected p-value

To clarify the incentive schemes corresponding to the numbers referenced in this section, please refer to Table 5 for a detailed breakdown of the incentive schemes.

First, all incentive schemes are compared to the green incentive to evaluate their relative effects. The results indicate that adding a high financial incentive had a noticeable effect on the number of time windows chosen (*1 vs. 3*), although this effect was not significant when corrected for multiple comparisons. The low financial incentive did not produce a significant effect, even before correction (*1 vs. 2*). Introducing a social norm incentive along with the green incentive resulted in a strong impact across all social norm levels, however when corrected only the neutral social norm stayed significant (*1 vs. 8*). When all three incentives (green, financial, and social norms) were combined, a significant difference was found only for the combination with the neutral social norm compared to the green incentive alone (*1 vs. 5*).

To further investigate the impact of adding different type of incentives into an existing scheme, several comparisons were made. The effect of adding a social norm incentive to a scheme with both the green and high financial incentives was examined. However, results show no significant effect, suggesting that adding a social norm incentive does not lead to a statistically different selection pattern when added to the green and financial incentive scheme (*3 vs. 4, 5, 6*). Another analysis assessed the impact of introducing a high financial incentive to schemes that included green incentives and various levels of social norms. Results indicate that adding a high financial incentive significantly changes the number of time windows selected for both the low and neutral level of social norm, even after applying corrected p-values (*4 vs. 7, 5 vs. 8*). In contrast, the addition of a high financial incentive to the high social norm level does not result in a significant difference (*6 vs. 9*).

5.4 Regression Analysis - Incentives

Based on significant findings from the chi-squared analysis, several linear regressions were performed to further explore the impact of different incentive schemes compared to the green incentive alone. Table 7 presents results from a linear regression model that includes all incentive schemes, using the green incentive as the reference category.

The results show that none of the incentive schemes achieve statistical significance. While the high financial incentive and the scheme combining high financial and neutral social norm incentives approach significance, the results still require cautious interpretation. Despite this, the effect sizes provide valuable insights into the nature of the incentive schemes. High financial incentives show a stronger positive effect than low financial incentives, indicating that the amount used as financial incentive is a relevant factor for the size of the effect. When combined with high financial incentives, social norms consistently shows positive effects, with the neutral social norm demonstrating the largest impact. This suggests that this specific combination may be the most effective at motivating participants. In contrast, social norm incentives without financial incentives generally show negative effects across all levels, suggesting that social norms alone are less effective than the Green incentive in encouraging participants to select more time windows.

Incentive scheme	Coefficient	Std. Error	p-value
Green, Financial (Low)	0.1447	0.999	0.885
Green, Financial (High)	1.6786	0.974	0.087
Green, Financial (High), Social Norm (Low)	1.3026	0.999	0.194
Green, Financial (High), Social Norm (Neutral)	1.9167	0.974	0.051
Green, Financial (High), Social Norm (High)	0.4405	0.974	0.652
Green, Social Norm (Low)	-1.0500	0.986	0.289
Green, Social Norm (Neutral)	-1.3816	0.999	0.169
Green, Social Norm (High)	-0.3690	0.974	0.705
<i>Intercept</i>	4.7500	0.697	<0.001

Table 7: Regression coefficients comparing all incentive schemes, with the green incentive as the reference.

Additionally, significant results from the chi-squared test for the low and neutral social norms with an added financial incentive prompted two further linear regressions. These models aim to identify whether the observed effects were positive or negative. Separate regressions were run for schemes including green, low social norm with and without high financial, and green, neutral social norm with and without high financial, leaving out the high social norm due to its lack of significant chi-squared results. Each model uses the scheme without the financial incentive as the reference category to better understand the effect of adding a financial incentive.

The model displayed in Table 8 compares green, low social norm with and without the addition of a high financial incentive. The results show a significant positive effect for green, high financial, low social norm, suggesting that the high financial incentive meaningfully increases the number of time windows selected.

Incentive schemes	Coefficient	Std. Error	p-value
Green, Financial (High), Social Norm (Low)	2.3526	0.831	0.007
<i>Intercept</i>	3.3684	0.617	<0.001

Table 8: Analysis of the impact of adding a financial incentive to a low social norm scheme.

The effect of adding a financial incentive to Green, neutral social norm is shown in Table 9. Here, adding a financial incentive again yields a significant positive effect on the number of time windows chosen.

Incentive schemes	Coefficient	Std. Error	p-value
Green, Financial (High), Social Norm (Neutral)	3.2982	0.852	<0.001
<i>Intercept</i>	3.3684	0.617	<0.001

Table 9: Analysis of the impact of adding a financial incentive to a neutral social norm scheme.

Linear regression models assume a normal distribution of the data; however, because the dependent variable is a count variable, it is more right-skewed, which can make the results less reliable. Therefore, an ordinal regression was also conducted, as it allows for categorization of the data and bypasses the normal distribution assumption. Table 10 presents the results of the ordinal regression models used. In each model, a subset of incentive schemes were included, which results in the incentive schemes that were excluded serving as the implicit baseline for that model.

Because the baseline shifts depending on which incentives are included in each model, it's important to interpret the results within each model independently, rather than comparing coefficients across models. Each coefficient in a given model reflects the log-odds change associated with that incentive relative to the baseline incentives. Significance here indicates whether an incentive has a distinct effect on the likelihood of selecting more time windows relative to the incentives not included in that model, rather than suggesting an absolute strength across all incentives.

The ordinal regression models assume proportional odds, meaning that the relationship between the incentive schemes and the log-odds of the outcome is consistent across all thresholds of that scheme. This assumption was not explicitly tested, and potential violations could influence the reliability of the model results.

