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# How retail marketing levers influence demand for plant-based products: a revealed preference analysis across food categories and urbanization levels



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## Abstract

**Purpose** – We aim to investigate how retail marketing levers influence the market share for different plant-based alternative (PBA) product categories compared to conventional counterparts across varying levels of urbanization.

**Design/methodology/approach** – The study analyzes four years (2020–2023) of panel data on sales of PB and conventional products in the Italian modern grocery distribution sector. The data, aggregated at a provincial level, is segmented into three urbanization levels (predominantly urban, intermediate and predominantly rural) defined based on consumers' residential locations according to the Eurostat urban–rural typology. The analysis employs fixed effects regression models to examine the influence of marketing levers (assortment, price and price-based promotions) on the market share of PBAs.

**Findings** – The results indicate that there is a significant association between store assortment and PBAs market share across all urbanization levels, with the strongest correlation in rural areas. Price-based promotions have the most substantial correlation in urban areas, while relative price differences are not significant drivers of market share. Product category-specific analysis reveals significant variations: assortment consistently improves PBAs demand, whereas relative price and price-based promotions exhibit mixed effects depending on the product and urbanization level.

**Practical implications** – Findings suggest that retailers should differentiate their strategies to the specific urbanization context to effectively promote PBAs. Deepening the assortment of PBAs is effective, especially in rural areas, while targeted price-based promotional activities are more effective in urban settings.

**Originality/value** – To our knowledge, this study is the first to investigate the role of the retailer in influencing consumer behavior toward PBAs using an actual sales dataset. Moreover, it is the first to analyze how consumer behavior changes according to different levels of urbanization.

**Keywords** Plant based, Alternative proteins, Meat substitute, Dairy, Sustainability, Assortment, Consumer preferences

**Paper type** Research article



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## 1. Introduction

Research suggests that the global food system is responsible for approximately one-third of all anthropogenic greenhouse gas emissions (Crippa *et al.*, 2021). As awareness of this significant impact grows, there is increasing demand for changes in production practices and the adoption of more sustainable approaches on both the demand and supply sides (Bragaglio *et al.*, 2018; Caccialanza *et al.*, 2023).

Given that individual food choices play a major role in influencing climate change (Springmann *et al.*, 2016), a shift in dietary habits is considered essential for the transition to more sustainable agri-food systems (Sodano *et al.*, 2016; Pang and Chen, 2024). One solution frequently cited in the literature and increasingly explored by the industry is to curb reliance on animal protein and instead adopt plant-based alternatives (PBAs) (Verneau *et al.*, 2014, 2016; Circus and Robison, 2018; Halme *et al.*, 2023; Demartini *et al.*, 2024). Indeed, meat production is widely debated for its significant environmental impacts (Allievi *et al.*, 2015; Collier *et al.*, 2021), which remain higher even when compared to the least sustainable production of PB foods, such as fruits, vegetables, legumes, pulses, and grains. This impact includes higher contributions to greenhouse gas emissions, water use, and land use (Allegretti *et al.*, 2018; Poore and Nemecek, 2018; Navarrete-Molina *et al.*, 2019).

In Western markets, consumer interest in reducing meat consumption and opting for PB foods and alternative proteins has been on the rise (BCG, 2021, 2023). In response, companies have introduced various food market innovations to cater to this growing trend and facilitating omnivorous consumers transition toward a *"meatless"* diet (Aschemann-Witzel *et al.*, 2021; Martinelli *et al.*, 2021; Habib *et al.*, 2024; Sirieix *et al.*, 2023).

Companies are increasingly channeling resources into the development of PBAs—food products designed to closely mimic the taste, flavor, and texture of conventional animal-based products, but with little to no animal content (Aschemann-Witzel *et al.*, 2021; Mann, 2021; Onwezen *et al.*, 2021; Paloviita, 2021; Sharma *et al.*, 2022; Hötzel and Vandresen, 2022). The market for PBAs is showing significant growth potential, particularly in Europe, where revenue is projected to increase by 8.43% annually (Statista Market Insights, 2024).

The increasing market diffusion and penetration of PBAs among consumers has made them a highly relevant context for research (Charlebois *et al.*, 2016; Clark and Bogdan, 2019; Carfora *et al.*, 2022). The literature on consumer preferences for PBAs is now well-developed and has primarily focused on stated preference methods, such as discrete choice experiments (DCEs) and surveys (see, for instance: Pohjolainen *et al.*, 2015; Slade, 2018; Van Loo *et al.*, 2020; Rondoni *et al.*, 2021; Cardello *et al.*, 2022; Spendrup and Hovmalm, 2022; Caputo *et al.*, 2023; Saini *et al.*, 2024; Demartini *et al.*, 2024; Caputo *et al.*, 2025).

