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**SHORT-TERM IMPACTS OF SUSTAINABLE
CERTIFICATIONS ON HORECA SECTOR
BUSINESSES: THE MICHELIN GREEN STAR CASE**

Supervisors:

Prof. Beretta Valentina

Prof. Bor Sanne

**Master Thesis by
Aricò Antonio**

Matr. n. 554156

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ENGLISH ABSTRACT

University Of Pavia

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Antonio Aricò

Short-term impacts of sustainable certifications on Horeca sector businesses: the Michelin green star case

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Associate professor Sanne Bor

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While literature discusses sustainability certifications in the Horeca sector across Popularity, Green reputation, and Economic performance, existing empirical studies are based on customer intention rather than actual behaviour, calling for additional quantitative analysis. To address this gap, this study provides a short-term impacts analysis on a sample of 128 European Restaurants awarded with the green Michelin star between 2020 and 2024, investigating how the certification affects the three macro areas, and the existence of cross-area relationships. Seven variables were extracted from Google Maps, Google Trends, Orbis, and APIs, distributed across the three macro-areas. The analysis adopts two analytical logics: Panel Fixed Effects and Random Effects regression models, and descriptive time-variation analysis. Results identify a significant relationship of certification with Customer attention and Total production, as well as a significant relationship between Online content and Total production. All analyses fail to find a significant relationship with Green Reputation variables. Literature suggests two main interpretations of this result: first, these awarded restaurants already enjoy exceptionally high prestige, leaving little room for further reputational gains, and second, consumers in the fine-dining sector assign a relatively lower emphasis to sustainability compared to the gastronomic experience itself. Lastly, the analysis reveals that customer-driven variables are more responsive and methodologically effective in capturing sustainability-related effects than business-driven metrics, which suffer from excessive statistical noise caused by external confounding factors, to which SMEs are particularly susceptible, risking obscuring empirical findings.

ITALIAN ABSTRACT

Università di Pavia

Dipartimento di Scienze Economiche e Aziendali

Double Degree con LUT University (Finland)

Antonio Aricò

Impatti a breve termine delle certificazioni di sostenibilità sulle imprese del settore Horeca: il caso della stella verde Michelin

Tesi Magistrale

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124 pagine, 13 immagini, 25 tabelle e 10 appendici

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Ass. Prof. Sanne Bor

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Sebbene la letteratura esamini le certificazioni di sostenibilità nel settore Horeca in termini di popolarità, reputazione e performance economica, gli studi empirici esistenti si basano sulle intenzioni dei clienti piuttosto che sul loro comportamento effettivo, rendendo necessaria un'ulteriore analisi quantitativa. Per colmare questa lacuna, il presente studio fornisce un'analisi degli impatti a breve termine su un campione di 128 ristoranti europei insigniti della stella verde Michelin tra il 2020 e il 2024, indagando in che modo la certificazione influisca sulle tre macroaree e l'esistenza di relazioni trasversali. Sono state estratte sette variabili da Google Maps, Google Trends, Orbis e APIs, distribuite tra le tre macroaree. L'analisi adotta due logiche analitiche: modelli di regressione a effetti fissi e a effetti casuali su panel, e analisi descrittiva delle variazioni temporali. I risultati identificano una relazione significativa della certificazione con l'attenzione dei clienti e la produzione totale, nonché una relazione significativa tra il numero di contenuti online e la produzione totale. Nessuna tra le analisi riesce a trovare una relazione significativa con le variabili della reputazione ecologica. La letteratura suggerisce due interpretazioni principali di questo risultato: in primo luogo, i ristoranti premiati godono già di un prestigio eccezionalmente elevato, lasciando poco spazio ad ulteriori guadagni in termini di reputazione; inoltre, i consumatori nel settore della ristorazione di alto livello attribuiscono un'importanza relativamente minore alla sostenibilità rispetto all'esperienza gastronomica stessa. Infine, l'analisi evidenzia che le variabili orientate al cliente sono più reattive e metodologicamente efficaci nel cogliere gli effetti legati alla sostenibilità rispetto agli indicatori orientati al business, che risentono di un eccessivo rumore statistico causato da fattori di disturbo esterni, ai quali le PMI sono particolarmente esposte, con il rischio di oscurare i risultati empirici.

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SYMBOLS AND ABBREVIATIONS

Horeca	Hotel, Restaurant, and Café/Catering
WTP	Willingness To pay
SMEs	Small and Medium Enterprises
eMICA	Extended Model of Internet Commerce Adoption
DIPs	Digital Interactive Platforms
SEO	Search Engine Optimization
SERP	Search Engine Results Page
CSR	Corporate Social Responsibility
KPI	Key Performance Indicator
UGC	User Generated Content
LDA	Latent Dirichlet Allocation
VADER	Valence Aware Dictionary for Sentiment Reasoning
FE/RE	Fixed/Random effects

1 Introduction

1.1 Background

The Kyoto Protocol (2005) marked the formal beginning of the global fight against climate change, as it has been the first legally binding framework for CO₂ emission reduction. Since then, sustainability has expanded far beyond that, reshaping global jurisdictions and creating a new paradigm that strongly influences how policies are written, how companies operate, and how consumers make choices. While the hospitality sector stands as the retail world's leading energy user, its granular structure poses significant barriers to sustainability. Dominated mainly by SMEs, the industry often lacks the financial and human capital necessary for large-scale environmental transitions, making widespread adoption of green practices particularly complex (Wang et al., 2013).

Horeca businesses, driven by the increasing popularity of sustainable dining, are becoming more aware of their socio-environmental impacts, like food waste, a source of unnecessary CO₂ emissions. This growing awareness is caused by a combination of normative, coercive, and mimetic isomorphism, which push firms to align their strategies with sustainable standards. Through relationships with various stakeholders (like food suppliers, employees and policymakers), restaurant management also represents a fundamental factor, necessary for the adoption of sustainable practices, positively influencing the entire supply chain. (Corte et al., 2025)

Customers represent one of the main drivers of this change, they are becoming more ecologically conscious, demanding more environmentally friendly products and expressing higher WTP (Willingness to pay) for less environmentally harmful dining experiences (Kwok,

Huang and Hu, 2016). Contemporary consumers have become more demanding under many perspectives when dealing with sustainable-branded products, being more attentive on the origin of food, the contained ingredients, the impacts it imposes on personal health, and the well-being of local communities and environment (Oh, Fiore, & Jeoung, 2007). The interest in sustainability involves all generations, especially Millennials, who emerge as the primary drivers of this change. Their dedication represents a market signal, creating the expectation that future business models will need to prioritize sustainability to be able to be successful (Kim and Park, 2019).

Cantele and Cassia (2020) point out that for businesses the acknowledgement of CSR (Corporate Social Responsibility) practices is increasingly required to be integrated in strategy and operations. The article argues this phenomenon is slowly causing an evolution from the traditional marketable sustainable concept, towards a more effective shared value approach, with sustainability merging with main business models. In this new frame, sustainability needs to be integrated in daily operations, not as an ethical forced compliance, but rather as a strategic component, with potential to increase the overall performance. Businesses have started adopting voluntary certifications to signal their effort in reducing emissions to consumers, proving their compliance with specific sustainability standards provided by reputable third parties. In this framework, certifications represent more than signalling tools, they offer reputational and economic advantages, like improved efficiency, increased customer trust, and therefore, higher employee satisfaction (Bigerna, Micheli and Polinori, 2025).

In the framework described by current literature, where profitability is mediated by customer satisfaction and competitiveness, certifications do not always represent financially sustainable strategy. Pursuing a structural change often required SMEs to make an investment that might not lead to an actual future profit, but yet necessary to adopt sustainable standards (Citterio, 2025). Restaurants risk focusing on technical requirements rather than customer satisfaction,

having their effort not recognized due to the Back-of-House effect, with most sustainable practices happening where it's not directly noticeable by the end-consumers, (Charlebois, Creedy and Massow, 2015), leading to a negative performance.

In this complex framework, where sustainability is addressed theoretically as both a potential survival factor and potential loss of resources, this research attempts to provide a perspective on how nowadays companies, which adopted sustainable certifications, are performing. The results will explain if sustainability is working as a mere positive and market friendly signalling strategy, or it's structurally and positively impacting awarded restaurants across three main areas. In the Horeca sector, where Michelin Guide is one of the most globally recognized quality certifications, popular for its historical relevance within the industry, this research will measure the impacts of green Michelin star awardee, comparing the empirical case study to current literature expectations.

1.2 Literature Contribution

Sustainability is a credence attribute, in fact sustainable certification cannot be enjoyed before or throughout purchase, its value is based on trust, because certifications have no flavour (Darby and Karni, 1973). The plurality of existing certifications leads the customer towards a pooling equilibrium, characterized by consumers being unable to spot differences between companies who truly commit to sustainability, and competitors who only signal it (Bergh et al., 2014). In this context, renowned certifications providers like Michelin Guide, assigning the green Michelin star award, assume the role of trust providers, allowing customers to truly recognize those businesses who are basing their strategy on sustainable standards (Hovland and Weiss, 1951). The award doesn't simply affect brand reputation, it helps reduce perceived risk for clients, boosting WTP, enhancing performance, and increasing overall popularity, with high

chances for restaurants of being often fully booked (Chiang and Guo, 2021). Literature suggests that certifications generate a lot of benefits, but the power of these benefits is mediated by diverse factors like industry sector, type of activity, company size, location, consumer awareness, and firm's approach (Citterio, 2025).

In a complex socio-political framework affecting the Horeca industry, where companies are now required to quickly adapt to the evolving needs of customers to survive, literature attempts to explain those dynamics through existing theoretical frameworks. Institutional theory provides a first interpretation of the possible reasons motivating organizations to adopt sustainability certifications, like gaining legitimacy within their socio-economic environment (Raab, Baloglu and Chen, 2017). Signalling theory can be applied to certifications, considering it a signal from businesses to consumers, transmitting a valuable and relevant, but otherwise unobservable, product attribute, highlighting their true quality (Kirmani and Rao, 2000). The classification as Credence attribute helps differentiating sustainability certifications' management from more traditional experience and search attributes, the ones people are more used to when considering dining experiences (Darby and Karni, 1973). Ultimately, Resource-Based View addresses strategy and Reputational Positioning. Sustainability can be considered as a rare resource that generates competitive advantage, those who are awarded with a certification could use it to increase the reputational capital, turning into ambassadors and role models within the industry (Pascual and Donaire Benito, 2025).

Current literature explains in depth many of the focal topics and dynamics of this sector, but it often considers those topics as silos, investigating limited universes of factors that can easily prove to be strongly associated between each other (Pascual and Donaire Benito, 2025).

Many of the studies analysing the topic use, as data collection method, surveys, which risks to only consider customer intention, therefore failing to understand actual consumer behaviour.

These same studies invite future research to adopt new research designs, including ex-post investigations with sustainability indicators, allowing to identify the best-case scenarios, which are not limited by hypothetical assumptions (Tölkes, 2018). Filimonau et al. (2017) also suggest the existence of discrepancies between consumer statements and actions, encouraging the scope of future research to be revisited, including tools capable of accounting for this discrepancy. This will help collecting more consumer behaviour data rather than intention or attitude, revealing customer's true determinants of restaurant food choice. Literature also pushes towards a major quantification of Economic data, linking sustainability, that usually is debated on the reputational side, to real financial sustainability. Pascual and Donaire Benito (2025) in their research write an invitation to future research:

“Due to the lack of accessible primary financial data, we were unable to conduct detailed cost–benefit or ROI analyses of restaurant initiatives; so future empirical research should collect these economic metrics to strengthen the business case.”
(p. 11).

Corte et al. (2025) as well notice that despite the proliferation of literature on environmental management and the development of sustainability in the Horeca industry (Cantele and Cassia, 2020; Filimonau et al., 2023), empirical studies providing evidence of those impacts remain limited. There is a gap in empirical research, especially when analysing how environmental concerns have the power to accelerate sustainable development in the Horeca industry, and how this change is impacting sustainability adaptors.

1.3 How this research contributes to literature

This study is designed to continue the investigation of sustainable certification's impact from the hints and suggestions that the relevant literature left, pursuing the quantification analysis

with the most recent data, through a diverse empirical dataset, unravelling how sustainable certifications influence businesses. The research is structured to collect and analyse data with the objective of answering the two research questions:

- Research question 1 (Q1): What are the Impacts and influences of the green Michelin star certification on Popularity, Green Reputation, and Economic Performance?
- Research question 2 (Q2): Are Popularity and Green reputation capable of significantly explaining changes in Economic performance?

The objective is to generate empirical insights into the impacts of sustainability certifications, offering a strategic framework to assist managers and owners in their decision-making processes when evaluating future market strategies. Figure 1 summarizes the initial hypothetical framework.

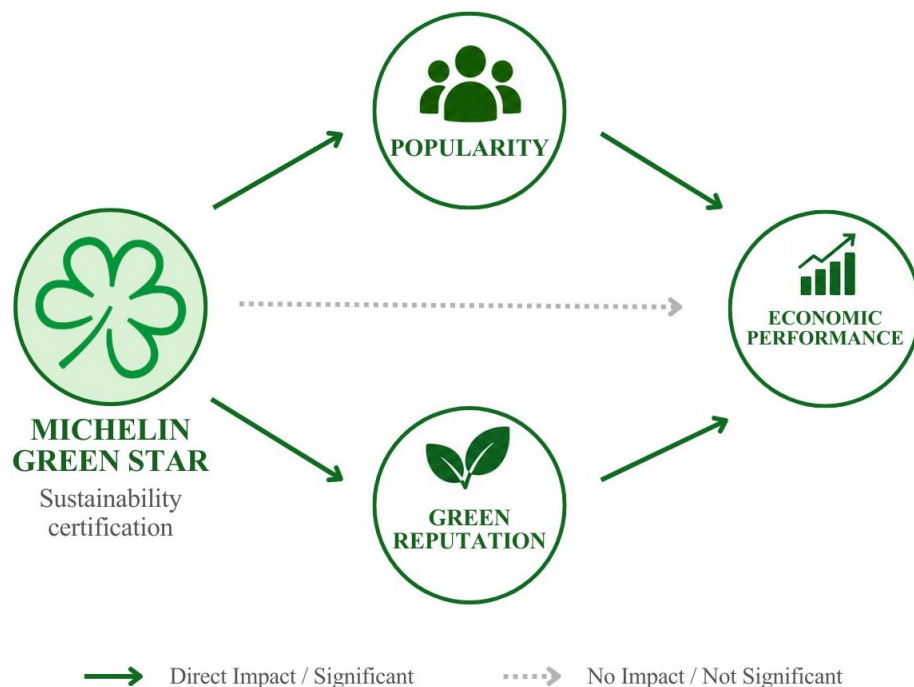


Figure 1. Impacts relationship

The granularity of the data will also offer a new perspective on the Horeca industry, addressing a category that often is too divided and dependent on critical local factors to be regrouped and analysed as a cohesive group, capable of producing significant data. In this research, this same heterogeneity will find a common factor, the green Michelin star, enabling this research to quantify, in a diverse and relatively small sample (due to the peculiar low number of certifications awarded), real dynamics that literature, so far, only analysed theoretically. Despite the relatively small sample size, the data are considered highly significant as it represents a substantial proportion of the total universe. Furthermore, as supported by existing literature, the scarcity of these certifications is precisely what enhances the credibility and trust associated with the few establishments that successfully obtain them.

The study will adopt diverse data extraction methods to tackle each category efficiently, collecting significant data and elaborating it with Excel and Stata to identify impacts and relationship between data type. Data heterogeneity has the objective of ensuring its validity, as the research quantifies diverse phenomena, and to reduce intra-data biases, a fundamental prerequisite for this type of cross-dimensional analysis. More specifically, I will collect data from year 2020 (Introduction year of the green Michelin star) to year 2025, using as sources Google Trends and API run through Python code for popularity data, Orbis for Economic Data, and Google Maps reviews scraped through Web API for Reputational data.

1.4 Structure of the study

The following sections of this research are structured as follows: chapter 2 will introduce the theoretical frameworks on which the research is framed. Chapter 3 will present a comprehensive literature review on the main topics discussed. It discusses how literature addresses sustainability certification drivers, the digital influence, and the three macro areas I will analyse in the

following chapters, identifying the hypotheses. Chapter 4 will provide a summary of the hypothesis and will represent the research conceptual framework. Chapter 5 will explain in detail the methodology adopted, and the reasons behind the choice of each type of data. Findings will follow in Chapter 6, including the results of each category of data with the identified trends and similarities. Chapter 7 will discuss the findings, comparing it to current literature's expectations, building a new framework and proposing potential future research ideas to further expand the academic understanding of sustainability impacts in the Horeca sector. Lastly, Chapter 8 will draw the conclusion of the research.

2 Theoretical Framework

To assess sustainability impact, and more specifically the influence of sustainable certifications on consumers, it is essential to first identify which factors mainly shape customer's perception, and by doing so, to also identify the most efficient green communication strategies. Sustainability has only recently become relevant in the Horeca sector, due to that we only have of few years of relevant data at our disposal. This prevents the chance of executing a specific and accurate long-term analysis. For this reason, it is useful to examine how theory frame the phenomenon, building a conceptual foundation to help projecting current data to the future, aiding in the assumption of its potential impacts.

2.1 Information Economy

For its very nature, sustainability often requires an abstract and theoretical approach. However, to better understand customer perceptions, this paragraph will adopt a narrower perspective, by considering sustainability as a product attribute, like it is mostly evaluated and weighted as by end consumers (Kwok, Huang and Hu, 2016).

Darby and Karni (1973) identify three types of attributes capable of characterizing a product. Search attributes are qualities that can be easily evaluated by the customer before the purchase. Experience attributes are qualities that can only be enjoyed through, or after, the purchase and use of the product. Lastly, Credence attributes are qualities that can never be evaluated or confirmed, their value remains mainly based on trust.

While traditional Horeca product and services are characterized by search and experience attributes, as customers can access information (such as the menu, availability and reviews) before purchase and personally evaluate the service during consumption, sustainability doesn't provide any evaluation or confirmation before, upon or after purchase, qualifying it as a Credence attribute (Kauppi, Hannibal and Bryde-Evens, 2025). In this situation of informational asymmetry, with perceived value heavily relying on trust, sustainable certifications (like the green Michelin star) can bridge between businesses and consumers, transforming the credence attribute into a more verifiable signal (Chiang and Guo, 2021).

2.2 Signalling Theory

Sustainable certifications act as signals, from businesses to consumers, communicating relevant, but otherwise unobservable, product attributes, with the goal of revealing their true type or quality (Kirmani and Rao, 2000). To fully understand this interaction, it is fundamental to also define the different factors influencing the overall outcome of the signal, including the principles defining communication effectiveness, its costs, and the external factors capable of influencing it.

As Ohanian (1990) explains, effective communication is grounded on three main principles: the first is trustworthiness, represented by the conviction that the speaker is professionally reliable and knowledgeable on the topic. In this case study, the organization assigning the green

Michelin star is the Michelin Guide, a highly reliable and recognized institution (Hovland and Weiss, 1951). The second is expertise, which is directly linked to the degree to which the recipient accepts the information. The last is attractiveness, which represent the recipient belief that the product promoted by the signal is attractive with respect to its use and consumption destinations.

Signalling costs are those expenses that businesses are required to sustain for them to be able to promote or manipulate signals. They do not correspond to the financial costs only, they might include also time and psychic efforts (Spence, 1973).

Kauppi, Hannibal and Bryde-Evens (2025) also introduce a third actor in the framework:

“Essentially, certificates make credence characteristics observable to the market.”
(p. 3).

Market is a tool, available to the consumer, for them to be able perceive and observe what the companies want to promote. It represents a third actor capable of influencing communication and alter weight, meaning and significance of the messages through its policies, increasing or decreasing the efficiency of sustainability signalling.

2.3 Voluntary Certifications and Sustainability

Voluntary certifications are private governance tool, used by businesses to provide assurance on a product on its alignment with a set of standards and criteria. Specifically, sustainable voluntary certification represents the effort of a business to contribute to SDGs objectives (Bigerna, Micheli and Polinori, 2025). There is no standard set of available certifications, but rather a dynamic plurality of evolving ones, similar but different both in standards, scope and popularity, even in-between those addressing the same product category. Certifications represent a social contract between businesses and customers, filling an institutional void,

enabling companies to transparently and responsibly disclose their commitment towards sustainable objectives. (Montiel, Christmann and Zink, 2019)

Citterio (2025) distinguishes between three types of sustainable certifications: Environmental Management Systems (EMS), focusing on structured environmental management. Companies adopting this kind of certifications are required to set clear goals for cutting pollution, using energy more efficiently and managing waste. Despite some companies use them primarily for symbolic reasons rather than environmental objectives, existing research suggest that the adoption of these standards often leads to efficiency increase (Boiral, 2011). The second type are Eco-labels, consumer-oriented attempts to reduce the informational gap between businesses and consumers, allowing companies to reach the target audience that care about sustainability and so, with higher brand loyalty and WTP (Hamilton and Zilberman, 2006). Lastly B-Corp certifications, they are an evolution of the market-oriented certification logic. The focus shift from third-party verification of individual product to the assessment of the entire firm, expanding the scope from environmental to integrated ESG accountability.

Currently, numerous regional, national, and international sustainability awards and recognition exist; among them, the Michelin Guide is acknowledged as one of the most authoritative global indicators. Since the green Michelin star program launch in 2020, it has gained significant attention for its role in promoting sustainability and is now considered one of the most representative sustainability standards in the Horeca sector. While Michelin starred restaurants are considered the most influential high-level tastemakers (Lane, 2013), the green Michelin star is awarded to businesses considered ambassadors of sustainable dining, integrating one or more Sustainable Development Goals (SDGs) into their operations (Huang, Hall and Chen, 2023).

2.4 Theory on adoption and sustainable innovation

To fully represent the theoretical framework, it is as well fundamental to first understand the foundations behind managers' and owners' decisions to adopt sustainable practices and seek high-profile certifications like the Michelin Green Star.

As institutional theory explains, organizations might adopt sustainable practices to gain legitimacy within their socio-economic environment. Their adoption is mainly driven by three types of isomorphism (Raab, Baloglu and Chen, 2017): Coercive, Normative and Mimetic. Coercive isomorphism addresses pressures from laws, regulations, or even supply chain partners. Normative isomorphism addresses pressures from professional organizations or industry standards. Lastly, Mimetic isomorphism imitates successful industry competitors. In the Horeca sector, this last driver is the main one to push businesses towards the adoption of green certifications.

The theory of planned behaviour (TPB) is also relevant to consider, in fact the green Michelin star is assigned, in most of the cases, to SMEs. In these restaurants, company behaviour is often heavily influenced by owners and managers, operating with full autonomy, and their reliance on informal and relationship-based control mechanisms, rather than standardized bureaucratic structures (Spence, 1999).

TPB analyses the choice of adopting certification through the manager perspective, introducing the three main behaviour pillars: aptitude (evaluation of the benefits), subjective norms (perceived social pressure from customers, suppliers, and employees), and perceived behavioural control (the perception of having the necessary resources and skills). Managers are mainly influenced by subjective norms, closer to their daily life reality, and perceived behavioural control, as they are more likely to implement practices they consider financially and technically viable given their resource constraints (Raab, Baloglu and Chen, 2017).

Lastly Resource-Based View offers a perspective on Strategic and Reputational Positioning, considering sustainability as a rare resource that generates competitive advantage. Following this theory, the few Horeca businesses that achieve the green Michelin star could potentially use it to increase the reputational capital, enabling them to act as ambassadors and role models within the industry (Pascual and Donaire Benito, 2025).

2.5 Signal Effectiveness, Market Equilibria and Greenwashing Risk

When discussing sustainability certification, it is fundamental to understand which conditions are able to move market preferences away from low-quality, cheaper, alternatives. In literature, three main conditions are highlighted: first is Market Equilibria, meant as the duality of separating and pooling equilibrium. Separating equilibrium is defined as the moment in which signalling results profitable for high quality firms, with gains deriving from signalling higher than costs, but not for low quality firms. This equilibrium allows customers to identify and distinguish the two categories (Kirmani and Rao, 2000). The opposite effect is called Pooling equilibrium, defined as the situation in which customers cannot distinguish between the two groups anymore. It happens when firms send identical signals, with customers unable to recognize and spot the differences. In this equilibrium, low-quality competitors are allowed to free ride on the reputation of high-quality competitors, without adopting the same practices (Bergh et al., 2014). The pooling equilibrium is further enhanced by the average customer disinformation, often leading to misinterpretation between different categories of certifications, different type of labels and different type of stringencies, leading towards a pooling equilibrium of certifications rather than a Separating one (Kauppi, Hannibal and Bryde-Evens, 2025).

The second condition relies on the reliability of the messages. In sustainable signalling, companies might try to signal a sustainable effort that doesn't represent reality, this phenomenon generates greenwashing. Delmas and Burbano, 2011 define greenwashing as "the

intersection of two firm's behaviours: poor environmental performance and positive communication about environmental performance", which, for most, is a strategic choice to gain legitimacy without making substantive capital investments. Greenwashing can be divided in two main categories based on its execution. Claim greenwashing uses textual arguments that overstate, implicitly or explicitly, the actual sustainable efforts, while executional greenwashing uses nature-evoking elements (like colours, sounds and animal species) to induce a false green perception (de Freitas Netto et al., 2020).

The third condition is a consequence of the first two, and it's directly reflected on the customer, which needs to elaborate decisions in a framework influenced by switching market equilibria and the constant need to identify which signal is greenwashing and which one isn't. As greenwashing practices grow, consumer trust slowly erodes, creating scepticisms that acts as a barrier to legitimate sustainable signals (Riva et al., 2022), as customer struggle to identify on which equilibria the market is based. Also, because in the dining sector most sustainable practices and innovations occur "back of house" (Charlebois, Creedy and Massow, 2015), remaining invisible and intangible to customers, they risk, if not integrated in the dining narrative, to be ignored or recognized as potential greenwashing.

3 Literature Review

The purpose of this paragraph is to examine how current academic literature frames the core concepts of this research, formulating hypotheses to test with the collected empirical data.

Given the abstract nature of the subject and its cross-dimensional scope, the literature selected for this review follows specific criteria of alignment with one or both: Horeca sector and sustainability. This selection process resulted in the following sub-chapters:

3.1 Drivers and Barriers

As previously discussed, a company might be pushed to adopt sustainable certifications by a variety of drivers, while also facing numerous barriers during its transition to obtain them. This happens because Horeca is a critical sector to efficiently adopt sustainability, due to its heavy dependence on resources and energy, generating waste and greenhouse gas emissions.

“According to Pacific Gas & Electric's Food Service Technology Center (FSTC), restaurants are the leading energy consumers in the retail industry. Every restaurant generates 490 tons of carbon dioxide yearly, based on the most current EPA carbon equivalents, and they use roughly seven times more energy per square meter as any other type of commercial building.” (Md. Delwar Hossien, 2023: 8).

Many Horeca businesses are small companies with a strong managerial driver. In these contexts, deciding to transition to a more sustainable strategy mainly depends on a combination of internal drivers, such as ethics and vision, and the rising external pressures (Cantele and Cassia, 2020).

3.1.1 Internal Drivers

Internal drivers represent one of the critical factors influencing the adoption of sustainable practices and certification in the Horeca sector. Here chef, managers, and business owners, are the main decision makers. The transition to a more sustainable business model requires them to possess leadership and entrepreneurial mindset to overcome the main barriers to adoption. Managers are required to be capable of professionally conduct the business while also accounting for responsibility towards society and environment. In this new role, they need to

promote and trust sustainability as a core pillar of their strategy, relying on its financial long-term stability as business orientation (Llach et al., 2013). In this new framework, where managers and employees are seen as two key stakeholders, the upper echelons theory posits that firms reflect their top management will, moving as one with its decision (Hambrick and Mason, 1984). Entrepreneurs with environmental awareness are also more likely to possess leadership by considering the long-term environmental implications of every operational decision (Madanaguli et al., 2022).

Heritage has an influence over authenticity. Many of the businesses awarded with the green Michelin star are, in fact, family-run (MICHELIN Guide), with core businesses values developed and inherited through generations and traditions. Family identity is a marketing concept that customers tend to associate with sustainability-related values (like commitment to the territory and respect for the surrounding nature), allowing businesses effort to appear more genuine and authentic (Olivieri, Testa and Giraldi, 2025).

Leadership is not only important for outward signalling, but also plays a fundamental role in internal communication, for promoting a business culture where employees are motivated and taught to adopt sustainable practices, even without an economic purpose. On this regard, Jang, Zheng and Bosselman (2017) affirm that managerial values have an important role in influencing employees to engage actively in green practices, because a firm's formal policies are generally an expression of such values. This study shows the difference in the adoption of green practices based on restaurant types. Independent restaurants usually have none or little formal environmental policies, and so, less structure to engage formally in green practices. In these businesses, leadership is fundamental to compensate for the lack of formal protocols (Baloglu, Raab and Malek, 2020).

3.1.2 External drivers

The adoption of sustainable practices and certifications, like the green Michelin star, can be as well forced on businesses by factors external to the firm. It frequently happens that organizations engage in green activities to gain recognition and legitimacy from the surrounding socio-economic environment and to avoid reputational or compliance risks (Heras-Saizarbitoria, Molina-Azorín and Dick, 2011). This process is often driven by coercive isomorphism, with firms responding to pressures from law, regulations, or powerful supply chain partners to avoid sanctions (Grewal and Dharwadkar, 2002). This perspective, if applied to an entire industry, could see sustainability certification becoming a license to operate, considering it a basic market requirement and an industry expectation rather than an additional optional value (Kauppi, Hannibal and Bryde-Evens, 2025).

The most juridically relevant sustainability guidelines originate from the UN Agenda and its SDGs, which increased global awareness on the sustainable issues to be tackled in every sector (United Nations, 2025). Additionally, international agreements like the Paris accord and regulations like EU Green Deal and CSRD, add more layers of instruction, offering guidance and applying pressure on firms, while improving transparency.

Literature recognizes that nowadays buyers have become more ecologically conscious (Dewald, Bruin and Jang, 2013), this creates social pressure in the shape of “Subjective Norms”. According to theory of planned behaviour, subjective norms often act as the best customer behaviour predictor for managerial decisions when implementing green practices (Raab, Baloglu and Chen, 2017). Given the increase of social awareness and consciousness towards sustainability, tools like certifications become a source of competitive advantage, where first mover advantage can enhance brands’ image and justify a price premium (Chen, Lai and Wen, 2006). Green Michelin star certification is a high quality, globally recognized, certification. It

can assume the role of industry steward indicator for customers, reducing the effort required of them to identify authentic sustainable experiences, while also directing the market towards the same sustainable path that the awarded businesses are walking (Huang, Hall and Chen, 2023). Literature supports that the certification is beneficial to restaurant's Green Reputation, both in perceived quality and perceived sustainability, as awards like the green Michelin star strategically merge culinary excellence with environmental stewardship to build a restaurant's reputational capital (Pascual and Donaire Benito, 2025; Bonfanti, Bagnato and Vigolo, 2025).

H1a: Green Michelin star certification positively influences perceived quality.

H1b: Green Michelin star certification positively influences perceived sustainability.

3.1.3 Operational, Economic and Market barriers

The shift toward a more sustainable business model and formal certifications involves various economic and operational challenges. Literature highlights that SMEs are more vulnerable to these barriers due to their resource limitations, a relevant information to consider given that they represent the majority of the Horeca industry (Klewitz and Hansen, 2011).

“Restaurants use a large amount of energy and generate a great amount of waste. Utility costs are high in restaurants due to the excessive amounts of gas, power, and water needed to produce food and beverage items. Using environmentally friendly equipment and applying proper equipment maintenance procedures can result in a significant reduction in energy usage.” (Baloglu, Raab and Malek, 2020: 271).