Despite these limitations, the results still offer valuable insight into which incentives influence the likelihood of selecting additional time windows.

Incentive(s)	Model 1	Model 2	Model 3	Model 4
Green	-0.99 (0.49)*	-1.60 (0.51)**	-	-
Green, Financial (Low)	0.13 (0.50)	-	0.77 (0.51)	-
Green, Financial (High)	0.55 (0.51)	-	1.19 (0.52)*	-
Green, Financial (High), Social Norm (Low)	-	-	1.50 (0.60)*	0.95 (0.62)
Green, Financial (High), Social Norm (Neutral)	-	-	1.75 (0.59)**	1.20 (0.61)*
Green, Financial (High), Social Norm (High)	-	-	0.98 (0.53)	0.43 (0.56)
Green, Social Norm (Low)	-	-1.10 (0.46)*	-	-0.42 (0.48)
Green, Social Norm (Neutral)	-	-1.67 (0.46)***	-	-0.99 (0.48)*
Green, Social Norm (High)	-	-0.58 (0.48)	-	0.09 (0.50)
Threshold: Low/Medium	-2.15 (0.26)***	-2.83 (0.32)***	-1.58 (0.27)***	-2.12 (0.33)***
Threshold: Medium/High	0.57 (0.13)***	0.63 (0.13)***	0.61 (0.13)***	0.61 (0.13)***

Table 10: Coefficients for ordinal regression models, segmented by different incentive schemes. (Standard Errors in Parentheses); significance levels: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Model 1: Green and Financial combination only (No Social Norm incentives)

This model includes the green incentive alone, and combined with either low or high financial incentives. The goal is to assess the effect of adding a financial incentive to the green incentive, with the results compared against a baseline of all incentive schemes that include social norms. The coefficients indicate the change in log-odds of selecting a higher category of time windows when Financial Incentives are included, relative to social norm-based schemes.

The results indicate that while the Green incentive alone significantly reduces the likelihood of selecting higher categories. Both low and high Financial incentives show upward trends, suggesting a potential for encouraging higher time window selections, though not reaching statistical significance.

To zoom into the effect of the adding a financial incentive to a green incentive a binary logistic regression was run with the Green incentive as the baseline. The results in Table 11 show that only the high financial incentive at the second threshold produced a significant improvement compared to the green incentive.

Incentive Scheme	Thresholds		
	1	2	3
Green, Financial (Low)	0.84 (0.64)	0.50 (0.54)	0.42 (0.47)
Green, Financial (High)	1.24 (0.71)	1.39 (0.69)*	0.73 (0.47)
<i>Intercept</i>	<i>0.89</i>	<i>0.67</i>	<i>0.02</i>

Table 11: Impact of low and high financial incentives at various thresholds. (Standard Errors in Parentheses); significance levels: *p < 0.05.

Model 2: Green and Social Norm combination only (No Financial incentives)

This model includes the green incentive and low, neutral, and high social norm incentives. The goal is to investigate how social norm incentives alone influence the likelihood of selecting higher categories of time windows, as well as compare the relative influence of different levels of social norm. The results are assessed against a baseline of all incentive schemes that include a financial incentive, with coefficients indicating the change in log-odds of selecting a higher category of time windows than when a financial incentives is included.

The Green incentive, once again, is associated with a reduced likelihood of choosing additional windows. The neutral and low social norm levels also reduce this likelihood, with neutral social norm showing the strongest discouraging effect. The high social norm, however, suggests a trend towards a more positive impact, although this effect is not statistically significant. This pattern hints that, without financial incentives, social norms do not have a consistent, upward linear effect on the number of time windows selected.

Model 3: All Financial incentives

This model includes the Green Incentive, low and high Financial Incentives, and combinations of these with low, neutral, and high social norm incentives. The goal is to assess whether adding social norm incentives to high Financial Incentives creates a cumulative effect, increasing the likelihood of selecting higher categories of time windows compared to Financial Incentives alone. The baseline includes all schemes without a Financial incentive, with coefficients reflecting the change in log-odds relative to these non-Financial schemes.

High financial incentives alone show a significant positive effect, indicating this is an effective motivator. When combined with low and neutral social norm levels, these incentive schemes are even more effective, with both combinations showing a statistically significant increase in the likelihood of choosing additional time windows. In contrast, the combination of high social norm with financial incentives does not produce a significant effect. This pattern is consistent with the previous model: the incentive scheme with neutral social norm shows the strongest effect, followed by low social norm, while high social norm produces a weaker, non-significant effect.

To evaluate the effect of combining a financial incentive to the incentive schemes including a social norm, a binary logistic regression was run with the high financial incentive set as the baseline. The results in Table 12 show that the incentive scheme involving a neutral social norm consistently produced positive coefficients across all thresholds. While the effects are not statistically significant, the consistent positive coefficients suggest a trend where this scheme might enhance the likelihood of selecting more time windows compared to the high financial incentive alone, where the results for low and high social norms are less clear.

Incentive Scheme	Thresholds		
	1	2	3
Green, Financial (Low)	0.06 (0.74)	-0.33 (0.58)	-0.26 (0.48)
Green, Financial (High), Social Norm (Low)	0.06 (0.74)	-0.06 (0.63)	0.36 (0.55)
Green, Financial (High), Social Norm (Neutral)	0.98 (1.04)	0.32 (0.70)	0.46 (0.53)
Green, Financial (High), Social Norm (High)	-0.45 (0.58)	-0.24 (0.57)	0.05 (0.48)
<i>Intercept</i>	<i>2.05</i>	<i>1.76</i>	<i>0.86</i>

Table 12: Impact of social norm levels (low, neutral, high) with financial incentives across thresholds. (Standard Errors in Parentheses).