However, the growth of the PB market has led to greater availability of secondary sales data, creating new opportunities to complement stated preference methods with revealed preference approaches to gain deeper insights into actual consumer behavior (Zhao *et al.*, 2023; Cuffey *et al.*, 2023; Wang *et al.*, 2024). Our study contributes to this emerging line of research by being the first study to investigate how retailer marketing levers influence consumer behavior in the PBAs sector.

Specifically, the study examines the influence of three key retail marketing levers – assortment, price, and price-based promotions–on consumer choice across PBAs product categories, as consumer preferences have been shown to differ across PB product types (Cardello *et al.*, 2022). The analysis also considers different levels of urbanization of the area where consumers reside, following the official Eurostat urban-rural typology, as the urban context plays a significant role in shaping PBAs consumption (Cuffey *et al.*, 2023). On these premises we investigate the following research questions:

*RQ1.* How do retail marketing levers affect the overall relative market share of PBAs across different levels of urbanization?

*RQ2.* How do retail marketing levers affect the relative market share of PBAs in different product categories at different levels of urbanization?

To achieve our research goals, we employed a panel dataset of real sales data (2020–2023), provided by Circana (formerly IRI), derived from a weekly census analysis of over 20.051 retail outlets of the Italian Modern Grocery Distribution (MGD). Italy represents a suitable context for the analysis since it is the third largest PBAs retail market in Europe (Martinelli and De Canio, 2024) with the fastest growing PB categories being PB meals PB meat and PB milk (Good Food Institute, 2021, 2022). Furthermore, as shown in Figures 1 and 2, consumer demand for PBAs has increased steadily during 2020–2023. Figure 1 shows the overall upward trend in PBAs sales over 2020–2023. Figure 2 breaks down these trends by urbanization level, showing that sales are highest in urban areas, followed by intermediate regions, and lowest in rural areas.

Drawing on an empirics-first panel-data approach, our study advances the debate on sustainable food consumption by demonstrating how retailers shape consumer access and choice across urbanization levels. These insights have managerial implications for retail strategies, suggesting that retailers should expand PBAs assortment and focus on price-based promotions in urban areas, while maintaining broad assortment and attention to relative price positioning in rural regions to accommodate differences in consumer behavior and regional market dynamics.

The remainder of this paper is organized as follows. Section 2 describes the relevant context for the study, while Section 3 illustrates dataset structure and the empirical approach used to estimate our models. Section 4 presents the analysis of the model, the key drivers for the growth of PBAs based on the distinction between predominantly rural areas and urban areas and the main implications. Section 5 exposes additional analysis and robustness checks, while Section 6 the discussion and implications. Finally, Section 7 presents the conclusions and research agenda.