Small activities also lack long-term planning and specialized staff to manage the complex sustainable transition. This knowledge deficit acts as a major deterrent adding up to the lack of

time to handle the bureaucracy associated with certification schemes, leading to a "wait and see" approach where they delay investment until a standard becomes a clear market necessity (Tan et al., 2018).

Another known barrier to adoption is the previously discussed "Back of House" phenomenon, demotivating managers from implementing sustainable strategies because they could potentially not be perceived by external stakeholders. Because these efforts are difficult for guests to perceive, managers remain often sceptical about whether those investments will be financially rewarded by the market (Jacobs, Singhal and Subramanian, 2010).

A last fundamental operational barrier is identified in the specifics of the sector itself. In the high-pressure environment of a commercial kitchen some operators recognize a conflict between environmental policies and strict sanitation standards. For instance, using green detergents or implementing water-saving procedures in the kitchen can be considered by owners as a potential threat to food safety (Wang et al., 2013). As a consequence, many managers opt for short-term financial survival and bottom-line concerns over long-term environmental stewardship (Berezan, 2010).

When considering market barriers, one of the most common issues across different geographical areas is the large variety of sustainability standards, making it hard for the customer to recognize them. To address this issue, literature identifies three distinct sources of uncertainties (Montiel, Christmann and Zink, 2019): first is the diversity of requirements, in fact the large amount and variety of certificates make it difficult for managers to identify which one to adopt. Dynamism is the second, as customer and market requirements change quickly, increasing the risk that an investment won't be returning a profit. The third is unpredictability, as businesses find it hard to identify which certification will produce positive effects in the long term.

3.2 Digital influence over Horeca Tourism

The Horeca sector has been undergoing a complex digital transformation process that reshaped tourism and hospitality dynamics. Business communication transitioned to social medias and online platforms as the primary channels through which sustainability is signalled, and consumer perception are shaped (Blanco-Moreno et al., 2025). In this framework, where search engines and social media are the first customers' touchpoint, one of the main abilities required for Horeca business to survive and prosper, is to be able to quickly adapt to the digital transition (Dinis et al., 2019).

3.2.1 Website Maturity and Online Visibility

DIPs (Digital Interactive Platforms) are one of the results of the digital transformation in the Horeca industry, acting as a communication ecosystem that significantly change customer's role. On those platforms customers are actively engaged, allowing them to evolve, from standard passive users to active co-creators, enabling them to satisfy their psychological needs for autonomy and competence, increasing subjective well-being (Roy et al., 2023). Quality and evolution of these platforms can be evaluated through eMICA framework, assessing their maturity through promotion of basic information, provision of interactive features, and processing of transactional features (es. Online booking).

For an efficient online marketing strategy, high quality websites and platforms are necessary to communicate signals like prestige, sustainability and unique values (Daries et al., 2018).

Xiang et al. (2008) argue that as much as a platform or website could be highly efficient, it is also to be considered that customers can only access a tiny fraction of the information, described as the thin interface effect. This same study introduces a significant visibility indicator, the

visibility ratio, calculated dividing the number of results actually presented to a user by the total number of pages indexed by a search engine. For tourism destination it resulted extremely low (0.032%), meaning that the design of search engine algorithms tends to filter a large volume of potentially useful information.

An increasing phenomenon, directly connected with the visibility ratio, is the popularity paradox: as a destination or brand becomes more popular, the number of indexed pages increases (which leads to a diminished visibility ratio). Earning visibility turned into a potentially time and cost consuming challenge for SMEs in the Horeca sector. Businesses who want to signal efficiently need to consider utilizing SEO technique to position themselves on the SERP, and to attract more consumer attention (Bakirtas and Gulpinar Demirci, 2022).

3.2.2 Big Data and Search Behaviour

Digital transition is generating an exponentially large amount of information (Big data). Search engine queries can be used as a useful indicator of real consumer interest and market demand, especially in tourism and hospitality. In this industry, search data are increasingly viewed as a tool able to capture people's intentions before they make any real-world decisions or purchase. Search engine traffic, monitored through tools like Google Trends, provide a general view of public interest by reporting word research volumes (Dinis et al., 2019). Most purchasing decisions nowadays start with web searches, the researched keywords result strongly associated with current and future consumer interests and purchase behaviour. This transform search data into a precious tool for predicting strategies and identifying customers trends and patterns, allowing firms to trace consumer preferences real-time (Bakirtas and Gulpinar Demirci, 2022).

All the available online data have the potential to become a powerful competitive advantage for those who learn how to use it, both in formulating long-term strategies and understanding

granular and microscopic predictions (Bakirtas and Gulpinar Demirci, 2022). With tools like Google Trends freely accessible to the public, researchers can easily compare various queries and validate findings through diverse methodologies. Social network analysis helps identifying the relationships within a network, with nodes and links representing brands and search frequencies. Centrality measures suggest the most influential brands in a network, indicating which node is closer to the consumer's decision-making centre (Ruhnau, 2000). Competitive intelligence allows to understand how the brand is perceived compared to its competitors.

3.3 Digital Popularity, Award Recognition, and Consumer Intent

Together with revenue, literature debate on the sustainable practices' influence on popularity. As previously mentioned, a certification has the potential to become a competitive advantage factor, capturing customers' attention and enabling them to identify themselves with the brand through positive green values.

3.3.1 Research trends

Literature supports that Horeca sector's digital transformation shapes the channels through which customers express their interests towards brands and products. For customers, digital platforms and websites now represent a tool actively affecting consumption decisions and experiences, shortening the customer journey while reducing the effort and the invisible barriers of on-site decision making (Koronaki, Vlachvei and Panopoulos, 2023). For companies, web searches work as indicators and forecast tool, allowing businesses to understand how their customer pool is evolving and how their interests are changing, controlling their behavioural patterns (Bakirtas and Gulpinar Demirci, 2022). As powerful as this type of tool may be, it requires careful use, as well as adequate background preparation to correctly interpret its results,

considering the fast-changing socio-economic environment of the last years (Arora, McKee and Stuckler, 2019). In fact, time-based tools collect results that are heavily affected by trends and public-relevant events like Covid-19. They also can be easily affected by language and performance biases, penalising the reliability of the information (Bakirtas and Gulpinar Demirci, 2022).

3.3.2 Michelin Reputation as Catalyst of fame

The Michelin guide is regarded by many articles, websites and sector experts, as one of the most reputable organizations certifying dining experiences, awarding the very best “tastemakers” of global gastronomy (Lane, 2013). Receiving a Michelin star provides Horeca businesses one of the strongest quality assurance certifications, offering an amazing marketing tool without having to face additional costs. This recognition functions as a high-visibility signal that attracts substantial attention from consumers, food critics, and the media, effectively orienting diners toward establishments with a proven commitment to sustainability (Kwok, Huang and Hu, 2016; Chiang and Guo, 2021; Olivieri, Testa and Giralaldi, 2025).

H2a: Green Michelin star certification positively influences customer attention.

The hidden mechanism of recognition reduces the perceived risk for clients, increasing WTP. With Popularity skyrocketing restaurants have high chances of being often fully booked (Chiang and Guo, 2021), resulting in increases of production and performance. The increase of fame, explained by the combination of immediate peak of popularity and increase in UGC content generated by the Michelin effect (Bang, Choi and Kim, 2022), also rises customer expectations, adding pressure on the business testing its solidity.

H3: Online content positively influences levels of Total Production.

While a Michelin star can bring diverse benefits to awarded restaurants, losing one can translate to negative impacts, in fact, while receiving a new star increases popularity and strengthen the WTP of customers, losing one, or more, sends the opposite signal, potentially scaring away customers and threatening future financial performance (Johnson et al., 2005).

3.3.3 Visibility and Target consumer

As previously mentioned, the “visibility ratio” can explain how an increase of popularity can lead to a loss of focus on the online contents, with browsers rendering only few of the potential accessible sources of information. This same research quantified further this phenomenon discussing the accessible results for each research. Through web mining, they proved that while search query presents a total number of results in the scale of hundreds of thousands, Google only showed the user less than one thousand search results accessible. It can be represented almost like an information oligopoly, with dominant players having priority over certain area topics with the information they provide, blocking potential competitor’s visibility. Those dominant players tend to be trusted more easily by consumers, which are more likely to already have consulted them in the past compared to their smaller competitors. This same research highlighted an additional penalizing factor, in fact not only it is hard for less dominant actors to access first results pages on browsers like Google and Yahoo, but it is also less likely that their result will be seen at all. The research shows that more than eighty-five percent of search engine users tend to never go past the third page of results, creating a run for companies to position themselves between the first thirty results through SEO strategies. (Xiang et al., 2008)

While businesses may have a specific target already identified, based on the proposed dining experience and marketing strategy, sustainability allows restaurants to enrich this existing client pool, reaching out to new categories of consumers who prove to be more responsive to

sustainability signals and recognize in sustainable dining an additional value. Millennials (Generation Y) is referred by literature as an ideal target for sustainable products and services, acting as a main driver and supporter of this trend, demanding markets to adapt (Juan Luis Nicolau et al., 2020).

H4a: Perceived quality positively influences level of Total Production.

H4b: Perceived sustainability positively influences level of Total Production.

3.3.4 UGC

When considering where to dine, most of the information the user goes through are usually UGC, spanning from reviews, to posts, to any shape of feedback consumers had on that specific dining experience. Mathayomchan and Taecharungroj (2020) explain in their article how significantly online reviews, and corresponding rating, affect businesses performance levels:

“Online reviews created by other users are often perceived by customers as being more credible and trustworthy than editor reviews and information provided by marketers (Zhang et al., 2010). This is since they are considered to be an authentic mixture of facts, opinions, impressions, and sentiments of real customers (Ye et al., 2014). Online reviews provide either a positive or negative signal of a restaurant to customers who, in turn, believe in and respond to such signals by behaving either positively or negatively towards the restaurant (e.g. in terms of approach or avoidance). The imperative for restaurants to examine customer experience and manage online perceptions in order to improve customer satisfaction, cultivate customer loyalty, and attract new customers to the restaurants becomes clear.” (p. 3).

This represents a new aspect to analyse when considering how to promote sustainable signals, as direct marketing might not be as effective and trusted as UGC, so businesses might need to consider new communication strategies to nudge customers in creating them.

Existing literature further discusses to which extent CSR and environment related words and mentions emerge in UGC. Juan Luis Nicolau et al. (2020) found out that only between 1.55% and 1.76% of online review content explicitly discusses CSR elements. This indicates that at the time the study was made, businesses still struggled to signal their efforts through an effective storytelling, and customers didn't value the CSR element important enough for them to be even mentioned in UGC.

Bang, Choi and Kim (2022) enhanced UGC value one step higher, utilizing variation in level of UGC content addressing the Michelin awarded restaurant to identify the "Michelin star effect". This effect, caused by the recognition of the award, generates a peak of reviews and digital activity, which manifests in the period of the award. The authors suggest that this variation in online popularity is driven by customer's desire to share the experience characterized by strong social and emotive value, incrementing word-of-mouth marketing.

H2b: Green Michelin star certification positively influences online content.

3.4 Profitability and organic growth

While adopting sustainability practices and obtaining certifications has been widely proved beneficial by literature, as also discussed in the previous sections, literature suggests a deeper analysis on the actual economic outcomes of its adoption (Citterio, 2025). In the Horeca industry, a large number of variables can influence financial performance, in fact, while the business case for greening has already been accepted by academic literature, the road towards stable profitability is often not linear and depends on operational factors.

3.4.1 Business performance

A first empirical study from Daries, Moreno-Gené and Cristobal-Fransi (2021) suggest that a Michelin star award, by increasing Popularity due to the Michelin guide fame, also increases profitability, with economic effects applying immediately on the award period. Given that popularity is closely tied to customer attention and online content (Bang, Choi, and Kim, 2022), it follows that a stronger online reputation directly translates into higher net revenue.

H5: Online content positively influences Net Revenue.

While it also requires higher maintenance costs to maintain the level of excellency, the study shows a positive ROA for each star on the analysed timespan, quantifying and proving through empirical data its impact on performance.

On the other side, Negruşa and Coroş (2026) discuss the Inverted U-Shaped Relationship, linking CSR to profitability through an inverse U-shaped relationship. The adoption of sustainability, which may initially penalize those who commit to it, is anyway considered a rational choice according to current literature. Research suggests that most sustainable strategies require a significant upfront investment, which is eventually offset only in the long-term through the competitive advantages it can generate (Citterio, 2025).

Also, in cases where companies heavily invest in CSR, the high maintenance costs required to sustain these standards over time may prevent business from reaching a break-even point. This reduces the chances of achieving a positive sustainable ROI, as the expenses may offset the strategic benefits (Negruşa and Coroş, 2026). It helps understanding how profitability depends not only on the sustainable nature of the investment, but also on the managerial ability to balance those efforts with market demand (Cantele and Cassia, 2020).

The way sustainability implementation affect business performance works similarly to a virtuous cycle, mediated by a plurality of factors which are necessary for achieving success. With the potential to enhance customer satisfaction and perceived quality, sustainability strengthens the brand reputation and allow the business to position itself on the market through a value differentiation strategy (Cantele and Cassia, 2020). Tighter standards lead to higher quality products and services, attracting a larger customer pool and creating pressure on competitors (Negruşa and Coroş, 2026).

A last contribution is added by Cantele and Cassia (2020), suggesting that the adoption of sustainable practices doesn't cause a direct, statistically significant, impact on Firm performance. Their study, based on survey data collected on 334 restaurants in North Italy, tests a new model of causal relationships, addressing sustainability in restaurants, utilising covariance-based models to prove that the positive effect of sustainable practices is entirely mediated by two intermediate measures of business success. The results of this research confirm the necessity of mediators, like customer satisfaction and firm competitiveness, to positively impact Firm performance in terms of profits and market share.

H6a: Green Michelin star certification is not significant in explaining changes in Net revenue.

H6b: Green Michelin star certification is not significant in explaining changes in Total Production.

H6c: Green Michelin star certification is not significant in explaining changes in Staff.

3.4.2 Firm size and turnover

The size of a company represents a critical factor when considering both scalability and ability to transform a competitive advantage, like sustainability, into financial profit. Horeca chains and more structured companies tend to have better chances to efficiently absorb higher initial costs when adopting sustainable standards (Testa et al., 2019). This leads to higher likelihood of bigger company to adopt sustainable certifications compared to SMEs. In the Horeca sector, where SMEs constitute 70% of the industry, resource deficit results to be a critical drawback from sustainable adoption, with lack of time, know-how and capital (Baloglu, Raab and Malek, 2020).

On this regard, literature highlights one reason why SMEs might still find it convenient to adopt potentially resource-consuming certifications, which is local differentiation. Most of the Horeca activities, in fact, operates on a local competition perspective, where a clear communication of authenticity and responsibility might bring local advantages that on a bigger market would lose value (Line, Hanks and Zhang, 2016).

3.4.3 Resilience and long-term value creation

Sustainability is a tool that can provide advantages if adopted with awareness of the required long-term objectives. Companies who manage to integrate this logic in their strategy tend to develop long-term resilience as well, learning how to preserve value (Corte et al., 2025).

An example in which resilience determinate survival of Horeca businesses is represented by Covid-19, and its complex consequences which tested the resilience of Horeca actors. The adoption of sustainable practices increased chances for most companies to survive the crisis by

improving resource efficiency and aligning with customer needs, while promoting and basing supply on a more local chain (García-Madurga, Esteban-Navarro and Morte-Nadal, 2021).

Analysing the Post Covid-19 period, Blanco-Moreno et al. (2025) discuss how sustainability emerged as a pillar of operational and strategic practices. Several themes highlighted how consumer and business priorities shifted towards sustainable practices, arguing:

“Studies explored how Gen Z’s perception of warmth and alignment with restaurants employing green practices influenced their willingness to pay, demonstrating a growing generational commitment to sustainability (Mahasuweerachai & Suttikun, 2022).

Sustainable tourism. The emphasis on eco-friendly hotel stays and environmentally conscious attitudes highlighted the growing importance of sustainability in shaping tourism choices (Sadiq et al., 2022).

Local food. Investigations into the local food distribution systems examined their feasibility and benefits, highlighting the role of localized supply chains in advancing sustainability (Paciarotti et al., 2022).” (Blanco-Moreno et al., 2025: 8).

Attempting to measure the financial performance of sustainable practices requires considering a variety of financial indicator and market metrics. Most existing literature opts for standard accounting KPIs, generic market indicators, and macroeconomic metrics. These, even if only partially relevant to sustainability, allow sustainability to be measured as an efficiency tool, analysing how profitability is affected by the adoption of a signalling tool like certifications.

Baldwin, Wilberforce and Kapur (2010) quantified the environmental footprint reduction caused by sustainable certifications adoption, raising up to 78% in some cases, without necessarily causing long term costs. In front of this positive number, literature reminds that the

financial performance depends on implementation and the local environment, so this same result might change if collected in a different context.

Literature identifies different types of sustainable investment based on ROI. High-impact technologies, like solar panels and AI waste monitoring. Because of the high initial investment required, businesses without concrete proof of high market demand for those technologies can result hesitant when considering their adoption, unless they possess abundant financial resources (Baloglu, Raab and Malek, 2020). Low investment solutions, like LED lighting and doggy bags, require low initial capital and represent quick wins for businesses, receiving immediate customer spillover (Cantele and Cassia, 2020). Lastly operational savings, as cost reduction is the main driver motivating customer to invest in energy efficient solutions and special machinery, attempting to reduce operational costs like energy and water consumption (Blanco et al., 2009; Hsieh, 2012).

3.4.4 Sustainability effect on Willingness To Pay

Literature confirmed a positive relation between sustainability and WTP, but it is still relatively little discussed how it quantifies in the Horeca sector. The Nielsen Media Research (2015) attempted quantifying it, finding out that 66% of global consumers express higher WTP for eco-friendly products, with younger consumers perceiving higher value in sustainable product than elder ones. New generations are also more likely to base their purchase behaviour on brands' or products' perceived sustainability.

H7a: Perceived quality positively influences Net Revenue.

H7b: Perceived sustainability positively influences Net Revenue.

This same report identifies the differences between product categories, analysing how in food & beverage products sustainability has higher priority compared to other categories, like, for example, generic house product. This can be partially explained by the fact that 57% of consumers believe that sustainable food is made with overall healthier and fresher ingredients, improving its quality.

Another empirical study attempted quantifying the actual value difference in WTP between standard dining experiences and sustainable ones. The results show that most consumers are willing to make marginal financial sacrifices, typically up to a 10% bill increase, with a smaller number of customers considering premiums of roughly 20% when sustainability is framed through authenticity and personal health. This same article discusses the sacrifice level that clients are willing to make in order to dine at a green restaurant. It is measured that diners who opt for virtuous establishments are willing to wait 1 to 20 minutes longer or travel up to 10 additional miles to support a green restaurant. (Kwok, Huang and Hu, 2016).

3.4.5 The organic cost of sustainability complexity

As literature underlines, the adoption of sustainable practices add new layers of complexity, requiring the business to align with new standards (Baloglu, Raab and Malek, 2020). Biloslavo and Janković (2025) proposed a case study on green Michelin star awardee, the results suggest that sustainable work practices and standards might push restaurants in hiring full-time employees to maintain consistency. This approach also provides workforce stability in all seasons, developing reliance to fluctuations in customer demand. This same study also discusses that the adoption of sustainable practices requires to account for the new labour-intensive processes such as on-site farming, closed-loop waste management, and complex food

preservation techniques like fermentation, increasing the workload up to double the standard effort.

Literature addresses the additional organic effort required to support the new processes, arguing that sustainable management models are strongly linked to revenue growth and subsequent manpower improvement, which represents a fundamental consequence of the operations expansions (Cantele and Cassia, 2020). Another factor to consider when analysing this logic is represented by the strong reputation of the Michelin Guide, which has a strong impact on booking rate, substantially increasing the average count of dining customers (Chiang and Guo, 2021). The combination of boost of reputation and increased amount of UGC due to the Michelin effect, positively influencing overall popularity and level of activity (Bang, Choi and Kim, 2022), inevitably requires restaurants an additional organic effort to manage the increased guest volume while maintaining the new service standards (Biloslavo and Janković, 2025).

H8a: Perceived quality positively influences amount of Staff.

H8b: Perceived sustainability positively influences amount of Staff.

H9: Online content positively influences amount of Staff.

3.5 Brand Reputation

Literature agrees on how sustainability is not just one possible characteristic that a brand can decide to have or not, but rather an increasingly fundamental “license to operate” (Kauppi, Hannibal and Bryde-Evens, 2025). It is also highlighted that, compared to other brand values that can be proved to customer through simple actions, sustainability requires slightly more complex signalling strategies to effectively pass to customers, like previously argued when discussing the “back of the house” phenomenon. In this complex framework that require

businesses to reduce information asymmetry, sustainable certification work to enhance the credence characteristic of sustainability itself, signalling a socio-ecological quality that cannot be confirmed through the product or service use (Hannibal and Kauppi, 2019).

Green Michelin star, since its first launch in 2020, represents one of the most reliable, globally recognized, sustainable certification in the Horeca sector. The reliability of this sustainability standard is backed by the existing reputation of the Michelin guide that has been operating for more than one hundred years, creating a new scale of sustainability evaluation that awards an elite group of selected businesses (Huang, Hall and Chen, 2023), enhancing this signal with scarcity bias.

The pursuit of a sustainability certification, which requires a long-term commitment, cannot be dismissed after the award, considering that it is also possible to lose a certification if those standards required for its recognition aren't met anymore. Restaurants losing the green star do not simply go back to the reputation possessed before achieving the green Michelin star. The sudden interruption of this positive sustainable signal can represent for customer a negative signal instead, leading up to a 50% drop in sales just due to reputational damage (Johnson et al., 2005).

3.5.1 Sustainability perception and Greenwashing Risk

Literature finds that many Horeca businesses “suffer” from sustainability marketing myopia, lacking sustainability signalling persuasiveness. A study from Villarino and Font (2015) emphasizes critical weaknesses of green signalling that could affect Horeca sector businesses. It includes lack of consumer-oriented communication, as businesses tend to focus on their product and services rather than the consumer needs, with sustainability being one of those. Emotionless benefits are offered, concerning health and relax but failing to appeal on personal

level to more abstract values. The majority of businesses that include socio-sustainable signals in their communication strategies often focus only on a societal impact rather than breaking it down all the way to the personal advantages. Customers can also suffer from passiveness and the lack of direct interaction, with around 90% of sustainable signals stating information without allowing the customer to experience it first-hand. Lastly, technical language can help reducing the risk of customers perceiving a signal as greenwashing.

Literature also introduces the psychological distance factor between abstract sustainable messages, long-term benefits, and potential negative outcomes. Abstract messages bear part of the true nature of sustainability, which is a time requiring discipline, but lacks effectiveness compared to more local and immediate impacts, which stimulates deeper information processing and positive responses from customers (Line, Hanks and Zhang, 2016).

Literature debates that an extremely efficient and sincere signal could still be misled as greenwashing. The culprit for this lack of trust is identified in negative events caused by competitors, lowering benchmark expectations for customers. After this type of event, customers are more likely to expect behaviours like selective disclosures, with businesses disclosing only minor positive indicators while hiding major negative ones, and decoupling, with companies practicing symbolic green talk without taking substantive actions (de Freitas Netto et al., 2020).

3.5.2 Consumer Sentiment analysis and Digital Feedback

As previously mentioned, brand reputation in the Horeca sector is not only shaped by signals from the businesses, but rather a mixture between those and the online response of customers, originating a continuous flow of feedback. Digital platforms like Google Maps and Tripadvisor have become a primary source of information, often more important than the information

sources directly controlled by the businesses itself, critically affecting brand online reputation (Mathayomchan and Taecharungroj, 2020).

Literature identifies few computational tools to analyse this type of heterogeneous data, attempting to identify the hidden drivers of online reputation. A study by Ramón Barrera-Barrera (2023) proposes the use of LDA to identify the attributes of a dining experience through a posteriori identification. This same study found out that for a Michelin star level dining experience the relevant factors be considered when evaluating customer satisfaction increase in number and complexity compared to a standard dining experience. The article also mentions VADER algorithm as an effective sentiment analysis tool, with the objective of understanding which product or service in a complex experience contributes the most in achieving the highest possible score.

Through text mining techniques like those just mentioned above, this same article identified four main topics customer refer to when describing standard dining experiences: Food quality, Customer service, Décor and ambience and Value for money. Ramón Barrera-Barrera (2023), after the initial findings, deepened the analysis investigating whether Michelin starred experiences were mainly affected by the same four attributes or not, identifying four additional attributes to be considered additionally to the standard ones: Tasting menu, as description and presentation of individual dishes (storytelling). Service failure, caused by higher sensitiveness to experience issues like waiting time and booking procedures. Context, linked to atmosphere expectations, and lastly Wine Pairing.

These additional factors are also relevant in contributing to the customer's perceived sustainability, which shapes the judgement of a restaurant's environmental superiority. When customers perceive environmental quality of food and services superior compared to the benchmark, they are more likely to revisit the restaurant (Riva et al., 2022).

4 Research framework development

4.1 Hypothesis summary

The 16 hypotheses formulated based on the literature review are divided into two categories, based on the research questions:

- Research question 1 (Q1): What are the Impacts and influences of the green Michelin star certification on Popularity, Green Reputation, and Economic Performance? (Hypothesis 1,2,6).
- Research question 2 (Q2): Are Popularity and Green reputation capable of significantly explaining changes in Economic performance? (Hypothesis 3,4,5,7,8,9).

Table 1. Summary of the Hypotheses

NO.	Hypothesis
H1a	Green Michelin star certification positively influences perceived quality.
H1b	Green Michelin star certification positively influences perceived sustainability.
H2a	Green Michelin star certification positively influences customer attention.
H2b	Green Michelin star certification positively influences online content.
H3	Online content positively influences levels of Total Production.
H4a	Perceived quality positively influences level of Total Production.
H4b	Perceived sustainability positively influences level of Total Production.
H5	Online content positively influences Net Revenue.
H6a	Green Michelin star certification is not significant in explaining changes in Net revenue.
H6b	Green Michelin star certification is not significant in explaining changes in Total Production.
H6c	Green Michelin star certification is not significant in explaining changes in Staff.
H7a	Perceived quality positively influences Net Revenue.
H7b	Perceived sustainability positively influences Net Revenue.
H8a	Perceived quality positively influences amount of Staff.

H8b Perceived sustainability positively influences amount of Staff.

H9 Online content positively influences amount of Staff.

Source: Author

4.2 Conceptual framework

In Figure 2 is represented the conceptual framework of the research, representing the connections between key theoretical frameworks, literature concepts, and hypotheses.

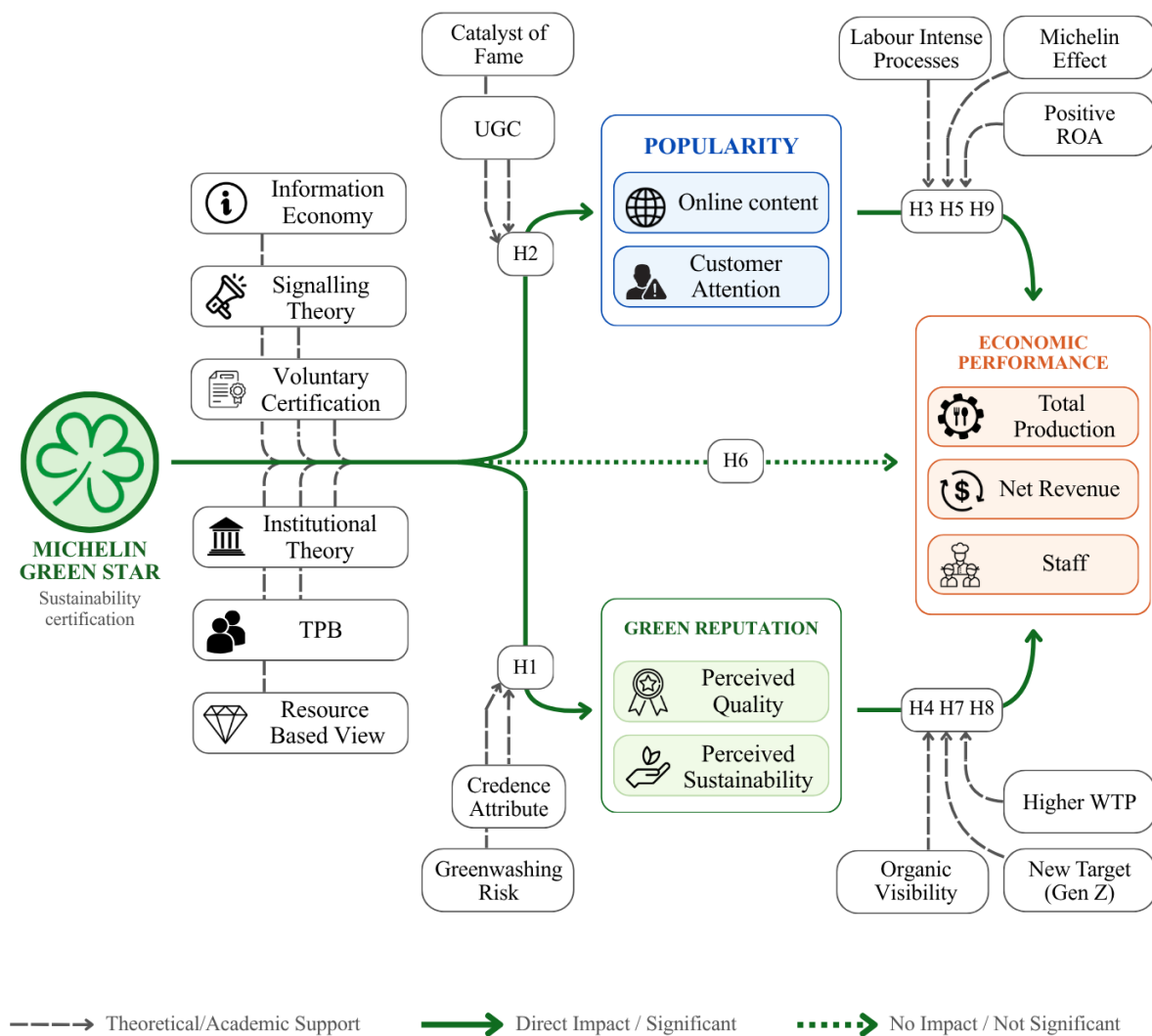


Figure 2. Conceptual Framework

5 Methodology

Sustainability represents a complex metric, difficult to measure when its effects are integrated in phenomenon not explicitly linked to social and environmental criteria. While its influence is observable in shifting consumer trends, isolating the net contribution of sustainability within these broader market changes remains a significant challenge (Bigerna, Micheli and Polinori, 2025). This chapter discusses the tools and processes involved in the quantification of sustainability impacts and in the investigation of potential relationship across factors, unveiling the degree to which theoretical framework is reflected by real data. This chapter will be composed of research design, data collection and analysis methods and finally a summary of the reliability and validity measures employed in the study.

5.1 Research context / case description

The first objective of this study is to quantify the impact of sustainable certifications on three main thematic pillars, identified through academic literature as core drivers of the Horeca Sector: Economics, Popularity and Reputation. Specifically, for this research I selected the green Michelin star as focal certification because it serves as a global benchmark, being recognized by most countries as a highly reliable and qualitative source of information (Chiang and Guo, 2021).

