Lisbon School of Economics & Management
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MASTERS IN MANAGEMENT (MIM)

MASTERS FINAL WORK

CONSULTING PROJECT

SUSTAINABLE PACKAGING - FINANCIAL ANALYSIS OF INCREASING RPET CONTENT

JOÃO PEDRO FERNANDES RODRIGUES

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ABSTRACT

The production of fossil-based plastics can be credited with the usage of around 4% to 8% of oil and gas globally, with current trends pointing to upwards of 20% in 2050, making this material a threat to the worsening of greenhouse emissions and global warming (Hopewell et al., 2009; Rhodes, 2018).

Within this problematic, the pollution created by single-use bottles has received a lot of regulatory oversight, with an increasing number of methods for the reduction of said waste having been developed in response to said regulations. One of the most popularly used materials within this market is Polyethylene terephthalate (PET), with Recycled Polyethylene terephthalate (rPET) standing out as the most economically and environmentally sustainable alternative.

With the introduction of regulations for the quantity of recycled content in PET bottles, several markets have been affected, though little regard has been given to the consequences of setting benchmarks that may be "overly prescriptive and market intrusive" (Ilie & Jurconi, 2019), with the market for rPET currently suffering from a supply-demand imbalance that has led to claims of economically unsustainable regulations.

The goal of this research was to assess the degree to which the rPET level in the current legislation, and superior levels of rPET content, affects the financial viability of products that use said materials. This being done through a financial viability analysis of introducing increasing amounts of this material in an existing, established olive-oil product.

It was found that for 30%, 50%, and 75% rPET content, financial viability could be reached for this specific unit in a static setting, this being concluded through an analysis of the willingness-to-pay (WTP) of consumers, measured by form of a questionnaire, and translated into the price sensitivity of demand of the three aforementioned product variants.

Keywords: Willingness-to-pay; Price Elasticity; Polyethylene terephthalate; Sustainability; Financial viability

RESUMO

A produção de plásticos com origem fóssil é responsável pela utilização de 4% a 8% do gás e petróleo produzido globalmente, com as atuais tendências a apontarem para que este valor atinja 20% em 2050, fazendo deste material, uma ameaça para a exacerbação da emissão de gases com efeito de estufa e do aquecimento global (Hopewell et al., 2009; Rhodes, 2018).

Dentro desta problemática, a poluição criada por garrafas descartáveis recebeu particular enfoque legislativo, com o número de métodos para a redução de tais efeitos tendo se multiplicado em resposta a tais regulamentações. Um dos materiais mais utilizados é o Polietileno tereftalato (PET), com o Polietileno tereftalato reciclado (rPET), a destacar-se como a alternativa sustentável com maior viabilidade económica.

Com a recente criação de regulamentações para a implementação de conteúdo reciclado nas garrafas PET, vários mercados foram afetados, no entanto, as consequências do estabelecimento de metas que podem ser demasiado prescritivas e intrusivas no funcionamento destes mercados, foi pouco considerada pelos reguladores (Ilie & Jurconi, 2019), com o mercado do rPET a sofrer, neste momento, de um desequilíbrio entre a procura e a oferta que tem levado a reivindicações de que estas regulamentações são economicamente insustentáveis.

O objetivo deste estudo foi determinar o impacto que o nível de rPET definido na atual legislação, bem como níveis superiores, afetam a viabilidade financeira de produtos que utilizam esses mesmos materiais. Isto foi feito através da análise da viabilidade financeira de introduzir quantidades ascendentes deste material num produto existente de azeite.

Foi descoberto que, para 30%, 50% e 75% de conteúdo rPET, a viabilidade financeira é atingida para a unidade estudada numa perspetiva estática, tendo sido isto concluído através da análise da disposição em pagar (DAP) dos consumidores, medida através de um questionário e subsequentemente transformado na sensibilidade de preço da procura das três variantes referidas.

Palavras-Chave: Disposição a pagar; Elasticidade de preço da procura; Polietileno tereftalato, Sustentabilidade; Viabilidade financeira

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ABBREVIATIONS

NMS – Newton-Miller-Smith extension

PET - Polyethylene terephthalate

PSM – Price Sensitivity Meter

rPET – Recycled Polyethylene terephthalate

SCM – Strategic Cost Management

WTP – Willingness-to-Pay

1. INTRODUCTION

“Sustainability is the term chosen to bridge the gulf between development and environment ... we could improve sustainability by examining each of our small life style choices” (Rogers et al., 2012).

1.1. Context

The need for sustainable development has permeated through nearly every facet of society and academia and will continue to do so in the future, with the waste that arises from packaging being no exception in that regard.

In pursuance of the EU target for 2030 of the Sustainable Development Goals (SDGs), especially the Responsible Consumption and Production (SDG 12) and the Reduction of Greenhouse gas emissions (SDG 13) (de Sousa, 2021), the need to analyze the future of fossil-based plastic packaging in all industries becomes clear, with a specific focus being taken in this study towards Polyethylene terephthalate or PET, which stands as the third most utilized plastic in Europe (Thompson et al., 2009).

Despite its current key role in the world´s economy, plastic production, and more specifically its usage in packaging or the so-called, single-use plastics (Hopewell et al., 2009; Thompson et al., 2009) and the waste that it generates is, irrefutably, one of the main foes of sustainable development (Geyer et al., 2017).

It has had a particular emphasis on the sustainability efforts of corporations and legislators (Marsh & Bugusu, 2007; Welle, 2011), leading to the development of the rPET bottle packaging market, a key and growing market (PRE et al., 2022).

These and other factors have meant that the rPET market, especially in the EU, is quite volatile, both in terms of price, and general availability of the recycled polymer, and despite the decision of rPET adoption needing not to be purely price-driven (Gopalakrishna & Reddy, 2019; Sundqvist-Andberg & Åkerman, 2021), the nature of legislations means that it may become economically unviable (Ilie & Jurconi, 2019) without further improvements in several aspects of the market.

Directive (EU) 2019/904 stands out as the so-called “single-use plastic directive”, setting goals for PET plastic bottles, for both recyclability percentage, of 77% in 2025 and 90% in 2029, being this an increase from the latest estimate of 61% in 2020, and also for the composition of said bottles to be at least 25% rPET in 2025 and 30% in 2030, also an improvement from the 2020 average estimated content of 17% in the EU (PRE et al., 2022).

The company that served as a basis for this analysis was the Company X Group (fictional name for confidentiality reasons), a key and historical player within the olive oil and seed oil sectors, with a special focus being put on their star brand in the olive oil sector, Brand A.

The European Union is the main producer, consumer and exporter of olive oil, with the Portuguese market being its 4th largest producer, accounting for around 5%-10% of the region's production in recent years, with the Spanish market dominating with almost 70% of EU production as of 2021 (IOC, 2022). Demand for the product is relatively stable in Portugal and generally across Europe, with increases in production usually being aligned with similar increases in demand, this pattern pointing towards the fact that this is a mature market, with little to no innovation (GPP, 2020; Kotler & Keller, 2016).

Brand A is presently packaged and distributed in glass and plastic bottles, and, much like other corporations across industries, massively increased their demand for rPET in light of recent developments, initiating this transition towards sustainable packaging back in 2017, and progressively increasing the amount of average rPET content in their Brand A and Brand B lines, with the former peaking at 20% average content in 2022.

This, of course, had repercussions on the operations of the company, requiring a change in suppliers and, more importantly for this analysis, the increase in raw material prices and, consequently, of product costs. Said changes were exacerbated when, following the 2020 global pandemic, the initial price differentials of PET and rPET increased massively, prompting the company to affirm that, at current they are unable, given their strategic intentions, to increase the recycled content of their rPET bottles.

1.2. Research Objective

The introduction of these regulations prompted the development of a consulting project for Company X, with this specific research focusing on the identified problem of financial viability of the products that are affected by regulation 2019/904, given the current price differential between PET and rPET, and the cost, price structures and strategies that are currently followed by the company.

The initial goal of this research was then to assess the degree to which the rPET level in the current legislation and superior levels of rPET content affects the financial viability of the products that use said materials.

To achieve said goal, an analysis of financial viability was conducted on 3 possible product variants with increasing rPET contents of 30%, 50%, and 75%, with everything else remaining the same.

For this, a basis on a specific existing SKU (stock-keeping unit) sold under Brand A was taken and used for the determination of the price elasticity of demand of each aforementioned variant. The translation of price elasticity of demand to the consequential variation on sales and profit merely serves as a benchmark for taking direct conclusions from the analysis, given that these represent the same relationship, i.e., our main measure should be taken to be the price elasticity of demand at the baseline price.

This was made in an attempt of detailing a concrete example of a wider cross-industry trend of coercive EU regulations that mandate such changes in corporations that utilize PET in their packaging from 2024 onwards as outlined in Directive (EU) 2019/904 (PRE et al., 2022), which mostly affects companies in the Food and Drinks sector.

Through determining the viability of a single product, in the specific situation that Company X finds itself in, there were hopes of obtaining wider market elations given that, despite the critical need for these industries to determine their strategic cost management goals, analysis regarding financial implications of the introduction of sustainable materials in manufacturing products remains very limited.

While increasing rPET content beyond what is legally required is seemingly financially irresponsible from the get-go from a pure profit-seeking lens, this fails to capture multiple dimensions. From a purely strategic standpoint, the company has positioned Brand A as its sustainability beacon. This then means that their Strategic Positioning is trending towards increasing their efforts, rather than mostly following the letter of the law as it appears they are “forced” to do currently, which, in part, justifies the need to study whether this change is financially viable.