Model 4: All Social Norm incentives

This model includes the Green incentive, all levels of Social Norm, and combinations of these with high Financial Incentives. The goal is to examine how the combination of Social Norm and high Financial Incentives influences the likelihood of selecting higher categories of time windows, while also comparing this to the effect of Social Norm incentives used alone. The baseline is set to incentive schemes that do not include a Social Norm, with coefficients representing the change in log-odds of selecting a higher category relative to these non-Social Norm schemes.

The incentive scheme including neutral Social Norm and a high Financial incentive has a significant positive effect, while the neutral Social Norm alone has a negative effect. For other Social Norm levels, the addition of a financial incentive also produces a more positive outcome, but these effects are not statistically significant. Overall, these results suggest that the neutral Social Norm stands out from other levels in its ability to steer consumer behaviour, either positively or negatively, depending on whether it is accompanied by a Financial incentive.

The results consistently show that the green incentive alone is associated with a negative effect, suggesting it is less effective at encouraging respondents to select additional time windows than when combined with other incentives.

High financial incentive demonstrated stronger effects than low financial incentive across multiple models, with a significant result in Model 3. Low financial incentives, however, had negligible effects, indicating that larger monetary rewards are needed to influence behaviour.

Social Norms on their own yielded negative effects, but when combined with financial incentives, the low and neutral social norms produced significant positive effects, as seen in Model 3 and Model 4. High social norms never produced significant results, regardless of the model. As mentioned before a consistent pattern emerged, where neutral social norm level had the greatest impact among the social norm levels. Interestingly, the direction of this effect varied depending on the presence of a financial incentive.

The results related to social norm seem to indicate a nuanced effect of social norm. In the particular setup of this study, respondents were informed that a certain percentage of costumers selected three or more time windows. The findings in Table 5 showed that the incentive schemes including green and various levels of social norm resulted in a mean closest to 3, with the smallest standard deviation compared to other incentive schemes. This could indicate that, rather than encourage respondents to choose as many time windows as possible, as was our original aim, the social norm incentive has reinforced the idea that three time windows were the “correct” or “appropriate” choice, as a large portion of respondents selected exactly this number. This may explain why social norm incentives, without an added financial incentive, appear to have a negative effect on the number of time windows selected compared to the other incentive schemes, as seen in both the linear regression and ordinal regression results.

To further explore the nuanced impact of social norm incentives, a binary logistic regression was also conducted for the incentive schemes including a social norm. To improve the interpretability of the coefficients, the green incentive was chosen as the reference category, allowing the effects of social norm incentives to be directly compared to this baseline. Specifically, the differing effects—whether positive or negative—between thresholds 1 and 2 compared to threshold 3 provide valuable insight. This analysis can help determine whether the social norm incentive’s impact is tied closely to the incentives number of time windows mentioned in the incentive (three or more).

Incentive Scheme	Thresholds		
	1	2	3
Green, Financial (High), Social Norm (Low)	0.52 (0.68)	0.49 (0.59)	0.97 (0.52)
Green, Financial (High), Social Norm (Neutral)	1.33 (0.89)	0.85 (0.64)	1.07 (0.51)*
Green, Financial (High), Social Norm (High)	0.07 (0.55)	0.34 (0.54)	0.69 (0.47)
Green, Social Norm (Low)	0.90 (0.76)	0.29 (0.54)	-0.40 (0.45)
Green, Social Norm (Neutral)	0.52 (0.68)	0.49 (0.59)	-1.08 (0.52)*
Green, Social Norm (High)	0.93 (0.76)	1.16 (0.72)	0.18 (0.44)
<i>Intercept</i>	<i>1.36</i>	<i>1.00</i>	<i>0.07</i>

Table 13: Influence of social norms incentive schemes compared to the green incentive across thresholds. (Standard Errors in Parentheses); significance levels: * $p < 0.05$.

Across thresholds 1 and 2, none of the coefficients are statistically significant. However, the overall positive coefficients suggest that all social norm incentives, whether combined with financial incentives or not, exhibit positive effects. At threshold 3, however, this pattern changes. For the incentive schemes without a financial incentive, low and neutral social norms show negative effects, with the neutral social norm even demonstrating a significant reduction in the likelihood of selecting more than three time windows. This shift supports the idea that social norm may establish a perceived “default” choice of three time windows, however these results suggest that this is only in the absence of financial incentives.

The results also conform that the effect of social norms varies depending on the presence of financial incentives. When financial incentives are added to social norm schemes, neutral social norm emerges as the most effective level across all thresholds and low and neutral social norm retain a positive effect even at threshold 3. This highlights the role of financial incentives in enhancing the influence of neutral social norm and mitigating the limiting “default” behaviour observed without financial incentives.

It is important to note that high social norm does not do quite the same thing as low and neutral social norm. High social norm does not turn negative at the threshold 3, instead diminishing to a small positive effect. At threshold 1 and 2, for the incentive schemes without a financial incentive, high social norm shows the biggest impact of all levels of social norm. However, when combined the financial incentive, the effect of the high social norm decreases at threshold 1 and 2, and only slightly improves at threshold 3.

In contrast to high social norm, neutral social norm becomes the most effective level across all thresholds when paired with financial incentives. At threshold 1, the combination of neutral social norm and financial incentives demonstrates the strongest positive effect. At threshold 2, high social norm without financial incentives has the strongest effect. At threshold 3, neutral social norm combined with financial incentives once again shows the most positive effect among all schemes, while the neutral social norm without financial incentives shows the strongest negative effect. These observations suggest that a financial incentive enhance the effectiveness of neutral social norm, particularly by maintaining a positive influence at higher thresholds where stand-alone social norms falter.