I decided to limit the geographical scope to Europe, which more than any other geopolitical area imposes rigorous sustainability targets on its member states through stringent legislation and deadlines. This focus also smooths down the cultural differences that could potentially influence data when considering different continents, permitting to significantly reduce external influence. Lastly, Europe's transparent disclosure policies allowed me to access more easily the

data I needed for my financial analysis. This last one represented an additional enabler to one of my main initial concerns about low availability of data regarding small sized companies, due to the limited obligations for them to disclose financial related reports. This is particularly critical given that the Horeca sector is mainly composed of SMEs (Baloglu, Raab and Malek, 2020).

The timeframe I selected for the analysis covers the last six years, from the introduction of the certification in 2020 to the last full year of data available in 2025. Even if relatively recent, I concluded this period to be sufficient to observe the short-term certification's effects, particularly because the recent increase in regulatory pressure has reduced greenwashing and boosted consumer trust in certified businesses. The timeframe also takes into consideration Covid-19, whose influence created a drastic change in the market, critical enough to potentially compromise any trend analysis directly involving these years. In fact, during the regression analysis I created dummy variables to potentially detect influences from timely factors such as Covid-19 (Bakirtas and Gulpinar Demirci, 2022).

An additional important “disturbance factor” might be represented by the internal mechanisms of the Michelin Guide. Every year a new ceremony awards restaurants with a new number of stars which might generate waves of popularity that do not align with the restaurant's ongoing operational reality. This creates risks when interpreting annual variations with only reference to the initial award year. To minimize long-term disturbances like changes in award status, this study will adopt a standard two-year observation window when addressing data variation, reducing significantly distortions in its interpretation.

5.2 Data collection methods

Considering the multidimensionality of this study, data collection required a heterogeneous approach, with the objective of efficiently capturing significant variations, while maintaining balance between methodical simplicity and statistical significance. Additionally, after examining each macro area in isolation, the analysis will focus on capturing the reciprocal influences between variables, through relationship between the different domains (Sebnem Kalemli-Ozcan et al., 2015).

Due to the scarcity of Economic data, which represented the most significant constraint in gathering data, I utilized financial data availability on Orbis as the primary selection criteria when identifying the restaurants to include in the analysis. The final sample is composed of all European restaurants awarded with the green Michelin star with accessible economic data, all other variables were then collected for this same group of businesses only, ensuring a consistent and integrated analysis.

5.2.1 Economic data

Economic data was extracted through Orbis (Moody's), the most comprehensive global resource database for firm level data (Sebnem Kalemli-Ozcan et al., 2015), also considered the standard for representative firm level research in Europe, particularly for private companies and SMEs. Here I investigated all available countries with green Michelin star awardee, collecting data on total production, net revenue and employees count for each year. I excluded from the analysis all data that couldn't provide significant and comprehensive information for at least one of the three variables.

5.2.2 Popularity data

To measure popularity I followed literature's suggestions, addressing web as the primary communication platform where modern consumers research information and where C2C and B2C interactions happen. In a framework which places the businesses as the centre of the "attention", my objective is to identify and capture both online and offline flows converging toward it, from customers and from other digital entities.

To analyse customer attention, as information flow consumer-to-business, I decided to utilise Google Trends, measuring the volume of online queries generated by online users and, therefore, allowing me to monitor the monthly interest. I decided to opt for monthly measurements rather than yearly to capture the immediate reaction of customers to the award, generating a relevant and insightful output that, combined with yearly online content, could provide a wider framework of analysis. Google Trends is a tool widely validated by literature for tourism research, forecasting and analysing consumer behaviour (Bakirtas and Gulpinar Demirci, 2022). It provides a normalized search interest index (0-100), reflecting user intentions and interest across the researched geographical region (Dinis et al., 2019). For this metric, after an initial attempt with a larger timeframe which resulted in highly fluctuating data, I decided to limit the total analysis timeframe to two years, ranging from the Michelin ceremony of the year before the award of the green Michelin star, to the month preceding the next ceremony after the award. The Michelin Guide award ceremony schedule, used as reference to extract the time intervals to analyse for each country, is available at Appendix 1.

This restriction is meant to isolate the impact of the Green Star by mitigating the effect of traditional Michelin Star assignments. Changes in the award of classic stars through the year could otherwise fluctuate online search volumes and significantly distort popularity metrics. I also filtered the Google Trend results collecting indexed searches only from the country where

the restaurant is located to reduce the risk of lexical ambiguity, avoiding 'false positives' in cases where a restaurant's name overlaps with common vocabulary or generic terms in other languages.

I conducted a short-term analysis to understand if the sustainable award caused a sudden peak of interest for customers, increasing the immediate online popularity of the brand on the month of the award, and the following one, compared to the one preceding the award. I decided to adopt two months instead of one to register the variation in immediate interest because some of the award ceremonies happened halfway or at the very end of the month, so their immediate influence might be reflected better on the following month rather than the one when the award was achieved.

I excluded from Google Trends analysis all the results without any data for most months of the timeframe, representing customers research of that restaurant. I also excluded all those businesses for which Google Trends couldn't specifically identify the Restaurant by the exact name, potentially mistaking it with another product, word or location.

To measure the online content (like news&media websites, review platforms, blogs, guides etc.), as an information flow web-to-business, I used a Python-managed API, more specifically SERPAPI (SerpApi). As previous studies already did before me, I used API to collect "hit counts", as the total number of indexed web contents associated with each business, followed by location and year (Xiang et al., 2008). The format: <BusinessName>_<City>_<Year>, was then processed three times, followed by each one of the words: Restaurant, Reviews and guide, with 1 query per each key word. The full python script is consultable at Appendix 2. While these counts are valuable for evaluating an entity's online "visibility", they are to be considered as estimates due to the dynamic, and sometimes inconsistent, nature of search engine algorithms (Uyar, 2009).

5.2.3 Green reputation data

To identify green reputation data, I first considered utilizing digital tools or services to measure social media interaction and direct brand references or mentions. This first approach resulted complicated to execute, due to the large effort requirement and the lack of resources and time to properly conduct it. These initial barriers, which would allow me to only extract a limited portion of the total necessary data, risked compromising information quality. On a second analysis, collecting social media mentions and interactions also resulted non optimal in capturing the reputational change. While it is true that social media UGC can effectively enhance the willingness of potential customers to engage in a dining experience, singular and disconnected UGC originating from personal accounts of customers typically triggers a limited network interaction, influencing only a marginal number of clients due to the restricted reach. For this reason, measuring the plurality of UGC might risk to not include certain age categories, less likely to be influenced by social medias, or socio-geographical groups, which might use different social medias compared to the ones analysed, or exclude customers that are not active on social media. The high variability of this initial method brought me to consider alternative options, ultimately following a methodology similar to the one adopted by Bang, Choi and Kim (2022), adopting Google Maps as data source.

Being Google maps a globally utilised tool, it bypasses the potential geographical limitations that social medias might face, providing a platform that directly link the online page of any business with a review system able to quickly and simply influence customers' decisions. Being able to provide a grade, a written review and pictures of the experience, Google maps represented the perfect data pool on which to base my perceived quality analysis. Also, by conducting text analysis on each comment, I was able to measure the number of sustainability-related mentions, quantifying perceived sustainability. The text analysis was conducted

identifying number of sustainability-related words, utilising the English version of each word, and the local translation, for each country. The full list sustainability-related words is available at Appendix 8.

The extraction selected the 500 most relevant reviews for each restaurant through an online Web Scraping API (Apify), a methodology I learned from other existing studies of this kind, like the one made by Mathayomchan and Taecharungroj (2020). I then categorized them by year of publication, average yearly grade and sustainability-related mentions. This analysis allowed me to extract important information regarding the variation in average grade through years, sustainability-related word count, and the overall most frequently mentioned words. I excluded from the research all that restaurant which didn't have at least 50 reviews comprehensive of text content.

5.3 Data analysis method

Out of all available data, I created different data groups, sorting the sample by year of award and geographical location, creating three main geographical clusters: North-Central Europe, South-East Europe and South-West Europe. My objective is to use these sub-categories to compare variables, identifying potential geo-cultural discrepancies in data variation and its consistency throughout different groups. All data was collected on Excel and processed through Stata to generate regression models, indicators, tables and graphs.

Two main analytical logics were adopted in analysing the variables:

- Time variation analysis: a descriptive contextual analysis of the data variation in relation to the period (month or year) of the award, with the objective to illustrate the evolution of variables around certification. While this analysis does not show causality with the award, it provides preliminary evidence of temporal patterns

and allows the identification of changes occurring in the measurements before and after the certification event.

- Panel Fixed Effects (FE) and Random Effects (RE) regression models: an empirical analysis aimed at identifying the factors significantly associated changes of the variables. The regression will investigate the certification's significance, and the significance of Reputation and Popularity as predictors of Economic performance. All regression models were initiated conducting FE analysis, however, because the FE estimator automatically omits time-invariant control variables, a substantial portion of the contextual data was dropped. In those cases where the certification didn't prove to be significant, I conducted Random Effects (RE) regression to investigate the significance of the variables omitted by the FE regression, subsequently conducting a Hausman specification test to verify the consistency and appropriateness of the RE model.

In the variable's variation analysis, all raw data was converted to calculate one or more the following type of variation: Total Variation, calculated as the relative performance variation between the average value of the two periods preceding the sustainable award, and the two years after (including year of award). Variation Before/After, calculated as the relative performance variation between the two-period preceding or following the year of award, and the year of the award. Shortvar/Longvar, calculated as the relative performance variation on short and long timeframes, with short timeframe including the period just before the award, and the two after (including award period), and long timeframe including all period available before award and those after (including award period).

The variation analysis investigated each variable's variation independently, calculating absolute and relative values such as observation count, mean, SD, min value, max value and

percentage of positive elements for each variable. It was also possible to investigate data consistency for each variable by utilising the geographical area year of achievement groups comparison.

In the regression analysis, the dataset was structured as a panel, based on calendar years and individual restaurants, including control variables for years, company size, sector, and geographical location to check influences of external factors and determine which elements significantly explain performance variations over time. For each singular variable, a regression model was estimated to verify if the Certification resulted to be statistically significant in explaining the variable's changes, using the investigated variable as Dependent, the certification as independent variable, and the previously mentioned categories as control variables.

Additionally, to investigate if Popularity and Green reputation could explain changes in economic performance with statistical significance, I estimated three regression models using as Dependent variable each Economic performance variable (Total Production, Net Revenue and Staff), as independent variables API, COMMENTS and STARS, and as control variables the previously mentioned categories.

Google Trends was excluded from the cross-variable analysis due to the data frequency mismatch, as its measurements are recorded on a monthly basis, whereas all other variables in the panel model are structured on a yearly timeframe.

5.4 Reliability and validity

To ensure robustness and to mitigate the impact of extreme values before conducting the variation analysis, the outliers were handled. Based on the already small size of the sample, it resulted wiser to avoid removing outliers which would have further reduced the sample, they

were instead winsorized. All data collected has been undergoing a first outlier management process, limiting their impact on the dataset by replacing outliers with a percentile threshold. Winsorization was applied at 5th and 95th percentiles (or at ± 2 standard deviations).

Before estimating the regression models, all continuous variables were mean-centered by subtracting their sample mean from each observation. Whenever I adopted random effect model, to test consistency I run the Hausman test, and only considered the result valid when the test failed to reject the null hypothesis, indicating that the random-effects estimates were consistent and appropriate. To account for additional external factors, I added dummies variables to the regression model, analysing as well potential significance of time over the analysed impact, accounting for the potential post-Covid rebound effect over data.

6 Findings

6.1 Descriptive statistics

The research initiated by selecting available data to create the total sample for the research. Out of the total universe of 382 restaurants awarded with the green Michelin star between 2020 and 2024 in Europe, the final sample involved 128 (33.51%), including 11 out of the 19 countries hosting green Michelin star restaurants. In Table 2 are reported the number of restaurants for each country. Also, the category 'Nordic countries' refers to the group comprising Denmark, Finland, Iceland, Norway, and Sweden. These nations are categorized together as they are unified under the same Michelin Guide and annual award ceremony.

Table 2. Sample data

Countries	Total Count	Analysed	Orbis Data
Italy	58	52	Data partially available
Spain	49	27	Data partially available
Nordic Countries	35	26	Data partially available
Belgium	11	6	Data partially available
Portugal	5	3	Data partially available
Slovenia	8	6	Data partially available
Hungary	5	1	Data partially available
Estonia	3	3	Data partially available
Croatia	3	2	Data partially available
Lithuania	1	1	Data available
Latvia	1	1	Data available
France	94	0	No data available
Germany	77	0	No data available
Netherlands	23	0	No data available
Greece	3	0	No data available
Austria	3	0	No data available
Luxembourg	1	0	No data available
Republic of Ireland	1	0	No data available
Poland	1	0	No data available
Europe	382	128	33.51%
Valid countries	179	128	71.51%
Countries	19	11	57.89%

I then created three geographical clusters to compare restaurants operating in different socio-cultural environments and to test whether the impact of certification differed across these groups. In Table 3 are reported the clusters.

Table 3. Sample clusters

CLUSTER	Country	Number of Restaurants	Total
SOUTH-EAST EUROPE	Italy	52	60
	Slovenia	6	
	Croatia	2	
CENTRE & NORTH EUROPE	Nordic Countries	26	38
	Belgium	6	
	Estonia	3	
	Hungary	1	
	Latvia	1	
	Lithuania	1	
SOUTH-WEST EUROPE	Spain	27	30
	Portugal	3	

In Table 4 are listed activity sector of each business to provide a quantification of the sample heterogeneity in business type.

Table 4. Industry Code

Industry Code	Count	Description
56100	40	Restaurants and mobile food service activities
561011	29	Food service activities with full service (restaurants)
561010	11	Restaurants
56101	6	Operation of restaurants and cafes
563000	2	Bars and similar activities
7225	1	Restaurants and Other Eating Places
551000	14	Hotels and similar accommodation
55200	3	Holiday and other short-stay accommodation
551010	2	Hotels
12100	8	Growing of grapes
15000	3	Mixed farming (crop and animal production)
14100	3	Dairy cattle and buffalo farming; raw milk production
14500	1	Sheep and goat farming
11310	1	Growing of vegetables
12600	1	Growing of oleaginous fruits
91020	1	Museums activities
8299	1	Other business support service activities
32100	1	Marine and brackish water aquaculture

By summarizing the data in five main activity categories I distinguished between businesses that focus exclusively on the culinary experience, belonging to the category Restaurants and Bars, from those where food service functions as secondary service to the core business activity. Figure 3 represents the resulting classification.

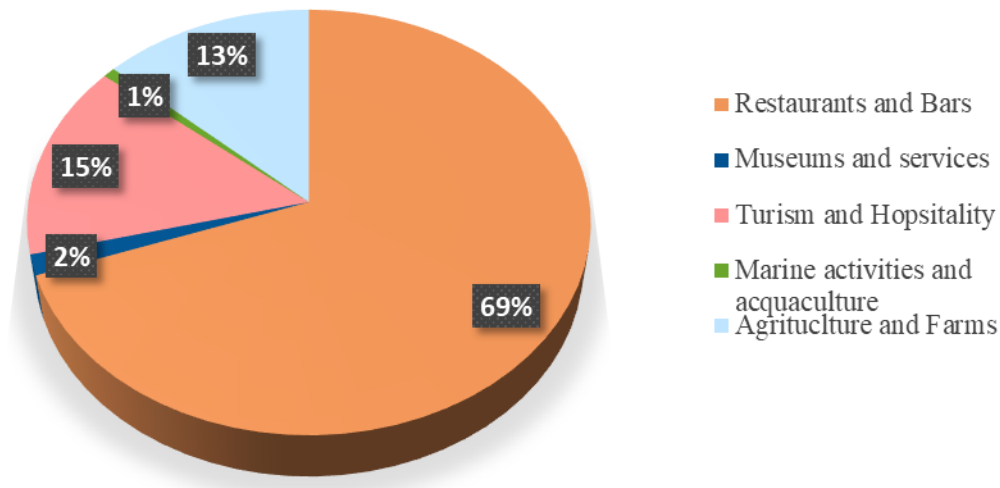


Figure 3. Industry distribution

Out of these, the staff data collected allowed me to quantify the size of the company, the result are represented in Figure 4.

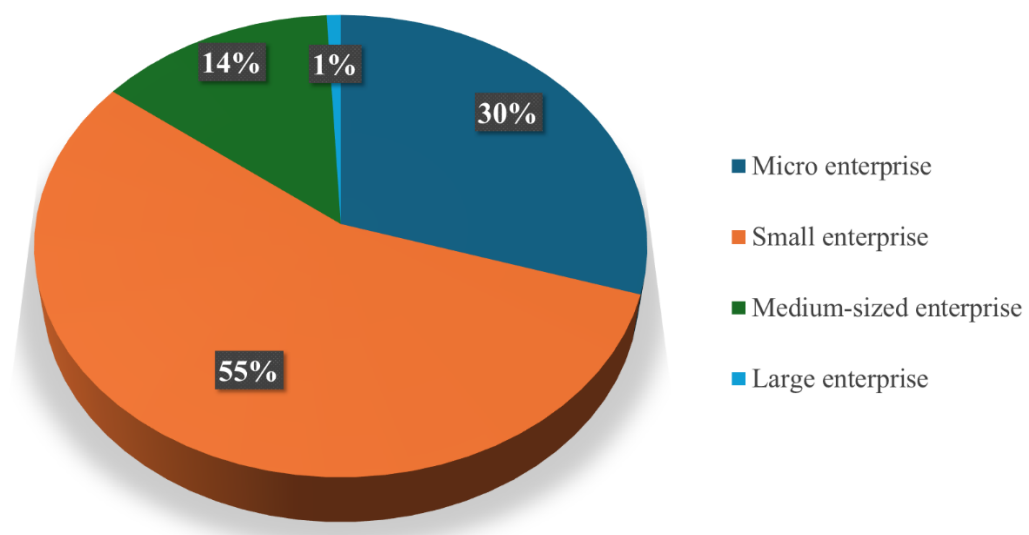


Figure 4. Company Size Distribution

While this representation displays four sizes category, respectively Micro (<10), Small ($10 < x < 50$), Medium ($50 < x < 250$), Large (>250), Literature often discusses Micro and Small

sizes together. This difference will be taken into account when comparing the results with the existing literature.

6.2 Popularity data results

6.2.1 Google Trends Data Variation

Out of the initial 128 businesses, 99 (77%) were clearly identifiable on the google trend search system and had enough data available to conduct a precise quantitative analysis. The complete data is available at Appendix 3.

Measuring the immediate online popularity boost, following the green Michelin star award ceremony, I obtained the following results: For 25% of the businesses analysed, Google Trends showed an absolute peak in research traffic directed towards the restaurant. At least one of the two months resulted as the best-performing month, over the entire two-year period; For 32% of the businesses analysed, Google Trend showed a relative peak in research traffic directed towards the restaurant. At least one of the two months resulted within the top 10% highest-performing months, over the entire two-year period; For the remaining 43% of the sample, the green Michelin award didn't noticeably impact immediate online popularity.

After the immediate popularity analysis, to measure overall popularity variation i calculated the monthly searches variation for each business, generating short-term and long-term analysis based on the timeframe considered. While monthly variations are represented at Appendix 4, the summary of results is reported in Table 5.

Table 5. Google Trend – Short & Long term variations

Country	Metric	Mean	SD	Min	Max	N	Positive
North Central Europe	TR Shortvar	0.1710	0.4874	−0.8270	1.0000	32	0.6563
North Central Europe	TR Longvar	0.5517	0.9675	−0.5116	3.6259	31	0.7742
South-East Europe	TR Shortvar	0.0921	0.4184	−0.8270	1.0000	48	0.6250
South-East Europe	TR Longvar	0.6486	1.1426	−0.3634	3.6259	48	0.7083
South-West Europe	TR Shortvar	0.3697	0.3835	−0.3333	1.0000	20	0.8500
South-West Europe	TR Longvar	0.1842	0.2453	−0.1300	0.7829	20	0.8000
Total	TR Shortvar	0.1729	0.4435	−0.8270	1.0000	100	0.6800
Total	TR Longvar	0.5244	0.9776	−0.5116	3.6259	99	0.7475

Total sample and two out of the three geographical cluster present strong similarities in amount positives variations, mean values and Shortvar to Longvar ratios through most variables, with the only exception of South-West Europe, which seems moving independently.

After comparing the three geographical clusters, I proceeded dividing restaurants by year of award, investigating how the same variables measured in restaurants awarded in different years.

The results are reported in Table 6.

Table 6. Google Trends – Yearly Short & Long term variations

Award Year	Metric	Mean	SD	Min	Max	N	Positive
2021	TR Shortvar	0.2129	0.4708	−0.8270	1.0000	50	0.7400
2022	TR Shortvar	0.0754	0.3931	−0.7500	1.0000	24	0.5000
2023	TR Shortvar	0.1613	0.4021	−0.7692	1.0000	15	0.6667
2024	TR Shortvar	0.2192	0.4963	−0.8270	1.0000	11	0.8182
Total	TR Shortvar	0.1728	0.4435	−0.8269	1.0000	100	0.6800

2021	TR Longvar	0.5444	0.8091	−0.5116	3.6259	49	0.8571
2022	TR Longvar	0.4223	1.0516	−0.3102	3.6259	25	0.6000
2023	TR Longvar	1.1315	1.4781	0.0196	3.6259	13	1.0000
2024	TR Longvar	−0.0020	0.3146	−0.3938	0.5033	12	0.3333
Total	TR Longvar	0.5244	0.9776	−0.5116	3.6259	99	0.7470

In Figure 5 are represented the distributions of Trends Shortvar and Longvar variation.

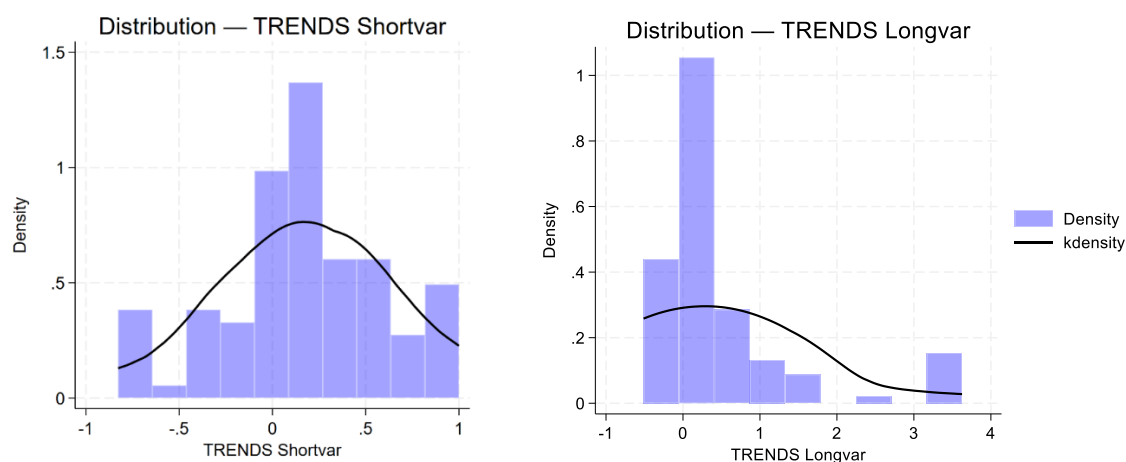


Figure 5. Google Trends – Shortvar & Longvar variation distribution

The histograms show a very different type of distribution between the two variables, both including a moderate amount of extreme values (Min/Max) due to the winsorization.

6.2.2 API Python Data Variation

The Python extraction produced 125 valid datasets, with only 3 extractions failing to reach a minimum amount of useful data to be considered significant, the data extracted is represented in Appendix 5.

In Table 7 is reported the summary of the variation analysis for the three API variables:

Table 7. Python - Extraction results

Country	Metric	Mean	SD	Min	Max	N	Positive
North-Central Europe	API Before	0.2170	0.7420	-0.8530	2.1550	37	0.5140
North-Central Europe	API After	0.3570	0.5460	-1.1290	1.6160	37	0.8650
North-Central Europe	API Var	0.8757	1.6205	-0.6618	5.9316	37	0.6486
South-East Europe	API Before	0.3380	0.6030	-0.8620	2.155	59	0.7120
South-East Europe	API After	0.2940	0.2900	-0.5310	0.8650	59	0.8810
South-East Europe	API Var	0.6229	0.8041	-0.8161	3.6810	59	0.8136
South-West Europe	API Before	0.3630	0.6750	-1.0000	2.1550	29	0.7240
South-West Europe	API After	0.1480	0.3450	-0.5530	1.0000	29	0.6550
South-West Europe	API Var	0.5772	0.9597	-0.1941	4.1837	29	0.8276

Total	API Before	0.3080	0.6610	-1.0000	2.1550	125	0.6560
Total	API After	0.2790	0.3990	-1.1290	1.6160	125	0.8240
Total	API Var	0.6871	1.1350	-0.8161	5.9316	125	0.7680

Like for Google Trends data, the results are similar across geographical regions, signalling a low level of cultural bias over online content production, ensuring data consistency. In Table 8 is reported the analysis of the impacts divided by year of award.

Table 8. Python – Yearly Before, After and Var variations

Award Year	Metric	Mean	SD	Min	Max	N	Positive
2021	API Before	0.2370	0.6100	-0.8620	2.155	56	0.5710
2022	API Before	0.2760	0.5800	-0.3980	2.155	30	0.7000
2023	API Before	0.3530	0.8400	-1.0000	2.155	21	0.7140
2024	API Before	0.5290	0.7090	-0.5450	2.155	18	0.7780
Total	API Before	0.3080	0.6610	-1.0000	2.155	125	0.6560

2021	API After	0.1990	0.3950	-1.1290	0.961	56	0.07680
2022	API After	0.2510	0.3510	-1.1290	0.649	30	0.9330
2023	API After	0.3430	0.3330	-0.2340	1.000	21	0.8570
2024	API After	0.5020	0.4830	-0.2090	1.616	18	0.7780
Total	API After	0.2790	0.3990	-1.1290	1.616	125	0.8240

2021	API Var	0.5893	1.1391	-0.8161	5.9316	56	0.6786
2022	API Var	0.5068	0.6782	-0.3716	2.8289	30	0.8333
2023	API Var	0.7753	1.2458	-0.6618	4.1837	21	0.8095
2024	API Var	1.1892	1.4907	-0.5000	5.9316	18	0.8889
Total	API Var	0.6871	1.1350	-0.8161	5.9316	125	0.7680

All data show similar trends, with peak mean values recorded on Year 2024, and average number of Positive values scoring the lowest in 2021 for all variables. The higher average standard deviation is registered on the total API variation, more than double of the other two.

Following are represented Figures 6 and 7, the first showing variables distribution for API Variation, the second displaying on a scatter plot the relationship between API Before and API After.

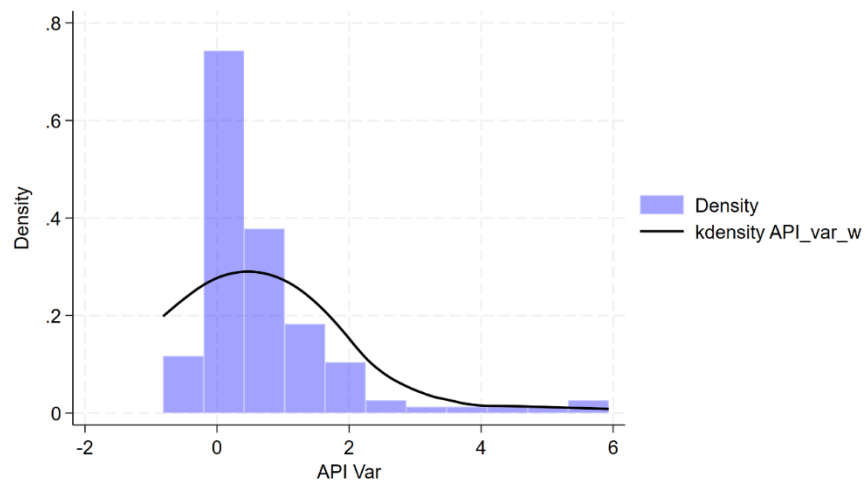


Figure 6. Python – API Var distribution

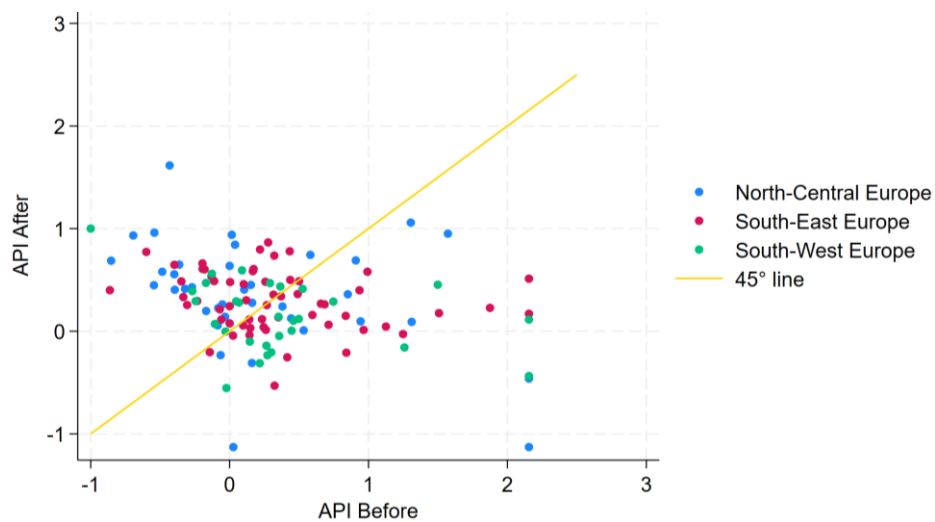


Figure 7. Python – API Before & API After scatter plot

The three geographical area show no strong correlation in Before-After API variation

6.2.3 Popularity Data Variation

Once executed the two initial analyses independently, a third step involved comparing them to each other, in Table 9 are summarized main indicators for all variables.

Table 9. Popularity – Variables total impacts

Metric	Mean	SD	Min	Max	N	Positive
TR Shortvar	0.1729	0.4435	-0.8266	1.0000	99	0.6800
TR Longvar	0.5244	0.9776	-0.5116	3.6259	99	0.7470
API Before	0.3081	0.6609	-1.0000	2.1548	125	0.6560
API After	0.2797	0.3985	-1.1287	1.6155	125	0.8240
API Var	0.6871	1.1347	-0.8161	5.9316	125	0.7680

While other variables present quite diverse values, API Var and Google Trends Longvar present very similar variations. I proceeded analysing yearly trend to understand if the similarities in variations are also showing similar trends through years. Results are represented in Figure 8.

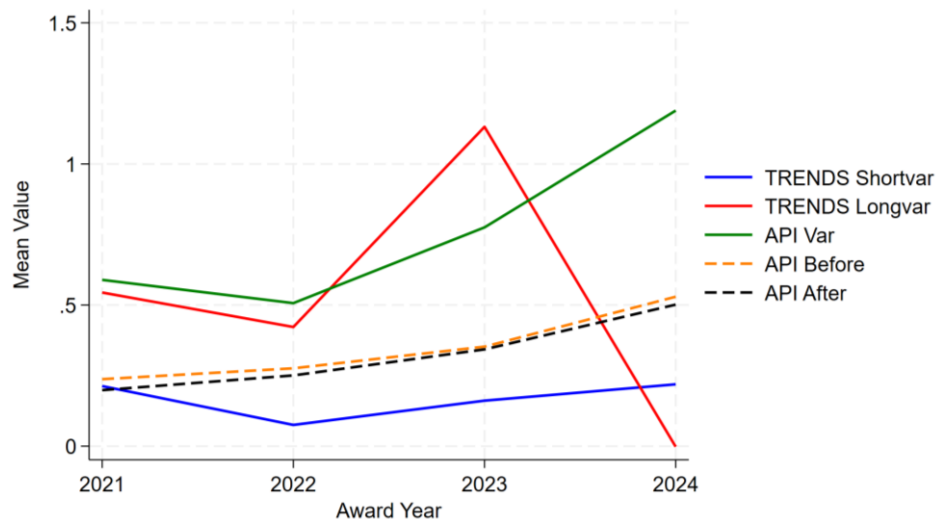


Figure 8. Popularity – Variables yearly mean

From the graph it's noticeable that the only means moving together through time are API Before and API After. A second similarity is observable in TRENDS Shortvar and API Var, with variables showcasing similar mean variation direction, with different intensity. TRENDS Longvar appear to be oscillating independently through years.