The conclusions taken in this study are relevant to the Food and Drinks sectors given the current panoply of existing, and ever more strict, environmental regulations, with, of course, the entities affected by the regulations for rPET content benefiting the most from these conclusions. Companies in this sector, and those with similarly applicable regulations in other sectors can take conclusions about the existence of a growing "sustainability rating" premium from a willingness-to-pay perspective, which, in conjunction with the conclusions of financial viability of the analyzed product variants, gives an example of a viable strategic cost management framework for products and product lines in similar situations. This study was able to validate the choice to comply with the regulations with no further "sacrifices" needing to be made, whilst also leaving room for, under certain conditions, a strategy to increase sustainability efforts beyond what is required.

1.3. Structure

This study is divided into 5 sections: Introduction, Literature Review, Methodology, Data and Data Analysis, and Conclusion.

The Introduction section provides a brief summary of the scope, relevance and context regarding the research objective, which is also defined in this section. The literature review section provides an exposition and analysis of the main theoretical concepts that cemented the work, as well as the theoretical framework that was followed given said concepts. Following that, the Methodology further details the research objective by detailing the tools utilized to answer such objective, including the type of study, questionnaire structure, sampling process and others, as well as the initial assumptions made for the use of such methods. The Data and Data analysis section presents and discusses the results obtained, by critically analyzing their meaning. The final, Conclusion section, summarizes the results obtained, while reflecting on the implications they may have.

This research utilized a case study research strategy, which, by way of a questionnaire on the willingness-to-pay of olive oil consumers and a structured interview to ascertain the price and cost strategies followed by the company, was able to analyze the price sensitivity of demand of consumers within the company´s strategic positioning, thereby determining the financial viability of the different product variants.

2. LITERATURE REVIEW

2.1. Material innovation

2.1.1. Sustainable Material Innovation and design

The introduction of sustainability in the choice of material is now a vital point of analysis for corporations due to factors ranging from a long-term investment perspective, societal pressure and also, and especially in Europe where material development knowledge is more advanced, regulations in terms of the usage of such materials in manufacturing (Geiser, 2001). In some cases, these changes cause industry-wide innovations in terms of processes and product design, all striving towards reducing a product's overall toxicity to the environment (Kovacic et al., 2019).

This dimension can be an opportunity for companies to pivot to new and key markets that will be increasingly relevant with the ramp-up in regulations and societal concerns, and should lead to increasing demand and capital flow in said industries (Boons et al., 2013).

One area that has sparked innovation and development is the use of so-called sustainable materials. Concerns are especially relevant for synthetic materials such as metals alloys, plastics or other composites (Geiser, 2001), and the by-products of their production, disposal and other ecological externalities such as transport and energy production (Bensaude-vincent, 2022). These concerns have sparked the continual development and research of more eco-friendly and economically-viable designs (Prendeville et al., 2014).

2.1.2. Environmental regulations and profitability

Michael Porter affirmed that, in a lot of situations, "environmental regulation inevitably raises costs" (Porter & Van der Linde, 1995), which, assuming a stable market is a relatively simple assumption to make. In a static state, this would seem like mostly unfavorable for companies, but static analysis fails to account for parameters such as dynamic consumer needs and innovation's ability to generate profitability, economic growth and competitive advantages (Porter & Van der Linde, 1995).

Of course, not all environmental regulations are the same, and as defined by Porter and Van der Linde (1995) in the popularly called Porter hypothesis, a significant portion of regulators sees an antithesis between ecology and economic growth, whilst arguing that "properly designed environmental standards", that being regulations with concrete goals but relatively loose approaches, may allow for innovative advances that would, at least, offset the cost of compliance, and eventually reach increased profitability.

This view isn't ubiquitous, and though arguments against the positive environmental impact of regulations in areas such as manufacturing are hard to make (Shapiro & Walker, 2018), the divergence on the effect of "proper" environmental regulations is in whether or not companies would, of their own profit-seeking motivation, end up adopting such innovations, with views such as that of Palmer et al. (1995) arguing that companies would naturally integrate them. For the time being, insufficient empirical research leaves the door open for both views to be possible (Brännlund et al., 1995; Rassier & Earnhart, 2010; Rassier & Earnhart, 2015).

2.2. Cost tracking and price setting

2.2.1. Cost Accounting

The practice of keeping track of revenues and costs and how they behave has historically been denominated as the practice of accounting (Datar & Rajan, 2018), a practice that predates that of money (Brown, 1969). The American Accounting Association defines accounting as being a "process of identifying, measuring and communicating economic information to permit informed judgments and decisions by users of the information" (Drury, 2013), this meaning that it provides and processes information for decision making of diverse stakeholders.

This information is recorded through accounting systems, which can vary depending on the type of corporation, information, end-use and type of stakeholder that will access them (Datar & Rajan, 2018), with the main ones being: management accounting, financial accounting and cost accounting (Datar & Rajan, 2018).

Cost accounting as defined by Datar and Rajan (2018), is comprised of all the activities that measure, study and register the costs of acquisition or usage of resources in an organization, linking, in one way or another, those costs to their sources. Its traditional use relates to the process of analyzing the financial impacts of various management decisions and alternatives (Datar & Rajan, 2018), this being the main source of information that informs what authors such as Shank et al., 1993, consider to be the successor to cost accounting, this being Costing Management or Managerial Costing analysis.

2.2.2. Volume-based costing systems

Costing systems consist of the sets of tools used by a business to analyze and allocate costs incurred by manufacturing products (Datar & Rajan, 2018). Traditional systems or volume-based systems function by allocating said costs such as direct labor, machine hours and others based on the volume produced, usually through metrics such as direct hours labored, with these costs firstly being allocated to production departments and later to specific products (Drury, 2013; Garner, 1947).

These so-called volume-based systems, typically process a large number of transactions or a high volume of data (Lewis, 1995), and their contemporary use often includes some sort of technology to streamline the process of recording and reporting financial information. Examples of volume-based systems include enterprise resource planning (ERP) systems, which are used to manage a wide range of business processes, including accounting, and data warehousing systems (Drury, 2013; Shehab et al., 2004).

These systems can automate the process of tracking and allocating costs, making it easier to calculate the cost of each unit. For example, an ERP system can be configured to track the cost of raw materials, labor, and overhead associated with a particular product. As the product moves through the production process, the system can automatically record the costs associated with each step (Shehab et al., 2004). By tracking the costs associated with each unit of a product or service, businesses can make more informed decisions about pricing and production (Datar & Rajan, 2018; Kaplan et al., 1990).

It's important to note that these systems can be configured in different ways to suit the specific needs of a business, but in general, the main idea is to have clear visibility of the costs associated with each unit, which can help in determining the price point for the unit or even identifying inefficiencies in the production process. (Kaplan et al., 1990).

In any case, these types of systems have been harshly criticized by authors since the late 80’s (Cooper & Kaplan, 1988a, 1988b) due to their inability to allocate non-volume dependent costs such as those needed to support activities, which are, in the modern world, a very significant portion of total costs of an organization (Drury, 2013; Wang et al., 2010).

These types of systems are then currently considered incomplete at best, not constituting a solid basis for decision-making, thereby necessitating the use of transaction-based cost systems, i.e., a structure that recognizes all costs as ultimately related to a product (Goebel et al., 1998), with the most commonly embraced being Activity Based Costing (ABC) (Drury & Tayles, 2006; Goebel et al., 1998), though it isn´t without fault as is the case for any cost system (Drury, 2013).

2.2.3. Transaction Based Costing systems

Activity-based costing (ABC) is a costing method that assigns costs to products or services based on the activities that are required to produce them, by recognizing that every activity, including supporting or indirect activities, support the making, marketing and transport of goods (Cooper & Kaplan, 1988b; Goebel et al., 1998), and thereby their costs should be assigned to products or services. This is an especially useful model for manufacturing organizations (Gunasekaran et al., 2005).

This costing system attempts to provide a more accurate picture of the true cost of production by recognizing that different activities within the company require different resources and that these overhead costs evolve over time (Drury, 2013), which can be useful for decision-making, identifying inefficiencies, production levels, and pricing, among other strategic issues. This then helps companies improve their profitability and competitiveness (Cooper & Kaplan, 1991).

Central to this methodology are the notions of cost objects and the corresponding resource driver and activity driver (Drury, 2013). A cost object is something for which a measurement of costs is required. This could be a product, a service, a department, a customer, or a project. A resource driver is a factor that influences the consumption of a particular resource. For example, the number of product orders might be a resource driver for the consumption of packaging materials. An activity driver is a factor that influences the consumption of resources by an activity. For example, the number of customer service calls might be an activity driver for the consumption of staff time. (Datar & Rajan, 2018; Drury, 2013; Goebel et al., 1998).

These concepts are interlinked given that "cost objects are the cause of activities and that resources exist solely to carry out those activities" (Goebel et al., 1998). After allocating resource costs to the correct activities, they are then subsequently assigned to cost objects by way of the activity drivers through a frequency-based model.

Detailed by Cooper and Kaplan (1991), within the purview of ABC, is the concept of a hierarchy of expenses that separates activities by their types, these being: Facility sustaining activities, Product sustaining activities, Batch level activities and Unit-level activities. This reinforces the necessity to allocate expenses to the correct resource driver, not confounding, for example, batch level costs, i.e., costs that occur with additional batches with unit level costs, these being costs that occur with every extra unit (Datar & Rajan, 2018).

2.2.4. Unit-level and Product-level Margin

Unit-level margin, also known as unit margin or unit gross margin, is a measure of profitability that looks at the profit earned on a per-unit basis. It is calculated by taking unit level revenues i.e., the price of sale, and subtracting the corresponding unit-level expenses (Cooper & Kaplan, 1988b).