To assess whether the observation regarding the effect of adding a financial incentive to incentive schemes including social norms also holds true at the lower thresholds, two additional comparisons were made. The results, displayed in Tables 14 and 15, confirm that adding a financial incentive provided the “extra push” needed to exceed the 3-window threshold for both the low and neutral social norms. However, at the lower thresholds, this effect did not have a significant impact for the lower thresholds.

Incentive Scheme	Thresholds		
	1	2	3
Green, Financial (High), Social Norm (Low)	0.18 (0.72)	0.37 (0.60)	1.14 (0.52)*
<i>Intercept</i>	1.86	1.16	-0.14

Table 14: Binary logistic results for low social norm schemes with and without financial incentives. (Standard Errors in Parentheses); significance levels: *p < 0.05.

Incentive Scheme	Thresholds		
	1	2	3
Green, Financial (High), Social Norm (Neutral)	1.10 (0.98)	0.58 (0.66)	1.68 (0.49)**
<i>Intercept</i>	1.80	1.38	-0.69

Table 15: Binary logistic results for neutral social norm schemes with and without financial incentives. (Standard Errors in Parentheses); significance levels: *p < 0.05.

5.5 Regression Analysis - Personality traits

To explore the relationship between the personality traits and environmental consciousness, a linear regression analysis was conducted for using the TIPI scores for each trait and the Environmental Attitudes Inventory (EAI) score as the dependent variable. The results are visually represented in Figure 5, which displays scatter plots for each of the five personality traits: Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness.

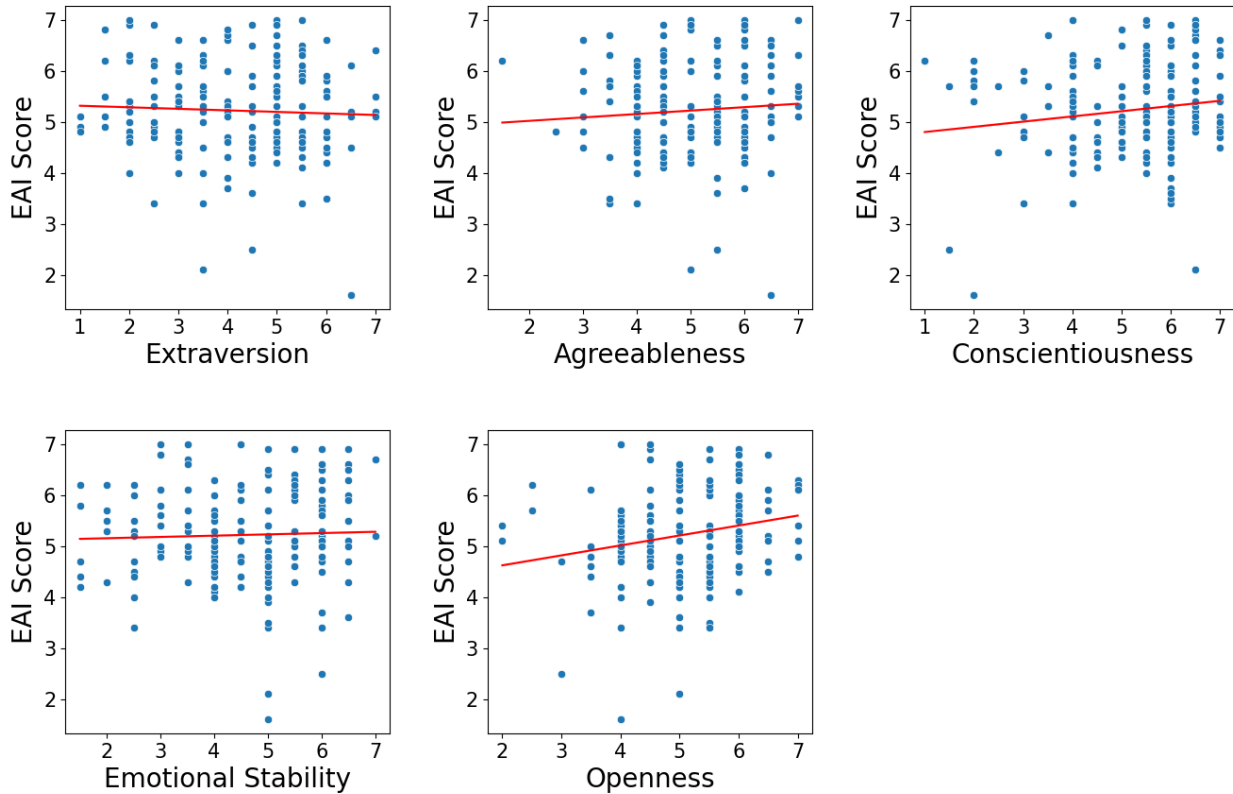


Figure 5: Scatter plots of environmental consciousness against each personality traits

In each scatter plot, the blue points represent individual respondents' scores, while the red line represents the linear regression. This regression line helps illustrate the direction and strength of the relationship between the personality trait and environmental consciousness. A steeper slope in the line indicates a stronger relationship, whereas a flatter line suggests a weaker or negligible relationship.