6.2.4 Certification statistical significance over Popularity

To test the statistical significance of the certification in explaining changes in Popularity data, I run regression models on the two variables Google Trends and API. In Table 10 are reported the results of the first FE regression analysis.

Table 10. Popularity – Certification Significance in explaining Google Trends (FE)

Variables	Coefficient	Std. Error	t-value	p-value	95% Conf. Interval
Certification	17.59	2.56	6.87	0.000	[12.51 ; 22.67]

Indicator	Value
Observations	2,448
Groups (Restaurant)	102
R-squared (within)	0.1581
R-squared (between)	0.0315
R-squared (overall)	0.0868
rho	0.432552
Std errors	Clustered (Restaurant)

The regression highlights the statistical significance of the certification over the value of Google TRENDS through time, with an average increase of 17.6 units after the award, and p-value equal to zero. The variability explained by the model accounts for around 16% of the total variation (R^2). The model also highlights strong structural differences between restaurants, with 43% of the variance explained by restaurant-specific factors (rho). Time also resulted highly significant, but It wasn't reported in the table due to the extensive full length of the table, the complete regression is available at Appendix 10.

I then proceeded with the FE regression to test the significance of the certification over API. This first analysis resulted in a non-significant relationship, so I proceeded with the RE regression analysis, followed by the Hausman test. In Table 11 are reported the results of the RE regression analysis.

Table 11. Popularity – Certification Significance in explaining API (RE)

Variables	Coefficient	Std. Error	t-value	p-value	95% Conf. Interval
Certification	-359.7482	809.8085	-0.44	0.657	-1946.944 ; 1227.447
Year 2021	374.2208	530.4610	0.71	0.481	-665.4636 ; 1413.905
Year 2022	1450.647	803.8278	1.80	0.071	-124.8268 ; 3026.120
Year 2023	2541.452	1146.664	2.22	0.027	294.032 ; 4788.873
Year 2024	4248.196	1624.787	2.61	0.009	1063.673 ; 7432.719
Year 2025	5800.932	1600.215	3.63	0.000	2664.569 ; 8937.294
South-East Europe	-3260.637	1866.780	-1.75	0.081	-6919.458 ; 398.185
South-West Europe	-1256.462	2641.709	-0.48	0.634	-6434.117 ; 3921.192
Marine activities	702.9487	1503.911	0.47	0.640	-2244.662 ; 3650.560
Museums & services	-4837.721	3279.859	-1.47	0.140	-11266.130 ; 1590.685
Restaurants & Bars	3315.221	1183.809	2.80	0.005	994.998 ; 5635.444
Tourism & Hospitality	-677.881	1313.169	-0.52	0.606	-3251.645 ; 1895.883
Medium	10292.03	4746.387	2.17	0.030	989.280 ; 19594.780
Micro	3970.613	4923.234	0.81	0.420	-5678.749 ; 13619.980
Small	4124.390	3513.329	1.17	0.240	-2761.609 ; 11010.390
AwardYear 2022	1524.373	2657.778	0.57	0.566	-3684.777 ; 6733.523
AwardYear 2023	-2245.352	1323.828	-1.70	0.090	-4840.007 ; 349.303
AwardYear 2024	-2393.278	2424.525	-0.99	0.324	-7145.260 ; 2358.705
Constant	-2202.486	4891.882	-0.45	0.653	-11790.400 ; 7385.427

Indicator	Value
Observations	678
Groups (Restaurant)	125
R-squared (within)	0.0950
R-squared (between)	0.1422
R-squared (overall)	0.1299
rho	0.6620
Standard errors	Clustered (Restaurant)

The regression shows that the certification has no statistical significance in explaining changes in API. By conducting Hausman test I obtained as results $\chi^2 = 1.84$ and $p = 0.93$, highlighting no systematic differences between RE and FE, confirming the validity of RE and therefore allowing me to investigate the significance of dummy variables over the change in API. The RE model shows that time causes a growth of API, especially in year 2023, 2024 and 2025. Size and Type of activity also result significant, highlighting a high heterogeneity of factor significantly affecting the variable.

6.3 Economic Data results

6.3.1 Orbis Data Variation

All Economic data was summarized and elaborated to extract the variations; it is available at Appendix 6.

I started by measuring on the overall reputation variation through all economic data extracted from Orbis. As a second analysis measured Before/After effects for each variable, the summary of main results is reported in Table 12.

Table 12. Orbis – Short & Long term variations

Country	Metric	Mean	SD	Min	Max	N	Positive
North-Central Europe	Prodvar Before	0.5307	0.5443	-0.6234	1.3288	19	0.8947
North-Central Europe	Prodvar After	0.3157	0.2579	0.0399	0.8520	14	1.0000
North-Central Europe	Prodvar	0.8375	1.0206	-0.6163	4.1903	19	0.8947
South-East Europe	Prodvar Before	0.9075	1.5863	-0.4899	9.9653	52	0.9231
South-East Europe	Prodvar After	0.4345	0.9341	-0.8748	3.5579	53	0.7547
South-East Europe	Prodvar	0.9403	1.1934	-0.4899	4.1903	52	0.9038
South-West Europe	Prodvar Before	0.4725	0.5638	-0.8711	1.4279	27	0.8889
South-West Europe	Prodvar After	0.1359	0.2462	-0.5539	0.6470	24	0.7917
South-West Europe	Prodvar	0.5604	0.6901	-0.8711	2.1376	27	0.8519
North-Central Europe	Netvar Before	0.7194	6.6436	-15.8683	19.1125	35	0.6286

North-Central Europe	Netvar After	0.0782	4.3261	-6.9738	13.4447	29	0.3793
North-Central Europe	Netvar	0.2486	4.4213	-11.8051	8.5332	35	0.6571
South-East Europe	Netvar Before	1.2117	3.2211	-2.7790	19.1125	44	0.7500
South-East Europe	Netvar After	1.3909	4.5332	-6.4231	13.4447	41	0.6098
South-East Europe	Netvar	1.1252	3.1357	-10.7332	13.8407	44	0.7727
South-West Europe	Netvar Before	2.7384	5.0742	-1.7670	19.1125	28	0.6786
South-West Europe	Netvar After	-0.4216	1.7045	-7.0749	2.6980	24	0.3750
South-West Europe	Netvar	2.0710	4.2139	-1.9310	13.8407	28	0.6786
North-Central Europe	Staffvar Before	0.3855	0.6671	-0.5556	2.5543	33	0.7273
North-Central Europe	Staffvar After	0.0774	0.2506	-0.3958	0.7857	29	0.5172
North-Central Europe	Staffvar	0.4309	0.7146	-0.6111	2.8625	33	0.8182
South-East Europe	Staffvar Before	0.2922	0.6030	-0.4762	2.5543	50	0.6000
South-East Europe	Staffvar After	0.1656	0.2767	-0.4419	0.7903	48	0.7292
South-East Europe	Staffvar	0.3873	0.6237	-0.5000	2.8625	50	0.7000
South-West Europe	Staffvar Before	0.2065	0.3620	-0.9355	0.8750	25	0.7600
South-West Europe	Staffvar After	0.1571	0.2794	-0.3333	0.7903	21	0.7143
South-West Europe	Staffvar	0.2832	0.4283	-0.9355	1.3214	25	0.8800
Total	Prodvar Before	0.7146	1.2272	-0.8711	9.9653	98	0.9082
Total	Prodvar After	0.3375	0.7387	-0.8748	3.5579	91	0.8022
Total	Prodvar	0.8157	1.0470	-0.8711	4.1903	98	0.8878
Total	Netvar Before	1.4502	5.0560	-15.8683	19.1125	107	0.6916
Total	Netvar After	0.5232	3.9769	-7.0749	13.4447	94	0.4787
Total	Netvar	1.0859	3.9077	-11.8051	13.8407	107	0.7103
Total	Staffvar Before	0.3009	0.5773	-0.9355	2.5543	108	0.6759
Total	Staffvar After	0.1377	0.2700	-0.4419	0.7903	98	0.6633
Total	Staffvar	0.3766	0.6123	-0.9355	2.8625	108	0.7778

A first phenomenon all variables show is weaker After variation compared to the before, with lower mean and a lower standard deviation, with the sole exception of South-East Europe, where Netvar presents higher standard deviation. South-East Europe represents the more unstable geographical area, while North-Central Europe is more coherent with the Total sample and South-West Europe.

After comparing the three geographical clusters, I proceeded dividing restaurants by year of award, investigating how the same variables influenced trends of restaurants awarded in different years, here I considered Longvar, Shortvar and Var variables, involving both pre and post certification periods in the analysed timeframe. Results are reported in Table 13.

Table 13. Orbis – Yearly Variation

Award Year	Metric	Mean	SD	Min	Max	N	Positive
2021	Prodvar	0.9787	1.0469	-0.6163	4.1903	37	0.9459
2022	Prodvar	1.2180	1.1179	-0.0111	4.1903	26	0.9615
2023	Prodvar	0.4633	1.0177	-0.3789	4.1903	18	0.8333
2024	Prodvar	0.2189	0.5330	-0.8711	1.3288	17	0.7059
Total	Prodvar	0.8157	1.0470	-0.8711	4.1903	98	0.8878

2021	Netvar	1.3567	4.7981	-11.8051	13.8407	47	0.7660
2022	Netvar	0.8644	3.9983	-10.7332	13.8407	27	0.7037
2023	Netvar	0.2428	1.7856	-1.9311	5.4880	16	0.5000
2024	Netvar	1.4827	2.1989	-1.1472	7.2688	17	0.7647
Total	Netvar	1.0859	3.9077	-11.8051	13.8407	107	0.7103

2021	Staffvar	0.3862	0.6110	-0.6111	2.8625	46	0.8043
2022	Staffvar	0.4975	0.7136	-0.5000	2.8625	26	0.8462
2023	Staffvar	0.3740	0.4389	-0.2941	1.6800	19	0.8421
2024	Staffvar	0.1684	0.6126	-0.9355	2.000	17	0.5294
Total	Staffvar	0.3766	0.6123	-0.9355	2.8625	108	0.7778

Data shows that all variables have different variation intensity, with strong similarities between Staffvar and Prodvar, while Netvar appears more oscillating, and independent through time. The Figure visually representing these values is available at Appendix 9, it shows that the three variables have very different variations for all years but 2023, where all of them have a similar value, and 2024, where Prodvar and Staffvar present almost the same variation. Additionally, only Prodvar and Staffvar prove to be aligned in variation direction through time, moving towards the same direction.

In Figure 9 are represented the distributions of variable's variation.

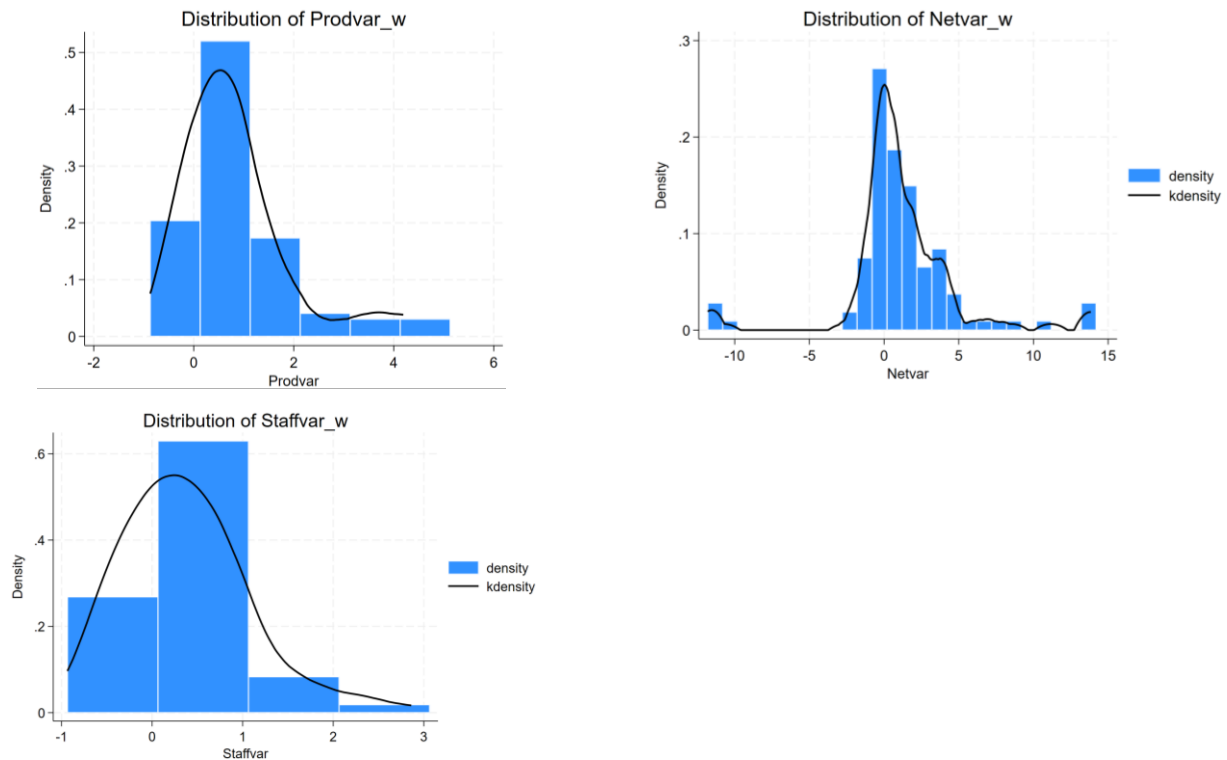


Figure 9. Orbis – Variables Distributions

While histograms show a different level of data distribution, Staffvar and Prodvar show very similar shapes and value concentration between 0 and 1. Netvar show a similar data intensity, with positive variations, but a wider dispersion of data, with a more noticeable amount of outliers. Figure 10 represents the relationship between the before and after values.

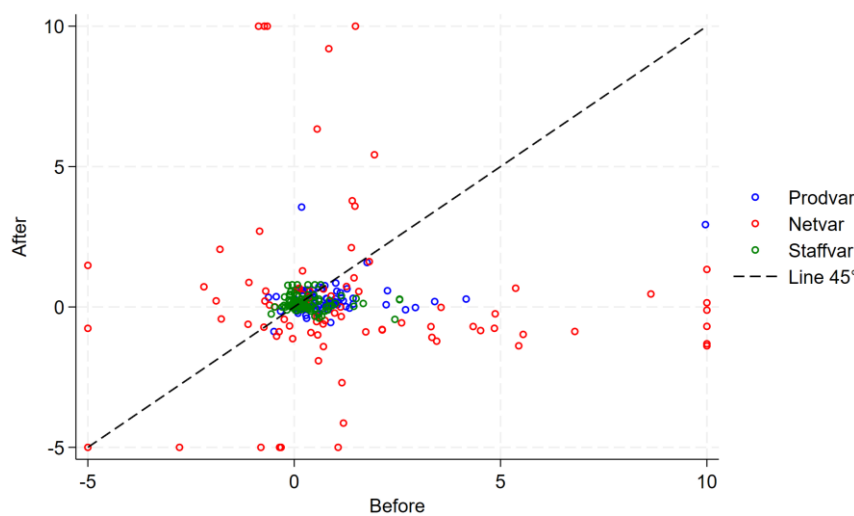


Figure 10. Orbis – Words Before/After scatter plot

Figure 10 signals a strong association between Production and Staff variation, Before & After award, with very few exceptions. It also helps understanding how Net revenue variation is completely more shattered through the whole graph.

6.3.2 Certification statistical significance over Economic Performance

While for Green reputation and Popularity the regression models were used to prove the existence of a significant relationship between certification and changes in the variables, for this analysis results will focus on testing the absence of a significant relationship with the certification, using the same methodology.

To test significance of the certification in economic performance data variation, I run regression models on the three Economic performance variables. I started from Production data, running a panel fixed-effect regression model. In Table 14 are reported the results of the FE regression analysis.

Table 14. Economic Performance – Certification Significance in explaining Production (FE)

Variable	Coeff.	Std. Err.	t	p	95% CI
Certification	287481.6	169268.7	1.70	0.092	-48110.03 ; 623073.2
Size	<i>omitted</i>	—	—	—	—
Sector	<i>omitted</i>	—	—	—	—
Country	<i>omitted</i>	—	—	—	—
AwardYear	<i>omitted</i>	—	—	—	—
Year 2021	838407.9	247087.5	3.39	0.001	348533 ; 1328283
Year 2022	1705813	370901.4	4.60	0.000	970464.9 ; 2441161
Year 2023	1847614	419585.1	4.40	0.000	1015746 ; 2679482
Year 2024	1895517	455125.0	4.16	0.000	993187.3 ; 2797846
Year 2025	4212930	2517394	1.67	0.097	-778048.8 ; 9203908
Constant	1702174	311634	5.46	0.000	1084330 ; 2320019

Indicator	Value
Observations	497
Groups (Restaurant)	107
R-squared (within)	0.2153
R-squared (between)	0.0052
R-squared (overall)	0.0197
rho	0.9295
Std errors	Clustered (Restaurant)

Results show a positive influence between certification and production levels, with marginal statistical significance. Time is also significant in explaining changes in Production. High rho suggests that most variance is caused by restaurant-specific characteristics rather than time variant factors.

I then proceeded with the FE regression to test the significance of the certification over Staff. This first analysis resulted in a non-significant relationship, so I attempted proceeding with the RE regression analysis, but the following Hausman test indicated that the random-effects model is inconsistent. Therefore, I kept the FE results as final, without investigating further the omitted additional factors. In Table 15 are reported the results.

Table 15. Economic performance – Certification Significance in explaining Staff (FE)

Variable	Coeff.	Std. Err.	t	p	95% CI
Certification	1.7133	1.5034	1.14	0.257	-1.2625 ; 4.6891
Size	<i>omitted</i>	—	—	—	—
Sector	<i>omitted</i>	—	—	—	—
Country	<i>omitted</i>	—	—	—	—
AwardYear	<i>omitted</i>	—	—	—	—
Year 2021	2.6826	1.1612	2.31	0.023	0.3840 ; 4.9812
Year 2022	7.3938	1.7080	4.33	0.000	4.0129 ; 10.7746
Year 2023	7.9334	2.2906	3.46	0.001	3.3992 ; 12.4675
Year 2024	8.8368	2.5960	3.40	0.001	3.6981 ; 13.9754
Year 2025	14.3340	7.3035	1.96	0.052	-0.1228 ; 28.7909
Constant	23.0089	1.2950	17.77	0.000	20.4455 ; 25.5722

Indicator	Value
N. Obs	563
Groups	124
R ² Within	0.1552
R ² Between	0.0059
R ² Overall	0.0055
rho	0.9381

Results show a non-significant relationship between certification and change in Staff, while they highlight high significance of Years in explaining the Staff variation. The Hausman test didn't support the use of RE model, preventing me from verifying the significance of the control variables omitted by the FE regression model. Rho is again very high, suggesting that also for Staff, most variance is caused by restaurant-specific characteristics rather than time variant factors.

I then proceeded with the FE regression to test the significance of the certification over Revenue. This first analysis resulted in a non-significant relationship, so I proceeded with the RE regression analysis, followed by the Hausman test. In Table 16 are reported the results of the RE regression analysis.

Table 16. Economic performance – Certification Significance in explaining Revenue (RE)

Variable	Coeff.	Std. Err.	z	p	95% CI
Certification	-58940.88	58110.31	-1.01	0.310	-172835 ; 54953.24
Size Medium	-588015.9	502473.7	-1.17	0.242	-1572846 ; 396814.4
Size Micro	-1137144	362992.0	-3.13	0.002	-1848595 ; - 425692.8
Size Small	-1130535	354420.2	-3.19	0.001	-1825186 ; - 435884.6
Marine activities	-305746.6	359870.0	-0.85	0.396	-1011079 ; 399585.7
Museums & services	-628762.1	486862.0	-1.29	0.197	-1582994 ; 325469.8
Restaurants & Bars	-125942.9	346161.3	-0.36	0.716	-804406.6 ; 552520.7
Tourism & Hospitality	-107765.4	365660.4	-0.29	0.768	-824446.6 ; 608915.7
South-East Europe	369576.0	151979.2	2.43	0.015	71702.22 ; 667449.7

South-West Europe	312035.6	99342.53	3.14	0.002	117327.8 ; 506743.3
AwardYear 2022	-274607.7	153449.2	-1.79	0.074	-575362.6 ; 26147.24
AwardYear 2023	-91173.55	114169.3	-0.80	0.425	-314941.3 ; 132594.2
AwardYear 2024	-104075.5	139907.4	-0.74	0.457	-378289 ; 170138
Year 2021	202895.7	47378.54	4.28	0.000	110035.5 ; 295755.9
Year 2022	310663.4	77169.38	4.03	0.000	159414.2 ; 461912.6
Year 2023	342423.6	86859.43	3.94	0.000	172182.2 ; 512664.9
Year 2024	339357.0	93028.69	3.65	0.000	157024.1 ; 521689.8
Year 2025	449469.3	146865.5	3.06	0.002	161618.2 ; 737320.4
Constant	934922.0	156199.1	5.99	0.000	628777.5 ; 1241067

Indicator	Value
Observations	543
Groups (Restaurant)	113
R-squared (within)	0.0878
R-squared (between)	0.2056
R-squared (overall)	0.1736
rho	0.6599
Standard errors	Clustered (Restaurant)

The regression shows that the certification has no statistical significance in explaining changes in Revenue. By conducting Hausman test I obtained as results $\chi^2 = 1.64$ and $p = 0.8966$, highlighting no systematic differences between RE and FE, confirming the validity of RE and therefore allowing me to investigate the significance of dummy variables over the change in Revenue. The RE model suggests that revenues are significantly impacted by years, like most of the previous variables, but also by size and geographical area of the restaurant, accounting together for a higher share of explainability of the model (lower rho) compared to other variables.

6.4 Green Reputation

6.4.1 Google Maps Data Variation

Out of the initial 128 businesses, 120 (94%) had enough Google Maps reviews to be included in the analysis, all summarized data are available at Appendix 7. Google Maps data and Appendix 8. Sustainability-related words.

I started by measuring the overall reputation variation through stars and comment variations. While for Sustainable words I decided to adopt the Before/After approach, to measure how surrounding periods performed compared to the award one in relation to the mentions of sustainable related words, I considered more insightful for the stars variation to conduct Short-term and long-term analysis, to fully assess differences in time framework importance when measuring variations in dining experience appreciation. In Table 17 are reported the results of the analysis.

Table 17. Google Maps – Short & Long term variation

Country	Metric	Mean	SD	Min	Max	N	Positive
North Central Europe	Stars Shortvar	0.0015	0.0583	-0.1184	0.1573	36	0.4167
South-East Europe	Stars Shortvar	-0.0028	0.0591	-0.1117	0.1573	50	0.4200
South-West Europe	Stars Shortvar	0.0070	0.0615	-0.1024	0.1517	28	0.3929
North Central Europe	Stars Longvar	0.0708	0.2678	-0.1364	0.9102	35	0.4286
South-East Europe	Stars Longvar	0.0285	0.1882	-0.1020	0.9102	50	0.4200
South-West Europe	Stars Longvar	0.0618	0.1951	-0.0834	0.9102	28	0.5357
North Central Europe	Stars Var	0.0032	0.0591	-0.0768	0.1761	36	0.3590
South-East Europe	Stars Var	0.0030	0.0571	-0.0768	0.1761	50	0.5254
South-West Europe	Stars Var	0.0135	0.0680	-0.0768	0.1761	28	0.5333
North-Central Europe	Words Before	0.6420	1.3560	-0.6890	3.5000	36	0.5640
South-East Europe	Words Before	0.6610	1.1930	-0.8100	3.5000	50	0.6780
South-West Europe	Words Before	0.2170	0.7830	-0.6030	3.1710	28	0.5670
North-Central Europe	Words After	1.0990	1.3730	-0.4190	4.7650	38	0.7950
South-East Europe	Words After	1.2050	1.5370	-0.4190	4.7650	54	0.7460
South-West Europe	Words After	0.424	0.8310	-0.3680	3.6890	28	0.7670

North Central Europe	Words Var	0.8210	1.1463	-0.6571	4.2449	38	0.8158
South-East Europe	Words Var	1.0279	1.4610	-0.7656	4.2449	54	0.7037
South-West Europe	Words Var	0.3194	0.7595	-0.3970	3.0924	28	0.5714
Total	Stars Shortvar	0.0010	0.0590	-0.1184	0.1573	114	0.4123
Total	Stars Longvar	0.0498	0.2164	-0.1364	0.9102	113	0.4513
Total	Stars Var	0.0056	0.0602	-0.0768	0.1761	114	0.4211
Total	Words Before	0.5460	1.1700	-0.8100	3.5000	114	0.6170
Total	Words After	0.9890	1.3770	-0.4190	4.7650	120	0.7660
Total	Words Var	0.7971	1.2522	-0.7656	4.2449	120	0.7083

Most of the variables show neutral or slightly negative results when considering both mean values and ratio of Positive values, stars var also reflect a similar neutrality in its impacts, with an average star value of 4.59 out of 5. Overall, words variation shows more positive results than stars variation, with peaks in mean average when considering Words Var and Words After.

After comparing the three geographical clusters, I proceeded dividing restaurants by year of award investigating how the same variables affected businesses awarded in different years, here I considered Longvar, Shortvar and Var variables, involving both pre and post certification periods in the analysed timeframe. The results are reported in Table 18.

Table 18. Google Maps – Yearly Var, Short & Long term variations

Award Year	Metric	Mean	SD	Min	Max	N	Positive
2021	Stars Shortvar	-0.0031	0.0621	-0.1184	0.1573	53	0.3585
2022	Stars Shortvar	-0.0041	0.0514	-0.1117	0.1573	27	0.3333
2023	Stars Shortvar	0.0035	0.0664	-0.1024	0.1573	17	0.5294
2024	Stars Shortvar	0.0192	0.0540	-0.0551	0.1573	17	0.5882
Total	Stars Shortvar	0.0010	0.0590	-0.1184	0.1573	114	0.4120

2021	Stars Longvar	-0.0044	0.0624	-0.1364	0.2286	53	0.3774
2022	Stars Longvar	0.0937	0.2977	-0.1020	0.9102	27	0.4444
2023	Stars Longvar	0.1112	0.3086	-0.1092	0.9102	17	0.6471
2024	Stars Longvar	0.0903	0.2471	-0.0585	0.9102	16	0.5000
Total	Stars Longvar	0.0498	-0.1364	-0.1364	0.9101	113	0.4510

2021	Stars Var	0.0028	0.0596	-0.0768	0.1761	53	0.3585
2022	Stars Var	0.0152	0.070	-0.0768	0.1761	27	0.4444
2023	Stars Var	0.0044	0.0611	-0.0768	0.1761	17	0.4375
2024	Stars Var	0.0006	0.0457	-0.0630	0.1339	17	0.4211
Total	Stars Var	0.0056	0.0602	-0.0768	0.1761	114	0.4210

2021	Words Var	0.6253	1.2394	-0.7656	4.2449	56	0.5714
2022	Words Var	1.3676	1.4730	-0.6000	4.2449	28	0.8929
2023	Words Var	0.7193	1.0207	-0.4783	4.2449	19	0.8421
2024	Words Var	0.5101	0.8835	-0.6571	2.7749	17	0.7059
Total	Words Var	0.7971	1.2522	-0.7656	4.2449	120	0.7080

Data shows that in most cases year 2021 appears to be the one with the lowest impacts and lowest Positive number of variations, highlighting potential External influences. Words var results to be oscillating a lot more compared to all Stars variables. In appendix 9 I also represented the two mean variations of Words Var and Stars Var, considering their yearly values, comparing their trends through time. In the graph, it turned out to be useful utilising different vertical axes to highlight their similar variation trends despite the intensity difference.

Figure 11 represent the distribution of Reputation variable's variation.

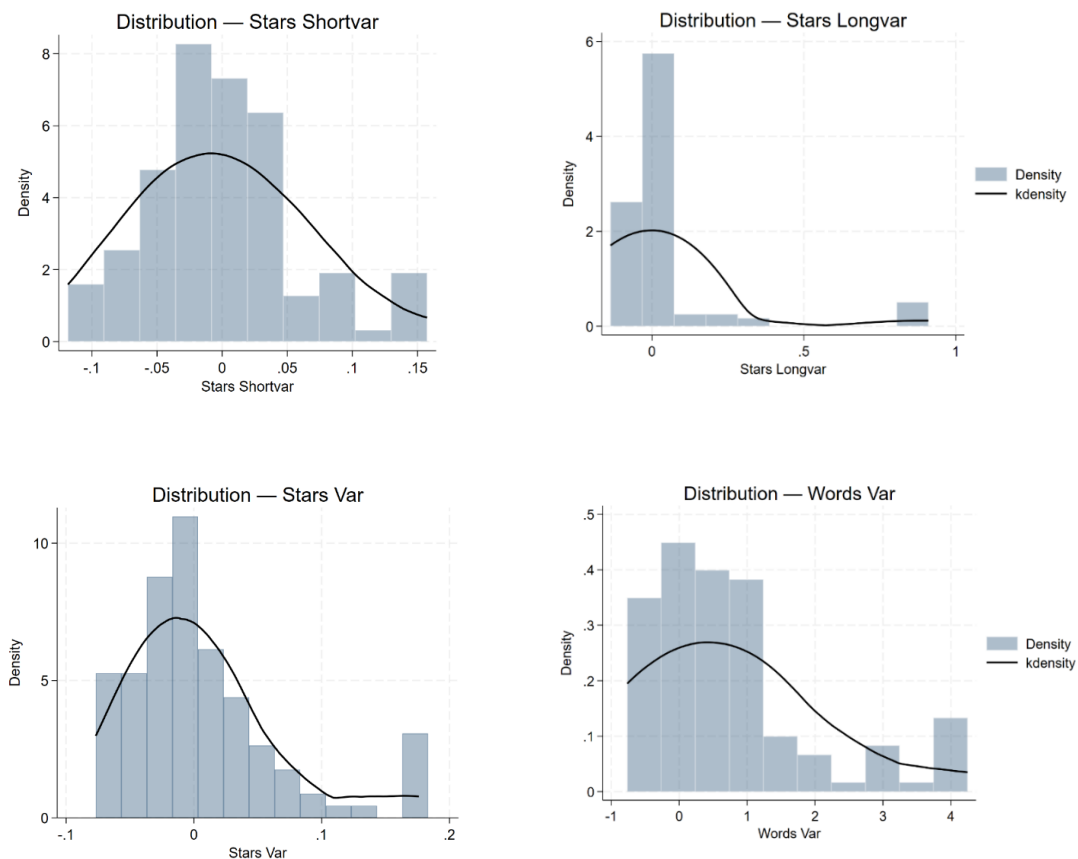


Figure 11. Google Maps – Stars and Words Distributions

Distributions show strong similarities between Star Vars variables and Star Shortvar Variables, while the other appear to have a more independent distribution. Figure 12 represents the relationship between Words Before and Words After.