Though the analysis on this basis has been criticized as inaccurate or obsolete within an ABC centric system (Cooper & Kaplan, 1991), arguments for its usage in specific unit-level analysis or in tandem with product level and batch level margin analysis is helpful internally, for understanding which products are more profitable and making better pricing and purchasing decisions (Kaplan et al., 1990). As is the case for the creation of ABC systems, the cost-benefit of the level of detail desired and needed must be made by corporations. (Drury, 2013).

2.2.5. Strategic Cost Management (SCM)

The concept of costing management is popularly viewed as the simple minimization or control of costs (Garner, 1947), however, this minimizes its importance in projecting and governing costs. Costing Management, serves as the intersection between increasing customer value and the advancement of organizational objectives, meaning a manager can increase costs, change product designs, prices, enter new markets, among others, if such decisions are made as a part of a larger strategic intent (Datar & Rajan, 2018).

But as cost accounting before it, the concept of Cost Management became outdated despite its continued importance, necessitating the evolution of the concept towards Strategic Cost Management (SCM) (Kaplan, 1984; Shank et al., 1993).

The adoption of cost as a strategic management aspect is what distinguishes it from the two prior “versions”, in the sense that it utilizes cost data derived from cost accounting systems to assist the strategic management process as it pertains to maintaining a sustainable competitive advantage (Hansen et al., 2021) in its various stages, including: the formulation of strategies, their communication to the organization, their effective implementation and its control by various systems of checks and balances (Shank et al., 1993). More specifically, Shank et al. (1993) proposes that the introduction of SCM leads to improvements in analyzing and developing 3 key areas: Value Chain analysis, Strategic Positioning analysis and Cost Driver analysis.

2.2.6. Pricing decisions

Though not the only factor for price setting, popularly the information derived from cost accounting is one of the main components of such decisions in corporations, namely for the sake of simplicity, popularizing the so-called “cost-plus” pricing method, that accounts for the individual cost of one unit and adds a margin or “plus” (Dolgui & Proth, 2010), this being especially popular for companies within highly competitive markets as exemplified by Guilding et al. (2005).

Though utilizing indicators such as the average cost of an item to determine price disregards the complexity and importance of a pricing system and are highly criticized as a stand-alone tool (Nagle & Müller, 2017), empirically they play a key role in an internal setting in allowing managers to make decisions and setting base-line prices that can then be adjusted according to various other external factors, marketing intentions, and pricing strategies (Drury & Tayles, 2006; Guilding et al., 2005). Setting profitability goals through a cost-plus method in any long-term way is, however, faulty logic given that, as set out by Nagle and Müller (2017), sales volume is dependent on pricing and, therefore, cannot be an assumption as is the case for average cost calculations.

2.2.7. Willingness-to-pay (WTP) and Price sensitivity of demand

A consumer´s willingness-to-pay (WTP) or reservation price is the theoretical maximum price that an individual is willing to pay for a given good (Cameron & James, 1987; Nagle & Müller, 2017). Price is then viewed as the cost of benefiting from a certain product cluster (Shipley & Jobber, 2001) and so, given a certain price, the consumer chooses whether or not their perceived value is higher than it, and, consequently, whether or not to acquire it.

This concept can be utilized by a multitude of actors, ranging from public policy makers to businesses, to assess the value that individuals place on certain goods or services. For example, if an individual is willing to pay a higher price for a product that is produced in an environmentally friendly way, this can be taken as evidence of their willingness-to-pay for environmental quality (Cameron & James, 1987).

From a consumer´s perspective, alterations in either side of the equation, being that from concrete alterations to the product or changes in its perception, make it so that a consumer’s or supplier’s willingness-to-pay changes, ultimately leading to the need to dynamically adapt and evolve prices (Shipley & Jobber, 2001).

A further problem of price setting, even assuming static market conditions, is the extremely complex relationship between demand and the price of the product (Dolgui & Proth, 2010), with this relationship being designated as the price sensitivity of demand, i.e., how much demand changes in response to a given price change (Shipley & Jobber, 2001). The price sensitivity of demand is generally measured by the price elasticity of demand, which is the percentual change in the quantity demanded of a good or service in response to a given percentage change in its price, which leads to a classification of the demand of a good as either elastic, inelastic, or unitary (Nagle & Müller, 2017).

If the elasticity of demand is greater than 1, the demand is said to be elastic, meaning that a small change in price can have a large impact on the quantity demanded. If the elasticity of demand is less than 1, the demand is said to be inelastic, meaning that a change in price has only a small impact on the quantity demanded. If the elasticity of demand is equal to 1, the demand is said to be unitary, meaning that a change in price has a proportionate impact on the quantity demanded (Dolgui & Proth, 2010; Nagle & Müller, 2017).

Understanding the price sensitivity of demand is important for businesses because it can help them determine the optimal price for their goods or services and the consequences of altering them in terms of profitability (Kotler & Keller, 2016).

2.2.8. Measuring Willingness-to-pay and price sensitivity of demand

Willingness-to-pay can be measured in a number of ways, including stated preference methods (e.g., questionnaires, experimental auctions, …), which involve the direct inquiry of individual consumer´s WTP, and revealed preference methods (e.g., observing actual behavior in the market), which revolve around observation (Breidert et al., 2006; Stoetzel, 1970).

Particular focus is often placed on stated preference methods, both in academia and in commercial settings (Cameron & James, 1987), given their ease of use and the availability of prior data to supplement new research, (Nagle & Müller, 2017) with both direct and indirect questionnaires often being the tools of choice (Breidert et al., 2006).

These and other methodologies aren't without their limitations, for example stated preference methods may be subject to biases such as hypothetical bias, where individuals' stated preferences may not match their actual behavior in the market, namely that there is a tendency to overestimate WTP (Kotler & Keller, 2016; Smith, 2021). Revealed preference methods may be limited by the availability of data on actual behavior in the market (Ollila, 2011).

These techniques can be pivoted to the estimation of the price sensitivity of demand, in addition to the use of historical data analysis and questionnaire or laboratory/controlled settings, with various specificities being added to such tactics depending on the conditions or goals of the researcher (Cameron & James, 1987; Dolgui

& Proth, 2010), but the key aspect is the need to isolate, as well as possible, the characteristic which the researcher is setting out to study in order to obtain the desired results (Kotler & Keller, 2016).

One of the most used techniques, was initially detailed by Van Westendorp (1976) as the Price Sensitivity Metter (PSM), asking respondents to identify four price points for a given product, ranging from: Too expensive (i), Expensive (ii), Cheap (iii) and Too cheap (iv) (Weinrich & Gassler, 2021). These price points allow for the determination of the cumulative distribution functions on a graph, which provides interception points, these being the: point of marginal cheapness (PMC), point of marginal expensiveness (PME), indifference price point (IDP), and optimal price point (OPP) (Roll et al., 2010; Weinrich & Gassler, 2021).

These points define a range of acceptable pricing points, placed between the PMC and PME, which are, respectively, the lowest and highest price points acceptable to consumers. Pricing below the lowest price point can damage a company's image and revenue, while pricing above the highest price point can lead to sales losses. The IDP is the price at which an equal number of respondents view the product as either "cheap" or "expensive.", this also being referred to as the consumer's reference price.

Lastly, the OPP is the price at which sales and market share are, theoretically, maximized, as there are equal numbers of respondents who think the product is "too cheap" and "too expensive.", with the argument being that, this is the point of least resistance for purchase for consumers, thereby making it the point for which market share is maximized (Kunter, 2016; Van Westendorp, 1976; Weinrich & Gassler, 2021).

To this method, one addition can be made to derive a “market-based prediction of the demand curve” (Orme & Chrzan, 2022) through the use of the Newton-Miller-Smith (NMS) purchase intention extension, with two additional questions on the likelihood of acquiring the given product at, respectively, the expensive (ii) and cheap (iii) price points on a scale ranging from: extremely likely (5) to extremely unlikely (1) (Newton et al., 1993). The scale choices have certain given discounted values that assume the likelihood of consumers purchasing the product at that level, with the attributed value varying from case to case (e.g.: Alletsee (2022), Orme and Chrzan (2022)).

This structure has often been criticized as being incomplete and even misleading in certain scenarios due to the lack of specific economic theory for the interception point that yields the OPP, though its continued usage in modern studies as a supplementary tool to provide some initial notions towards establishing optimal price, points towards its relevance as a toll (Roll et al., 2010).

One alternative methodology is the Gabon-Granger price sensitivity approach (Gabor & Granger, 1979), which involves a series of sequential yes/no questions on a given product´s price, in which a respondent is asked whether or not they would purchase it at a certain price, if the answer is “yes”, a random, higher, price is presented and the question is made again, if however the answer is “no”, a lower price is chosen and the individual is questioned again until a final, highest, individual price point is reached from within the initial pre-selected prices (Lipovetsky et al., 2011; Orme & Chrzan, 2022). The data points taken from this questionnaire structure are then utilized to create a demand curve from the cumulative distribution of responses pertaining to the individual highest prices (Lipovetsky et al., 2011).

However, once more, as set out by Nagle and Müller (2017), these pricing models, even if perfectly done will only provide rough estimates of the actual price sensitivity given all the biases and other factors that still affect consumer choices, even in a more controlled or laboratory settings.

The conjoint analysis approach provides some different elements to the prior two and has received less criticism from academics (Ollila, 2011), while also being one of the most commonly used methodologies. A conjoint analysis consists of presenting respondents with a series of product profiles that vary across a set of pre-determined features.

Respondents are asked to choose their preferred product from the set of profiles presented to them, i.e., they are asked for a ranked degree of preference, which in turn allows researchers to determine the relative importance of different features and how much of a price premium consumers are willing to pay for each feature (Carroll & Green, 1995; Wittink & Cattin, 1989). This method can be used to understand consumer price sensitivity in a variety of contexts, including determining the optimal pricing for a new product, understanding how changes in the market or competitive environment may affect consumer demand, and identifying opportunities for product innovation (Breidert et al., 2006).