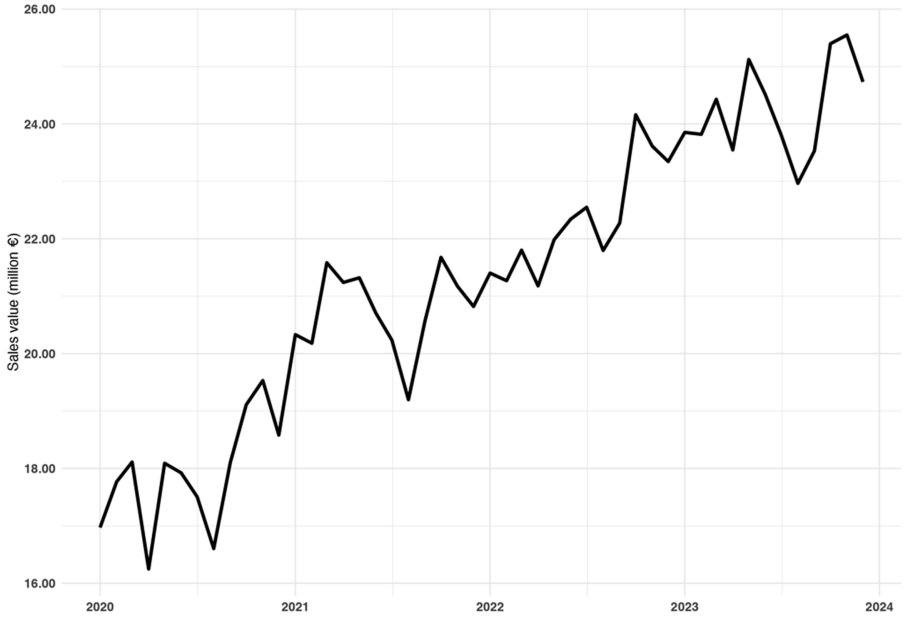


**Figure 1.** Trend of PBAs product sales in Italy over 2020–2023. Description of Figure 1. This figure shows the monthly trend of PBAs product sales in Italy from 2020 to 2023. All PBAs product categories considered in our analysis are aggregated in this series. **Source:** Authors' own compilation with Circana data, 2020–2023

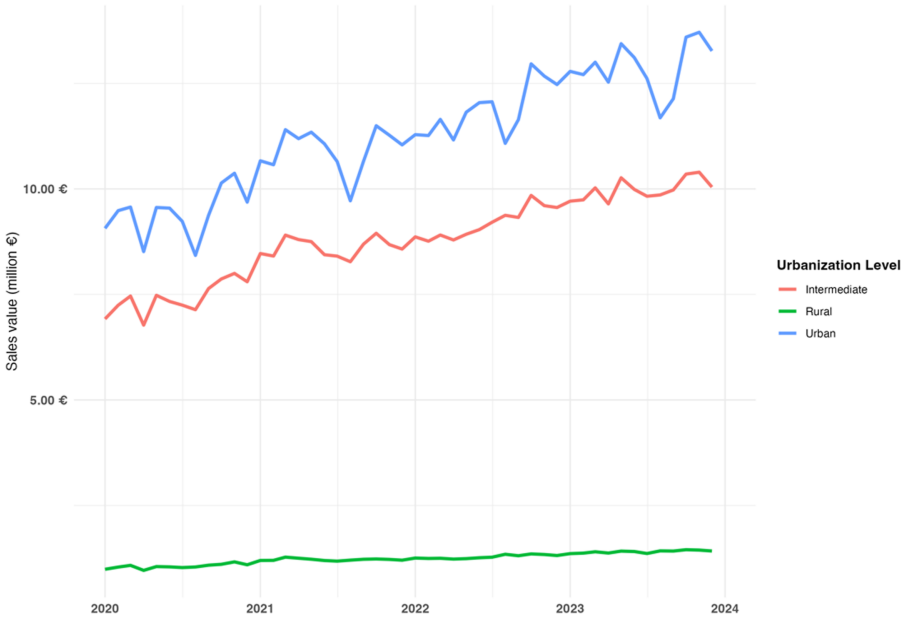


**Figure 2.** Trend of PB product sales in Italy over 2020–2023 across different urbanization levels. Description of Figure 2. This figure shows the monthly trend of PB product sales in Italy from 2020 to 2023, disaggregated by urbanization level. Urbanization level is classified according to Eurostat's urban-rural typology. All PB product categories considered in our analysis are aggregated in this series. **Source:** Authors' own compilation with Circana data, 2020–2023

## 2. Background

### *2.1 Stated and revealed preferences*

To date, previous studies have mostly focused on exploring consumer preferences for PBAs under hypothetical scenarios, typically relying upon experimental methods to elicit stated preferences. These studies consistently find that the market share of PBAs remains lower than that of conventional products (e.g. Slade, 2018; Van Loo *et al.*, 2020; Rondoni *et al.*, 2021, 2022; Caputo *et al.*, 2023; Sucapane *et al.*, 2021). However, there is evidence that certain marketing strategies and information campaigns can help mitigate consumer aversion to PBAs and increase their behavioral intention to consume these alternatives (e.g. Van Loo *et al.*, 2020; Rondoni *et al.*, 2022; Sucapane *et al.*, 2021).

Despite some limitations, such as hypothetical bias, stated preference methods are valuable when market data is lacking. However, as the market for PBAs has matured–at least in certain food categories and for certain technologies–there have been efforts to apply revealed preference approaches. These approaches, which analyze actual consumer behavior, can complement the insights provided by stated preference methods.