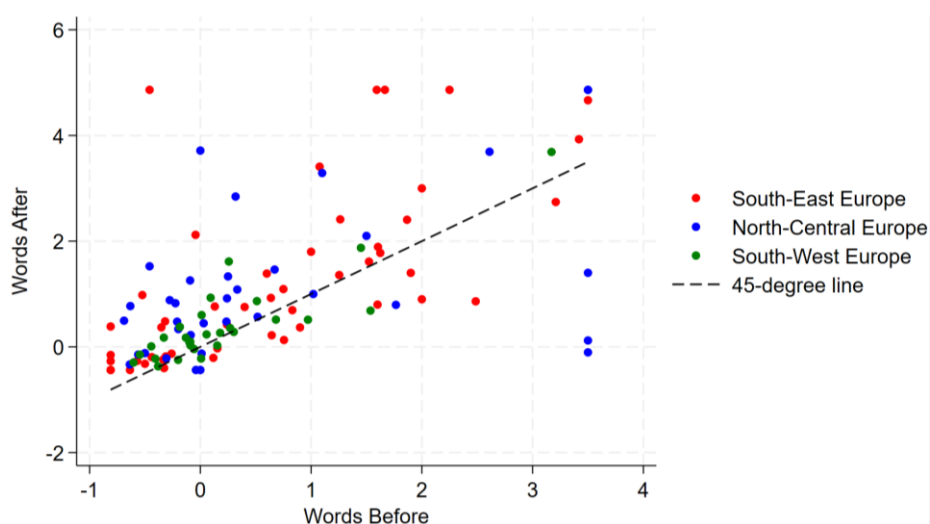


Figure 12. Google Maps – Words Before/After scatter plot

The scatterplot suggests a relative consistent behaviour in Before and After effect for Words variation, with few outlier values for South-East and North-Central Europe.

6.4.2 Certification statistical significance over Reputation

To test significance of the certification in the variation measured from data, I run regression models on the three variables. I started from Comments data, running a panel fixed-effect regression model, which resulted in a non-significant relationship, so I proceeded with the RE regression analysis, followed by the Hausman test. The results of the analysis are reported in Table 19.

Table 19. Reputation – Certification Significance in explaining Comments (RE)

Variable	Coeff.	Std. Err.	z	p	95% CI
Certification	-0.0150	0.0216	-0.70	0.487	-0.0574 ; 0.0273
Size Micro	0.0406	0.0514	0.79	0.429	-0.0601 ; 0.1413
Size Small	0.0321	0.0509	0.63	0.528	-0.0677 ; 0.1319
Marine activities	0.0403	0.0561	0.72	0.472	-0.0696 ; 0.1503
Museums & services	-0.1647	0.0730	-2.26	0.024	-0.3078 ; -0.0216
Restaurants & Bars	-0.0155	0.0534	-0.29	0.772	-0.1201 ; 0.0892
Tourism & Hospitality	0.0637	0.0934	0.68	0.495	-0.1193 ; 0.2467
South-East Europe	-0.1123	0.0438	-2.57	0.010	-0.1981 ; -0.0265
South-West Europe	0.1765	0.0469	3.76	0.000	0.0845 ; 0.2685
AwardYear 2022	-0.0408	0.0551	-0.74	0.459	-0.1487 ; 0.0671
AwardYear 2023	-0.1145	0.0490	-2.34	0.019	-0.2106 ; -0.0185
AwardYear 2024	-0.1498	0.0430	-3.49	0.000	-0.2340 ; -0.0656
Year 2021	0.0764	0.0297	2.58	0.010	0.0183 ; 0.1346
Year 2022	0.1148	0.0313	3.67	0.000	0.0534 ; 0.1761
Year 2023	0.1698	0.0364	4.67	0.000	0.0985 ; 0.2410
Year 2024	0.2032	0.0392	5.19	0.000	0.1265 ; 0.2800
Year 2025	0.2443	0.0384	6.36	0.000	0.1690 ; 0.3196
Constant	0.2292	0.0742	3.09	0.002	0.0837 ; 0.3746

Indicator	Value
Observations	720
Groups (Restaurant)	120
R-squared (within)	0.1839
R-squared (between)	0.3125
R-squared (overall)	0.2623
rho	0.5091
Std errors	Clustered (Restaurant)

The Hausman test yields $\chi^2 = 0.00$ and $p = 1.000$, indicating no systematic differences between fixed and random effects estimators, suggesting that both models produce virtually identical

estimates in this setting, confirming the validity of RE and therefore allowing me to investigate the significance of dummy variables over the change in Comments. Results fail to prove the significance of the certification in explaining the change in comments. This information is anyway followed by the negative and significant relevance of Award Years, suggesting that restaurants achieving certification later experience different changes in comments compared to earlier adopter. Years and geographical area also appear, once again, as significant factors, with restaurants located in South-West Europe showing significantly higher sustainability-related word mentions, while South-East Europe presents lower values.

I then proceeded with the FE regression to test the significance of the certification over stars. This first analysis resulted in a non-significant relationship, so I proceeded with the RE regression analysis, followed by the Hausman test. The results of the RE regression analysis are reported in Table 20.

Table 20. Reputation – Certification Significance in explaining Stars (RE)

Variable	Coeff.	Std. Err.	z	p	95% CI
Certification	0.1948	0.1267	1.54	0.122	-0.0536 ; 0.4432
Size Micro	0.0976	0.1065	0.92	0.360	-0.1112 ; 0.3064
Size Small	-0.1027	0.1067	-0.96	0.336	-0.3119 ; 0.1065
Marine activities	0.2309	0.1977	1.17	0.243	-0.1566 ; 0.6185
Museums & services	-0.2888	0.4049	-0.71	0.476	-1.0823 ; 0.5047
Restaurants & Bars	0.3328	0.2193	1.52	0.129	-0.0971 ; 0.7626
Tourism & Hospitality	-0.0180	0.2392	-0.08	0.940	-0.4870 ; 0.4509
South-East Europe	0.0889	0.1143	0.78	0.437	-0.1352 ; 0.3130
South-West Europe	0.1568	0.1082	1.45	0.147	-0.0552 ; 0.3688
AwardYear 2022	0.0614	0.0823	0.75	0.455	-0.0998 ; 0.2227
AwardYear 2023	-0.1851	0.1712	-1.08	0.280	-0.5207 ; 0.1505
AwardYear 2024	-0.0013	0.1332	-0.01	0.992	-0.2624 ; 0.2598
Year 2021	0.0975	0.1240	0.79	0.432	-0.1455 ; 0.3406

Year 2022	0.1547	0.1503	1.03	0.303	-0.1399 ; 0.4492
Year 2023	0.2173	0.1416	1.54	0.125	-0.0601 ; 0.4948
Year 2024	0.1853	0.1525	1.22	0.224	-0.1136 ; 0.4842
Year 2025	0.1681	0.1523	1.10	0.270	-0.1305 ; 0.4666
Constant	3.9145	0.2692	14.54	0.000	3.3869 ; 4.4421

Indicator	Value
Observations	716
Groups (Restaurant)	120
R-squared (within)	0.0496
R-squared (between)	0.1839
R-squared (overall)	0.0985
rho	0.2226
Std errors	Clustered (Restaurant)

The regression shows that the certification has no statistical significance in explaining changes in Stars. By conducting Hausman test I obtained as results $\chi^2 = 0.33$ and $p = 0.9969$, highlighting no systematic differences between RE and FE, confirming the validity of RE and therefore allowing me to investigate the significance of dummy variables over the change in Stars. The regression showed no significant relationship with certification and control variables, but still certification possess the lower p-value out of all variables in the model (0.142). This suggests that certified restaurants tend to have higher average ratings. but the effect is not statistically robust at conventional significance levels. Among control variables, Sector, geographical area and years showed also some effect but statistically non-significant. Rho shows that approximately 22% of the variance is attributable to differences between restaurants, while most variations occurring within restaurants over time.

6.4.3 Comments vocabulary analysis

As a final step, I performed a frequency analysis on the entirety of customer reviews to provide quantified feedback on the expectations identified during the literature review. By isolating the most frequent terms, while excluding non-indicative words such as articles and conjunctions, I tried to determine the topical salience of sustainability. This approach allows to observe where environmental commitment ranks within the hierarchy of priorities that define the modern dining experience, and how that hierarchy compare to academic literature expectations. The 100 most repeated words through comments are reported in Table 21.

Table 21. Total vocabulary count

Word	Count	Word	Count	Word	Count	Word	Count
food	5744	dishes	1801	vini	1119	dinner	878
experience	4683	cucina	1788	trato	1108	casa	867
service	4640	esperienza	1576	local	1102	table	862
restaurant	4419	cibo	1565	time	1081	sapori	861
menu	3608	super	1547	locale	1074	plato	859
comida	2717	location	1545	course	1067	cuisine	832
experiencia	2597	bien	1544	calidad	1037	fine	821
piatti	2550	qualità	1544	delicious	1015	degustazione	802
great	2548	ottimo	1505	tasting	960	taste	783
staff	2517	top	1485	atención	957	gusto	782
todo	2495	posto	1442	buena	952	ever	775
menú	2484	like	1405	about	947	perfect	774
chef	2396	dining	1369	stato	946	recomendable	769
michelin	2393	personal	1362	recommend	935	precio	766
wine	2359	dish	1331	worth	931	piatto	749
servizio	2271	lugar	1329	star	920	fantastic	710
ristorante	2156	excellent	1312	hotel	917	prezzo	707
amazing	2133	menù	1307	restaurants	916	sabores	704
restaurante	2106	excelente	1262	sitio	915	degustación	666
servicio	2006	cocina	1253	friendly	911	dessert	652
best	1948	ambiente	1241	carta	909	ingredients	649
good	1926	meal	1189	ottima	895	loro	649
platos	1902	cena	1148	pairing	893	world	615
place	1814	espectacular	1140	atmosphere	891	estrellas	613
personale	1804	nice	1135	vino	881	vegetables	607

Results show that only four mentions that could potentially also refer to sustainable related topics, respectively “ambiente”, “local”, “locale”, “estrellas “ and “vegetables”. There is no clear connection in all other 95 words with sustainability or green Michelin star certification.

6.5 Popularity and Reputation as predictors of Performance

To answer to the second question of the thesis, investigating whether Popularity and Reputation variables can significantly explain changes in Economic performance, I conducted fixed effect and random effect regressions. In Table 22, 23 and 24, are reported the results of the three regressions addressing each Economic performance variable.

Table 22. Cross-area relationship – Production (RE)

Variable	Coeff.	Std. Err.	z	p	95% CI
API	113.1293	51.7945	2.18	0.024	11.6139 ; 214.6448
STARS	155905.3	244101.9	0.64	0.523	-322525.7 ; 634336.3
COMMENTS	-151039.9	620296.2	-0.24	0.808	-1366798 ; 1064718
Year 2021	582643.3	147021.0	3.96	0.000	294487.5 ; 870799.1
Year 2022	1387676	257200.3	5.40	0.000	883572.8 ; 1891780
Year 2023	1438584	300976.3	4.78	0.000	848681.6 ; 2028487
Year 2024	1340379	341281.3	3.93	0.000	671479.5 ; 2009278
Year 2025	1752241	300661.3	5.83	0.000	1162955 ; 2341526
South-East Europe	797801.3	593073.3	1.35	0.179	-364601.1 ; 1960204
South-West Europe	257586.3	759475.9	0.34	0.734	-1230959 ; 1746132
Marine activities	-2340249	1141296	-2.05	0.040	-4577149 ; - 103350
Museums & services	1504282	2139236	0.70	0.482	-2688543 ; 5697107
Restaurants & Bars	-1312495	1080937	-1.21	0.225	-3431093 ; 806102.1
Tourism & Hospitality	-80360.01	1428081	-0.06	0.955	-2879347 ; 2718627

Micro	-6725839	1312213	-5.13	0.000	-9297728 ; -4153949
Small	-5598238	1330405	-4.21	0.000	-8205784 ; -2990692
AwardYear 2022	150377.6	717481.5	0.21	0.834	-1255860 ; 1556615
AwardYear 2023	-341902.8	445770.1	-0.77	0.443	-1215596 ; 531790.5
AwardYear 2024	319083.4	1021865	0.31	0.755	-1683736 ; 2321903
Constant	6040024	1618251	3.73	0.000	2868311 ; 9211737

Indicator	Value
Observations	427
Groups (Restaurant)	98
R-squared (within)	0.2574
R-squared (between)	0.5219
R-squared (overall)	0.4925
rho	0.8289
Std errors	Clustered (Restaurant)

The Hausman test yields $\chi^2 = 1.45$ and p-value = 0.9840, highlighting no systematic differences between RE and FE, confirming the validity of RE and therefore allowing me to investigate the significance of dummy variables over the change in Production. Results show that production is positively and significantly associated to API, but not to COMMENTS and STARS. Through the RE it was also possible to identify a significant and negative relationship with Size and Sector factors.

After Production I analysed relationship for Revenue, conducting again fixed effect and random effect regressions. In Table 23 are reported the results of RE regression analysis.

Table 23. Cross-area relationship – Revenue (RE)

Variable	Coeff.	Std. Err.	t	p	95% CI
API	1.4093	1.9257	0.73	0.464	-2.3650 ; 5.1836
COMMENTS	-55974.32	92109.85	-0.61	0.543	-236506.3 ; 124557.7
STARS	-12987.66	21100.22	-0.62	0.538	-54343.34 ; 28368.02

Year 2021	156415.4	41728.86	3.75	0.000	74628.34 ; 238202.4
Year 2022	234919.7	73675.49	3.19	0.001	90518.42 ; 379321
Year 2023	274699.2	79540.40	3.45	0.001	118802.8 ; 430595.5
Year 2024	273562.3	81786.50	3.34	0.001	113263.7 ; 433860.9
Year 2025	227336.7	71196.33	3.19	0.001	87794.49 ; 366879
Marine activities	-325687.1	372233.2	-0.87	0.382	-1055251 ; 403876.5
Museums & services	-649984.1	483657.8	-1.34	0.179	-1597936 ; 297967.8
Restaurants & Bars	-146239.5	358002.7	-0.41	0.683	-847911.8 ; 555432.9
Tourism & Hospitality	-82022.17	380654.7	-0.22	0.829	-828091.8 ; 664047.4
Micro	-451114.8	316759.4	-1.42	0.154	-1071952 ; 169722.2
Small	-477885.6	344312.1	-1.39	0.165	-1152725 ; 196953.8
South-East Europe	367714.3	165812.2	2.22	0.027	42728.3 ; 692700.3
South-West Europe	332172.0	104535.1	3.18	0.001	127287.1 ; 537057
AwardYear 2022	-273483.8	156380.7	-1.75	0.080	-579984.3 ; 33016.67
AwardYear 2023	-88021.82	134555.5	-0.65	0.513	-351745.8 ; 175702.1
AwardYear 2024	-137216.2	166104.6	-0.83	0.409	-462775.3 ; 188343
Constant	378969.2	524952.4	0.72	0.470	-649918.5 ; 1407857

Indicator	Value
Observations	469
Groups (Restaurant)	103
R-squared (within)	0.0790
R-squared (between)	0.1627
R-squared (overall)	0.1282
rho	0.7076

The Hausman test yields $\chi^2 = 1.46$ and p-value = 0.9837, highlighting no systematic differences between RE and FE, confirming the validity of RE and therefore allowing me to investigate the significance of dummy variables over the change in Revenue. Results show that no significant relationship emerges between changes in revenue, and Reputation or Popularity variables. The only significant factors highlighted by the model are Years and geographical area, positively

influencing revenue. Rho is relatively high, signalling that most variance is explained by restaurant-specific factors.

Lastly, I analysed relationship for Staff, conducting again fixed effect and random effect regressions. In Table 24 are reported the results.

Table 24. Cross-area relationship – Staff (RE)

Variable	Coefficient	Std. Error	z-stat	p-value	95% CI
API	0.000082	0.000152	0.54	0.590	[-0.000216 ; 0.000380]
COMMENTS	-0.715	2.586	-0.28	0.782	[-5.784 ; 4.354]
STARS	0.323	0.700	0.46	0.644	[-1.048 ; 1.695]
Year 2021	2.685	0.989	2.72	0.007	[0.747 ; 4.623]
Year 2022	7.341	1.544	4.75	0.000	[4.314 ; 10.367]
Year 2023	7.928	1.749	4.53	0.000	[4.500 ; 11.356]
Year 2024	7.732	2.089	3.70	0.000	[3.638 ; 11.827]
Year 2025	7.234	3.993	1.81	0.070	[-0.591 ; 15.060]
South-East Europe	0.545	3.721	0.15	0.884	[-6.749 ; 7.838]
South-West Europe	3.985	8.375	0.48	0.634	[-12.429 ; 20.399]
Marine activities and aquaculture	-5.105	7.323	-0.70	0.486	[-19.457 ; 9.248]
Museums and services	-1.331	6.461	-0.21	0.837	[-13.995 ; 11.333]
Restaurants and Bars	2.762	4.767	0.58	0.562	[-6.582 ; 12.105]
Tourism and Hospitality	3.325	8.983	0.37	0.711	[-14.281 ; 20.930]
Micro	-82.623	13.893	-5.95	0.000	[-109.853 ; -55.393]
Small	-67.629	14.107	-4.79	0.000	[-95.278 ; -39.980]
AwardYear 2022	6.142	7.238	0.85	0.396	[-8.045 ; 20.329]
AwardYear 2023	1.486	3.546	0.42	0.675	[-5.464 ; 8.435]
AwardYear 2024	3.376	10.167	0.33	0.740	[-16.552 ; 23.303]
Constant	76.102	9.180	8.29	0.000	[58.109 ; 94.094]

Statistic	Value
Observations	488
Groups (Restaurants)	113
Within R ²	0.1291
Between R ²	0.6167
Overall R ²	0.5784
rho	0.8536

The Hausman test yields $\chi^2 = 2.32$ and p-value = 0.9400, highlighting no systematic differences between RE and FE, confirming the validity of RE and therefore allowing me to investigate the significance of dummy variables over the change in Staff. Results show that no significant relationship emerges between changes in revenue, and Reputation or Popularity variables. The only significant factors highlighted by the model are Years, positively influencing revenue, and Size, with negative effect on Staff. Rho is relatively high, signalling that most variance is explained by restaurant-specific factors.

7 Discussion

The discussion will test literature expectation, expressed through the previous identification of hypothesis, with the research findings. The section will be divided in two main areas, providing answers, if emerged from findings to the initial research questions regarding quantification of the impacts of the green Michelin star certification and potential relations between the different variables considered.

7.1 Q1: Certification Significance

7.1.1 Popularity data considerations

The main contribution to the impacts of certification over Google Trends data is provided by the regression model whose result are represented in Table 10. Findings highlighting a strong relationship between change customer attention and the award of the certification, with p-value of 0.000 and a positive coefficient of 17.59, confirming **Hypothesis 2a**. Like literature predicts, green Michelin star helps transforming sustainability from a credence attribute to a verifiable one (Chiang e Guo, 2021), able to be perceived and appreciated by customers.

The variation, by analysing each month's popularity analysis, finds that for 25% of the sample the award month and (or) the following one, represented the most popular of the whole timeframe. Additionally, a second group, composed of 32 % of the total sample, resulted within the 10% best performing months of the total two year. These results validate the theory of Hovland e Weiss (1951), recognizing the high reputation and recognition of the Michelin Guide, preventing this certification from being affected by the pooling equilibrium (Bergh et al., 2014). It is an indicator of effective immediate popularity impact caused by the award, involving more than half of the sample. Analysing TRENDS variation also provided additional information's on how customer's reaction differs through time and based on geographical location, as indicated in Table 5 and 6. The yearly variation remain stable when considering short term variation, both in mean and Positive amount of results, but become more volatile if the timeframe is extended to the whole year. Also, while North Central and South-East Europe shows very similar trends, South-West Europe differ from the previous two, with lower standard deviation and different mean to positive ratios, suggesting a potential geographical bias in popularity impacts.

While the statistical significance of time was confirmed by the regression results in Table 10 (yielding significant p-values across most periods), it was not possible to assess whether additional time invariant controls like geographic area were influenced by the certification. As the Hausman test rejected the Random Effects (RE) specification, the Fixed Effects (FE) was selected as the only consistent estimator, while omitting all time-invariant variables.

Overall, long term variation analysis present better results compared to short term, with higher mean value and amount of positive variations, but also higher standard deviation, more than double compared to short term variation. Compared to short term variation, a larger timeframe produced more oscillating results through time, with very different outcomes based on the analysed year. This allows me to consider the Dynamic uncertainty of Montiel, Christmann and Zink (2019) as potential cause. As markets change and evolve through time, the impact of a sustainable signal will also change in intensity and efficacy on the same target pool.

Opposed to Google Searches measured through Google Trends, the web ecosystem reacted by publishing more online content addressing the awardee restaurants, as observable in Table 7 and 8. Online content variation, measured as results detected by API run through Python, resulted consistent both when considering different geographical locations and year of award, with 2024 performing better than previous years for all variables. Analysing both Pre and Post award period it results that the growth of online content is constant through time, without focusing only on the award year. While the variation results identify a strong effect in correspondence of the certification award, the regression analysis represented in Table 11 shows no statistically significant relationship between variation in online content and Certification award or geographical area, rejecting **Hypotheses 2b**. The regression, accounting approximately for 13% of the overall variance, highlights the significance of Years, Size and Sector, in explaining the variation in API. These results suggest that sector-specific factors and size-dependent dynamics structurally affect hospitality businesses, and significance of the time

variables is likely attributable to the post-Covid rebound effect. In a plurality of instances, academic literature widely identifies this post-pandemic recovery as a dominant macroeconomic shock that systematically impacted every operational and financial dimension analysed in this research (García-Madurga, Esteban-Navarro and Morte-Nadal, 2021; Blanco-Moreno et al., 2025; Liew, 2022). Also, geographical effects are not statistically significant in this analysis, indicating limited geographical differences when popularity variation is accounted for. This finding aligns with Chiang and Guo's (2021) article, which explains that green Michelin star is a global benchmark, being recognized by most countries as a highly reliable and qualitative source of information, and therefore impactful across regions.

In analysing the variation of two variables together, initially separated due to their different timeframe measurement, Table 9 and Appendix 9 show a very similar behaviour through years for all variables but TRENDS Longvar. This reveals that 4 variables out of 5, when clustered by year of award, show similar intensity and direction of their variation, supporting the interpretation of a relationship between growth in Google TRENDS and online response measured through API.

While API regression's result doesn't match with Hypothesis 2, as Certification is not statistically significant in explaining the variation in online content, it also doesn't reject the hypothesis. While the certification proved to be significant in increasing consumer interest, as measured through Google Trends, this effect does not appear to translate into a statistically significant increase in content production. This finding suggests that consumer intent and content creation may follow different mechanisms and time horizons. Considering this explanation, the empirical evidence supports the existence of a popularity effect but does not provide sufficient evidence of a direct effect on the volume of online content.

7.1.2 Economic data considerations

Contrary to literature expectations, as Table 14 shows, the model identify a positive and marginally significant relationship between certification and Total production, rejecting **Hypothesis 6b**. A potential interpretation of this result could be attributable to the business development process associated with the adoption of sustainable practices. Biloslavo and Janković (2025) suggests that sustainable practices increase the amount of labour-intensive processes like on-site farming, waste management, preservation and food processing techniques. The introduction of these additional processes could explain the increase in value of Total Production, which do not necessarily translate in the additional profitability. This explanation also aligns with results of Tables 15 and 16, which finds no significant effect of the certification in explaining changes in Net Revenue and Staff, confirming **Hypotheses 6a and 6c**.

Additionally to this finding, strong significance was also found in Time, Size and Geographical area factors. These results suggest that, while cultural factors and size-dependent dynamics structurally affect hospitality businesses, the significance of the time variables is likely attributable to the post-Covid rebound effect, which positively influence most variables.

Considering the variable variation analysis, table 12 shows an interesting discrepancy between production, organic growth, and net revenue. While Staff and production results positive across all countries, with a slight worse performance in South-West Europe, the results for net revenue variation are less consistent. The worse performance of Net revenues variation is likely caused by the U-shaped relationship (Negruşa and Coroş, 2026), with initial revenues being diluted by the high implementation costs of sustainable practices (Citterio , 2025). One more hint that brings me to consider this relation to be the explanatory cause of this difference between net revenues and the other two variables is the Before and After impacts. While before impacts for

net revenue always show very strong improvements across all geographical areas, the after-effects prove to be significantly lower, signalling a decrease in revenue variation between award year and the following. This could be explained by the high maintenance costs required by the sustainable practices (Negruşa and Coroş, 2026). To confirm this relation, it would be interesting to conduct additional future research on these same restaurants to investigate if the initial low performance will increase with time, assuming the expected U shape. Staff and Production variation move more similarly, with closer standard deviations, means, and Positive amount of values through the data sample. This confirms that awardee restaurants tend to invest on human capital to manage the new processes, volumes of work and to surpass the initial resource deficit (like know-how) (Baloglu, Raab and Malek, 2020). After and Before variables reflects a trend similar to net revenues, with the after effect being less intense than the before, but with a still impactful mean variation.

As Daries, Moreno-Gené and Cristobal-Fransi 2021 predicts, overall economic variations are positive for all variables, both when considering overall variation or Before and After variations.

Both Table 13 and the relative graph at Appendix 9 highlights that, while staff and production variation impact businesses similarly based on the year of award, net variation appear to be moving independently. Figure 10 also provide a similar Before and After effect for production and staff variables, while net revenues show significantly larger values and greater standard deviation. The less consistent pattern, with data points scattering widely across the chart and oscillating unpredictably, is potentially explained by the wide variety of factors, like management skills and market conditions, that could heavily affect highly sensitive data like business revenues (Cantele and Cassia, 2020).

The post-Covid period, which was initially expected to heavily affect the first or second year of the timeframe, corresponding to Award year 2021 and 2022, shows no significant negative performance when comparing the initial periods with the following ones. This confirms García-Madurga, Esteban-Navarro and Morte-Nadal's (2021) theory, which states that businesses which adopt sustainable practices develop a stronger resilience to events like Covid-19, reducing their impact on the restaurant's performance. As the regression coefficients indicate, this macro-environmental effect likely influences the entire timeframe, exerting a significant impact on the overall results without selectively penalizing the periods immediately following the outbreak

7.1.3 Reputation data considerations

Regression analysis available in Table 22 and 23 reveal no significant relationship between sustainable certification and Reputation variables, rejecting **Hypothesis 1a and 1b**. In this analysis I also identified two anomalies which I consider interesting to mention. For Stars regression, while certification couldn't prove to be statistically significant, with p-value equal to 0.122, it still represented the most significant factor between all those utilised in the regression, including time, which previously always resulted a strongly significant factor. Also, for the comment regression, while Time and Geographical factors were confirmed once again as statistically significant, also Sustainable certification Award Year resulted to be significant for the very first time in the analysis. This can be considered a contradictory result to my research, because while the certification itself resulted to be non-significant, most of the certification award years resulted to be significant, creating confusion in the results interpretation.

While both these regression models do not allow me to consider Hypothesis 1 true, they highlight a potential research input for future research, as this study might have adopted a wrong approach in analysing Reputation, or failed to account for additional external factors.

Variation analysis results, available in Table 17, highlight the very small variation in mean rating in correspondence of the award. This could be explained by the already high level of dining experiences these businesses already had before obtaining the star. As Lane (2013) suggests, these restaurants already are considered tastemakers, the green Michelin star adds an additional ethical dimension that might not impact the numeric grading of food and experience, which is already at an extremely high value, which averages at 4,59 out of 5. While the relative mean variation is positive but low, data shows a consistent trend of results across geographical regions, with around 40-45% of the analysed businesses experiencing a positive variation in rating. These results are contradictory, in fact while the majority of restaurant experience a decrease in average rating, the total variation mean remain positive, signalling that the rating decreases are smaller in intensity compared to the Increases.

I conducted a second analysis to frame this contradiction, investigating if the paradox could be justified by the initial rating, where low ratings were strongly positively influenced, while already high rating were only slightly negatively affected, but results highlighted no meaningful relationship between initial rating and post-award variation. Further research could investigate if this analysis is being disturbed by external factors not yet accounted for, or if alternative online reputation scores and metrics could capture better the green Michelin star impact on reputation.

Sustainable words have increased in amounts after the award, with overall consistent intensity across geographical areas, with South-West Europe experiencing a smaller variation compared to the other two regions. While words count shows strong positive results, with mean variation

of 79.71% and Positive amount of variation of 70.83%, this increase wasn't enough to strongly include sustainable related vocabulary into the 100 most frequently mentioned words list. This could be explained by the same logic mentioned before which assumes customers consider sustainability as a side priority in the overall dining experience. Another explanation could be provided by the back of the house phenomenon, hiding most of the sustainable efforts where customers cannot see them and fully appreciate them (Charlebois et al., 2015). Juan Luis Nicolau et al. (2020) also discuss this phenomenon when applied to more generic UGC, where only between 1.55% and 1.76% of online review content explicitly discusses CSR elements. This first analysis on words count shows green Michelin star not capable of significantly increasing the visibility of CSR related terms in comments.

For the first time, the scatter plot represented at Figure 12 shows a stronger association between before and after words variation effect, with few outliers for South-West and North-central Europe, signalling an overall controlled and consistent phenomena. Also, when analysing Table 18 and its visual representation available at Appendix 9, Words and Star variation present very different variation intensity but follow an extremely similar trend in growth and degrowth through time, suggesting that green reputation variation is strongly associated with dining perceived quality variation.

Lastly, this research didn't manage to investigate one of the more discussed phenomena that should be affected by green reputation, WTP. Literature expects sustainability to increase the level of WTP (Nielsen Media Research, 2015), but as it wasn't a core objective of the study it wasn't specifically investigated, no conclusion was made from available data. Findings suggests that the increase in total production could confirm the literature's expectation, with customer accepting the price premium for a sustainable dining experience, even without mentioning significantly often in the reviews. While findings and literature could both be suggesting this conclusion, substantial data to statistically prove this relationship and establish

significant dynamics of its dynamics is still required to be able to address it with academic rigor. This research could be used as a beginning point for future research addressing this topic.

7.1.4 Data accuracy

Considering Baloglu, Raab and Malek (2020) expectations, and the findings available at Figure 4, the analysed sample involve a similar number of small companies as the literature also expects when addressing the Horecas sector, validating the comparison between Academic literature and the sampled data.

A potential disturbance factor that literature identifies when considering the efficacy of certification benefits is represented by the combination of industry sector, type of activity, location, consumer awareness, and firm's approach (Citterio, 2025). While firm's approach and consumer awareness are not accounted for in this research, as they are highly dynamic and dependent on market and restaurant specific factors, Industry sector and location are addressed in the research. As illustrated in Figure 3, which breaks down the sample by activity type, the dataset exhibits moderate heterogeneity. Results show that, even while most of the sample is composed by restaurants and Bars activity (which still might contain very different sizes and market positioning), a voluminous 30% of the sample is composed by activities whose primary activity is not focused on dining, whose findings might be dependent on a plurality of additional external factors. In extracting the data, I excluded all data that could not be directly attributed to dining operations. Nevertheless, a restaurant's affiliation with a larger corporate or business entity may still influence its financial performance, introducing statistical noise that could potentially weaken or obscure the identification of clear relationship.

An initial assessment of the different variables suggests that while Covid-19 may have critically affected the first award year (2021), its impact was asymmetrical across data categories.

Specifically, only reputation metrics and the Python API data show a significantly lower mean variation during the first year, while Google Trends and financial performance metrics remain resilient. This could be explained by the Covid-19 influence, because as García-Madurga, Esteban-Navarro and Morte-Nadal (2021) explain, sustainable businesses are more cost resilient than normal businesses. Another possible explanation is that the first year of green Michelin star adoption happened in 2021, so metrics directly related to customer perception, like popularity and reputation, might have been impacted less by its adoption due to its new implementation.