It´s argued that it provides the researcher with a more true-to-life structure given its comparative approach. Though more complex than other stated preference methods, it is considered more appropriate in dealing with hundreds or thousands of different products, as it may be the case for R&D development processes or initial market testing (Breidert et al., 2006; Ollila, 2011).

The PSM analysis with the NMS extension, as well as the Gabon-Granger method are by contrast, then, less capable of providing a comparative perspective that is almost ubiquitously present in real-life scenarios (Kotler & Keller, 2016), though their simplicity often makes them a preferred and more efficient choice if we are dealing with one or a very reduced batch of products (Orme & Chrzan, 2022) or if time and/or monetary constraints are present within a given study.

2.3. Theoretical Framework

In the case of this research project, clarification is required in terms of the utilized costing system for cost calculations, as well as the estimation of the willingness-to-pay (WTP) and consequent price sensitivity calculations, and finally the price setting technique implemented, with this information being summarized in Table 1.

The information that was facilitated by the company, cost-wise, meant that the only way to determine the unitary margin of the product was through a volume-based process, by way of multiplying costs by the quantities of raw materials used in each unit. This however seems like a valid choice given the short-term view taken in terms of the measurement of changes in variable costs, which doesn´t fall within the objectives of an ABC system (Jeyaraj, 2015).

In any event, the single product framework taken means that we can view this cost analysis as that of a company with a single product and, as detailed by Kaplan (1988), these types of companies can "estimate product costs with a trivial system". In this same way, prices were set in a cost-plus perspective, not because it exemplifies the best form of price setting, but because the simplistic method allows for comparison between the different product variants, thereby allowing the study of the research objective.

Table 1 – Theoretical Framework

Approached used	Description	Author
Cost-plus pricing	Method for pricing products that accounts for the individual cost of one unit and adds a margin or "plus"	Sudhir Jain
Volume-based costing system	Costing system that allocates costs such as direct labor and machine hours based on the volume produced, with these costs firstly being allocated to production departments and later to specific products	Jerome Lee Nicholson
Price Sensitivity Metter	Questionnaire technique for measuring the stated willingness-to-pay of consumers, through asking respondents to identify 4 price points	Van Westendorp
Newton Miller Smith extension	Purchase intention addition to the PSM that allows for the establishing of a price elasticity curve	Newton, Miller, Smith

3. METHODOLOGY

With this project, the aim was to determine whether the current legislation for rPET content incorporation and other superior levels of rPET, affects the financial viability of products that utilize the aforementioned materials, this being done through an analysis of the financial ramifications of implementing 30%, 50% and 75% rPET content in the packaging of the titular product of an organization in the Olive Oil sector.

The indicator for financial viability was, in this case, understood to be the total profitability obtained from the analyzed SKU ("Brand A (750ml)") throughout 1 year, taking 2022 sales data as the baseline. If the total revenue deviated significantly and negatively from the base value, it would be understood as being financially unviable, if not, the altered product would be considered, financially viable.

For this, a unitary cost measure was taken for the analyzed product using both information provided by the company, as well as publicly available sources. This information was processed by way of a spreadsheet in the software Excel. The price-sensitivity estimations were then derived using the Price Sensitivity Metter questionnaire, with the inclusion of the NMS extension. The resulting data was analyzed through the statistical analysis software R and the package by the name of "price-sensitivity-meter" (Alletsee, 2022).

3.1. Methodological choice

The choice of research strategy developed through this research was the Case Study approach, with the specific problematic identified in Company X being analyzed, with the ultimate goal of obtaining conclusions for the specific problem as it applies to the studied company, as well as other entities. For the purposes of this study, a mixed-methods research design was selected, combining the usage of quantitative and qualitative data collection procedures (Saunders et al., 2012).

The use of the questionnaire strategy was enacted through the deployment of cross-sectional, self-administered questionnaires (Bryman, 2006) collected through web and mobile mediums, using the tool "Qualtrics", and disseminated through social media platforms such as Facebook, Instagram and LinkedIn (Annex 1). This aimed to glance at the current predisposition of respondent's price sensitivity, with the main goal of estimating the possible consequences of price changes in a specific product, through the use of a modified Price Sensitivity Metter (PSM) as detailed initially in Van Westendorp (1976), with the addition of the Newton Miller Smith (NMS) extension (Newton et al., 1993; Orme & Chrzan, 2022), which was the main output required for the price elasticity analysis. The full structure of the questionnaire is defined in Annex 1.

Regarding the type of sample, a convenience sample was the most compelling and readily available way to obtain responses given the exploratory nature that was aimed with this method, with respondents being those that were willing to respond to the online questionnaire. The targeted population was that of regular olive oil buyers. A pre-test was conducted on 7 individuals, with improvements being made in regard to the visual representation of the 3 product variations, a rewriting and reduction in the length of the initial context text, and a few modifications of possible answers in the demographic portion of the questionnaire.

The question at hand for this questionnaire was: “What is the price sensibility of consumers for the analyzed product and do increased quantities of rPET content have an effect on it?”. An attempt was made to determine demand changes given potential price increases that could have been enacted to combat cost increases due to increased levels of rPET intake, as well as potential product repositioning given the increased strategic commitment on behalf of the company towards selling a sustainable product.

The respondents were given price point options that ranged from 2€ to 12€, with price steps of 0,10€ for the 3 alternative products, with the only differentiating characteristic being the amount of rPET content present within the packaging of an olive oil bottle, with the values: 30%, 50% and 75% being proposed. Some context was given in the preamble to the questionnaire for the environmental advantages of rPET over virgin PET.

The Newton-Miller-Smith purchase intention extension built upon the PSM questions, by presenting a 1-5 scale for each question from Extremely likely (5) to Extremely unlikely (1), with the likelihood of purchasing being later discounted for each level of the scale, with these being assumed as, respectively: 70% (5), 50% (4), 30% (3), 10% (2) and 0% (1) (Alletsee, 2022). This method allowed for the creation of a demand curve for each of the variants.

The questionnaire was deployed from the 20th of January 2023 to the 31st of January 2023, eliciting a total of 282 responses, with it being open to all respondents, but only accepting answers from regular shoppers of olive oil, through the use of a filter question (Saunders et al., 2012), which meant the accepted responses stood at 229, though full completion of the questionnaire was done by only 155 individuals.

Qualitative research methods were also enacted, in an effort to build a framework of understanding (Creswell & Creswell, 2017; Saunders et al., 2012) for the company´s strategic cost management and positioning analysis, through the use of a semi-structured interview, such as defined by Shank et al. (1993), with an approximate duration of 25 minutes. This interview was conducted with the sustainability director for the company, as well as a further representative from the same department, with the recording of said interview having been transcribed and subsequently analyzed.

Additionally, secondary data was collected from both public and non-public sources, with the analyzed company having provided past financial information related to product costs and with pricing data being adapted from the Portuguese online platform “Super Save”, which tracks the prices of some retail products, including the SKU studied.

3.2. Assumptions

As detailed by Simon (2011), assumptions are key tools for research but must be justified as opposed to merely stated. Given this, six main assumptions were taken.

Firstly, given that the research objective was defined as a static analysis, a point in time had to be defined. The dates chosen were November and December of 2022 and January of 2023, given that the data for prices was vastly collected in this time period, however, some deviations were made for the sake of presenting the most appropriate and relevant data.

Secondly, in terms of costs, the company affirmed that half the costs that are associated with PET and rPET bottles are related to transport, prompting the addition of a 50% premium to the assumed costs that were provided by the company, also meaning that higher priced rPET had a per gram marginally higher cost of transport.

This premium came in line with the third assumption, which was the benchmarking a price premium for rPET costs for scenarios other than the base one. The company stated that the amount of rPET they were consuming on a yearly basis was limited by supply and that they had commitments to other clients on portions of the bought material, meaning it couldn´t, for the most part, be redistributed. It’s therefore reasonable to assume that purchases of increased quantities would warrant a price premium.

Simply put, the amount of rPET needed to produce a bottle that had 20% rPET content was taken to be priced at the baseline price of the average price for 2022; but any amount of rPET content that went over that 20%, was calculated to have a cost equivalent of the average of the last 6 months of 2022, a period during which rPET prices increased compared to the first half of the year, with this scenario better emulating the 70% price premium that Company X’s management referenced during the interview process.

The other cost component was the Olive oil prices, which was the fourth assumption taken, given that, despite the fact that for the sake of this study, the exact value for olive oil cost used is merely a fixed component in the calculations, meaning exactitude on its cost isn´t crucial for the conclusions taken, there is a need to establish a cost value, which was taken to be the average 2022 cost of wholesale Extra Virgin olive oil with under 0,8º of acidity from the Alentejo and Ribatejo regions, as defined by the "Gabinete de Planeamento, Políticas e Administração Geral" (GPP).

The fifth assumption was of the price point used as a baseline value in both the unitary profit margin and price sensitivity calculations. In this case, the available prices were only for B2C sales, meaning that attempting to estimate the exact margins that Company X made from their sales wasn't an option, and in turn, led to the conclusion that estimating the margins in a relative scale would be the best choice for determining the necessary price increases for maintaining the same unitary profit margin for this product.

The baseline price was then estimated through the use of the platform "Super Save", with a total of 12 price points being obtained from October and December 2022, as well as for January 2023, with a simple unweighted average being made from these to define the baseline price that was assumed to have been the price practiced through 2022.