Personality Trait	Coefficient	Intercept	R-squared	P-value
Extraversion	-0.0301	5.3442	0.0022	0.5373
Agreeableness	0.0671	4.8832	0.0060	0.3094
Conscientiousness	0.1021	4.6962	0.0210	0.0555
Neuroticism	0.0252	5.1050	0.0014	0.6285
Openness	0.1949	4.2346	0.0442	0.0053

Table 16: Linear Regression Results for Personality Traits and EAI Score

The linear regression analyses, summarized in Table 16 and visualized in Figure 5, reveals key insights into the relationship between the personality traits and environmental consciousness. The results show that Openness has the strongest and only statistically significant relationship with environmental attitudes. This indicates that individuals who score higher on Openness are more likely to exhibit greater environmental consciousness. Conscientiousness also shows a positive relationship with environmental attitudes, though it is not statistically significant at the standard threshold. These results are in line with previous research as discussed in the theoretical background.

The other personality traits show weak, non-significant relationships. This suggests these traits have little to no measurable impact on environmental consciousness in this context. The only notable observation is that Extraversion shows a slight negative relationship with environmental attitudes. However, given the weak relationship, these results are insufficient to draw any meaningful conclusions.

To further understand how personality traits and environmental consciousness interact with incentive schemes to influence the number of time windows, a linear regression analysis was conducted. Interaction terms were included to determine whether individual traits or attitudes moderate the effectiveness of incentives. Positive interactions indicate that certain traits or attitudes enhance the incentive’s impact, while negative interactions suggest they reduce its effectiveness.

First, an analysis was conducted combining all incentive schemes with personality traits and the environmental consciousness. The significant and near-significant results are summarized in Table 17. The results highlight that Neuroticism appears to have a positive effect on incentive schemes including a social norm. This also seems a rational outcome as people who are less emotionally stable and thus more susceptible to social cues would be more likely to respond positively to social norms.

Agreeableness yields significant results for financial incentive schemes; however, the effect is significant only for the high financial incentive. Additionally, personality traits such as Openness and Extraversion also show significant results for high financial incentives, with all three traits—Agreeableness, Openness, and Extraversion—exhibiting negative effects. This suggests that financial incentives may be less effective for customers with these personality traits compared to schemes involving non-financial incentives, such as the baseline green incentive.

Incentive(s)	Interaction Variable(s)	Coefficient	Std. Error	p-value
Green, Financial (Low)	Agreeableness	-1.75	1.01	0.086
Green, Financial (High)	Openness	-4.56	1.43	0.002
Green, Financial (High)	Extraversion	-2.40	0.93	0.011
Green, Financial (High)	Agreeableness	-2.14	1.00	0.034
Green, Financial (High), Social Norm (Neutral)	Neuroticism	2.29	1.00	0.025
Green, Financial (High), Social Norm (High)	Neuroticism	2.18	1.13	0.056
Green, Social Norm (Low)	Neuroticism	2.26	1.12	0.047
Green, Social Norm (Neutral)	Neuroticism	2.29	1.00	0.025
Green, Social Norm (High)	Neuroticism	1.87	1.07	0.083

Table 17: Summary of Significant Regression Results by Incentive and Interaction Variable.

As including so many variables resulted in multicollinearity. A smaller model was made to see how this could influence the model. Based on previous research, and supported by findings in this study, it was chosen to include the personality types Openness and Conscientiousness as interactive variables in combination with the number of time windows selected. The results of this smaller model are presented in Table 18.

Incentive(s)	Interaction Variable(s)	Coefficient	Std. Error	p-value
Green, Financial (Low)	Openness	-1.75	1.03	0.091
Green, Financial (High)	Openness	-3.82	1.26	0.003

Table 18: Summary of Significant Regression Results by Incentive and Interaction Variable ($p < 0.10$).

The findings align with the previous results, as for Openness a negative effect is again observed in combination with the Financial incentive. Since the green incentive was used as the reference in this model, this negative relationship indicates that individuals high in Openness responded better to the green incentive alone. This can be explained by the motivation crowding effect, where the addition of the financial incentive diminishes the impact of the green incentive. For individuals who score high in Openness—and thus are also more environmentally conscious, as found in our research—the green incentive alone might already align strongly with their intrinsic motivations. The additional financial incentive likely shifted their focus toward extrinsic rewards, making it counterproductive and reducing the overall effectiveness of the incentive scheme.

6 Discussion

The primary focus of this study was to examine how different incentive schemes affected the number of time windows selected for grocery deliveries and how these incentives interacted with each other. Additionally, the study explored the influence of personality traits on the decision-making process. The results will be discussed in the context of the formulated hypotheses for both incentives and personality traits.

H1: The combination of a financial incentive (low or high) with a green incentive will not significantly increase the number of time windows selected for grocery delivery compared to using only a green incentive

The results demonstrated different effects for low and high financial incentives. Low financial incentives showed a slight positive effect on the number of time windows chosen but did not result in a statistically significant change, aligning with the hypothesis. High financial incentives, on the other hand, significantly increased the number of time windows selected for the specific instance of selecting more than two time windows. These results demonstrate that financial rewards, when big enough, can add value to the green incentive but this effect can be very specific for certain threshold, partially contradicting this hypothesis.

H2: The combination of a social norm incentive with a green incentive will result in a higher number of time windows chosen for grocery delivery compared to using only a green incentive.

The results revealed a more complex relationship than initially expected. Rather than broadly increasing the number of time windows selected, there was evidence of a conformity effect, where respondents aligned their behaviour with the incentives norm. In this case, the social norm emphasized selecting *three or more time windows*, leading many respondents to conform to the minimum incentivized number of three time windows. This effect was particularly pronounced for the low and neutral social norms. For high social norms, however, this pattern was less clear. It is possible that for some respondents, the stronger social pressure exerted by the high social norm was sufficient to encourage them to exceed the minimum incentivized number of time windows, resulting in a more varied response.