7.2 Q2: Cross dimensional data analysis

The cross-area regression analysis, represented in Tables 22, 23 and 24, investigated the significance of Reputation and Popularity, in explaining variations in Economic performance variables.

The only significant relationship was identified in API as a predictor of Production variation, with a positive coefficient of 113.13 and p-value equal to 0.024, successfully linking online content to Total production, therefore confirming **Hypothesis 3**. This confirms the expectations from literature by successfully connecting the green Michelin star, effectively seen as a global level gastronomy indicator (Lane, 2013), to its direct impact on the increase in production level, as awardee restaurants have high chances of being often fully booked (Chiang and Guo, 2021). By contrast, Reputation variables didn't result significant in explaining changes in Total production levels, rejecting **Hypothesis 4a and 4b**, while also highlighting the significance of Time and Size control variables.

Revenue showed no significant relationship with Reputation and Popularity variables rejecting **Hypotheses 5, 7a and 7b**, this could potentially be attributed to the U-Shaped Relationship

(Negruşa and Coroş, 2026) as the initial investment and maintenance costs could dilute increases in revenue generated by popularity. This interpretation is supported by the lack of pluriannual data that could prove different long-term effects. Lastly, while Size appears to be also critical, with larger businesses absorbing better the initial costs, a final consideration is suggested by Citterio (2025), with managerial structure and skills being fundamental to translate sustainability into positive revenue.

Staff as well showed no significant relationship with Reputation or Popularity variables, ultimately rejecting also **Hypotheses 8a, 8b and 9**. Like for all previous variables, also for staff time represented a significant factor, capable of explaining an organic increase through time. Size also results relevant, but with negative coefficient, highlighting that the resource deficit of SMEs represents an operational barrier to the that absorbs the expansion of human capital, even when the prestige of a certification might suggest a need for growth (Testa et al., 2019; Baloglu et al., 2020).

7.3 Summary of Hypotheses and results

The summary of hypotheses updated with the research results is reported in Table 25.

Table 25. Summary of Hypotheses and Results

NO.	Hypothesis	<i>Supported</i>
H1a	Green Michelin star certification positively influences perceived quality.	No
H1b	Green Michelin star certification positively influences perceived sustainability.	No
H2a	Green Michelin star certification positively influences customer attention.	Yes
H2b	Green Michelin star certification positively influences online content.	No
H3	Online content positively influences levels of Total Production.	Yes
H4a	Perceived quality positively influences level of Total Production	No

H4b	Perceived sustainability positively influences level of Total Production.	No
H5	Online content positively influences Net Revenue.	No
H6a	Green Michelin star certification is not significant in explaining changes in Net revenue.	Yes
H6b	Green Michelin star certification is not significant in explaining changes in Total Production.	No
H6c	Green Michelin star certification is not significant in explaining changes in Staff.	Yes
H7a	Perceived quality positively influences Net Revenue.	No
H7b	Perceived sustainability positively influences Net Revenue.	No
H8a	Perceived quality positively influences amount of Staff.	No
H8b	Perceived sustainability positively influences amount of Staff.	No
H9	Online content positively influences amount of Staff.	No

Source: Author

8 Conclusions

8.1 Summary

While not all hypotheses proved to be true, it was possible to identify the significance of three relationships, confirming only partially the validity initial framework. Findings also allowed me to identify additional significant factors capable of explaining variation of the variables through time, which the research didn't initially include as core variable. The framework created through the academic review was fundamental to analyse the certification impacts singularly, breaking down to direct analysis a phenomenon that literature often interpret systematically. While the framework builds a first logical interpretation on how green Michelin star affects Economic performance, and how Economic performance is affected by Popularity and Reputation, it still fails to successfully prove being fully aligned with current empirical

findings. Figure 13 represents the research framework updated with the results of the regression analysis.

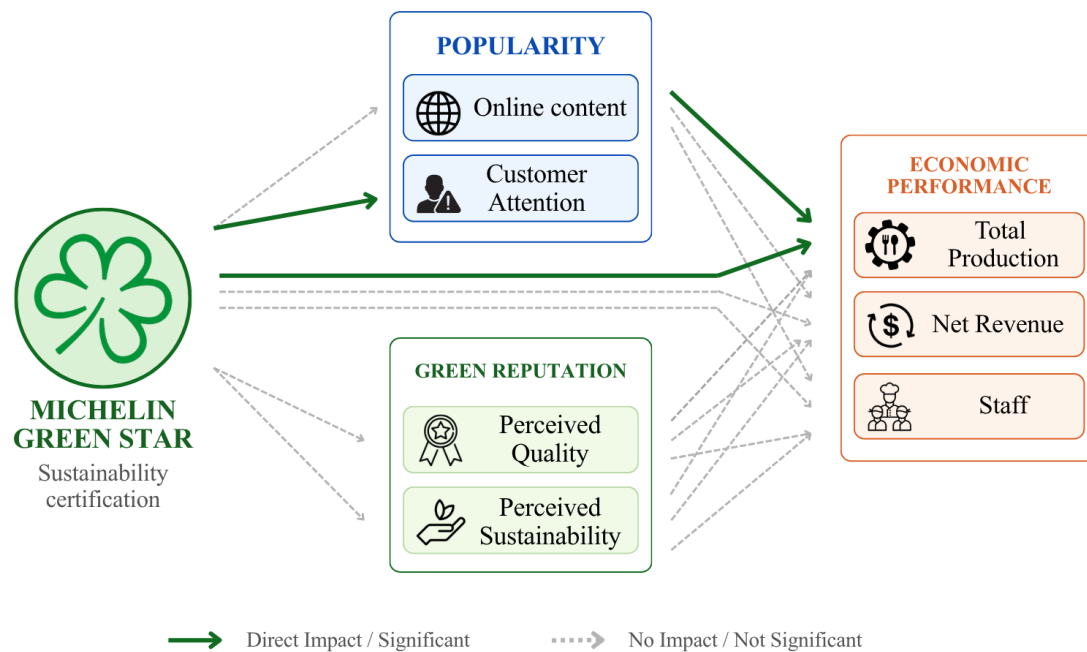


Figure 13. Significant impacts framework

Online attention (Popularity) positively proved to be directly affected by green Michelin star, and online content (Popularity) proved to directly affect Total Production (Economic performance), with also Total production being significantly affected by the certification award. Green reputation achieved the opposite result, failing to reach the statistical significance in the relationship with the award, and in explaining economic performance variations. The research also discusses literature-based interpretations for this negative outcome, as the analysed restaurants are already regarded as very high-quality dining experiences, with very high ratings even before the award (Pascual and Donaire Benito, 2025). As also the words count in comment highlighted, sustainability is still perceived as a secondary priority in the overall dining experiences, and this inevitability affects the factors considered by customer when rating the experience (Ramón Barrera-Barrera, 2023). Combined, these factors tend to combine multiple

“hidden” drivers within aggregate metrics like customer ratings (Cantele and Cassia, 2020). While isolating the specific impact of the certification requires these overlapping elements to be fully broken down, such a granular analysis was unsuccessful and could not be fully executed within the scope of this research. While it is true that online content does act as a predictor of total production, identifying a significant connection between Popularity and Economic Performance, it is also important to specify that not all analysed variables from the two macro-area are equally associated. In fact, out of the two popularity variables, only the API data was adopted in this regression analysis, as Google Trends operated on a different temporal framework characterized by monthly rather than yearly measurements. Due to this discrepancy in data granularity, and considering the short-term nature of customer attention, integrating monthly Google Trends data into a model with annual economic performance variables proved methodologically inappropriate. At the same time, out of the three economic performance variables analysed, only production resulted associated with API.

Literature provides a possible interpretation on these results which aligns with the findings, identifying size, implementation and maintenance costs, and managerial skills, as critical factors, capable of highly impacting the performance of each restaurant singularly, reducing the significance of certification. The reason production deviates from this logic is not yet addressed by the current literature. Based on the findings, a potential explanation could be represented by the different main driver for the three variables. In fact, while API and Production variation are mainly customer-driven, staff and revenues are heavily affected by sector-specific and restaurant-specific factors. Following this interpretation, the certification's impact remains significant through cross-variable interactions only when the analysis relies on customer-driven metrics. These also resulted, through the analysis, to be more stable and capable of reflecting the clear impacts of sustainable certifications. On the contrary, business-driven variables

resulted highly susceptible to internal and external confounding factors, which introduces operational noise that can obscure the observable effects of the certification.

External control variables such as firm size, geographic location, and industry sector emerged as highly significant during the analysis. However, time effects clearly dominated, serving as the most frequent and consistent predictor of upward variations across the dependent variables. The suggested explanation for this strong influence is attributed to the post-Covid rebound effect (Bakirtas and Gulpinar Demirci, 2022).

8.2 Theoretical contributions

The research offers a new framework to evaluate the impacts of sustainable certifications within the Horeca sector. As this might be also applicable to other sectors, considerations on the variation and sector-specific factors will be fundamental to be addressed. The findings also suggest the adoption of customer-driven variables might be more sensitive to sustainable practices adoption like a certification, being able to better identify and analyse their impact. When analysing SMEs within this specific sector, firm-level variables resulted to have little or no statistically significant relationships. This potentially signals that traditional financial metrics may fail to provide meaningful insights into marginal operational impacts (Citterio, 2025), such as those generated by a sustainability certification, which are often absorbed within broader corporate dynamics.

The research validates the adoption of the signalling theory to explain sustainable certifications adoption, as a trust provider signal that turns an unverifiable into a credence attribute, capable of being perceived and appreciated by customers (Kauppi, Hannibal and Bryde-Evens, 2025). The research also offers empirical evidence on the effect of the inverted U-shaped relationship on SMEs businesses in the Horeca sector (Negruşa and Coroş, 2026).

A last theoretical contribution can be provided by this research as it is an attempt to conduct a behaviour analysis instead of intention research (Blanco-Moreno et al., 2025). While this research obtained a heterogeneous set of results and adopted diverse data collection and analysis methodology, in the selection of variables and in their analysis, it was possible to measure not only the interest of customers, but also to check their sequent actions. A clear example can be provided by the popularity increase, elaborated as increase of online research of the brand name (intention), translating into an increased production, caused by the increase in diners (behaviour).

8.3 Practical implications

As for practical implications, this research allows Managers and Chefs, that are considering adopting a sustainable certification, to have an overview of the short-term effects they can expect to experience in a similar socio-economic environment. By combining a robust theoretical background with empirical evidence from both data and relationship analyses, this study serves a dual purpose. It can be used not only as a reference framework to anticipate the impacts of certification, but also as a strategic guide for identifying efficient practices to mitigate potential challenges during the adoption and maintenance of sustainability practices.

An additional practical implication originates from the application of the signalling theory to this empirical study. In fact, being able to recognize the properties of the sustainable certification increase awareness about the narrative procedure required for efficiently communicating the sustainable efforts to customers, for them to be understood and appreciated by customers. While strongly recognized certifications like green Michelin star might not need additional advertisement for customer to be able to appreciate the, fully (Lane, 2013), less known sustainable certifications will likely require the managers to actively implement

communication strategies to convert the initial credence attribute into an effective signal (Kauppi, Hannibal and Bryde-Evens, 2025).

Lastly, a warn for readers which consider basing future strategic decision based on these results is necessary. Readers considering the adoption of a sustainable strategy should not merely expect the mean results reported in this research to be replicable in all contexts. Instead, they must account for all the contextual factors identified as relevant, such as size, geographic location, sector, and time. Most of the estimated regression models present an R-squared below 25%, indicating a relatively low explanatory power of the regression models, this suggests that most of the variation is driven by unobserved, sector-specific factors which this research didn't fully address. As highlighted in the previous section, the temporal dimension is critical in this study because of the post-Covid rebound effect. This macroeconomic phenomenon likely influenced positively all metrics, as also regression models highlight. Interpreting these findings as entirely unbiased and without considering the influence of this effect when predicting future impacts of the award would be misleading, as readers might expect identical outcomes to repeat in standard economic conditions.

8.4 Limitations and future research directions

The first limitation encountered in the study regard the size and the timeframe analysed. In analysing sustainability strategies and practices, effects like the inverted U-shaped relationship often requires longer periods before reaching a break-even. Another time requiring process is the know-how development necessary to efficiently integrate additional practices, and their costs, in the business model (Negruşa and Coroş, 2026). At the same time, an analysis including multiple areas and utilising statistical analysis would benefit a larger sample size to provide even more precise and consistent data. While this research gathered enough restaurants to

provide an initial empirical overview on the green Michelin star adoption in the Horeca sector, it can only provide a short-time span of analysis, as the certification has been adopted since only 2020. Future studies could expand this analysis to a larger sample with a set of variables collected on a larger timeframe. Additional future research could also execute an ex-post analysis on the same restaurants identified by this research, collecting new data and comparing it with this one.

A third suggestion to continue this study could also involve integrating two additional groups of restaurants to the sample, one awarded with a traditional Michelin star, and one without any award. By doing so it could be possible to analyse whether the results identified by this study are attributed to the green Michelin star or by the overall reputation of the Michelin Guide, as well as identifying how the three categories differ from one another in being impacted by time events, testing literature's claims, as it is supported that that businesses that adopt sustainable practices tend to be long-term resilient (Corte et al., 2025).

One last invite to future research regards the difference identified between customer-based and business-based variables, in relation to how they are impacted by sustainable certifications. In this research it resulted that all statistically relevant connections concerned customer-based variables, while business-base variables couldn't provide clear significance as probably too affected variables resulted highly susceptible to internal and external confounding factors to observe the certification's effect. It could be possible for future research to test the consistency of this theory, by either confirming it or rejecting it, proving that it might just have been a coincidence.

References

Apify. *Web Scraping, Data Extraction and Automation · Apify*. [online] Apify. Available at: <https://apify.com/>.

Arora, V.S., McKee, M. and Stuckler, D. (2019). Google Trends: Opportunities and limitations in health and health policy research. *Health Policy*, 123(3), pp.338–341. doi:<https://doi.org/10.1016/j.healthpol.2019.01.001>.

Bakirtas, H. and Gulpinar Demirci, V. (2022). Can Google Trends data provide information on consumer's perception regarding hotel brands? *Information Technology & Tourism*, 24(1), pp.57–83. doi:<https://doi.org/10.1007/s40558-022-00220-1>.

Baldwin, C., Wilberforce, N. and Kapur, A. (2010). Restaurant and food service life cycle assessment and development of a sustainability standard. *The International Journal of Life Cycle Assessment*, [online] 16(1), pp.40–49. doi:<https://doi.org/10.1007/s11367-010-0234-x>.

Baloglu, S., Raab, C. and Malek, K. (2020). Organizational Motivations for Green Practices in Casual Restaurants. *International Journal of Hospitality & Tourism Administration*, 23(2), pp.1–20. doi:<https://doi.org/10.1080/15256480.2020.1746216>.

Bang, D., Choi, K. and Kim, A.J. (2022). Does Michelin effect exist? An empirical study on the effects of Michelin stars. *International Journal of Contemporary Hospitality Management*, 34(6). doi:<https://doi.org/10.1108/ijchm-08-2021-1025>.

Berezan, O. (2010). Reducing the restaurant sector's energy and water use. *FIU Hospitality Review*. [online] Available at: https://www.academia.edu/12105878/Reducing_the_restaurant_sector_s_energy_and_water_use.

Bergh, D.D., Connelly, B.L., Ketchen, D.J. and Shannon, L.M. (2014). Signalling Theory and Equilibrium in Strategic Management Research: An Assessment and a Research Agenda. *Journal of Management Studies*, 51(8), pp.1334–1360. doi:<https://doi.org/10.1111/joms.12097>.

Bigerna, S., Micheli, S. and Polinori, P. (2025). Effects of voluntary certifications on sustainable development goals. *Journal of Environmental Management*, [online] 391, p.126370. doi:<https://doi.org/10.1016/j.jenvman.2025.126370>.

Biloslavo, R. and Nikolina Janković (2025). Sustainable Practices in Hospitality: A Case Study of a Slovenian Michelin Green Star Restaurant. *Sustainability*, [online] 17(10), pp.4271–4271. doi:<https://doi.org/10.3390/su17104271>.

Blanco, E., Rey-Maqueieira, J., & Lozano, J. (2009). Economic incentives for tourism firms to undertake voluntary environmental management. *Tourism Management*, 30(1), 112–122. <https://doi.org/10.1016/j.tourman.2008.04.007>

Blanco-Moreno, S., Aydemir-Dev, M., Santos, C.R. and Bayram-Arlı, N. (2025). Emerging sustainability themes in the hospitality sector: A bibliometric analysis. *European Research on Management and Business Economics*, [online] 31(1), p.100272. doi:<https://doi.org/10.1016/j.iedeen.2025.100272>.

Boiral, O. (2011). Managing with ISO Systems: Lessons from Practice. *Long Range Planning*, [online] 44(3), pp.197–220. doi:<https://doi.org/10.1016/j.lrp.2010.12.003>.

Bonfanti, A., Bagnato, G. and Vigolo, V. (2025). The contribution of sustainable practices to the creation of memorable customer experience: Empirical evidence from Michelin Green Star restaurants. *International Journal of Hospitality Management*, [online] 126, p.104110. doi:<https://doi.org/10.1016/j.ijhm.2025.104110>.

Cantele, S. and Cassia, F. (2020). Sustainability implementation in restaurants: A comprehensive model of drivers, barriers, and competitiveness-mediated effects on firm performance. *International Journal of Hospitality Management*, 87, p.102510. doi:<https://doi.org/10.1016/j.ijhm.2020.102510>.

Charlebois, S., Creedy, Amy and Massow, M. von (2015). Back-of-house study on Food Waste in Fine Dining: The case of Delish Restaurants. *International Journal of Culture Tourism and Hospitality Research*, [online] 9(3), pp.278–291. Available at: https://www.researchgate.net/publication/280712980_Back-of-house_study_on_Food_Waste_in_Fine_Dining_The_case_of_Delish_Restaurants.

Chen, Y.-S., Lai, S.-B. and Wen, C.-T. (2006). The Influence of Green Innovation Performance on Corporate Advantage in Taiwan. *Journal of Business Ethics*, 67(4), pp.331–339. doi:<https://doi.org/10.1007/s10551-006-9025-5>.

- Chiang, C.-F. and Guo, H.-W. (2021). Consumer perceptions of the Michelin Guide and attitudes toward Michelin-starred restaurants. *International Journal of Hospitality Management*, 93, p.102793. doi:<https://doi.org/10.1016/j.ijhm.2020.102793>.
- Citterio, A. (2025). Do Environmental Certifications Pay? A Bibliometric and Systematic Review of Environmental Management Systems and Eco-Label Impacts. *Business Strategy and the Environment*. doi:<https://doi.org/10.1002/bse.70392>.
- Corte, V.D., Amin, M., Sepe, F., Luongo, S. and Cihan Cobanoglu (2025). Exploring the impact of environmental management on sustainable concerns in restaurants. [online] (7). doi:<https://doi.org/10.1108/BFJ-04-2024-0327>.
- Darby, M.R. and Karni, E. (1973). Free Competition and the Optimal Amount of Fraud. *The Journal of Law & Economics*, [online] 16(1), pp.67–88. doi:<https://doi.org/10.2307/724826>.
- Daries, N., Moreno-Gené, J. and Cristobal-Fransi, E. (2021). Michelin stars shine brightly, but are they profitable? *International Journal of Gastronomy and Food Science*, 24, p.100352. doi:<https://doi.org/10.1016/j.ijgfs.2021.100352>.
- Daries, N., Cristobal-Fransi, E., Ferrer-Rosell, B. and Marine-Roig, E. (2018). Maturity and development of high-quality restaurant websites: A comparison of Michelin-starred restaurants in France, Italy and Spain. *International Journal of Hospitality Management*, [online] 73, pp.125–137. doi:<https://doi.org/10.1016/j.ijhm.2018.02.007>.
- de Freitas Netto, S.V., Sobral, M.F.F., Ribeiro, A.R.B. and Soares, G.R. da L. (2020). Concepts and forms of greenwashing: A systematic review. *Environmental Sciences Europe*, 32(1), pp.1–12. doi:<https://doi.org/10.1186/s12302-020-0300-3>.
- Delmas, M.A. and Burbano, V.C. (2011). The Drivers of Greenwashing. *California Management Review*, 54(1), pp.64–87. doi:<https://doi.org/10.1525/cmr.2011.54.1.64>.
- Dewald, B., Bruin, B.J. and Jang, Y.J. (2013). US consumer attitudes towards ‘green’ restaurants. *Anatolia*, 25(2), pp.171–180. doi:<https://doi.org/10.1080/13032917.2013.839457>.
- Dinis, G., Breda, Z., Costa, C. and Pacheco, O. (2019). Google Trends in tourism and hospitality research: a systematic literature review. *Journal of Hospitality and Tourism Technology*, ahead-of-print(ahead-of-print). doi:<https://doi.org/10.1108/jhtt-08-2018-0086>.
- Filimonau, V., Algboory, H., Mohammed, N.K., Kadum, H., Qasem, J.M. and Muhialdin, B.J. (2023), “Food waste and its management in the foodservice sector of a developing economy:

an exploratory and preliminary study of a sample of restaurants in Iraq”, *Tourism Management Perspectives*, Vol. 45, 101048, doi: 10.1016/j.tmp.2022.101048.

Filimonau, V., Lemmer, C., Marshall, D. and Bejjani, G. (2017). Restaurant menu re-design as a facilitator of more responsible consumer choice: An exploratory and preliminary study. *Journal of Hospitality and Tourism Management*, 33, pp.73–81. doi:<https://doi.org/10.1016/j.jhtm.2017.09.005>.

García-Madurga, M.-Á., Esteban-Navarro, M.-Á. and Morte-Nadal, T. (2021). CoVid Key Figures and New Challenges in the HoReCa Sector: The Way towards a New Supply-Chain. *Sustainability*, 13(12), p.6884. doi:<https://doi.org/10.3390/su13126884>.

Grewal, R. and Dharwadkar, R. (2002). The Role of the Institutional Environment in Marketing Channels. *Journal of Marketing*, 66(3), pp.82–97. doi:<https://doi.org/10.1509/jmkg.66.3.82.18504>.

Hambrick, D.C. and Mason, P.A. (1984). Upper Echelons: The Organization as a Reflection of Its Top Managers. *The Academy of Management Review*, 9(2), pp.193–206. doi:<https://doi.org/10.2307/258434>.

Hamilton, S.F. and Zilberman, D. (2006). Green markets, eco-certification, and equilibrium fraud. *Journal of Environmental Economics and Management*, 52(3), pp.627–644. doi:<https://doi.org/10.1016/j.jeem.2006.05.002>.

Hannibal, C. and Kauppi, K. (2019). Third party social sustainability assessment: Is it a multi-tier supply chain solution? *International Journal of Production Economics*, 217, pp.78–87. doi:<https://doi.org/10.1016/j.ijpe.2018.08.030>.

Heras-Saizarbitoria, I., Molina-Azorín, J.F. and Dick, G.P.M. (2011). ISO 14001 certification and financial performance: selection-effect versus treatment-effect. *Journal of Cleaner Production*, 19(1), pp.1–12. doi:<https://doi.org/10.1016/j.jclepro.2010.09.002>.

Hovland, C. and Weiss, W. (1951). The Influence of Source Credibility on Communication Effectiveness. *Source*, [online] 15(4), pp.635–650. Available at: <https://fbaum.unc.edu/teaching/articles/HovlandWeiss-POQ-1951.pdf>.

Hsieh, Y. J. (2012). Hotel companies’ environmental policies and practices: A content analysis of their web pages. *International Journal of Contemporary Hospitality Management*, 24(1), 97–121. <https://doi.org/10.1108/095961112>

Huang, Y., C. Michael Hall and Ning Chris Chen (2023). The sustainability characteristics of Michelin Green Star Restaurants. *Journal of Foodservice Business Research*, 28(2), pp.1–26. doi:<https://doi.org/10.1080/15378020.2023.2235258>.

Jacobs, B.W., Singhal, V.R. and Subramanian, R. (2010). An empirical investigation of environmental performance and the market value of the firm. *Journal of Operations Management*, 28(5), pp.430–441. doi:<https://doi.org/10.1016/j.jom.2010.01.001>.

Jang, Y.J., Zheng, T. and Bosselman, R. (2017). Top managers' environmental values, leadership, and stakeholder engagement in promoting environmental sustainability in the restaurant industry. *International Journal of Hospitality Management*, [online] 63(101-111), pp.101–111. doi:<https://doi.org/10.1016/j.ijhm.2017.03.005>.

Johnson, C., Surlemont, B., Nicod, P. and Revaz, F. (2005). Behind the Stars. *Cornell Hotel and Restaurant Administration Quarterly*, 46(2), pp.170–187. doi:<https://doi.org/10.1177/0010880405275115>.

Juan Luis Nicolau, Mireia Guix, Hernandez-Maskivker, G. and Molenkamp, N. (2020). *Millennials' willingness to pay for green restaurants*. [online] ResearchGate. Available at: https://www.researchgate.net/publication/342696695_Millennials.

Kauppi, K., Hannibal, C. and Bryde-Evens, M. (2025). 'The certificate doesn't taste like anything': Perspectives of sustainability signaling in global supply chains. *European Management Journal*. doi:<https://doi.org/10.1016/j.emj.2025.11.003>.

Kim, D.-Y. and Park, S. (2019). Rethinking millennials: how are they shaping the tourism industry? *Asia Pacific Journal of Tourism Research*, 25(1), pp.1–2. doi:<https://doi.org/10.1080/10941665.2019.1667607>.

Kirmani, A. and Rao, A.R. (2000). No Pain, No Gain: A Critical Review of the Literature on Signaling Unobservable Product Quality. *Journal of Marketing*, 64(2), pp.66–79. doi:<https://doi.org/10.1509/jmkg.64.2.66.18000>.

Klewitz, J. and Hansen, E.G. (2011). Sustainability-Oriented Innovation in SMEs: A Systematic Literature Review of Existing Practices and Actors Involved. *Proceedings of the XXII ISPIM Conference*. [online] Available at: https://www.researchgate.net/publication/228320231_Sustainability-Oriented_Innovation_in_SMEs_A_Systematic_Literature_Review_of_Existing_Practices_and_Actors_Involved.

Koronaki, E., Vlachvei, A. and Panopoulos, A. (2023). Managing the online customer experience and subsequent consumer responses across the customer journey: A Review and Future Research Agenda. *Electronic Commerce Research and Applications*, 58, p.101242. doi:<https://doi.org/10.1016/j.elerap.2023.101242>.

Kwok, L., Huang, Y.-K. and Hu, L. (2016). Green attributes of restaurants: What really matters to consumers? *International Journal of Hospitality Management*, 55, pp.107–117. doi:<https://doi.org/10.1016/j.ijhm.2016.03.002>.

Lane, C. (2013). Taste makers in the ‘fine-dining’ restaurant industry: The attribution of aesthetic and economic value by gastronomic guides. *Poetics*, 41(4), pp.342–365. doi:<https://doi.org/10.1016/j.poetic.2013.05.003>.

Liew, V. K. S (2022). The effect of novel coronavirus pandemic on tourism share prices. *Journal of Tourism Futures*, 8(1), 109–124. <https://doi.org/10.1108/JTF-03-2020-0045>

Line, N.D., Hanks, L. and Zhang, L. (2016). Sustainability communication: The effect of message construals on consumers’ attitudes towards green restaurants. *International Journal of Hospitality Management*, 57, pp.143–151. doi:<https://doi.org/10.1016/j.ijhm.2016.07.001>.

Llach, J., Perramon, J., Alonso-Almeida, M. del M. and Bagur-Femenías, L. (2013). Joint impact of quality and environmental practices on firm performance in small service businesses: an empirical study of restaurants. *Journal of Cleaner Production*, [online] 44, pp.96–104. doi:<https://doi.org/10.1016/j.jclepro.2012.10.046>.

Madanaguli, A., Dhir, A., Kaur, P., Srivastava, S. and Singh, G. (2022). Environmental sustainability in restaurants. A systematic review and future research agenda on restaurant adoption of green practices. *Scandinavian Journal of Hospitality and Tourism*, [online] 22(4-5), pp.1–28. doi:<https://doi.org/10.1080/15022250.2022.2134203>.

Mahasuweerachai, P., & Suttikun, C. (2022). The effect of green self-identity on perceived image, warm glow and willingness to purchase: A new generation’s perspective towards eco-friendly restaurants. *Sustainability*, 14(17). <https://doi.org/10.3390/su141710539> (Switzerland).

Mathayomchan, B. and Taecharungroj, V. (2020). ‘How was your meal?’ Examining customer experience using Google maps reviews. *International Journal of Hospitality Management*, 90, p.102641.

Md. Delwar Hossien (2023). *Developing green management standards for restaurants: An application of green supply chain management*. [online] Available at: https://www.researchgate.net/publication/373770468_Developing_green_management_standards_for_restaurants_An_application_of_green_supply_chain_management.

MICHELIN Guide. *Sustainable Gastronomy - The MICHELIN Guide*. [online] Available at: <https://guide.michelin.com/en/articles/sustainable-gastronomy>.

Montiel, I., Christmann, P. and Zink, T. (2019). The Effect of Sustainability Standard Uncertainty on Certification Decisions of Firms in Emerging Economies. *Journal of Business Ethics*, [online] 154(3), pp.667–681. doi:<https://doi.org/10.2307/45022898>.

Moody's. *Orbis*. [online] www.moody.com. Available at: <https://www.moody.com/web/en/us/capabilities/company-reference-data/orbis.html>.

Negrușă, A.L. and Coroș, M.M. (eds.) (2026) Innovation, Sustainability, and Growth in a VUCA Environment: Proceedings of the 5th International Conference on Modern Trends in Business, Hospitality and Tourism (ICMTBHT), Cluj-Napoca, Romania, May 22-24, 2025. Cham: *Springer Nature*. doi: 10.1007/978-3-032-11639-0.

Nielsen Media Research (2015) <https://www.nielsen.com/us/en/insights/reports/2015/the-sustainability-imperative.html>.

Oh, H., Fiore, A.M. and Jeoung, M. (2007). Measuring Experience Economy Concepts: Tourism Applications. *Journal of Travel Research*, [online] 46(2), pp.119–132. doi:<https://doi.org/10.1177/0047287507304039>.

Ohanian, R. (1990). Construction and Validation of a Scale to Measure Celebrity Endorsers' Perceived Expertise, Trustworthiness, and Attractiveness. *Journal of Advertising*, [online] 19(3), pp.39–52. doi:<https://doi.org/10.1080/00913367.1990.10673191>.

Olivieri, M., Testa, G. and Giraldi, L. (2025). Communication Strategies in Hospitality: A Study on Michelin Green Star Sustainable Restaurants. *Business Strategy and the Environment*.