As for the sixth and final assumption, the rationale for the three product variants of 30%, 50% and 75% needs explaining. The 30% rPET content is, short-term, the most important reference value for Company X and any company that utilizes PET bottles, as it represents the minimum rPET content that will be required within the EU from 2030 onwards, meaning, come 2030 there won´t be a financially viable alternative other than complying with this percentage; a 50% rPET content bottle is the middle ground that was often cited in various pledges from conglomerates such as The Coca-Cola Company, Danone, Nestlé, … as their 2030 goal across all their product lines. In addition, it was also the initial goal stated by Company X in their 2020 and 2021 sustainability reports as their goal for 2023 and 2024.

The highest incorporation percentage of 75% corresponds to the theoretical highest percentual incorporation of rPET content in plastic bottles with the current technology (Pinter et al., 2021), and assuming very bold structural and legislative advances until 2029 (Kahlert & Bening, 2022; Pinter et al., 2021).

4. DATA AND DATA ANALYSIS

4.1. Sector and Company

Through analysis of the company’s sustainability reports, as well as through meetings with the employees of the sustainability area, it was concluded that, initially, the company demanded high sustainability standards for itself, aiming to surpass the 30% EU mandated rPET content well before the 2030 deadline, with goals of reaching 50% recycled content in the near future.

Some years on this isn´t quite the case. Company X affirmed that their initial commitments and strategies were made at a time when the price premium of rPET, when compared with PET, was along the 20-30% range, and was a figure that the company could manage, but now this differential is up to 70% as stated by the company, and reached as high as 93% in June 2020 (Annex 2), making these commitments, according to the company, financially unviable in the current macroeconomic climate, given the company’s unwillingness to increase their prices and pass these costs onto the consumer.

A scale-back on rPET content was made from 2022 onwards, with the sustainability department reinforcing their commitment to accompany the directives given by the EU on this matter, but, stating that aiming for higher rPET content than the minimum required will be dependent on the evolution of said market, concluding with the statement that the rPET market won´t stabilize in the near future; claims which may prove to be accurate according to academic, governmental and institutional research (Geyer et al., 2017; Grant et al., 2022; Kahlert & Bening, 2022).

This pattern of going beyond the regulation’s requirements was transversal across other companies and industries, with entities such as The Coca-Cola Company, Nestlé, PepsiCo and others being at the forefront of these practices (Kahlert & Bening, 2022). In accordance with the company’s claims, are the scaling back of these commitments by some of the aforementioned companies, accompanied by the reduction in their marketing efforts in this direction (Kahlert & Bening, 2022; PRE et al., 2022).

4.2. Data

It was found that around 17% of inquired respondents weren't "regular shoppers" of olive oil, meaning that a total of 235 respondents were then included in the sample for the data points taken.

The sample taken was female skewed, with college educated 35-44 year old usual buyers of brand name olive oil being the most common respondent (Annex 3). Of the obtained demographic results, 187 individuals responded to sections flowing the demographic portion, meaning that around 18% didn't proceed from this section. The questionnaire in its entirety was completed by 155 regular olive oil shoppers, meaning a conversion rate of 68% was achieved (Annex 3).

The price estimation for the baseline 2022 product variant of 20% rPET, which stood at €4,50, in conjunction with the average relative unitary product margin, allowed for the definition of a target price that was associated to each product variant as the required price to maintain the current unitary profit margin of around 42% (Table 2).

Initial data pertaining solely to the costs from PET and rPET mixed bottles indicates that the difference between the highest considered rPET content (75%) to the lowest (20%), i.e., the baseline case, is of around €0,03 per unit.

The price required to maintain a constant relative unitary margin differed by €0,05 between these same product variants, while only a €0,01 increase was required between the 20% and 30% rPET variants.

Table 2 – Price and cost estimations for constant relative unitary margins

Product variant	Unitary cost (€)	Price for base scenario unitary margin (€)
Base	2,61	4,50
Bottle with 30% rPET	2,62	4,51
Bottle with 50% rPET	2,63	4,53
Bottle with 75% rPET	2,64	4,55

The results for the willingness-to-pay progressed ascendingly, this meaning that for each level of rPET content, the average price point chosen by respondents is higher than the level chosen in the lower quantities of rPET in every situation, though the standard deviation of responses also follows this same logic (with the notable exception of the “Too cheap” price point), denoting a more disperse response set for higher levels of rPET content. In any event, the maximum and minimum obtained values for all levels were, respectively of 12€ and 2€, these coinciding with the extremities of the possible values in this questionnaire, with the number of respondents choosing these value accounting for an average of 31% of the total responses across the 3 product variants (Table 3).

Table 3 – Average price preference (€) by product variant for regular shoppers

Product variant	Metric	N	Too cheap	Cheap	Expensive	Too expensive
Bottle with 30% rPET	Average	187	3,30	3,42	5,38	6,79
	Standard Deviation		1,67	1,27	1,76	1,67
Bottle with 50% rPET	Average	164	3,34	3,69	5,81	7,14
	Standard Deviation		1,58	1,38	1,93	2,41
Bottle with 75% rPET	Average	154	3,46	4,09	6,04	7,24
	Standard Deviation		1,51	1,68	2,07	2,44

Taking a demographic perspective to these results (Annex 4), respondents under 35 years of age consistently responded with inferior average prices for all price points across product variants (with the exception of the “Too Expensive” price for the 30% variant), when compared to respondents over 35 years old.

As for the Education level of respondents, those with a middle school education level yielded the highest average results, though the split of results according to this metric doesn´t yield a clear trend across the different product variants.

Analyzing the metric of average monthly household income, the results indicated that the average respondent with over €2.500 in monthly household income tended to respond, on average, with inferior prices relative to the respondents who earn over €2.500 for the Too Cheap and Cheap price points, with this trend reversing for the higher bound prices of Expensive and Too Expensive.

Regarding the inputs for the willingness-to-pay analysis associated with the NMS extension (Table 4), the average approximate response for each of the products equals that the average respondent is “Somewhat likely” to purchase the product at the chosen “Cheap” price point, and “Neither likely nor unlikely” to do so at the “Expensive” price, with the notable exception of the 75% rPET variant, which elicited an average of “Somewhat unlikely” purchase likelihood at the “Expensive” point.

Table 4 – Average willingness-to-pay preference (1-5) by product variant for regular shoppers

Product variant	Metric	N	Likelihood to buy at the cheap price	Likelihood to buy at the expensive price
Bottle with 30% rPET	Average	187	3,88	2,53
	Standard Deviation		1,14	0,96
Bottle with 50% rPET	Average	164	3,85	2,51
	Standard Deviation		1,01	0,94
Bottle with 75% rPET	Average	154	3,81	2,40
	Standard Deviation		1,05	0,99

Respondents under 35 years old were more willing to purchase the respective product variant at the cheap price than those older than 35, with the inverse being true for the likelihood of purchasing at the expensive price point (Annex 5).

Those with incomes over €2.500 were, on average more likely to purchase the olive oil bottle at both price levels. Once more, the results regarding the education level didn´t yield any consistent trends (Annex 5).

The individual quantitative results from the questionnaire were structured through the use of Excel in order to allow them to be directly imported into the R statistical software as a single table. And were manipulated and analyzed through the use of the “price-sensitivity-meter” package and transformed into graphical functions of the cumulative distributions for the different prices of the respective product variants, as well as the determination of the main outputs that occur in the interceptions between the aforementioned cumulative distributions (Table 5).

By this point, additional questionnaire logic was applied within the R software, by not considering answers that weren’t ascending in price i.e., the respondents were expected to answer such that: Too cheap < Cheap < Expensive < Too Expensive. This led to around 23% of answers being considered invalid for the remainder of the analysis (Table 4).

Price ranges in all instances (Table 5) stood between €3,10 and €3,50 for the lower bound and €6 and €6,50 for the upper bound, meaning the price points chosen for analysis stood inside theses ranges of prices.

Table 5 - PSM output in R

Product variant	N total	N valid	PMC	PME	IDP	OPP
Bottle with 30% rPET	186	145	3,10	6,00	4,50	4,50
Bottle with 50% rPET	164	118	3,20	6,10	4,60	4,70
Bottle with 75% rPET	154	126	3,50	6,50	5,00	5,00

The product variants analyzed had price points for maximum revenue and, more importantly for this analysis, for maximum trial, which stood between €4 and €5 in all instances (Annex 6).

The obtained data for the trial value allowed for the determination of price elasticity of demand (Table 6) and in consequence, the values associated with each price point for the likelihood of the sampled individuals purchasing each of the product variants, allowing for the calculation of the variation in the quantity purchased in comparison to the base-line price and the associated revenue variation (Table 7).

The values for price elasticity vary across product variants, with the 30% rPET bottle having a higher and positive price elasticity of demand, whilst the 50% variant stands at an almost unitary value, and finally, the 75% rPET variant provides a negative price sensitivity of demand.

Taking the base price of 4,5€ and assuming that it corresponded to the amount of bottles sold for 2022 of 1.039.743 units, interpolation to the quantities sold for the remaining prices was possible and allowed for total revenue calculations (Table 7).