To answer this hypothesis, a more nuanced explanation is required. While adding social norms improved the effectiveness of the incentive scheme for thresholds 1 and 2, the data does not confirm that social norms encourage customers to choose a higher number of time windows overall. This is likely because the incentivized number of time windows was set lower than the average selected with the Green Incentive alone. The results emphasize that the effectiveness of the social norm incentive depends heavily on the specific number of time windows emphasized. As such, the current results are inconclusive. However, the limitations provide direction for future research to explore the broader influence of social norms on time window selection.

H3: Higher levels of social norm incentives will result in a greater number of time windows chosen for grocery delivery compared to lower levels of social norm incentives

The results indicate that there are differences between the levels of social norms but the pattern was highly dependent on the presence of a financial incentive. Without financial incentives, high social norms demonstrated the most positive influence on time window selection, supporting the hypothesis in this specific context. However, the pattern changed when financial incentives were introduced. Neutral social norms, when paired with financial incentives, showed the most significant positive impact, outperforming both low and high social norms. This shift may be explained by the interaction between extrinsic motivators (financial rewards) and the subtler guidance provided by neutral social norms. High social norms, by contrast, may have created a sense of excessive pressure or unrealistic expectations, diminishing their effectiveness when combined with financial incentives. This finding suggests that stronger social norms are not always the most effective in promoting behaviour change, particularly when combined with extrinsic motivators like financial incentives.

H4: The combination of green, financial, and social norm incentives will result in a greater number of time windows chosen for grocery delivery compared to using only a green incentive combined with either financial or social norm incentive alone.

Compared to the green incentive alone, the combination of all three incentives—green, financial, and social norms—led to an increase in the number of time windows selected, as shown in the regression analysis. For the scheme including the neutral social norm a statistically significant improvement was found.

While this combination appeared more effective than using only the financial incentive, this improvement was not statistically significant. It is worth considering that if the incentivized number of time windows in the social norm were set higher—potentially exceeding the average number chosen with financial incentives alone—the impact of the social norm might be more pronounced. Further research is needed to explore this hypothesis by testing alternative "norms" for the social norm incentive.

Adding a financial incentive to schemes that included a social norm was shown to significantly increase the number of time windows selected for both low and neutral social norms. This effect was particularly evident at the threshold of three time windows, where the financial incentive provided the additional motivation needed to exceed the minimum incentivized selection. For thresholds of one and two time windows, the financial incentive also had a positive effect, though these were not statistically significant. These findings support the notion that the primary value of adding the financial incentive lies in encouraging participants to select more time windows beyond the minimum norm.

In conclusion, the hypothesis is partially supported. The combination of green, financial, and neutral social norm incentives resulted in a greater number of time windows chosen compared to schemes combining the green incentive with only a social norm. However, whether adding a social norm to the financial incentive scheme significantly increases the number of time windows selected requires further research.

H5: Higher scores for personality traits Conscientiousness and Openness will be positively associated with greater environmental consciousness.

The findings in this study partially support this hypothesis. The linear regression analysis revealed that Openness exhibited the strongest and only statistically significant positive relationship with environmental attitudes (EAI score), consistent with prior research linking this trait to pro-environmental behaviour. Conscientiousness also showed a positive relationship with environmental attitudes but did not reach statistical significance. The other personality traits—Extraversion, Agreeableness, and Neuroticism—demonstrated weak or negligible relationships with environmental attitudes, with Extraversion showing a slight negative trend.

H6: Higher scores in Conscientiousness and Openness will be positively associated with selecting a higher number of delivery time windows for grocery delivery.

The results did not fully align with initial expectations but provided valuable insights into how personality traits influence the effectiveness of incentives. Openness showed a negative relationship with the number of time windows selected for the incentive scheme including the green and high financial incentive, possibly due to the motivation crowding effect. Other personality traits, such as Extraversion and Agreeableness, were also negatively associated with this scheme.

Conscientiousness did not produce any significant effects across the models, underscoring its limited influence on this specific behaviour in this dataset, in contract with our initial hypothesis

Interestingly, Neuroticism emerged as an important factor when combined with social norm incentives, resulting in a positive effect on the number of time windows selected. This suggests that individuals with higher Neuroticism scores may be more sensitive to social cues. This finding highlights the potential relevance of traits beyond Openness and Conscientiousness, particularly in contexts where social norms are present.

7 Conclusion

This study sought to answer the question: How do incentives influence the number of time windows chosen by customers for grocery delivery?

The results demonstrated that combining green, financial, and social norm incentives yields the most effective strategy for encouraging the highest number of time windows selected. Among single-incentive additions, only the high financial incentive added to the green incentive scheme was found to be effective. However, careful consideration is required, as respondents scoring higher on personality traits such as Openness, Extraversion, and Agreeableness were negatively influenced when a financial incentive was added compared to the green incentive alone. The effectiveness of financial incentives also depends on surpassing a certain threshold, as smaller financial incentives did not lead to significant changes in behaviour. This means that the financial incentive required to make the scheme effective exceeds the actual savings identified in previous research that retailers might gain from more flexible time window selections.

The role of social norms proved to be context-dependent. While social norms alone did not significantly increase the overall number of time windows chosen, they clearly influenced time window selection behaviour. Low and neutral social norms were primarily effective in aligning choices with the incentivized norm, while higher social norms were necessary to encourage selections beyond this threshold. When paired with financial incentives, low and neutral social norms demonstrated improved effectiveness, as the financial incentive provided the additional push needed to exceed the incentivized norm. Although adding social norms to an existing financial incentive did not result in significant overall improvements, it did mitigate the negative relationship with personality traits such as Openness, potentially reducing the motivation crowding effect caused by financial incentives alone. Social norms also proved to be an interesting incentive for individuals with higher neuroticism, who demonstrated a greater responsiveness to these cues, highlighting their potential for influencing behaviour among specific personality profiles.