Zhao *et al.* (2023) and Cuffey *et al.* (2023) used scanner data to analyze demand patterns for PB meat alternatives in the US. Their findings were consistent in that the market share of PB meat alternatives, while growing, remains significantly lower than that of conventional meat products. Consumers do not consistently incorporate these alternatives into their diets and often purchase them on impulse, confirming findings from previous stated preference analyses. In addition, education, income and geographic location were identified as important predictors of PBAs purchases. Wang *et al.* (2024) examined the effect of advertising on demand for PB burgers by matching advertising data with scanner data. Their findings support the notion that it is difficult to retain consumers for repeat purchases of PB meat alternatives,

suggesting difficulties in cultivating consumer loyalty. However, the study also found that advertising plays a role in increasing the likelihood of purchasing these products. This effect is particularly pronounced among consumers who are already familiar with vegan burgers, while meat consumers are less influenced by advertising, underscoring that PB burgers still lack the same appeal as traditional meat burgers for these individuals. Petersen *et al.* (2024) examine local variations in meat substitute consumption across Germany by analyzing sociodemographic factors and regional election results, highlighting differences tied to political leanings from 2017 to 2021. Findings reveal that regions with higher support for the Green Party and climate-focused parties correlate with greater meat substitute consumption, while areas favoring conservative parties show lower adoption rates, suggesting targeted marketing could effectively address these distinct consumer segments.

### *2.2 Retail marketing levers to influence consumer behavior*

Shoppers are generally known to have a variety-seeking behavior and those retailers capable of fulfilling at best these needs with a complete (i.e. with a consistent number of references) and distinctive assortment (i.e. with a minor overlapping rate of brands/items than the competitors' one), obtain a competitive advantage (Chernev, 2011). Indeed, retailers can strategically manage their assortment's breadth and depth as well as their pricing strategies for differentiation purposes (Broderick *et al.*, 2011; Broniarczyk *et al.*, 1998; Kahn *et al.*, 2014). In fact, while product quality depends entirely on manufacturers, retailers can directly manage assortments as a fully-fledged strategic lever.

It is well known that retailers consider product assortment as the most critical element of their strategy since they use it to satisfy consumers' needs and influence their decision-making (Hamlin, 2016; Hamlin *et al.*, 2022; Simonson, 1999). The evidence thus exists of the fact that consumers tend to focus on the set of options they observe in a specific context (i.e. the available items on a supermarket shelf), proving that assortments have a positive and significant effect on spending at the chosen store, also influencing store patronage directly (Fox *et al.*, 2004).

The literature long established that the number of brands and the availability of consumers' favorite brands, two core characteristics of product assortments, represent the most important attributes to evaluate the variety and thus determining store choice and spending (Sethuraman *et al.*, 2022; Oppewal and Koelemeijer, 2005; Briesch *et al.*, 2009). When it comes to so-called "destination" categories (Briesch *et al.*, 2013) such as PBAs, these attributes are even more significant and influent in determining the store choice. In the light of these considerations, the variety of PBAs offered in each category, in terms of alternative brands and alternative price levels, has been proven to be unsatisfactory as too limited (Saini *et al.*, 2024). Inadequate assortment depth represents a major concern for PBAs, forcing consumers to make restricted and monotonous choices (Donato *et al.*, 2024). All the above set the availability issue as a primary constraint to introduce or switch to PBAs in a diet.

Another supply-side and retailing relevant concern to switching and adopting PBAs instead of conventional alternatives comes from pricing and price-based-promotions strategies in general. It is proven in retailing literature that price-based-promotions enhance substitution (Walters, 1991), tough still little is known about the magnitude of the across-category substitution effect. The need to investigate for cross-price elasticities and substitutability between PBAs and their conventional counterparts has shown up in literature only in recent years together with the newfound popularity of scanner data analysis (Van Heerde and Dekimpe, 2024). PBAs are, in general, more expensive than conventionals: in the US, for example, prices for meat-alternatives exceed the conventional counterparts by over 20% and shoppers, both omnivores and flexitarians, perceive meat as offering better value than PB meat alternatives in terms of price (Good Food Institute, 2024a). In response, grocery chains worldwide are leveraging their private label offerings to provide consumers with a wider range of PBAs at affordable prices, often aligned to conventional products (Vegconomist, 2023). Leveraging competitive prices, with the help of targeted price-based promotional activities,

might enhance the likelihood of consideration, thus leading to greater choice in an equal playing field between PBAs and their conventional counterparts (Jahn *et al.*, 2024). However, while price adjustments may effectively influence behavior in the short term, they could inadvertently reinforce the perception of meat as a status symbol and PBAs as inferior (Garnett *et al.*, 2021).