Table 6 – Trial value and price elasticity of demand results by product variant

Product variant	Price (€)	Trial Value	Price elasticity of demand (@4,5€)
Bottle with 30% rPET	4,51	0,2602749638	2,4363713
Base case	4,50	0,2616917980	
Bottle with 50% rPET	4,53	0,2524903810	0,9912065
Base case	4,50	0,2541698710	
Bottle with 75% rPET	4,55	0,2392127620	-0,0995438
Base case	4,50	0,2389483410	

Table 7 – Estimation for Quantity sold and Total revenue values by product variant

Product variant	Quantity sold (units)	Quantity sold Δ to Base case (%)	Total revenue (€)	**Total revenue Δ to Base case (%)**
Base case	1 039 743	0,00%	4 678 843,50	**0,00%**
Bottle with 30% rPET	1 034 113	-0,54%	4 663 849,63	**-0,32%**
Bottle with 50% rPET	1 032 872	-0,66%	4 678 910,16	**0,001%**
Bottle with 75% rPET	1 040 893	0,11%	4 736 063,15	**1,10%**

For the 3 product variants, the variation of total units sold was inferior to 1% in all cases, with the 50% rPET bottle eliciting the biggest negative swing of around 7.000 fewer units sold. As for the total revenue, only for the case of the 30% rPET bottle was there a negative swing in total revenue, though less than 1% or around €15.000 for this product variant.

The 75% rPET variant stood as the only that had an increase in the amount of units sold, with revenue also increasing as a result, having a variation of 1,1% or €57.219,65, with this being by far the biggest variation in revenue. Lastly, and once more in line with the results of the price elasticity of demand, the 50% rPET product variant elicited a €66,66 increase in revenue, consistent with the almost unitary price elasticity of demand for this product.

4.3. Data Analysis

On the face of it, the initial variation of only €0,03 in total unitary costs seems insignificant, and hints that the company's best course of action, given their sustainability push and the campaigns launched by other companies, should be to aim towards the maximum value of 75% rPET, however, that are a lot of variables to consider.

Firstly, the olive oil industry is, at least in the Portuguese market, based on high volume, rather than high margins, with these claims having been made by the company, affirming that unitary margins for their olive oil were around €0,05, meaning that a variation of even €0,01 is extremely high, for their unitary profits. Analysis of cost data seems to be congruent with the "razor thin" unitary margins that are claimed by Company X, and gives credibility to the situation the company finds itself in.

Another factor to consider is the fact that the company sells several products and product lines, not only in the olive oil business but also other food oils. This means that they could, in theory, increase the rPET content to 100% for some references, and are planning to do just that for a specific limited edition release later in 2023, but this would be eating into the scarce amount of rPET content that they are able to acquire at a financially sustainable price throughout the year and across their product lines, which, if taken in a global market perspective, would be compounding the current issue of the supply-demand imbalance in the rPET market.

In terms of the direct conclusions that can be taken from the quantitative data, the obtained results were, for the most part, congruent with the analyzed literature with regards to consumers' willingness-to-pay more, or at least affirm they are willing to pay more (Biswas & Roy, 2016; Tsen et al., 2006) for a more sustainable or "green" product in certain scenarios and assuming a certain level of prior knowledge and concern around the issue (Joshi & Rahman, 2015; Song et al., 2019).

These claims, however, can't be extended to the expected results for the demographic characteristics of consumers, with the higher average price points for consumers over the age of 35 being present for most recorded cases (with exception of the Too Expensive point for the 30% rPET variant) and standing at around 8% across product variants and price points. These differences would be expected to be, *ceteris paribus,* reversed according to literature, with younger consumers, in the millennial and younger generations generally regarded as more environmentally conscious (Tyson et al., 2021), and the most immediate factor of differences in household income virtually non-existent between these groups, and if anything, favoring the younger group in terms of income.

These results may, then, be a representation of several factors, chief among them the differences between environmental consciousness and actual purchasing intentions and behaviors, with studies suggesting that the relationship between these two variables is often quite weak, and that the actual conversion to green purchasing habits stems from emotional or subjective social norms rather than an often superior, but superficial knowledge of environmentalism by younger generations (Bang et al., 2000; Joshi & Rahman, 2015).

This bodes well with the commonly accepted hypothesis that price differentials often outweigh other factors, thereby contributing to the widening of this "green attitude-behavior gap" (Connell, 2010; Padel & Foster, 2005), though, of course, this factor can have, as seen in this studies' price results, some positive effect in the willingness-to-pay of consumers.

However, for the case of the likelihood to purchase, different results were obtained, with respondents under 35 being, on average, more likely to purchase at their selected cheap price point, but less likely to purchase at the expensive one, reinforcing, the aforementioned, patent differences between purchasing behaviors and intentions, and presenting some dissonance between price point definition, and actual purchasing intention.

Analysis of the qualitative data obtained from interviews and the aforementioned cost and price preference elations taken in this study, give credibility to the current strategic position taken by the company for this reference as a part of the implementation of their strategic cost management, viewing cost data derived from cost accounting systems as a tool to assist the strategic management process as it pertains to maintaining a sustainable competitive advantage (Hansen et al., 2021).

The PSM presented interesting results, especially regarding the Optimal Price Point which, for all product variants, stands at or slightly above the baseline price of the SKU, meaning that, for this sample, the current price point of the product and the subsequent product variants introduced, seems to generally be at around the price point of least resistance to purchase.

Equality of the OPP and IDP points are an expected occurrence that is present in this analysis and bodes well for reinforcing their reliability given that, for normal markets, it's expected that the difference between these points is marginal or non-existent (Van Westendorp, 1976).

The PMC and PME are useful for our purposes given that they provide a range of acceptable prices for the product variant, thereby giving general guidelines for price positioning. For all instances, the price chosen for each price variant stands between these ranges, hitting that, in a general sense, consumers are aligned with the pricing strategies of the company.

A more exact analysis, as predicted, didn´t yield as promising results. For the 75% rPET variant, but also for the 50% variant, the OPP point stands above the price point utilized for this analysis, with the 75% standing €0,45 above the base price, a significant difference that reinforces the perspective taken, not to attempt to determine exact price points in this case study, merely utilizing the PSM results as indicative of price ranges and basis for pricing strategies. In any event, the OPP price point corresponds to the price point at which resistance to purchase is the smallest, not to be confused with the optimum price point often searched for in Economic theory.

The NMS output, the main output required to answer the research question, provided the most interesting results, with some conclusions aligning with those initially posited by the company, as well as some key divergences.

The obtained results for price elasticity of demand exemplify the convoluted relationship between price and demand, with the context in which the different product variants were presented leading to descending price elasticities, hinting to considerable variations in the perception of the products by the inquired consumers, and showcasing the complex task of strategic price setting. This isn´t surprising as different contexts and product characteristics are in fact expected to yield different results as shown by prior empirical research (Roll et al., 2010; Weinrich & Gassler, 2021).

The first variant can be classified as very price sensitive. These results are coherent with the sentiment shared by the company that consumers aren't willing to pay more for minimal differential increases in the quantities of rPET content, with the 10 p.p. from 20% to 30% rPET content, providing a very high price elasticity of demand and hinting at a snap conclusion of non-viability for this product variant.

This would be true if not for the assumption taken for only a €0,01 increase in price from the base case, which, though relevant with it causing both a decrease in the quantity sold and overall profitability, added up to under 1% in relative variation, with a decrease in €15.000 in overall profits. This is, of course, unwanted, but provides some reassurance for the company in the ramp-up to the 2030 regulations.

For a higher price jump the consequences would, however, prove harsher, with an alternative €0,10 increase leading to over 5% in reduction of total sales and almost 4% reduction of total revenue for this reference, a more significant value if extrapolated to all product lines, and showcases the sensitivity that assumptions for costs have in this study. In any case, the financial viability of this product variant can, given these parameters, be affirmed in a static perspective.

The impact on Company X of Directive (EU) 2019/904 can, however be concluded as negatively affecting the company, this being in line with claims of Porter and Van der Linde (1995) regarding the negative impacts that environmental regulations have on a corporation's bottom-line. However, these claims can't, in the case of this analysis, be extended to other, more stringent, future regulations with different rPET content levels, nor can the conclusions taken for the 30% variant necessarily be extended to a long-term perspective, with some authors advocating for the long-term positive effects for the market, the most important of which being, in this case, the pursuance of the 2030 SDG's (de Sousa, 2021) and the positive externalities that may come from reaching said goals.

The remaining variants yielded more unorthodox, but perhaps not more unexpected, results. Starting with the 50% rPET content bottle this product's price sensitivity of demand can be classified as slightly inelastic but, rounded up, it can be interpreted as unitarily elastic. The final variant of 75% had a negative price elasticity of demand, meaning that the 75% rPET bottle variant can be classified as a Giffen good, i.e., a normally low price and non-luxury product that, against economic theory, rises in demand when its price increases (Dougan, 1982).

Price inelasticity would be expected in price points between the IDP and OPP points (Weiner, 2001), however the utilized base price point for price sensitivity calculations stands under both these points for the aforementioned product variants, with this placement proving key, given that, the number of consumers at this price point that find the product cheap and too cheap is superior to those that find it, respectively, expensive and too expensive.

This seems to explain the descending nature of the price elasticity of demand throughout the product variants' evolution, with a static initial price point being combined with ever increasing OPP and IDP price points.

These results can be interpreted as the functioning of the PSM and NMS mechanisms, given that, the utilized price and base prices for these product variants are too low to be ideal for maximum market share and total sales of the product, thereby resulting in the aforementioned descending price elasticities. Once more these conclusions are echoed by the prices for maximum trial and maximum revenue obtained in the NMS section of the analysis, with both these values being superior to the referenced price used for the 75% variant and the maximum revenue price being higher for the 50% variant.

From a price setting perspective, these results seem to be congruent with the analyzed literature, given that despite the chosen theoretical framework, cost-plus pricing, even in a relative fashion, is an inefficient and theoretically wrong fashion of defining sales prices, despite its popular use (Dolgui & Proth, 2010), with the reference prices used in this study not attempting to match any sort of ideal price point.

Nonetheless, the conclusions taken do have weight in terms of the ascending nature of willingness-to-pay which, even not considering the PSM and NMS analysis, somewhat disprove statements of unwillingness-to-pay for these green characteristics.