E-grocery retailers can leverage these findings to design more effective delivery incentives. Financial incentives remain a strong driver of consumer behaviour, but their effectiveness depends on meeting a certain threshold. Social norms, while less impactful on their own, provide a low-cost and scalable solution for guiding specific behaviours. Combining social norms with financial incentives can enhance overall effectiveness, particularly by mitigating negative effects associated with certain personality traits. This study underscores the importance of customer segmentation and tailoring incentives to customer profiles, enabling e-grocery retailers to optimize delivery planning while maintaining high levels of customer satisfaction.

8 Limitation

Despite the valuable insights gained through this research, several limitations should be acknowledged to contextualize the findings.

The sample used in this study, while diverse in terms of demographic, consists predominantly out of respondents from the United Kingdom and the Netherlands. This limits the generalizability of the findings to other cultural or socio-economic contexts.

The survey attempted to elicit representative responses by emphasizing that respondents should consider their actual schedules when selecting delivery time windows. This approach was intended to mirror real-world decision-making as closely as possible. However, the hypothetical nature of the scenario remains a limitation. Respondents may have behaved differently, for instance, by choosing more time windows than they would in reality, knowing that the scenario was fictional and would not require actual commitments.

Another limitation of this study was the formulation of the social norm incentive. The social norm incentive used “three or more” as the incentivized number of time windows, and the results were closely tied to this specific norm. This raises the question of whether using a different number of time windows in the formulation of the social norm would yield similar results but centred around the new norm, or whether the effect of the social norm would diminish. As the results are so closely tied to the chosen norm, the conclusions this study can draw about the full potential effect of social norms are limited and may not fully apply to other contexts. Future research should experiment with varying the incentivized number of time windows to better understand the broader potential of social norms in influencing consumer behaviour.

References

- [AB23] Kelly Main Anna Baluch. 38 e-commerce statistics of 2023. <https://www.forbes.com/advisor/business/ecommerce-statistics/>, Last Updated: 08.02.2023. Accessed: 16.03.2024.
- [ACF⁺13] Niels A. H. Agatz, A. Campbell, M. Fleischmann, J. van Nunen, and M. Savelsbergh. Revenue management opportunities for internet retailers. *Journal of Revenue and Pricing Management*, 12:128–138, 2013.
- [AFN06] Niels A. H. Agatz, M. Fleischmann, and J. Nunen. E-fulfillment and multi-channel distribution - a review. *Eur. J. Oper. Res.*, 187:339–356, 2006.
- [AFS21] Niels A. H. Agatz, Yingjie Fan, and D. Stam. The impact of green labels on time slot choice and operational sustainability. *Production and Operations Management*, 30:2285–2303, 2021.
- [Aga09] Niels Agatz. *Demand Management in E-Fulfillment*. PhD thesis, apr 2009.
- [BGF24] Michael Emmerich Burak Gülmez and Yingjie Fan. Multi-objective optimization for green delivery routing problems with flexible time windows. *Applied Artificial Intelligence*, 38(1), 2024.
- [CBP⁺15] C. Chiorri, F. Bracco, T. Piccinno, Cinzia Modafferi, and V. Battini. Psychometric properties of a revised version of the ten item personality inventory. *European Journal of Psychological Assessment*, 31:109–119, 2015.
- [CKR91] Robert B. Cialdini, Carl A. Kallgren, and Raymond R. Reno. A focus theory of normative conduct: A theoretical refinement and reevaluation of the role of norms in human behavior. volume 24 of *Advances in Experimental Social Psychology*, pages 201–234. Academic Press, 1991.
- [CM14] Choongbeom (CB) Choi and Anna Mattila. The effects of promotion framing on consumers’ price perceptions: The moderating role of a personal sense of power. *Journal of Service Management*, 25, 03 2014.
- [CS06] A. Campbell and M. Savelsbergh. Incentive schemes for attended home delivery services. *Transp. Sci.*, 40:327–341, 2006.
- [DCHW15] Christophe Demarque, Laetitia Charalambides, D. Hilton, and L. Waroquier. Nudging sustainable consumption: The use of descriptive norms to promote a minority behavior in a realistic online shopping environment. *Journal of Environmental Psychology*, 43:166–174, 2015.
- [Duo21] Doanh Duong. Big five personality traits and green consumption: bridging the attitude-intention-behavior gap. *Asia Pacific Journal of Marketing and Logistics*, ahead-of-print, 09 2021.