### *2.3 Rural and urban consumption*

Literature identified different attitudes towards PBAs between urban and rural consumers. From the earliest studies on the introduction of PBAs, it emerged that rural consumers were averse to high price points for this product category (McEachern and Warnaby, 2006), a dynamic (partly) attributable to the lower purchasing power of rural populations (Vinnari *et al.*, 2010). Cullen and Kingston (2009) analyzed rural and urban consumers and divided them into food-related lifestyle consumer segments, noticing that urban consumers are more responsive toward new food products. Furthermore, Shaw and Iomaire (2019) pointed out that – for the Irish context – urban consumers showed greater openness to cultured meat and expressed significant concerns about the environmental impact of conventional meat production. In contrast, rural consumers were more worried about the potential negative effects of cultured meat production on agri-business and the livelihoods of Irish farmers. Kröger *et al.* (2022) found significant differences between the two groups, noticing that rural consumers were more price-conscious and less propense to accept novel foods. However, it must be pointed out that both rural and urban environments pose challenges to the consumption of PBAs: rural areas might face poor or difficult access to grocery stores, while urban consumers often report challenges in choosing PBAs among vast assortments (Fergus *et al.*, 2021).

## 3. Data description and empirical approach

Our analysis is based on a database provided by Circana (formerly, IRI) for the period 2020–2023, aggregated at provincial level. The dataset contains information on real monthly sales of conventional and PBAs in the Italian MGD sector. The database covers the following conventional product categories: processed poultry, processed pork, processed beef, würstel, cured meats, frozen meats, UHT milk and cheese. Moreover, it covers the following PB categories: PB milk, PB würstel, PB cheese, PB cured meats, PB burgers/nuggets, PB meatballs, PB patties, and frozen PBAs. While the dataset contains the PB counterpart for almost all conventional categories directly, we had to sum over PB burgers/nuggets, PB meatballs, PB patties to obtain the PB meat category. We excluded PB cheese from the analysis as there are few observations for this category in the database. This lack of observations reflects a real trend in consumption, as aggregated data shows that the value of sales of PB cheese is around €7.7 million, a small value compared to, for example, the €310.4 million for PB milk (Good Food Institute, 2023). The performance of the PBAs across product categories is shown in Table 1.

At a first glance, Table 1 indicates the slow but steady diffusion of PBAs across the Italian MGD and highlights a few performance indicators: market shares generally report positive trends across the years, as well as average assortments per-store indicating that shelves are gradually more populated by PBAs to conventional food and dairy products. Moving to prices, the average PB price ratio in respect to the conventional counterparts is systematically greater than 1, showing that PB foods are more expensive, priced 33–322% higher compared to conventional products. Following the same logic, the promotional pressure (i.e. the sales volumes achieved under a discount of at least 5% compared to the baseline) of PBAs is systematically lower than that of conventional products. For example, the promotional pressure of cured meats in Italy is systematically greater than 50%, while the promotional pressure of PB cured meats is approximately 20%, and the same goes for every other food category included in our study. Over the years, there has been a gradual increase in promotional pressure, albeit modest, indicating that retailers occasionally include PBAs in their price-based promotional strategies to generate more traffic.

**Table 1.** Performance of PBAs by product category in the Italian MGD 2020–2023

| Year | Market share vs conventional (%) | Average price ratio vs. conventional | Share of sales with price cuts (%) | Average per store assortment |
|---|---|---|---|---|
| *PB Meat Alternatives* | | | | |
| 2020 | 15.23 | 1.61 | 28.03 | 6 |
| 2021 | 18.14 | 1.60 | 29.49 | 6 |
| 2022 | 19.19 | 1.55 | 28.34 | 6 |
| 2023 | 20.74 | 1.51 | 34.55 | 6 |
| *PB Frozen Meat Alternatives* | | | | |
| 2020 | 17.21 | 1.66 | 19.34 | 5 |
| 2021 | 18.93 | 1.69 | 20.73 | 6 |
| 2022 | 17.19 | 1.59 | 21.79 | 6 |
| 2023 | 16.18 | 1.57 | 26.03 | 7 |
| *PB Cured Meat Alternatives* | | | | |
| 2020 | 0.38 | 1.37 | 16.71 | 3 |
| 2021 | 0.50 | 1.40 | 19.75 | 3 |
| 2022 | 0.55 | 1.41 | 20.75 | 3 |
| 2023 | 0.59 | 1.33 | 21.51 | 4 |
| *PB Würstel Alternatives* | | | | |
| 2020 | 0.95 | 3.22 | 17.05 | 1 |
| 2021 | 1.02 | 3.21 | 22.53 | 1 |
| 2022 | 0.92 | 3.13 | 20.85 | 1 |
| 2023 | 0.79 | 3.00 | 23.33 | 1 |
| *PB Milk Alternatives* | | | | |
| 2020 | 17.65 | 2.10 | 21.46 | 41 |
| 2021 | 19.95 | 2.12 | 23.41 | 43 |
| 2022 | 18.97 | 1.92 | 21.55 | 45 |
| 2023 | 17.69 | 1.77 | 24.78 | 48 |