The strategic intent on the positioning of this specific SKU and the analyzed brand towards sustainability, given the current socio-economic climate and regulations, and the previously proved and hereby re-proved appetite from consumers for sustainable products, bodes well for the future profitability of the company, while reinforcing the initial strategy design from 2017 of increasing the costs of production in conjunction with a larger strategy as defined by a Strategic Cost Management framework.

In any event, and through analysis of the evolution of olive-oil prices, as well as the raw oil prices, the recent market volatility in the rPET can, at least partially be explained by economic conditions (Ilie & Jurconi, 2019), hinting that the severity of the current cost premium for rPET, and the price increase that it has caused for Company X, may be minimized in the absence of said, expectedly transitory, conditions.

5. CONCLUSION

The analyzed problematic in this case study in the spirit of the developed consulting project for the Company X corporation, was the degree to which the rPET level in the current legislation and superior levels of rPET content affects the financial viability of products that use said materials, with the following sections describing the conclusions reached, the implications of said conclusions, the limitations encountered throughout the analysis, and suggestions for future research.

5.1. Main Conclusions

This study found that, for a pre-determined set of cost and price variations, the introduction of 30%, 50% and 75% rPET content in a brand name olive oil product is financially viable in a static setting. These conclusions should be taken under the assumed conditions, with extrapolation to other price and cost assumptions not being clear. In any event, claims about the refusal of consumers to pay for this additional “green quality" aren't completely substantiated, though stating that some level of price aversion isn´t present also isn't accurate.

It should be stated that the conclusions taken lack the in-depth Marketing management strategy and analysis, which should be understood as a pre-requisite for the future success of the product. Though in this case simply increasing the "sustainability rating" of a product without any other sort of change seemed not to be too harmful to the company's bottom line, and actually beneficial in the 75% rPET variant, this may be a poor strategy if executed in this manner (Kotler & Keller, 2016; Nagle & Müller, 2017; Smith, 2021).

This strategic placement must, of course, be made in combination with increased efforts in the communication of this sustainability, in addition to the fostering of sustainability practices in consumers, which all-in-all may prove to be the long-term solution, and more in line with the sustainability as an investment vision presented throughout the interview process with Company X.

5.2. Research implications

The research done in this case study is novel in this specific industry and quite unexplored in general. In terms of relevancy to businesses, and more specifically to companies in the Food and Drinks sectors, this case study is highly relevant in the current climate of ever more restrictive environmental regulations, not only pertaining to rPET content but to other similar current and future regulations that may force companies to adopt new materials, techniques, or other changes in their production.

For the case of rPET regulations, and given the current pledges, there is a need for a 130% increase in production until 2030 (Kahlert & Bening, 2022), meaning that this problem is likely to persist in the foreseeable future, making the analysis of the financial viability of the affected products a key point for the continued success of the industry.

Encouraging signs for the company and industry at large may be taken from these results, with a patent willingness-to-pay for green products being present across the board, as was to be expected from literature analysis, though, of course, the translation of the obtained results to a real-life setting wouldn´t and wasn´t aimed to be a one-to-one match, with the aim simply being to prove that these product variants were financially viable, and not to analyze the exact prices, costs or profitability of the products.

Once again, the generalization of these case study results must be done with caution, not in the least due to the sample of the questionnaire and the specific conditions of the company not being necessarily applicable to other companies in the food and drinks sector.

The financial viability of these products also somewhat validates strategies for cost management currently employed by Company X of complying with regulations, not attempting to increase their rPET level beyond what is required, by way of pledges.

However, on the other side of this strategy, the very elevated levels of rPET content presented by some corporations such as Coca-Cola and Nestlé can be, at least from a willingness-to-pay perspective, economically rational, given the aforementioned price premium presented for a product's "sustainability rating", making this strategic product placement also a viable strategy in certain conditions, and assuming an all-encompassing strategy from the individual companies and products.

The long-term effects of Directive (EU) 2019/904 on the development of this specific industry are then, as presented and predicted in literature, still unknown.

5.3. Limitations

Several limitations on the quality and quantity of information constricted the scope of this study, thereby reducing the generalizations that could be made from it, both within the same industry, as well as across other areas that are or will be constricted by regulations that alter their operations.

The non-representativity of the sample is, of course, the first factor that impedes this, while the applicability of the results to markets other than the Portuguese is also dubious.

The restriction of data obtained from the company for confidentiality reasons, also limited the scope and applicability of the results, with the assumptions taken meaning that the prices analyzed don´t actually represent those practiced by the company, but by B2C corporations, and though the results obtained under these conditions can still be applied to the situation in question, this, of course, restricts extrapolations that could be made in a wider industry sense.

In addition to this, the conditions of the Portuguese market for olive oil, as well as the macroeconomic conditions at the time of the study will have affected the results obtained given that the high inflation levels would have been predicted to lead to higher price elasticity (Gordon et al., 2013), but being the olive-oil market a mature one in the European Union given its stable consumption (GPP, 2020), it is predicted to be less elastic than other low-cost frequently bought items (Bijmolt et al., 2005), though the relative effects of each of these factors is unknown and would require a different type of research.

5.4. Future studies and Research directions

In addition to the aforementioned unexplored dimension of marketing management, further analysis using a choice-based conjoint questionnaire would be a needed next step in order to introduce the concept of a competitive landscape in the olive-oil market which wasn't analyzed in this research but could prove key in both short and long-term perspectives.

A revealed preference method should also be considered, given that this methodology, though more complex than stated preference, could also be important in combating the biases that consumer's stated preferences may have had, thereby bridging the gap between intention and behavior required for this information to be actionable.

The continued importance of this theme in several dimensions, not the least of which legislative, will continue to necessitate efforts for the deepening of knowledge in this direction. Continued market volatility is a big threat for any corporation that utilizes PET and rPET in any significant sense, which will mean that companies in different fields will need to be ever more certain of the willingness-to-pay of consumers for rPET content.

Companies therefore cannot base the success of their pricing and strategic costing strategies on the "pure ambition" that stems from a positive sentiment of providing maximum value to consumers, as Company X initially did, but on delivering a sustainable product that allows for the continued financial viability of the company.

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ANNEXES

Annex 1 – Questionnaire final version

<u>Section 1</u> – Presentation and research purpose

Obrigado pela participação! O presente questionário enquadra-se no âmbito da realização de uma dissertação de mestrado em Gestão no Instituto Superior de Economia e Gestão de Lisboa. O foco desta análise é o de analisar a disposição de consumidores de azeite em pagar por um produto embalado com diferentes percentagens de material reciclado.

A resposta a este questionário demora cerca de 5 minutos. As suas respostas são muito importantes, completamente anónimas e serão usadas apenas para fins académicos.

<u>Section 2</u> – Inquiry about olive oil buying habits

Costuma comprar azeite regularmente?

- ○ Sim
- ○ Não

<u>Section 3</u> – Demographic characteristics of respondents

Qual o seu género?

- ○ Masculino
- ○ Feminino
- ○ Não binário/ 3º género
- ○ Prefiro não dizer

Qual o seu nível de instrução completado?

- ○ Ensino Básico (9º ano)
- ○ Ensino Secundário (12º ano)
- ○ Curso Profissional
- ○ Licenciatura (antigo Bacharelato)
- ○ Pós-graduação
- ○ Mestrado
- ○ Doutoramento

Qual a sua idade?

- ○ Menos de 18
- ○ 18-24
- ○ 25-34
- ○ 35-44
- ○ 45-54
- ○ 55-64
- ○ 65+

Qual o rendimento familiar mensal médio?

- ○ Prefiro não dizer
- ○ Até 760€
- ○ Entre 760€ e 1000€
- ○ Entre 1000€ e 1500€
- ○ Entre 1500€ e 2500€
- ○ Entre 2500€ e 4000€
- ○ Acima de 4000€

<u>Section 4</u> – Inquiry about type olive oil buying habits

Que tipo de azeite considera que compra mais frequentemente?

- ○ Marca branca (e.g.:Continente, Pingo Doce, ...)
- ○ Marca Própria

<u>Section 5</u> – Context on rPET bottles and what is being inquired

<u>Garrafas Sustentáveis</u>

- A produção de plástico com origem fossil utiliza <u>*4-8% do petróleo*</u>, tendo em 2021 sido produzidos o equivalente ao peso de todos os cerca de 300 milhões de carros a circular na Europa.
- Neste sentido, alguns produtores de azeite começam a utilizar <u>***plástico reciclado***</u> nas suas garrafas o que evita produzir novo plástico, sendo, assim, <u>***mais sustentável***</u>, e tendo as garrafas a mesma qualidade mas um preço mais elevado.

Imagine nos seguintes cenários que <u>está à procura de comprar uma garrafa de ***750ml azeite de marca própria*** com **diferentes níveis de plástico reciclado** nas suas embalagens</u>.

<u>Section 6</u> – PSM for 30% rPET bottle variant

<u>Produto 1</u> - Garrafa com <u>**30%**</u> de plástico reciclado (rPET)

Qual o preço abaixo do qual considera que o produto é demasiado barato para ter a qualidade esperada? (<u>**Demasiado barato**</u>)

	€										
	2	3	4	5	6	7	8	9	10	11	12
Demasiado barato											

Qual o preço abaixo do qual considera que o produto é uma pechincha - uma grande compra pelo preço? (**Barato**)

€

2 3 4 5 6 7 8 9 10 11 12

Barato

Qual o preço a partir do qual considera que o produto começa a ficar caro, tal que consideraria adquiri-lo, mas teria de pensar bem? (**Caro**)

€

2 3 4 5 6 7 8 9 10 11 12

Caro

Qual o preço a partir do qual considera o produto demasiado caro, e que não consideraria adquiri-lo? (**Demasiado caro**)

€

2 3 4 5 6 7 8 9 10 11 12

Demasiado caro

Section 7 – NMS for 30% rPET bottle variant

Qual a probabilidade de comprar o produto ao preço que considerou **barato** - ${q://QID16/ChoiceNumericEntryValue/1}€?