Paciarotti, C., Mazzuto, G., Torregiani, F., & Fikar, C. (2022). Locally produced food for restaurants: A theoretical approach for the supply chain network design. *International Journal of Retail and Distribution Management*, 50(13), 164–183. <https://doi.org/10.1108/IJRDM-10-2021-0477>

- Pascual, M. and Donaire Benito, J.A. (2025). Green revolution: A systematic review of sustainable practices in restaurants. *Applied Food Research*, [online] 5(2), p.101331. doi:<https://doi.org/10.1016/j.afres.2025.101331>.
- Raab, C., Baloglu, S. and Chen, Y.-S. (2017). Restaurant Managers' Adoption of Sustainable Practices: An Application of Institutional Theory and Theory of Planned Behavior. *Journal of Foodservice Business Research*, 21(2), pp.154–171. doi:<https://doi.org/10.1080/15378020.2017.1364591>.
- Ramón Barrera-Barrera (2023). Identifying the attributes of consumer experience in Michelin-starred restaurants: a text-mining analysis of online customer reviews. *British Food Journal*, 125(13), pp.579–598. doi:<https://doi.org/10.1108/bfj-05-2023-0408>.
- Riva, F., Magrizos, S., Rubel, M.R.B. and Rizomyliotis, I. (2022). Green consumerism, green perceived value, and restaurant revisit intention: Millennials' sustainable consumption with moderating effect of green perceived quality. *Business Strategy and the Environment*, [online] 31(7). doi:<https://doi.org/10.1002/bse.3048>.
- Roy, S.K., Singh, G., Sadeque, S., Harrigan, P. and Coussement, K. (2023). Customer engagement with digitalized interactive platforms in retailing. *Journal of Business Research*, [online] 164(1), p.114001. doi:<https://doi.org/10.1016/j.jbusres.2023.114001>.
- Ruhnau, B. (2000). Eigenvector-centrality — a node-centrality? *Social Networks*, 22(4), pp.357–365. doi:[https://doi.org/10.1016/s0378-8733\(00\)00031-9](https://doi.org/10.1016/s0378-8733(00)00031-9).
- Sadiq, M., Adil, M., & Paul, J. (2022). Eco-friendly hotel stay and environmental attitude: A value-attitude-behaviour perspective. *International Journal of Hospitality Management*, 100, Article 103094. <https://doi.org/10.1016/j.ijhm.2021.103094>
- Sebnem Kalemli-Ozcan, Sørensen, B.E., Villegas-Sanchez, C., Vadym Volosovych and Sevcan Yesiltas (2015). How to Construct Nationally Representative Firm Level Data from the Orbis Global Database: New Facts and Aggregate Implications. *Social Science Research Network*. doi:<https://doi.org/10.3386/w21558>.
- SerpApi. *Google Search API*. [online] Available at: <https://serpapi.com/>.
- Spence, L.J. (1999). Does size matter? The state of the art in small business ethics. *Business Ethics: A European Review*, 8(3), pp.163–174. doi:<https://doi.org/10.1111/1467-8608.00144>.

- Spence, M. (1973). Job Market Signaling. *The Quarterly Journal of Economics*, 87(3), pp.355–374. doi:<https://doi.org/10.2307/1882010>
- Tan, B.C., Lau, T.C., Yong, G.F., Khan, N. and Nguyen, T.P.L. (2018). A qualitative study of green practices adoption for restaurants in Malaysia. *Social Responsibility Journal*, [online] 15(8), pp.1087–1099. Available at: <https://ideas.repec.org/a/eme/srjpps/srj-07-2017-0119.html>.
- Testa, F., Todaro, N., Gusmerotti, N.M. and Frey, M. (2019). Embedding corporate sustainability: An empirical analysis of the antecedents of organization citizenship behavior. *Corporate Social Responsibility and Environmental Management*, 27(3), pp.1198–1212. doi:<https://doi.org/10.1002/csr.1875>.
- Tölkes, C. (2018). Sustainability communication in tourism – A literature review. *Tourism Management Perspectives*, 27, pp.10–21. doi:<https://doi.org/10.1016/j.tmp.2018.04.002>.
- Uyar, A. (2009). Investigation of the accuracy of search engine hit counts. *Journal of Information Science*, 35(4), pp.469–480. doi:<https://doi.org/10.1177/0165551509103598>.
- United Nations (2025). *Document Viewer*. [online] Un.org. Available at: <https://docs.un.org/en/A/RES/70/1>.
- Villarino, J. and Font, X. (2015). Sustainability Marketing Myopia: the Lack of Persuasiveness in Sustainability Communication. *Journal of Vacation Marketing*, 21(4), pp.326–335. doi:<https://doi.org/10.1177/1356766715589428>.
- Wang, Y.-F., Chen, S.-P., Lee, Y.-C. and Tsai, C.-T. (Simon) (2013). Developing green management standards for restaurants: An application of green supply chain management. *International Journal of Hospitality Management*, [online] 34, pp.263–273. doi:<https://doi.org/10.1016/j.ijhm.2013.04.001>.
- Ye, Q., Li, H., Wang, Z., Law, R., 2014. The influence of hotel price on perceived service quality and value in e-tourism: an empirical investigation based on online traveler reviews. *J. Hosp. Tour. Res.* 38 (1), 23–39.
- Zhang, Z., Ye, Q., Law, R., Li, Y., 2010. The impact of e-word-of-mouth on the online popularity of restaurants: A comparison of consumer reviews and editor reviews. *Int. J. Hosp. Manag.* 29 (4), 694–700.

Zheng Xiang, Wöber, K. and Fesenmaier, D.R. (2008). Representation of the Online Tourism Domain in Search Engines. *Journal of Travel Research*, 47(2), pp.137–150.
doi:<https://doi.org/10.1177/00472875083211>

Appendices

Appendix 1. Michelin Guide award ceremony schedule

Country	Michelin Guide Year (a)	Ceremony Month and Year
Italy	2024	November a-1
Italy	2023	November a-1
Italy	2022	November a-1
Italy	2021	November a-1
North Europe	2024	June a
North Europe	2023	June a
North Europe	2022	July a
North Europe	2021	September a
Spain	2024	November a-1
Spain	2023	November a-1
Spain	2022	December a-1
Spain	2021	December a-1
Slovenia	2024	June a
Slovenia	2023	September a
Slovenia	2022	September a
Slovenia	2021	September a
Croatia	2023	June a
Croatia	2021	September a
Hungary	2022	November a
Belgium	2023	March a
Belgium	2021	January a
Estonia	2024	May a
Estonia	2022	May a
Latvia	2024	November a-1
Portugal	2024	February a
Portugal	2023	November a-1
Portugal	2022	December a-1

Appendix 2. API Script

```

import pandas as pd
from serpapi import GoogleSearch
import time

SERPAPI_KEY = "*****"

def search_serpapi(query):
    params = {
        "q": query,
        "hl": "it",
        "gl": "it",
        "engine": "google",
        "api_key": SERPAPI_KEY,
        "num": 10
    }

    search = GoogleSearch(params)
    results = search.get_dict()

    try:
        return int(results.get("search_information", {}).get("total_results", 0))
    except:
        return 0

df = pd.readcsv("restaurant.csv", sep=";")
anni = list(range(2020, 2024)) # 2020–2023

output = []

for _, row in df.iterrows():
    brand = row["name"]
    city = row["city"]
    print(f'Elaborate: {brand} ({city})')

    results_per_year = {}

    for each year:
        query = f'{brand} {city} {year} restaurant OR review OR guide'
        total = search_serpapi(query)
        risultati_per_anno[str(anno)] = total
        time.sleep(2) # avoid rate limit

    output.append({
        "nome": brand,
        "citta": city,
        "**Results_per_year
    })

df_out = pd.DataFrame(output)
df_out.to_csv("PopularityResults.csv", index=False, sep=";

```

Appendix 3. Google trends data

BSN	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	X	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	
1	82	59	58	60	68	100	80	44	64	88	78	84	42	36	41	46	82	60	36	31	40	53	50	34	
2	66	66	67	43	66	49	73	60	67	100	52	55	66	75	43	46	45	61	38	0	60	59	0	34	
3	19	33	17	31	22	23	15	31	27	13	19	21	17	26	25	100	25	11	11	21	47	47	28	27	
4	0	0	0	100	27	12	30	18	39	47	42	14	0	16	41	16	14	19	18	25	34	31	0	6	
5	37	54	44	65	60	24	34	24	48	29	0	54	39	36	65	72	100	85	68	52	62	53	65	47	
6	76	88	62	73	60	79	56	65	72	90	69	80	71	85	73	100	75	85	55	67	79	82	69	47	
7	0	9	0	0	14	6	8	27	44	100	41	51	38	37	38	28	25	37	17	43	15	31	18	24	
8	57	75	56	81	87	35	63	31	57	27	27	52	67	48	58	66	80	100	71	79	76	65	51	44	
9	48	44	54	35	100	38	40	53	49	67	35	35	62	60	46	45	40	30	0	31	40	40	29	22	
10	50	57	58	40	21	29	57	68	75	81	61	63	71	45	40	41	24	43	38	65	100	71	52	36	
11	33	78	70	54	39	28	70	23	29	59	20	25	44	22	100	71	62	82	66	59	78	55	71	60	
12	79	51	49	32	43	36	32	37	40	35	19	20	18	26	32	30	67	92	57	98	73	100	56	46	
13	58	91	78	66	57	50	42	0	70	61	45	57	89	100	96	59	64	0	50	55	67	40	39	46	
14	0	0	68	32	0	0	0	0	0	0	0	0	34	74	100	41	0	47	0	63	29	0	49	49	
15	62	80	87	83	75	44	49	62	57	30	31	47	76	74	73	78	87	77	100	83	83	78	68	57	
16	44	64	89	58	41	24	42	16	66	24	31	71	100	64	65	69	45	46	59	46	53	46	69	55	
17	69	81	45	71	68	32	45	43	66	38	52	98	79	64	76	80	75	99	77	80	100	85	80	67	
18	0	0	0	0	0	0	0	0	41	0	0	55	0	27	0	0	100	37	29	39	31	0	0	64	
19	0	0	0	0	0	0	0	0	0	0	42	75	61	65	59	100	76	64	66	60	59	31	70	72	
20	39	26	49	26	12	20	21	17	24	30	26	25	32	29	100	30	16	19	20	15	15	27	24	20	
21	53	57	87	63	25	42	23	29	37	0	0	32	55	69	100	52	72	28	51	45	31	31	42	38	
22	24	22	17	26	21	31	27	20	25	22	25	28	100	41	33	38	34	39	26	16	8	0	11	11	
23	100	36	25	37	24	37	20	27	37	58	31	27	37	31	25	31	29	28	25	24	28	42	32	22	
24	35	40	38	53	41	16	37	26	56	17	25	40	56	55	35	67	94	100	90	87	84	79	70	78	
25	100	92	67	76	71	71	57	52	75	77	55	84	83	98	80	64	39	65	65	54	80	81	65	61	
26	57	63	59	59	58	50	47	36	43	38	50	85	85	63	100	60	58	49	54	39	43	52	52	59	
27	76	88	48	75	33	28	87	73	60	69	40	100	82	80	85	77	33	49	38	45	52	55	32	27	
28	71	60	79	38	0	77	64	46	69	35	24	79	69	44	79	34	100	100	73	84	71	37	0	30	
29	28	36	56	41	32	0	0	13	29	24	18	58	66	75	100	80	32	31	14	21	39	30	57	41	
30	0	54	96	0	44	0	0	31	0	0	0	41	0	49	100	31	58	58	36	42	49	31	28	35	
31	0	0	26	0	24	0	0	29	37	54	51	42	40	35	37	66	50	81	100	83	59	54	63	58	57
32	50	37	37	62	51	38	49	22	36	0	0	16	50	49	45	89	97	90	90	100	91	71	78	76	
33	69	54	59	56	29	59	38	41	100	54	30	36	80	52	59	59	42	44	33	40	31	59	51	56	
34	24	16	13	13	49	15	17	14	17	13	15	18	24	22	12	100	22	18	15	17	14	12	17	22	
35	15	10	24	18	16	23	25	40	100	51	26	8	12	27	15	29	24	31	24	56	52	64	35	21	
36	91	92	62	87	73	77	100	68	70	87	74	72	97	75	81	68	71	91	47	65	62	62	63	62	
37	0	0	0	0	0	0	0	0	0	27	29	23	26	0	21	23	24	100	37	43	47	42	66	48	
38	64	59	71	66	36	35	49	45	51	36	32	72	90	60	74	100	86	67	58	53	61	54	64	57	
39	0	0	0	0	0	52	19	14	21	28	22	12	100	0	0	0	20	25	13	16	33	39	14	0	
40	0	0	0	0	0	0	0	0	0	0	0	45	41	51	62	48	25	100	0	0	27	42	32	33	
41	26	46	33	38	40	100	68	54	48	54	51	37	66	47	35	56	27	34	0	21	34	0	36	27	
42	53	70	68	66	42	32	53	44	39	44	100	72	56	54	45	53	46	56	41	23	55	25	33	0	
43	17	17	17	18	11	9	14	24	28	48	29	34	48	100	44	42	36	58	59	61	53	70	78	42	
44	48	58	47	27	15	12	14	44	75	49	48	72	100	68	65	61	69	81	68	62	57	83	60	51	
45	0	0	0	0	0	0	0	0	0	0	0	0	100	14	11	11	9	16	7	9	11	9	61	21	
46	30	35	28	29	24	31	38	45	100	72	53	38	40	44	54	52	27	39	39	38	31	27	29	45	
47	0	24	0	0	0	0	0	0	42	39	28	52	100	35	46	70	48	47	33	41	51	53	70	38	
48	76	0	0	0	0	0	0	0	79	56	48	0	100	51	0	0	83	61	60	0	0	0	0	0	
49	78	100	46	43	42	44	46	40	38	36	68	73	85	87	81	53	63	77	68	77	62	65	81	68	
50	61	65	46	58	21	36	32	40	82	60	100	64	31	61	51	54	63	34	46	52	54	48	61	48	
51	54	36	14	0	0	0	0	0	37	100	78	64	31	33	37	16	46	46	44	55	69	69	78	55	
52	50	51	51	46	43	34	26	22	56	49	59	68	79	100	54	57	40	56	66	49	59	61	49	46	
53	11	100	74	23	0	18	0	16	22	11	15	13	14	12	14	0	17	16	22	12	16	14	0	11	
54	52	75	64	66	30	52	39	45	84	55	75	82	100	61	58	48	38	86	52	64	56	52	84	61	
55	65	53	30	27	22	23	10	16	21	35	85	54	100	75	46	25	34	26	57	35	40	43	60	50	
56	83	85	66	64	62	60	51	54	59	83	94	92	82	83	79	72	71	71	67	69	76	82	90	100	
57	46	43	57	42	24	31	0	0	49	56	100	56	68	84	49	60	0	52	64	80	63	46	63	75	
58	40	24	42	38	35	27	14	0	27	29	34	29	45	53	79	44	28	49	100	61	59	49	48	76	
59	23	18	26	30	23	25	22	24	26	23	29	27	54	100	33	27	27	29	28	32	31	44	40	32	
60	88	88	50	47	34	59	37	40	56	62	82	100	80	74	75	57	61	83	66	75	81	55	73	56	
61	25	21	24	31	42	35	29	32	45	45	40	100	53	32	44	61	60	57	38	42	54	46	34	40	
62	16	15	13	14	13	0	6	0	12	16	15	14	58	18	15	0	9	20	9	11	100	12	15	18	
63	0	0	0	0	0	0	0	0	0	0	0	55	92	66	100	65	28	27	43	33	46	54	79	50	42
64	35	36	50	34	33	21	13	31	30	23	22	23	20	21	24	24	29	21	25	18	23	11	12	100	
65	100	16	18	15	10	14	15	14	14	48	14	14	20	25	13	15	11	12	16	10	13	15	15	12	
66	32	23	22	49	24	29	36	31	31	28	34	35	39	30	33	55	29	32	31	100	38	30	29	34	
67	25	28	24	12	12	18	74	41	29	27	26	15	28	13	10	21	22	21	29	100	27	34	33	30	
68	17	0	0	35	49	40	29	100	63	39	38	0	36	0	0	37	28	25	54	43	62	38	37	44	

Appendix 4. Google trend monthly variation

Country	Name	Award Year	Short Term Variation	Long Term Variation
Italy	Restaurant 1	2024		-0.36
	Restaurant 3	2022	0.22	-0.31
	Restaurant 5	2023	0.02	0.25
	Restaurant 6	2022	-0.75	-0.22
	Restaurant 7	2021	-0.44	0.57
	Restaurant 8	2022	-0.03	0.08
	Restaurant 10	2023	0.00	
	Restaurant 11	2022	-0.36	0.20
	Restaurant 12	2021	0.10	0.24
	Restaurant 13	2022	0.43	-0.26
	Restaurant 14	2022	-0.09	-0.05
	Restaurant 15	2021	0.24	0.53
	Restaurant 16	2024	0.09	0.47
	Restaurant 17	2022	0.40	0.04
	Restaurant 18	2021	1.00	3.86
	Restaurant 19	2021	0.37	0.32
	Restaurant 20	2021	0.13	0.26
	Restaurant 21	2021	-0.37	0.36
	Restaurant 22	2023	1.00	4.20
	Restaurant 23	2023	-0.19	5.69
	Restaurant 24	2023	0.18	0.10
	Restaurant 25	2021	0.48	0.37
	Restaurant 27	2022	0.60	0.24
	Restaurant 29	2024	0.21	-0.23
	Restaurant 30	2021	0.28	1.11
	Restaurant 31	2022	0.07	-0.05
	Restaurant 33	2022	-0.15	0.11
	Restaurant 34	2021	-0.23	-0.16
	Restaurant 35	2022	-0.40	0.12
	Restaurant 36	2021	0.18	0.75
	Restaurant 37	2021	-0.67	0.94
	Restaurant 39	2023	-0.11	1.45
	Restaurant 40	2021	0.68	1.33
	Restaurant 41	2022	0.45	-0.03
	Restaurant 42	2023	0.22	0.32
	Restaurant 43	2022	0.59	0.10
	Restaurant 44	2024	0.16	-0.11
	Restaurant 45	2023	0.00	
	Restaurant 46	2023	-0.77	5.04
	Restaurant 47	2021	0.04	0.34
	Restaurant 48	2022	0.50	0.79
	Restaurant 49	2022	0.02	9.24
	Restaurant 51	2021	0.35	-0.36
	Restaurant 52	2022	-0.31	-0.29
North Europe	Restaurant 53	2021	0.54	1.60
	Restaurant 54	2021	0.14	0.62
	Restaurant 55	2021	1.00	
	Restaurant 56	2022	0.10	-0.11
	Restaurant 57	2021	0.23	2.42
	Restaurant 58	2021	1.00	0.38
	Restaurant 59	2021	0.15	0.33
	Restaurant 60	2021	0.11	-0.02
	Restaurant 61	2021	-1.13	0.58
	Restaurant 62	2021	0.24	0.27
	Restaurant 63	2021	0.00	-0.51
	Restaurant 66	2021	-0.02	0.03
	Restaurant 67	2021	0.38	0.36
	Restaurant 68	2021	-0.05	0.12
	Restaurant 69	2024	0.26	0.40
	Restaurant 70	2021	0.41	1.04
	Restaurant 71	2021	0.65	0.61
	Restaurant 72	2021	-0.30	0.13
	Restaurant 73	2024	-1.35	0.20
	Restaurant 74	2021	0.63	1.13
	Restaurant 75	2021	-0.11	3.31
	Restaurant 76	2022	-0.12	-0.07
	Restaurant 77	2024	0.38	-0.39
Spain	Restaurant 79	2022	-0.01	0.28
	Restaurant 80	2021	0.27	0.11
	Restaurant 81	2022	1.00	-0.01
	Restaurant 82	2021	0.87	0.78
	Restaurant 83	2021	0.12	0.26
	Restaurant 85	2023	0.64	0.20
	Restaurant 87	2021	0.44	0.65
	Restaurant 88	2021	0.04	0.06
	Restaurant 89	2021	0.49	0.07
	Restaurant 91	2024	0.14	-0.13
	Restaurant 92	2023	0.22	0.08
	Restaurant 95	2021	0.15	-0.08
	Restaurant 98	2022	0.09	0.42
	Restaurant 100	2021	0.58	0.11
	Restaurant 101	2021	0.49	0.29
	Restaurant 102	2021	0.23	0.10
	Restaurant 103	2024	1.00	-0.07
	Restaurant 104	2021	1.00	0.01
	Restaurant 105	2022	-0.02	0.05
Slovenia	Restaurant 106	2021	0.30	0.37
	Restaurant 107	2024	-0.01	-0.19
	Restaurant 108	2022		1.76
	Restaurant 109	2021	0.73	1.40
	Restaurant 110	2021	-1.07	-0.27
Croatia	Restaurant 111	2023	0.09	0.97
	Restaurant 113	2023	0.45	0.39
Belgium	Restaurant 115	2021	-1.52	0.04
	Restaurant 116	2021	0.77	-0.08
	Restaurant 117	2023	0.20	0.05
	Restaurant 118	2021	-0.49	0.25
Estonia	Restaurant 119	2023	0.48	0.02
	Restaurant 121	2022	-0.09	6.40
Latvia	Restaurant 123	2024	1.00	-0.10
	Restaurant 124	2024	0.01	0.50
Portugal	Restaurant 126	2022	-0.33	0.50

Appendix 5. Python extraction

Country	Name	Year	2020	2021	2022	2023	2024	2025
Italy	Restaurant 1	2024	564	711	600	475	270	1370
	Restaurant 2	2021	181	407	571	231	204	1390
	Restaurant 3	2022	51	67	65	93	147	499
	Restaurant 4	2024	242	67	123	112	447	523
	Restaurant 5	2023	1060	1330	1350	2670	4910	7800
	Restaurant 6	2022	785	1300	1190	1210	1480	2970
	Restaurant 7	2021	815	835	732	870	568	1930
	Restaurant 8	2022	894	1360	1390	1510	1640	4130
	Restaurant 9	2021	1190	1020	981	713	1990	1910
	Restaurant 10	2023	1740	1200	1450	1790	2210	1930
	Restaurant 11	2022	786	1190	1300	2020	2020	2860
	Restaurant 12	2021	710	493	699	626	574	984
	Restaurant 13	2022	374	801	805	1030	1410	911
	Restaurant 14	2022	1330	1500	1420	2360	3190	4540
	Restaurant 15	2021	1970	1510	1920	2360	3130	5230
	Restaurant 16	2024	2290	1870	1310	2990	3920	3100
	Restaurant 17	2022	3130	1900	2890	2740	3230	5710
	Restaurant 18	2021	651	524	907	1760	2030	2930
	Restaurant 19	2021	11300	10500	11900	14800	34200	51800
	Restaurant 20	2021	740	846	826	805	909	1780
	Restaurant 21	2021	1700	2250	1110	1830	2170	3670
	Restaurant 22	2023	342	163	257	786	1180	2040
	Restaurant 23	2023	3550	2300	11800	6130	16800	9630
	Restaurant 24	2023	-	913	885	1140	1400	1660
	Restaurant 25	2021	468	440	522	471	-	-
	Restaurant 26	2024	-	-	1620	1770	2240	3890
	Restaurant 27	2023	678	401	325	833	1010	-
	Restaurant 28	2022	64	-	168	-	236	-
	Restaurant 29	2024	-	-	2250	2510	3040	5670
	Restaurant 30	2021	6770	13100	23600	20000	-	-
	Restaurant 31	2022	946	846	1130	1180	1110	-
	Restaurant 32	2023	-	254	334	438	777	597
	Restaurant 33	2022	1600	1900	1920	1960	2110	-
	Restaurant 34	2021	322	249	519	1010	-	-
	Restaurant 35	2022	867	1070	632	-	1230	-
	Restaurant 36	2021	941	2000	2020	2170	-	-
	Restaurant 37	2021	70	116	163	154	-	-
	Restaurant 38	2021	380	570	894	1330	-	-
	Restaurant 39	2023	-	642	528	713	2690	4310
	Restaurant 40	2021	6	-	-	7	-	-
	Restaurant 41	2022	810	656	1170	1320	1460	-
	Restaurant 42	2023	942	942	1200	1250	1780	4250
	Restaurant 43	2022	31400	26200	28800	36400	39800	-
	Restaurant 44	2024	-	-	9430	10900	14600	21900
	Restaurant 45	2023	-	2850	2170	2810	3170	4880
	Restaurant 46	2023	-	3530	3010	9400	7550	16800
	Restaurant 47	2021	738	1450	2370	667	-	-
	Restaurant 48	2022	1210	1580	1240	1660	3190	-
	Restaurant 49	2022	394	935	1220	1510	1360	-
	Restaurant 50	2022	296	260	326	778	879	-
	Restaurant 51	2021	136	171	411	249	-	-
	Restaurant 52	2022	1050	910	1650	1710	2760	-
North Europe	Restaurant 53	2021	3540	8180	9030	8970	74900	59200
	Restaurant 54	2021	1450	444	5510	7780	10800	10700
	Restaurant 55	2021	181	335	157	890	705	1460
	Restaurant 56	2022	11100	7670	5980	12400	21700	25300
	Restaurant 57	2021	626	287	7120	7470	6890	18900
	Restaurant 58	2021	2350	1210	1310	4450	3160	3910
	Restaurant 59	2021	1980	1810	1620	2220	3060	5470
	Restaurant 60	2021	571	631	935	1390	2310	4500
	Restaurant 61	2021	587	539	485	908	2110	1340
	Restaurant 62	2021	5040	3050	4910	5330	6980	8750
	Restaurant 63	2021	3470	13100	6430	11500	10700	8730
	Restaurant 64	2021	7720	15000	16100	17100	15200	20900
	Restaurant 65	2022	3050	2520	2860	640	758	3270
	Restaurant 66	2021	6480	6140	7340	9290	7320	24500
	Restaurant 67	2021	15200	23300	20900	26100	29300	41400
	Restaurant 68	2021	65	66	845	1350	970	2740
	Restaurant 69	2024	2870	2550	2090	3560	6510	13400
	Restaurant 70	2021	7270	7030	8300	8060	-	-
	Restaurant 71	2021	10200	10600	44500	90400	-	-
	Restaurant 72	2021	70	101	59	152	-	-
	Restaurant 73	2024	15600	15600	17200	17200	31300	52900
	Restaurant 74	2021	32100	37300	47700	55500	-	-
	Restaurant 75	2021	835	969	620	860	-	-
	Restaurant 76	2022	6410	4710	4620	4810	6700	-
	Restaurant 77	2024	-	-	4100	4590	5010	7270
	Restaurant 78	2024	-	-	66	103	48	186
Spain	Restaurant 79	2022	18100	18900	18900	23100	30200	-
	Restaurant 80	2021	2670	4000	4640	4450	-	-
	Restaurant 81	2022	584	716	567	1050	1530	-
	Restaurant 82	2021	2220	3030	3390	7350	-	-
	Restaurant 83	2021	158	276	331	445	-	-
	Restaurant 84	2022	187	128	119	169	168	-
	Restaurant 85	2023	-	1810	1700	2220	1610	2280
	Restaurant 86	2023	-	212	476	502	376	742
	Restaurant 87	2021	6430	6240	6110	6330	-	-
	Restaurant 88	2021	8300	8860	10300	14300	19300	27000
	Restaurant 89	2021	1510	1350	1980	924	2410	8570
	Restaurant 90	2024	912	1220	776	816	1080	1030
	Restaurant 91	2024	1110	1350	1800	2330	3150	4450
	Restaurant 92	2023	202	449	899	734	1250	2360
	Restaurant 93	2021	1240	1420	1420	1160	1440	1550
	Restaurant 94	2023	154	104	92	656	360	1120
	Restaurant 95	2021	724	529	638	1100	1030	2760
	Restaurant 96	2024	62	76	182	143	367	309
	Restaurant 97	2023	685	1050	859	546	678	967
	Restaurant 98	2022	94	204	635	506	378	858
	Restaurant 99	2022	632	783	913	2710	728	2490
	Restaurant 100	2021	1210	1750	2060	1460	3450	2490
	Restaurant 101	2021	329	273	408	624	397	597
	Restaurant 102	2021	1310	1280	871	777	1680	2410
	Restaurant 103	2024	794	854	839	1330	1410	1120
	Restaurant 104	2021	166	202	132	176	83	503
	Restaurant 105	2022	29500	10200	49600	60500	121000	95400
Slovenia	Restaurant 106	2024	1120	1360	1020	907	1650	1760
	Restaurant 107	2021	3	2	5	5	8	10
	Restaurant 108	2024	26	24	24	37	25	63
	Restaurant 109	2022	82	5	6	10	10	50
	Restaurant 110	2021	25	10	10	78	113	87
	Restaurant 111	2021	49	61	55	72	78	637
	Restaurant 112	2023	307	213	440	462	667	70
	Restaurant 113	2021	201	188	142	163	146	302
	Restaurant 114	2024	50	124	128	143	92	157
	Restaurant 115	2021	10	44	6	9	9	133
Belgium	Restaurant 116	2021	68	10	36	28	100	196
	Restaurant 117	2023	471	56	73	102	164	632
	Restaurant 118	2021	1920	1400	2650	2250	1290	1550
	Restaurant 119	2023	298	378	316	479	578	685
Estonia	Restaurant 120	2022	165	91	77	94	252	155
	Restaurant 121	2023	2	2	4	7	10	82
Latvia	Restaurant 122	2024	3	161	2	5	9	184
Lithuania	Restaurant 123	2024	308	45	132	79	48	87
Portugal	Restaurant 124	2022	191	124	213	186	310	345
	Restaurant 125	2022	583	272	544	324	558	356