**Source(s):** Authors' own work

To study the influence of marketing levers on the purchase of PBAs by consumers at different levels of urbanization, we divided the Italian provinces into three levels: predominantly rural, intermediate and predominantly urban, according to the Eurostat urban-rural typology for NUTS 3 regions-the most detailed level of the EU's official statistical geography. In Italy, NUTS 3 corresponds to the subdivision of the provinces [1]. According to Eurostat's methodology, provinces are considered predominantly rural if more than 50% of the population lives in rural areas; intermediate if the rural population share is between 20 and 50%; and predominantly urban if less than 20% of the population lives in rural areas; using this classification allows us to analyze differences in consumer residential patterns, which directly influence shopping behaviors, store accessibility, and consumer preferences. It should be noted that the Circana database covers 86 of Italy's 107 provinces, with the excluded provinces being mostly in the South or the Islands. Figure 3 shows the three levels of urbanization in the Italian provinces and the areas included in our analysis. Unsurveyed areas coincide with predominantly rural regions that are not monitored by the field operators of our data provider, Circana. This is due to the territorial distance from the company's headquarters located in Milan, northern Italy, which explains the lack of coverage in various southern provinces, especially located in the main islands of Sardinia and Sicily, as well as the challenging accessibility of certain rural and mountainous areas in northern and central Italy.

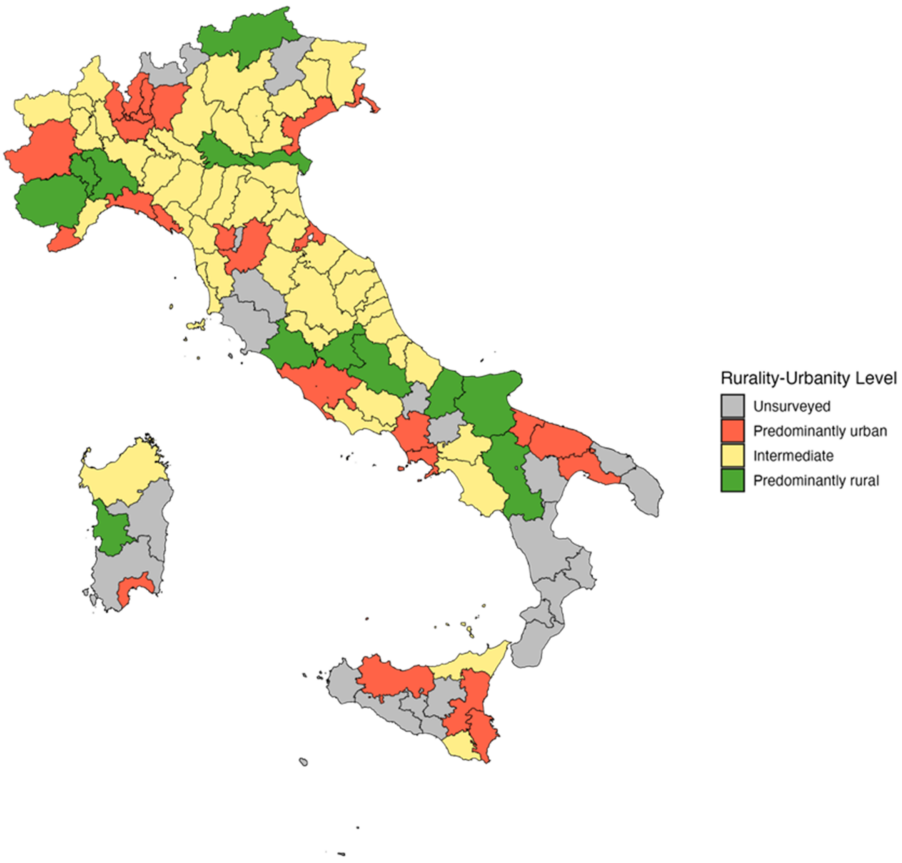


**Figure 3.** Urbanization level across Italian provinces. Description of Figure 3. This map illustrates the level of urbanization for each Italian province based on Eurostat's urban-rural typology. Data on administrative boundaries were sourced from ISTAT. Predominantly urban areas are shown in red, intermediate areas in yellow, and predominantly rural areas in green. Gray-colored areas are the provinces not surveyed by Circana and thus were not included in our analysis. Source: Authors' own compilation