- 5 - Muito alta
- 4 - Alta
- 3 - Nem alta nem baixa
- 2 - Baixa
- 1 - Muito baixa

Qual a probabilidade de comprar o produto ao preço que considerou **caro** - *${q://QID17/ChoiceNumericEntryValue/1}€?*

- 5 - Muito alta
- 4 - Alta
- 3 - Nem alta nem baixa
- 2 - Baixa
- 1 - Muito baixa

Section 8 – PSM for 50% rPET bottle variant

Produto 2 - Garrafa com **50%** de plástico reciclado (rPET)

Qual o preço abaixo do qual considera que o produto é demasiado barato para ter a qualidade esperada? (**Demasiado barato**)

€

2 3 4 5 6 7 8 9 10 11 12

Demasiado barato

Qual o preço abaixo do qual considera que o produto é uma pechincha - uma grande compra pelo preço? (**Barato**)

€

2 3 4 5 6 7 8 9 10 11 12

Barato

Qual o preço a partir do qual considera que o produto começa a ficar caro, tal que consideraria adquiri-lo, mas teria de pensar bem? (**Caro**)

€

2 3 4 5 6 7 8 9 10 11 12

Caro

Qual o preço a partir do qual considera o produto demasiado caro, e que não consideraria adquiri-lo? (**Demasiado caro**)

€

2 3 4 5 6 7 8 9 10 11 12

Demasiado caro

Section 9– NMS for 50% rPET bottle variant

Qual a probabilidade de comprar o produto ao preço que considerou **barato** - ${q://QID42/ChoiceNumericEntryValue/1}€?

- 5 - Muito alta
- 4 - Alta
- 3 - Nem alta nem baixa
- 2 - Baixa
- 1 - Muito baixa

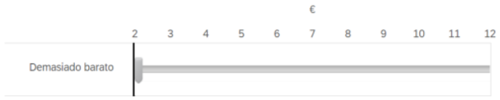
Qual a probabilidade de comprar o produto ao preço que considerou **caro** - ${q://QID43/ChoiceNumericEntryValue/1}€?

- 5 - Muito alta
- 4 - Alta
- 3 - Nem alta nem baixa
- 2 - Baixa
- 1 - Muito baixa

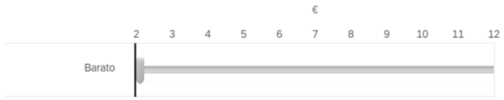
Section 10 – PSM for 75% rPET bottle variant

Produto 3 - Garrafa com **75%** de plástico reciclado (rPET)

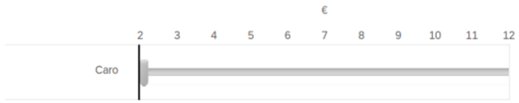
Qual o preço abaixo do qual considera que o produto é demasiado barato para ter a qualidade esperada? (**Demasiado barato**)



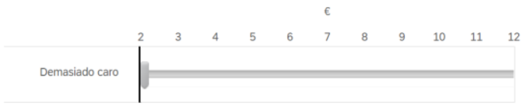
Qual o preço abaixo do qual considera que o produto é uma pechincha - uma grande compra pelo preço? (**Barato**)



Qual o preço a partir do qual considera que o produto começa a ficar caro, tal que consideraria adquiri-lo, mas teria de pensar bem? (**Caro**)



Qual o preço a partir do qual considera o produto demasiado caro, e que não consideraria adquiri-lo? (**Demasiado caro**)



Section 11 – NMS for 75% rPET bottle variant

Qual a probabilidade de comprar o produto ao preço que considerou **barato** - ${q://QID49/ChoiceNumericEntryValue/1}€?

- 5 - Muito alta
- 4 - Alta
- 3 - Nem alta nem baixa
- 2 - Baixa
- 1 - Muito baixa

Qual a probabilidade de comprar o produto ao preço que considerou **caro** - ${q://QID50/ChoiceNumericEntryValue/1}€?

- 5 - Muito alta
- 4 - Alta
- 3 - Nem alta nem baixa
- 2 - Baixa
- 1 - Muito baixa

Annex 2 – Iberian PET and rPET prices from 2020 to 2022

Month	PET (€/Ton)	rPET (€/Ton)	rPET premium (€/Ton)	rPET premium (%)
jan/20	884	1312	428	48%
fev/20	894	1312	418	47%
mar/20	874	1312	438	50%
abr/20	776	1317	541	70%
mai/20	696	1327	631	91%
jun/20	672	1297	625	93%
jul/20	684	1273	589	86%
ago/20	708	1250	542	77%
set/20	716	1241	525	73%
out/20	720	1225	505	70%
nov/20	753	1196	443	59%
dez/20	733	1187	454	62%
jan/21	751	1187	436	58%
fev/21	822	1211	389	47%
mar/21	869	1270	401	46%
abr/21	977	1367	390	40%
mai/21	980	1462	482	49%
jun/21	983	1600	617	63%
jul/21	981	1717	736	75%
ago/21	1011	1783	772	76%
set/21	1029	1821	792	77%
out/21	1040	1827	787	76%
nov/21	1079	1827	748	69%
dez/21	1101	1867	766	70%
jan/22	1089	1961	872	80%
fev/22	1506	2090	584	39%
mar/22	1511	2191	680	45%
abr/22	1641	2272	631	38%
mai/22	1722	2350	628	36%
jun/22	1660	2423	763	46%
jul/22	1678	2496	818	49%
ago/22	1758	2512	754	43%
set/22	1595	2504	909	57%
out/22	1474	2465	991	67%
nov/22	1398	2328	930	67%
dez/22	1354	2167	813	60%

Annex 3 – Demographic characteristics (N = 229)

Variable	Description	%
Age	15-34	24,7%
	35-44	49,5%
	45-54	18,8%
	≥65	7,0%
Gender	Male	36,0%
	Female	64,0%
Education Level	Middle school (9th grade)	7,0%
	Highschool (12th grade)	30,1%
	College degree	62,9%
Household income (€)	<760€	4,3%
	760€ - 1500€	11,0%
	1500€ - 2500€	17,1%
	2500€ - 4000€	32,9%
	>4000€	25,6%
Type of olive oil mostly bought	Name brand product	65,6%
	White label product	34,4%

Annex 4 – PSM results per product variant according to demography

Product Variant	Demographic Metric	Metric	Too cheap	Cheap	Expensive	Too expensive
Bottle with 30% rPET	Age (years)	≤ 35	2,81	3,09	5,29	6,65
		> 35	3,46	3,52	5,42	6,84
	Monthly Household Income (€)	≤ 2500	3,29	3,45	5,19	6,56
		> 2500	3,13	3,25	5,47	7,06
	Education Level	Middle school (9th grade)	3,62	3,45	5,03	6,27
		Highschool (12th grade)	3,21	3,28	5,36	6,88
		College degree	3,32	3,49	5,44	6,80
Bottle with 50% rPET	Age (years)	≤ 35	2,92	3,64	5,75	6,98
		> 35	3,46	3,77	5,80	7,16
	Monthly Household Income (€)	≤ 2500	3,44	3,84	5,76	7,07
		> 2500	3,11	3,61	5,79	7,30
	Education Level	Middle school (9th grade)	3,75	3,82	5,86	7,07
		Highschool (12th grade)	3,14	3,71	5,85	7,22
		College degree	3,38	3,74	5,76	7,08
Bottle with 75% rPET	Age (years)	≤ 35	3,13	3,83	5,89	7,16
		> 35	3,58	4,17	6,13	7,28
	Monthly Household Income (€)	≤ 2500	3,51	4,21	6,04	7,21
		> 2500	3,38	3,91	6,09	7,49
	Education Level	Middle school (9th grade)	4,10	4,20	6,31	7,34
		Highschool (12th grade)	3,28	3,85	6,08	7,47
		College degree	3,49	4,18	6,04	7,15

Annex 5 - NMS results per product variant according to demography

Product Variant	Demographic metric	Metric	Likelihood to buy at the cheap price	Likelihood to buy at the expensive price
Bottle with 30% rPET	Age (years)	≤ 35	4,43	2,48
		> 35	3,69	2,54
	Monthly Household Income (€)	≤ 2500	3,91	2,53
		> 2500	3,95	2,61
	Education Level	Middle school (9th grade)	4,08	2,77
		Highschool (12th grade)	3,66	2,48
		College degree	3,96	2,52
Bottle with 50% rPET	Age (years)	≤ 35	4,18	2,36
		> 35	3,75	2,55
	Monthly Household Income (€)	≤ 2500	3,82	2,43
		> 2500	4,00	2,71
	Education Level	Middle school (9th grade)	4,18	2,55
		Highschool (12th grade)	3,77	2,43
		College degree	3,86	2,54
Bottle with 75% rPET	Age (years)	≤ 35	4,00	2,21
		> 35	3,74	2,47
	Monthly Household Income (€)	≤ 2500	3,81	2,36
		> 2500	3,83	2,65
	Education Level	Middle school (9th grade)	4,10	2,60
		Highschool (12th grade)	3,88	2,40
		College degree	3,74	2,39

Annex 6 – NMS main output in R

Product variant	Price for max trial	Trial value	Price for max revenue	Revenue value
Bottle with 30% rPET	4,00	0,32	4,00	1,28
Bottle with 50% rPET	4,00	0,27	4,60	1,14
Bottle with 75% rPET	4,60	0,24	5,00	1,12