- [FAM06] Elena Fraj Andrés and Eva Martinez. Influence of personality on ecological consumer behavior. *Journal of Consumer Behaviour*, 5:167 – 181, 05 2006.
- [FBMM11] Andrea Fossati, Serena Borroni, Donatella Marchione, and Cesare Maffei. The big five inventory (bfi). *European Journal of Psychological Assessment*, 2011.
- [GCG08] Noah J. Goldstein, R. Cialdini, and Vladas Griskevicius. A room with a viewpoint: Using social norms to motivate environmental conservation in hotels. *Journal of Consumer Research*, 35:472–482, 2008.
- [Gel24] Koen van Gelder. Topic: Online grocery shopping in the netherlands, Jan 2024. Accessed: 12.08.2024.
- [GRS03] Samuel Gosling, Peter Rentfrow, and William Swann. A very brief measure of the big-five personality domains. *Journal of Research in Personality*, 37:504–528, 12 2003.
- [HLLL14] Hao-Chen Huang, Tzong-Huei Lin, Mei-Chi Lai, and Tzu-Ling Lin. Environmental consciousness and green customer behavior: An examination of motivation crowding effect. *International Journal of Hospitality Management*, 40:139–149, 07 2014.
- [IC20] B. Ignat and S. Chankov. Do e-commerce customers change their preferred last-mile delivery based on its sustainability impact? *Sustainable behaviour in last-mile logistics*, 2020.
- [IY18] H. Iwasa and Y. Yoshida. Psychometric evaluation of the japanese version of ten-item personality inventory (tipi-j) among middle-aged, and elderly adults: Concurrent validity, internal consistency and test–retest reliability. *Cogent Psychology*, 5, 2018.
- [JDK91] Oliver P John, Eileen M Donahue, and Robert L Kentle. Big five inventory. *Journal of personality and social psychology*, 1991.
- [KEC19] Charlotte Köhler, Jan Ehmke, and Ann Campbell. Flexible time window management for attended home deliveries. *Omega*, 91, 01 2019.
- [Kon18] Spyridon Kontaxis. Making the e-grocery attended home delivery more efficient: An empirical research on the impact of green incentives and discounts on customer’s delivery-window choice, 2018.
- [Kva15] Olga Kvasova. The big five personality traits as antecedents of eco-friendly tourist behavior. *Personality and Individual Differences*, 83:111–116, 09 2015.
- [LW18] Mingnan Liu and Laura Wronski. Examining completion rates in web surveys via over 25,000 real-world surveys. *Social Science Computer Review*, 36:116 – 124, 2018.
- [MD10] Taciano Milfont and John Duckitt. The environmental attitudes inventory: A valid and reliable measure to assess the structure of environmental attitudes. *Journal of Environmental Psychology*, 30:80–94, 03 2010.

- [MHG07] P. Muck, Benedikt Hell, and S. Gosling. Construct validation of a short five-factor model instrument: A self-peer study on the german adaptation of the ten-item personality inventory (tipi-g). *European Journal of Psychological Assessment*, 23:166–175, 2007.
- [MMZ18] Daniele Manerba, Renata Mansini, and Roberto Zanotti. Attended home delivery: reducing last-mile environmental impact by changing customer habits. *IFAC-PapersOnLine*, 51:55–60, 01 2018.
- [Nae23] Farah Naeem. The big five personality traits as antecedents of eco-friendly tourist behavior. *International Journal of Advance Research and Innovation*, 11(1):83–88, 03 2023.
- [RBVM21] Heleen Buldeo Rai, C. Broekaert, S. Verlinde, and C. Macharis. Sharing is caring: How non-financial incentives drive sustainable e-commerce delivery. *Transportation Research Part D: Transport and Environment*, 2021.
- [SWGL18] Ying Sun, Shanyong Wang, Lan Gao, and Jun Li. Unearthing the effects of personality traits on consumer’s attitude and intention to buy green products. *Natural Hazards*, 93, 08 2018.
- [Vis19] Thomas R. Visser. Vehicle routing and time slot management in online retailing. 2019.
- [WO01] Gail H. Weems and A. Onwuegbuzie. The impact of midpoint responses and reverse coding on survey data. *Measurement and Evaluation in Counseling and Development*, 34:166 – 176, 2001.
- [YSCE14] Xinan Yang, Arne Strauss, Christine Currie, and Richard Eglese. Choice-based demand management and vehicle routing in e-fulfillment. *Transportation Science*, 50:140807110218007, 08 2014.
- [Zho19] Xiaochen Zhou. The effectiveness of donation incentive as an intrinsic motivation for consumers within the context of online grocery, 2019.

A Survey questions

General demographic information

- Please select your gender (Categorical)
 - *Man, Woman, Non-binary / third gender*
- Please enter your Age (Integer)
- Please select the Country in which you currently reside (Categorical)
 - *Pre-Made Qualtrics List of all countries*
- Please enter your Highest form of Education (Categorical)
 - *High school, VET/MBO, Bachelor degree, Master Degree, PHD or higher*
- Please select your Personal Situation (Categorical)
 - *Employed full-time, Employed part-time, Unemployed, Retired, Student*
- Please select your Household Size; 1 means you live alone (Categorical)
 - *1, 2, 3 or more*

Shopping habits

- How frequently do you shop online? (Categorical)
 - *Daily, 2-3 times a week, Once a week, Once every 2-3 weeks, Once a month, Less than once a month, Never*
- How frequently do you order groceries online? (Categorical)
 - *Daily, 2-3 times a week, Once a week, Once every 2-3 weeks, Once a month, Less than once a month, Never*

Personality questions

- Extraverted, enthusiastic
- Critical, quarrelsome (R)
- Dependable, self-disciplined
- Anxious, easily upset (R)
- Open to new experiences, complex
- Reserved, quiet (R)
- Sympathetic, warm
- Disorganized, careless (R)
- Calm, emotionally stable
- Conventional, uncreative (R)

Environmental Attitudes Inventory

- I could not be bothered to save water or other natural resources (R)
- I make sure that during the winter the heating system in my room is not switched on too high.
- In my daily life I'm just not interested in trying to conserve water and/or power. (R)
- Whenever possible, I take a short shower in order to conserve water.
- I always switch the light off when I don't need it on any more.
- I drive whenever it suits me, even if it does pollute the atmosphere. (R)

- In my daily life I try to find ways to conserve water or power
- I am NOT the kind of person who makes efforts to conserve natural resources. (R)
- Whenever possible, I try to save natural resources.
- Even if public transportation was more efficient than it is, I would prefer to drive my car. (R)

R = reversed coded items.