After splitting the database, we constructed the variables needed for the estimation. Since our aim is to measure how (and where) the marketing levers influence the relative market share for PB products compared to conventional products (e.g. how the market share of PB milk versus conventional milk is affected by the relative price of PB milk versus conventional milk).

Following Fornari *et al.* (2021), to construct the share variables, we created comparable categories for conventional and PBAs. The Circana database directly provided PB counterparts for milk, würstel, cured meats and frozen meats. Instead, we had to systematically construct the counter-variable for the meat category. For the conventional product we combined data for processed poultry, processed pork and processed beef, while for the PB meat counterpart we combined PB burgers/nuggets, PB meatballs, PB patties, as mentioned above.

For each product category we then constructed the following variables:

(1) **MSHA**: market share of PB products versus conventional counterparts. It represents the relative demand of PB products compared to the conventional and thereby is the dependent variable to be used in the main models.

(2) **ASSORTMENT**: average per-store assortment of PB products versus conventional counterparts. It represents the relative per-store assortment of PB products compared to conventional, it can also be interpreted as a proxy of space allocation and visibility. ASSORTMENT is used as an explanatory variable in the main model.

(3) **PRICE**: price of PB products versus conventional counterparts. It represents the relative price of PB products compared to conventional ones. PRICE is used as an explanatory variable in the main model.

(4) **PROMOTION** [2]: share of sales realized thanks to price-based-promotions of PB products versus conventional counterparts. It represents the relative promotion intensity of PB products compared to conventional. PROMOTION is used as an explanatory variable in the main model.

To examine how different marketing leverages influence the overall market share of PBAs across different urbanization levels (i.e. RQ1), we estimated a two-way fixed effects regression model. The model includes interactions between the marketing levers and urbanization categories to compare their effects across different urbanization contexts.

The model specification is as follows:

$$\begin{aligned} MSHA_{it} = {} & \beta_0 + \beta_1 PRICE_{it} + \beta_2 ASSORTMENT_t + \beta_3 PROMOTION_{it} \\ & + d_1 PRICE_{it} * Middle_i + d_2 PRICE_{it} * Rural_i + d_3 ASSORTMENT_{it} * Middle_i \\ & + d_4 ASSORTMENT_{it} * Rural_i + d_5 PROMOTION_{it} * Middle_i \\ & + d_6 PROMOTION_{it} * Rural_i + \alpha_i + \lambda_t + \varepsilon_{it} \end{aligned} \tag{1}$$

Where $i = 1, \ldots, 5$ indicates the product category, $t = 01/2020, \ldots, 12/2023$, $\alpha_i$ represents the unit-specific fixed effects, $\lambda_t$ is the time-specific effects, and $\varepsilon_{it}$ is the idiosyncratic error term. $Middle_i$ and $Rural_i$ are binary variables for intermediate and predominantly rural areas respectively, while predominantly urban areas serve as the reference category.

To investigate the influence of marketing leverage on the relative market share of PBAs across different product categories and different levels of urbanization (i.e. RQ2), we split the Circana dataset by product category. This segmentation resulted in 5 separate panel datasets. For the analysis, we used a fixed effects regression model that includes both time-specific effects and interactions between marketing levers and urbanization levels. We specified the model as follows:

$$\begin{aligned} MSHA_{it} = {} & \beta_0 + \beta_1 PRICE_{it} + \beta_2 ASSORTMENT_{it} + \beta_3 PROMOTION_{it} \\ & + d_1 PRICE_{it} * Middle_i + d_2 PRICE_{it} * Rural_i + d_3 ASSORTMENT_{it} * Middle_i \\ & + d_4 ASSORTMENT_{it} * Rural_i + d_5 PROMOTION_{it} * Middle_i \\ & + d_6 PROMOTION_{it} * Rural_i + \lambda_t + \varepsilon_{it} \end{aligned} \tag{2}$$

Where $i = 1, \ldots, 86$ indicates the Italian provinces in our dataset, $t = 01/2020, \ldots, 12/2023$, $\lambda_t$ is the time-specific effects, and $\varepsilon_{it}$ is the idiosyncratic error term. This model was applied to each of the 5 datasets.