Appendix 6. Orbis Data

Year	2025	Total Production										Net Revenue										Staff count					
		2024	2023	2022	2021	2020	2019	2018	2017	2016	2015	2024	2023	2022	2021	2020	2019	2018	2017	2016	2025	2024	2023	2022	2021	2020	
1		9,621,000	11,091,000	10,058,000	9,546,000																50	42	35	29			
2		198,000	197,000	197,000	197,000																2	2	2	2			
3		628,000	1,200,000	1,004,000	867,000																26	24	21	21			
4	24,609,341	20,648,176	19,685,702	16,436,916	7,121,785	3,827,755	1,543,546	1,406,617	1,497,315	1,796,608	262,413	61,926	168	140	137	126	54										
5		2,395,999	529,809					-101,096	2,806												20	19					
6		16,282,478	12,811,111	9,213,245	4,307,985	1,345,026		1,089,542	1,025,536	519,199	-663,678	-								76	70	58	9	6			
7		867,000	1,102,096	1,068,000	1,002,000																17	17	16	15			
8		370,141	358,093	409,111	347,678	273,360		2,096	3,348	3,278	7,364	-1,322	2	2	5	3				16	29	29	22	16			
9		1,023,546	1,012,841	1,046,576	976,242	649,855		1,706,669	1,645,563	1,757,710	-53,548	-141,421								16	29	29	22	16			
10		3,553,716	3,259,653	3,281,273	2,834,797	1,874,760		460,356	460,013	807,665	81,175	200,893	24	43	14	11	11			24	43	14	11	11			
11		3,840,000	5,417,000	5,141,000	2,960,000			1,667,660	1,660,999	1,255,707	1,208,555	616,024	18	19	20	15				18	19	20	15				
12		1,667,660	1,660,999	1,255,707	1,208,555	616,024		4,562	2,371	2,369	104,424	-22,958	21	15	14	12	11			21	15	14	12	11			
13		1,090,387	933,503	264				142,298	93,093	4,340			12	18						12	18						
14		2,381,767	2,400,158	2,274,206	1,486,471	993,866		40,666	80,159	19,158	-222,542	22,405	33	16	10	12	9			33	16	10	12	9			
15		1,066,538	1,273,186	1,172,211	547,366	940,175		33,701	90,717	61,280	55,700	191,782	21	22	20	9				21	22	20	9				
16		2,454,967	362,686	2,976,025	2,378,231	1,432,824		25,266	-2,70,052	263,304	206,473	48,610	25	6	28	18	12			25	6	28	18	12			
17		1,143,976	969,853	847,589	603,447	531,898		8,771	22,154	-3,351	27,944	-43,536	13	13	7	5	8			13	13	7	5	8			
18		1,084,918	853,671	673,710	420,958	241,624		125,324	112,581	83,107	17,714	-14,520	15	13	10	8	4			15	13	10	8	4			
19		18,661,122	17,659,219	17,160,354	10,953,501	7,543,846		3,219,256	3,126,774	4,357,476	2,099,208	1,423,031	100	80	66	52	49			100	80	66	52	49			
20								4,000	11,762																		
21			1,002,000	881,000	797,000	400,000																					
22		246,630	184,894	94,779	83,992	37,006		41,419	5,645	4,484	1,810	-5,700	3	2	2	2	2			3	2	2	2	2			
23		3,610,012	2,816,875	1,086,416	4,003	1		203,584	-24,832	-297,911	-10,381	-22,168	24	23	12	2				24	23	12	2				
24		460,000	540,000	619,000	1,191,000								30	23	21	20				30	23	21	20				
25		525,000	626,000	640,000	321,000								12	8	9	13	5	8			12	8	9	13	5	8	
26		464,353	760,839	687,632	523,419	470,051		41,429	24,786	60,987	-22,012	-46,203	4	7	9	8	8			4	7	9	8	8			
27		1,478,632	1,777,438	1,777,438	1,777,438	1,777,438		-268,971	205,117	115,671	16,724	99,600	16	13	9	10	4			16	13	9	10	4			
28		4,416,569	3,850,836	3,732,258	2,389,993	681,354		364,216	115,671	16,724	99,600	22,105	21	21	15	10	4			21	21	15	10	4			
29																											
30		1,993,311	2,044,090	1,817,664	1,201,842	911,625		487,368	258,614	226,505	145,460	-33,313	15	17	15	13	19			15	17	15	13	19			
31		1,443,125	1,210,443	1,277,056	995,351	461,169		48,182	39,646	40,987	40,981	478	12	10	11	25	17			12	10	11	25	17			
32		3,031,000	4,325,000	3,085,000	1,051,000								41	29	36	28				41	29	36	28				
33		1,141,872	1,132,560	1,053,196	528,236			136,155	38,320	7,103	52,411		2	12	14	17				2	12	14	17				
34		13,653,011	12,105,762	9,209,690	7,192,490	5,997,223		5,395,177	4,612,239	3,391,918	2,751,590	2,297,749	108	102	93	65				108	102	93	65				
35		962,168	625,304	610,423	511,253	473,125		14,944	15,736	88,829	27,390	18,226	10	10	8	8	8			10	10	8	8	8			
36		1,654,695	1,513,730	1,392,560	1,515,647	447,259		143,984	49,613	-2,568	128,142	-112,930	14	14	13	12	6			14	14	13	12	6			
37		270,000	312,500	312,500	212,000								7														
38			8,101,444	7,034,105	3,041,997	1,099,498		1,466,093	1,386,194	376,038	-795,759		11	8	9	12				11	8	9	12				
39		1,092,556	1,076,836	1,007,510	806,862	474,634		95,751	89,527	93,625	7,425	46,462	33	31	32	32	34			33	31	32	32	34			
40			767,000	1,692,000	1,256,000	319,000							35	35	27	26	25			35	35	27	26	25			
41		1,584,355	1,676,540	1,584,355	932,404			234,161	229,456	-240,206	-370,462	-102,711	16	13	12	10	5			16	13	12	10	5			
42		364,000	610,000	491,000	444,000								6	6	9	8				6	6	9	8				
43		1,746,420	1,800,125	1,496,440	899,828	640,420		192,829	91,631	91,631	-79,019	-245,158	17	15	13	8	6			17	15	13	8	6			
44		3,085,599	2,810,510	2,713,237	2,445,414	2,123,146		25,386	13,072	38,361	126,944	2,622	32	31	32	29	26			32	31	32	29	26			
45		1,650,000	1,136,000	1,338,000	805,000			187,883	177,636	97,626	41,375	1,127,539	15	17	17	16				15	17	17	16				
46		12,536,857	12,728,119	10,419,544	2,682,491	3,657,320							45	45	44	40	47			45	45	44	40	47			
47		4,866,339	4,654,314	3,589,558	1,607,431	781,847		68,000	-75,407	-125,414	-256,965	-284,130	59	42	38	28				59	42	38	28				
48		3,499,270	3,432,184	3,672,173	2,431,369	1,803,739		105,653	110,575	679,805	159,489	86,395	47	47	45	44	42			47	47	45	44	42			
49		2,145,769	1,859,427	1,536,999	1,100,225	627,820		1,405,109	1,302,932	1,857,465	1,184,996	-99,886	70	76	71	50	27			70	76	71	50	27			
50			276	76	45	1		-539,279	-340,731	-63,803	-77,307		2	1													
51		142,789	225,330	-	5,877	4,979		-197,279	-189,352	-9,141	-13,370	-10,150	3	8						3	8						
52		10,272,192	11,119,554	13,727,098	12,645,899	12,478,697		-10,287	6,34,589				32														

Appendix 7. Google Maps data

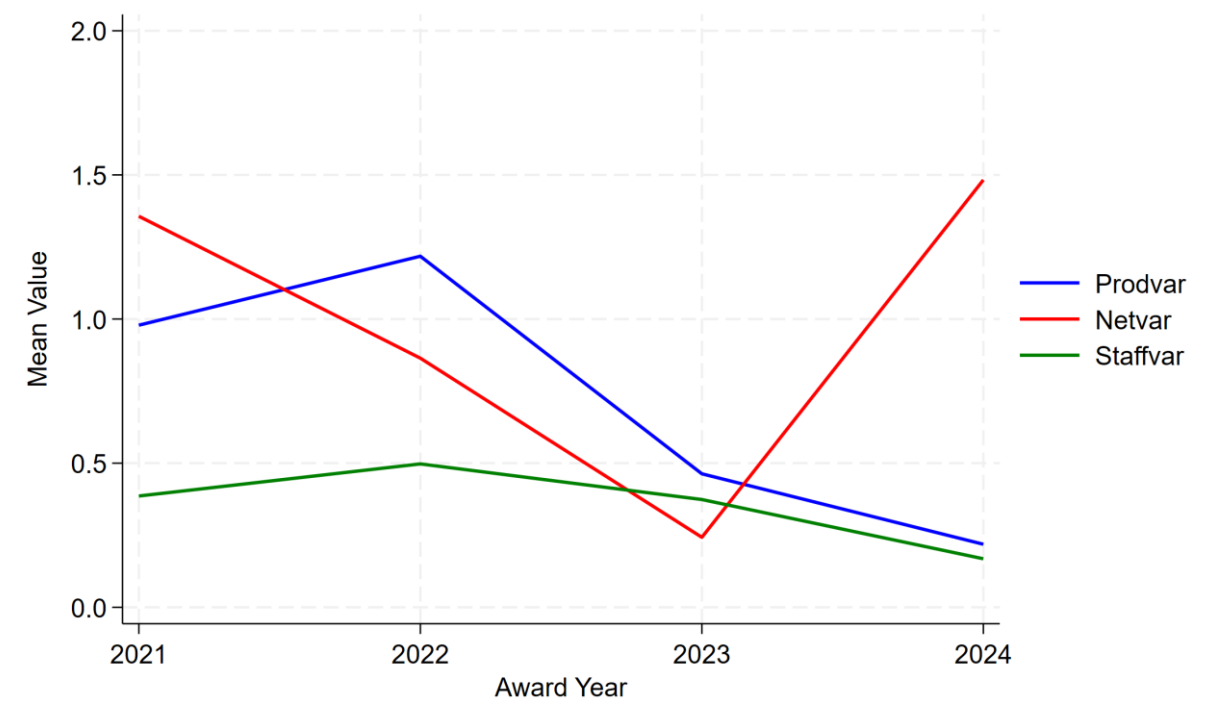
Restaurant / Year	Comments					Stars				
	2020	2021	2022	2023	2024	2020	2021	2022	2023	2024
Restaurant 1	0.692308	0.731707	0.380282	0.453488	0.532526	0.491018	4.076923077	4.707317073	4.591549296	4.197674419
Restaurant 2	0.054054	0.136364	0.210526	0.076923	0.057143	0.071428	4.72972973	4.386363636	4.578947368	4.615384615
Restaurant 3	0.022222	0.024	0.0625	0.113636	0.02439	0.122449	4.644444444	4.728	4.25	3.97569756
Restaurant 4	0	0	0	0.117647	0.638889	0.125	0	0	0	4.72415793
Restaurant 5	0.088235	0.073529	0.117647	0.047619	0.098039	0.112903	0	0	0	4.62173913
Restaurant 6	0.088235	0.098592	0.057143	0.054054	0.069444	0.246154	4.75	4.294117647	4.691176471	4.761904762
Restaurant 7	0	0.5	0	0	0.2	0.090909	4.764705882	4.61971831	4.771428571	4.783783784
Restaurant 8	0.133333	0	0.0625	0.117647	0.266667	0.28	5	5	4.928571429	4.9
Restaurant 9	0	0	0	0.184211	0.216216	0.142857	4.416666667	4.8	4.692307692	4.466666667
Restaurant 10	0	0.03125	0.083333	0.12069	0.276869	0.511628	0	0	4.866666667	4.965517241
Restaurant 11	0.074074	0.014085	0.081633	0.066667	0	0.033333	4.777777778	4.90625	4.9375	4.948275862
Restaurant 12	0.032258	0.076923	0.089597	0.090909	0.111111	0.28125	4.685185185	4.887323944	4.836734694	4.733333333
Restaurant 13	0.046512	0.117647	0.215385	0.139353	0.0625	0.244896	4.419354839	4.730769231	4.826060957	4.909090909
Restaurant 14	0.2	0.148148	0.125	0.25	0.307692	0.5	4.534883721	4.784313725	4.492307692	4.581395349
Restaurant 15	0	0	0.234138	0.166667	0.113636	0.272727	3.75	3.444444444	4.375	3.875
Restaurant 16	0.025	0.071429	0.1	0	0.153846	0.666667	4.857142857	4.764705882	4.189655172	3.333333333
Restaurant 17	0	0.192308	0.4	0.315789	0.4	0.560976	4.725	4.857142857	4.7	4.615384615
Restaurant 18	0.142857	0.375	0.436364	0.78947	0.366667	0.321429	4.222222222	4.4	4.727272727	4.394736842
Restaurant 19	0.34	0.12	0.234138	0.145455	0.488372	0.259259	4.428571429	4.479166667	4.072727273	3.8
Restaurant 20	0.072727	0.16394	0.186441	0.164537	0.137255	0.3	4.68	4.413793103	4.218181818	4.258181953
Restaurant 21	0.060606	0.133333	0.3	0.142857	0.391304	0.444444	4.872727273	4.85249016	4.762711864	4.658227848
Restaurant 22	0	0	0.533333	0.510204	0.362069	0.791667	4.944444444	4.714285714	4.416666667	4.529417765
Restaurant 23	0	0.2	0.227273	0.15625	0.066667	0.126984	0	0	4.5	4.341463415
Restaurant 24	0.241379	0.103448	0.21875	0.208955	0.218182	0.166667	5	5	4.848736842	5
Restaurant 25	0.275	0.173913	0.128571	0.099375	0.116279	0.325359	4.76896552	4.793103448	4.701492337	4.272727273
Restaurant 26	0.085106	0.072727	0.306122	0.588674	0.237079	0.323358	4	4.826060957	4.571428571	4.546867
Restaurant 27	0	1.8	1.166667	1.363636	1.166667	1.363636	4.744680851	4.490909091	4.459183673	4.512820513
Restaurant 28	0.089286	0.076923	0.091743	0.069767	0.157895	0.384615	0	4.8	5	5
Restaurant 29	1.153846	0.767442	0.972603	0.892587	0.951613	1	4.857142857	4.743589744	4.834860385	4.76744186
Restaurant 30	0	0	0.102564	0.25	0.2	0.115385	4.5	4.069767442	4.082191781	4.464285714
Restaurant 31	0	0.166667	0	0.105263	0	0	0	0	0	0
Restaurant 32	0	0.072727	0.125	0.111111	0	0.636364	0	0	0	0
Restaurant 33	0.257143	0.14433	0.207547	0.27027	0.272727	0.184211	4.705882353	4.833333333	4.794871795	4.833333333
Restaurant 34	0.314815	0.114754	0.147059	0.236111	0.134615	0.246154	5	4.833333333	3.913043478	4.736842105
Restaurant 35	0	0.8	0.5	0.581818	0.679245	0.75	4.723076923	4.611111111	4.604166667	4.666666667
Restaurant 36	0.09375	0.04918	0.067797	0.236364	0.102041	0.054054	4.314285714	4.329896907	4.471698113	4.297297297
Restaurant 37	0.095238	0.166667	0.304348	0.127273	0.22449	0.211538	4.666666667	4.655737705	4.808823529	4.611111111
Restaurant 38	0.029412	0.235294	0.033333	0.253331	0.263518	0.04	#DIV/0!	2.941176471	3.837209402	4.166666667
Restaurant 39	0	0.046412	0.036412	0.133333	0.16	0.181818	4.78125	4.819672131	4.93233539	4.790909091
Restaurant 40	0.068966	0.078947	0.348337	0.372093	0.372549	0.166667	4.976190476	4.761904762	4.565271391	4.836363636
Restaurant 41	0.06	0.015873	0.068966	0.107692	0	0.108696	4.558823529	5	4.7	4.626865672
Restaurant 42	0.071429	0.02	0.028571	0.074074	0.272727	0.380952	4.975	4.906976744	4.651162791	4.633333333
Restaurant 43	0.052632	0.8	0	0.26897	0.534884	0.878788	4.655172414	4.684210526	4.534883721	4.604651163
Restaurant 44	0.176471	0.288389	0.365385	0.365854	0.808219	0.691589	4.64	4.825396825	4.24137931	4.515384615
Restaurant 45	0	0.157895	0.333333	0.333333	0.627586	4.833333333	4.8	4.685714286	4.79626296	4.909090909
Restaurant 46	0	0.115385	0.0625	1.166667	0.4	0.636364	4.526315789	4	4.531333333	4.551724138
Restaurant 47	0.26087	0.116279	0.204082	0.2	0.235294	0.297297	4.470588235	4.155555556	4.019230769	4.34163415
Restaurant 48	0.355556	0.23913	0.272727	0.127273	0.352941	0.256757	0	0	4.9375	4.90625
Restaurant 49	0.025641	0.018688	0.029412	0.037037	0.076923	0.173913	5	4.846153846	4.625	5
Restaurant 50	0.111111	0	0.093023	0.078431	0.056604	0.157895	0	0	0	0
Restaurant 51	0.025641	0.083333	0.283019	0.205882	0.131579	0.325259	0	0	0	0
Restaurant 52	0.178571	0.032787	0.086719	0.476959	0.230769	0.219512	4.217391304	4.674418605	4.63263061	4.35
Restaurant 53	0.02439	0.181818	0.105263	0.171077	0.206897	0.145455	4.488888889	4.434782609	3.872727273	4.018181818
Restaurant 54	0	0.192308	0.054545	0.169492	0.084746	0.212121	4.837837838	4.720930233	4.852941176	4.592592593
Restaurant 55	0.6	0.115385	0.4	0.238095	0.06383	0.375	4.944444444	4.714285714	4.860465116	4.843137255
Restaurant 56	0.352941	0.176471	0.244444	0.512821	0.617021	0.373333	4.871794872	4.694444444	4.698113208	4.882352941
Restaurant 57	0.235294	0.071371	0.52459	0.458333	0.933333	0.886792	4.696428571	4.688852459	4.684210526	4.75
Restaurant 58	0	0.5	0.290323	0.357343	0.212286	0.27586	4.243902439	4.393939394	4.447368421	4.615384615
Restaurant 59	0	1.22449	0.94898	1.367797	1.109917	1.145455	4.684931307	4.279272727	4.696428571	4.479672131
Restaurant 60	0.055556	0.318415	0.263889	0.431373	0.625	0.409091	4.961538462	4.692	4.523809524	4.382978723
Restaurant 61	0.068966	0.090909	0.25	0.454545	0.636364	0.142857	4.980392157	4.970588235	4.844444444	4.858974359
Restaurant 62	0	0.151515	0.208791	0.263636	0.232877	0.459459	4.852941176	4.756097561	4.836605574	4.722222222
Restaurant 63	0.277778	0.121951	0.380952	0.283333	0	0.571429	5	5	4.612903226	4.5
Restaurant 64	0.040875	0.017241	0.115385	0.116667	0.192308	0.666667	0	4.612244898	4.56122449	4.53164557
Restaurant 65	0.161765	0.27027	0.4	0.2	0.283714	0.31654	4.666666667	4.541666667	4.599893522	4.538461538
Restaurant 66	0.263158	0.190476	0.527778	0.799231	0.733333	0.3125	4.757575758	4.857142857	4.787878788	4.909090909
Restaurant 67	0.157895	0.142857	0.205882	0.16	1	0.478261	2.9	3.787878788	3.692307692	3.654545455
Restaurant 68	0.064516	0.096774	0.129032	0.148148	0.272727	0.173913	3.972222222	3.87804878	3.952380952	4.615384615
Restaurant 69	0.052632	0.34375	0.234043	0.530303	0.576923	0.661765	4.515625	4.637931034	4.288461538	4.1
Restaurant 70	0	0.102564	0.05571	0.15625	0.057692	0.086667	4.764705882	4.297297297	4.725	4.75
Restaurant 71	0.448089	0.162162	0.551351	0.380952	0.170923	0.142857	4.684210526	4.857142857	4.478	4.846153846
Restaurant 72	0.16129	0.366667	0.27341	0.27341	0.25	0.435484	4.315789474	4.714285714	4.208883333	4.48
Restaurant 73	0.395349	0.4	0.318841	0.116832	0.684211	0.282609	4.693548387	4.580645161	4.709677419	4.481818181
Restaurant 74	0.447368	0.678571	0.71831	0.709677	1	0.72043	4.473684211	4.875	4.872340426	4.727272727
Restaurant 75	0.057143	0.206349	0.307692	0.290323	0.2	0.361111	4.944444444	4.358974359	4.482142857	4.734375
Restaurant 76	0.09434	0	0.078947	0.285714	0.259259	0.289474	4.808510638	4.756756757	4.783783784	4.952380952
Restaurant 77	0.833333	0.8	0	0.307692	0.125	0.6	4.677419355	4.8	4.619047619	4.583333333
Restaurant 78	0.26087	0.285714	0.227273	0.029412	0.857143	4.744186047	4.675	4.565217391	4.85148515	4.273684211
Restaurant 79	0.117647	0	0.111111	0.333333	0.3125	0.435484	4.710526316	4.678571429	4.709235352	4.64516129
Restaurant 80	0	0.1	0.166667	0.089597	0.089597	0.125	4.314285714	4.2698421	3.907692308	3.548387097
Restaurant 81	0.333333	0	0.378049	0.428571	0.393939	0.513889	4.886792453	4.607142857	4.842105263	4.742857143
Restaurant 82	0.261905	0.325	0.578313	0.603774	0.297872	0.705882	5	5	5	4.615384615
Restaurant 83	0.320888	0.253731	0.405797	0.762712	0.538462	0.5	4.739130435	4.25	4.454545455	3.970588235
Restaurant 84	0.3	0.333333	0.466667	0.480769	0.490196	0.62609	4.882352941	4.727272727	4.777777778	4.466666667
Restaurant 85	0.1	0.27696	0.130435	0.131579	0.363834	0.5	0	0	0	0
Restaurant 86	0.470588	0.285714	0.252926	0.526316	0.5875	0.633333	#DIV/0!	4.7	4.766666667	4.434782609
Restaurant 87	0.493827	0.342466	0.291139	0.527778	0.698413	0.717391	4.444444444	4	4.658535858	

Appendix 8. Sustainability-related words

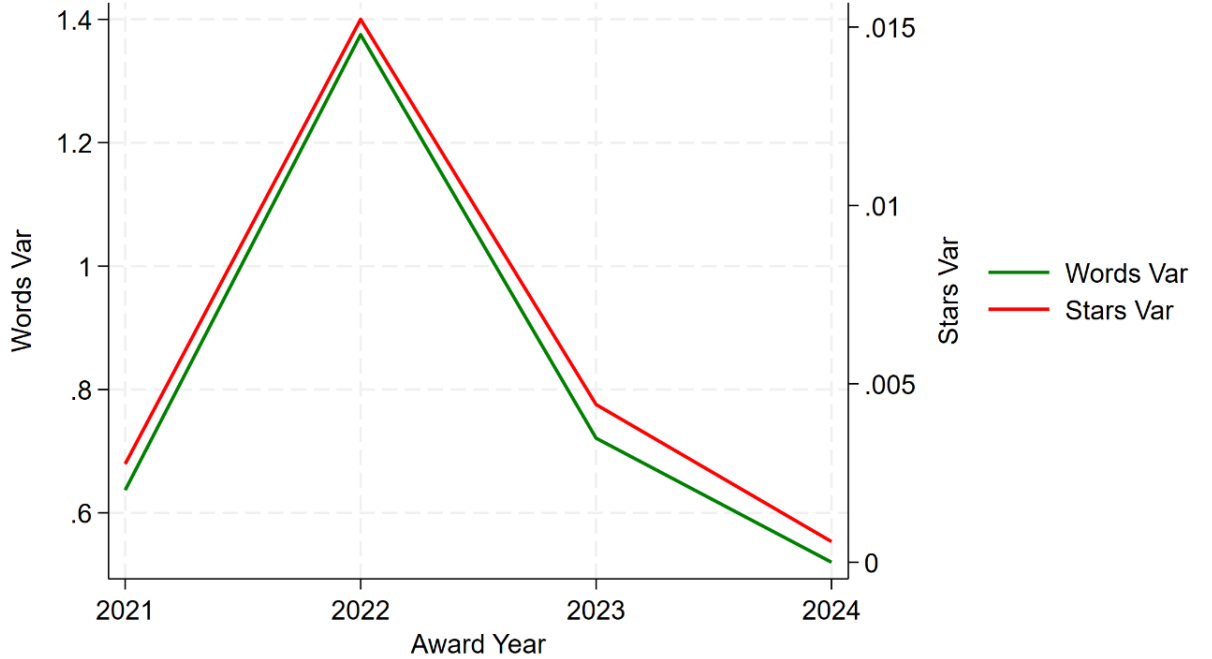
biodiverse	*farm-to-table*	*natural*	*seasonal*
biodiversity	*local supplier*	*natural ingredients*	*seasonal ingredients*
biodegradable	*food waste*	*nature friendly*	*seasonal menu*
carbon	*foraged*	*net zero*	*seasonality*
carbon footprint	*foraged ingredients*	*no plastic*	*self grown*
carbon neutral	*foraging*	*no waste*	*short supply chain*
climate	*fresh ingredients*	*nose to tail*	*short supply chains*
climate friendly	*fresh produce*	*nose-to-tail*	*small farms*
compost	*garden*	*organic*	*small producers*
compostable	*garden produce*	*organic ingredients*	*sustainable*
composting	*green*	*own garden*	*sustainable dining*
conscious	*green restaurant*	*packaging free*	*sustainable farming*
conscious cooking	*green star*	*plant based*	*sustainable gastronomy*
eco	*grown on site*	*plant focused*	*sustainable packaging*
eco conscious	*homegrown*	*plant forward*	*sustainable seafood*
eco dining	*house grown*	*plant-based*	*sustainable fish*
eco gastronomy	*independent producers*	*plant-forward*	*sustainability*
eco packaging	*ingredient respect*	*plastic free*	*thoughtful cooking*
eco restaurant	*ingredient traceability*	*plastic-free*	*traceable*
eco-friendly	*kitchen garden*	*recyclable*	*transparent sourcing*
eco-conscious	*less plastic*	*recycled*	*transparent supply chain*
environmental	*line caught*	*recycling*	*vegan*
environmentally conscious	*local farmers*	*reduced waste*	*vegetable focused*
ethical	*local farms*	*regional ingredients*	*vegetable forward*
ethical farming	*local ingredients*	*regional produce*	*vegetarian*
ethical food	*local produce*	*regenerative*	*waste conscious*
ethically	*local sourcing*	*regenerative agriculture*	*waste minimization*
farm	*locally sourced*	*responsible*	*waste reduction*
farm based	*low impact*	*responsibly*	*wild caught*
farm to fork	*low-impact*	*restaurant garden*	*wild herbs*
farm to table	*Michelin green*	*reusable*	*wild ingredients*
farm-based	*minimal packaging*	*root to stem*	*wild plants*
farm-to-fork	*minimal waste*	*root-to-stem*	*wild produce*
whole vegetable			

Appendix 9. Additional graphs

Economic performance variable yearly mean variation



Reputation variables yearly mean variation



Appendix 10. Complete regression data

TRENDS FE+RE Regression

Google Trends FE					
Variabile	Coeff.	Std. Err.	t	p	95% CI
Certification	17.5923	2.5606	6.87	0.000	12.5127 ; 22.6719
country_id	omitted	---	---	---	---
sector_id	omitted	---	---	---	---
size_id	omitted	---	---	---	---
AwardYear	omitted	---	---	---	---
Year dummy	Coeff.	Std. Err.	t	p	95% CI
21884	10.9002	4.1104	2.65	0.009	2.7463 ; 19.0541
21915	11.2262	5.8076	1.93	0.056	-0.2946 ; 22.7470
21946	12.2929	3.3472	3.67	0.000	5.6530 ; 18.9328
21975	-4.2404	4.4864	-0.95	0.347	-13.1402 ; 4.6593
22006	-13.6404	4.8225	-2.83	0.006	-23.2069 ; -4.0740
22036	-7.0404	4.0388	-1.74	0.084	-15.0523 ; 0.9714
22067	-0.2404	4.3409	-0.06	0.956	-8.8515 ; 8.3707
22097	13.1596	4.4033	2.99	0.004	4.4245 ; 21.8946
22128	8.3262	6.7139	1.24	0.218	-4.9923 ; 21.6448
22159	1.6785	4.9168	0.34	0.734	-8.0751 ; 11.4321
22189	6.2863	4.0905	1.54	0.127	-1.8282 ; 14.4009
22220	-5.2824	3.7754	-1.40	0.165	-12.7717 ; 2.2070
22250	-4.1554	4.6386	-0.90	0.372	-13.3571 ; 5.0464
22281	-7.0412	5.0646	-1.39	0.168	-17.0881 ; 3.0057
22312	-9.4162	4.6454	-2.03	0.045	-18.6313 ; 0.2010
22340	-11.1106	4.7635	-2.33	0.022	-20.5600 ; -1.6612
22371	-7.8884	5.0589	-1.56	0.122	-17.9238 ; 2.1470
22401	-3.9538	4.5232	-0.87	0.384	-12.9266 ; 5.0190
22432	-2.1730	4.9268	-0.44	0.660	-11.9464 ; 7.6005
22462	9.0030	4.8285	1.86	0.065	-0.5755 ; 18.5815
22493	6.8163	4.8409	1.41	0.162	-2.7867 ; 16.4193
22524	5.2238	5.5945	0.93	0.353	-5.8741 ; 16.3218
22554	3.0372	5.3460	0.57	0.571	-7.5678 ; 13.6421
22585	-5.5722	6.0362	-0.92	0.358	-17.5463 ; 6.4020
22615	-13.2170	6.4359	-2.05	0.043	-25.9840 ; -0.4500
22646	-11.2412	6.3819	-1.76	0.081	-23.9013 ; 1.4188
22677	-11.5269	6.2943	-1.83	0.070	-24.0132 ; 0.9594
22705	-11.9530	6.4044	-1.87	0.065	-24.6576 ; 0.7516
22736	-13.5737	6.5423	-2.07	0.041	-26.5518 ; -0.5955
22766	-16.0839	6.4896	-2.48	0.015	-28.9574 ; -3.2104
22797	-14.2189	6.5665	-2.17	0.033	-27.2451 ; -1.1927
22827	-7.8491	6.4008	-1.23	0.223	-20.5466 ; 4.8483
22858	-12.3915	6.3003	-1.97	0.052	-24.8897 ; 0.1067
22889	-16.9779	7.1338	-2.38	0.019	-31.1293 ; -2.8264
22919	-16.0035	6.9264	-2.31	0.023	-29.7436 ; -2.2634
22950	-11.4596	8.8889	-1.29	0.200	-29.0928 ; 6.1736
22980	-19.4829	8.2843	-2.35	0.021	-35.9168 ; -3.0490
23011	-19.6029	8.9426	-2.19	0.031	-37.3426 ; -1.8633
23042	-9.7229	9.5813	-1.01	0.313	-28.7297 ; 9.2839
23070	-12.6503	10.0569	-1.26	0.211	-32.6006 ; 7.3000
23101	-8.4903	9.7390	-0.87	0.385	-27.8100 ; 10.8293
23131	-12.7297	8.6896	-1.46	0.146	-29.9676 ; 4.5082
23162	-10.6879	9.3731	-1.14	0.257	-29.2817 ; 7.9059
23192	-14.4589	8.6056	-1.68	0.096	-31.5302 ; 2.6123
23223	-17.6512	8.2795	-2.13	0.035	-34.0755 ; -1.2269
23254	-16.2509	8.9655	-1.81	0.073	-34.0361 ; 1.5343
23284	-14.5971	10.1253	-1.44	0.152	-34.6829 ; 5.4888
23315	-33.2877	11.1276	-2.99	0.003	-55.3619 ; -11.2135
23345	-38.4877	10.9172	-3.53	0.001	-60.1444 ; -16.8310
23376	-36.3544	9.6222	-3.78	0.000	-55.4423 ; -17.2664
23407	-33.8210	11.4219	-2.96	0.004	-56.4790 ; -11.1630
23436	-29.7205	12.1502	-2.45	0.016	-53.8232 ; -5.6177
23467	-18.4128	11.5844	-1.59	0.115	-41.3931 ; 4.5676
23497	-17.9968	14.1299	-1.27	0.206	-46.0267 ; 10.0332
23528	-30.9139	12.3138	-2.51	0.014	-55.3411 ; -6.4867
23558	-36.9909	12.5904	-2.94	0.004	-61.9667 ; -12.0150
23589	-37.1447	13.1660	-2.82	0.006	-63.2625 ; -11.0269
23620	-36.3859	11.5527	-3.15	0.002	-59.3033 ; -13.4686
23650	-41.6359	13.1083	-3.18	0.002	-67.6393 ; -15.6325
23681	-40.9653	13.1257	-3.12	0.002	-67.0031 ; -14.9275
23711	-38.7653	12.2274	-3.17	0.002	-63.0210 ; -14.5095
23742	-26.1653	14.0891	-1.86	0.066	-54.1144 ; 1.7838
23773	-37.3653	13.0184	-2.87	0.005	-63.1903 ; -11.5403
23801	-34.9653	12.8770	-2.72	0.008	-60.5098 ; 9.4208
23832	-49.1653	15.0188	-3.27	0.001	-78.9586 ; -19.3720
23862	-35.9980	13.9904	-2.57	0.012	-63.7512 ; -8.2448
23893	-60.3807	13.9306	-4.33	0.000	-88.0152 ; -32.7462
23923	-57.3807	13.9306	-4.12	0.000	-85.0152 ; -29.7462
23954	-57.3807	13.9306	-4.12	0.000	-85.0152 ; -29.7462
23985	-64.3807	13.9306	-4.62	0.000	-92.0152 ; -36.7462
24015	-5.3807	13.9306	-0.39	0.700	-33.0152 ; 22.2538
24046	-99.3807	13.9306	-7.13	0.000	-127.0152 ; -71.7462
24076	-99.3807	13.9306	-7.13	0.000	-127.0152 ; -71.7462
24107	-99.3807	13.9306	-7.13	0.000	-127.0152 ; -71.7462
24138	-56.3807	13.9306	-4.05	0.000	-84.0152 ; -28.7462
24166	0.6193	13.9306	0.04	0.965	-27.0152 ; 28.2538
24197	-99.3807	13.9306	-7.13	0.000	-127.0152 ; -71.7462
24227	-59.3807	13.9306	-4.26	0.000	-87.0152 ; -31.7462