## 4. Results

Table 2 shows the descriptive statistics of the variables aggregated by product category, i.e. the variables used to estimate Model 1. Descriptive statistics of the variables of the product

**Table 2.** Summary statistics of variables used in the two-way fixed effects model (aggregated by product category)

| | Statistics | Predominantly urban | Intermediate | Predominantly rural |
|---|---|---|---|---|
| MSHA | Mean (s.d.) | 0.14 (0.13) | 0.13 (0.12) | 0.11 (0.09) |
| | Min–Max | 0.00–0.67 | 0.00–0.52 | 0.00–0.46 |
| Price | Mean (s.d.) | 1.96 (0.68) | 1.94 (0.67) | 1.94 (0.60) |
| | Min–Max | 1.00–5.10 | 0.91–5.30 | 0.98–4.78 |
| Assortment | Mean (s.d.) | 0.38 (0.34) | 0.38 (0.35) | 0.36 (0.33) |
| | Min–Max | 0.00–1.29 | 0.00–1.34 | 0.00–1.29 |
| Promotion | Mean (s.d.) | 0.78 (0.43) | 0.86 (0.51) | 0.80 (0.53) |
| | Min–Max | 0.00–3.85 | 0.00–5.13 | 0.00–6.02 |

**Source(s):** Authors' own work

category specific datasets used to estimate Model 2 are presented in Appendix 1 (see Table A1 in Appendix).

Before estimating the models, we conducted an exploratory analysis using a one-way ANOVA to analyze whether MSHA differed across urbanization levels. The one-way ANOVA showed there is a statistically significant difference in mean MSHA between at least two of the three levels ($F(2, 22{,}263) = 94.57$, $p < 0.001$). To go more in depth, we also conducted Tukey's HSD test for multiple comparisons. The test showed a statistically significant difference in the mean MSHA among all pairs of urbanization categories. Specifically, urban provinces have a higher MSHA on average when compared both to rural ($p < 0.001$, 95% C.I. = [0.0291, 0.0336]), and intermediate provinces ($p < 0.001$, 95% C.I. = [0.0037, 0.0079]). Accordingly, intermediate areas also exhibit a higher mean MSHA than rural areas ($p < 0.001$, 95% C.I. = [0.0234, 0.0278]). In terms of relative differences among groups, compared to rural areas, urban and intermediate areas have 31.45 and 23.52% higher MSHA, respectively. The smallest relative difference is found between urban and intermediate areas, where urban areas have a 6.42% higher MSHA.

### *4.1 PBAs across different levels of urbanization*

Table 3 shows the results of the two-way fixed effects regression model specified in Equation 1. To control for heteroskedasticity, standard errors were clustered by product category.

Results show that relative price and price-based-promotions are not significantly associated with the aggregate market share of PBAs. While the lack of a significant price effect may seem counterintuitive at first, we believe this is due to the fact that we are looking at the relative prices of conventional versus PB products, rather than absolute price levels. Consumption choices for PBAs are often value-driven, with decisions motivated more by health, ethical or environmental considerations than by price, similar to what has been observed in other speciality markets such as gluten-free products (Fornari *et al.*, 2021) and PBAs (Hoek *et al.*, 2011). This suggests that even if the relative price of PBAs increases compared to conventional products, consumers may not switch back to animal-based products, indicating a potentially low degree of substitutability between PB and conventional meat products (Caputo *et al.*, 2025).

Conversely, assortment has a statistically significant positive association overall (0.31***). This implies that having a wider variety of products generally increases the market share of PBAs in Italy. However, interactions of Assortment with Middle (−0.04*) and Rural (−0.10**), with Urban being the reference category, are both significant and negative. This suggests that the positive correlation of assortment with PBAs market share decreases in less urbanized contexts. In particular, the stronger negative coefficient observed in rural provinces compared to middle ones suggest that the association between assortment strategies and PBAs market share weakens progressively as the degree of urbanization decreases.

**Table 3.** Two-way fixed effects analysis of marketing levers on PBAs market share in Italian provinces

| | Estimate |
|---|---|
| Price | −0.01 |
| | (0.02) |
| Assortment | 0.31*** |
| | (0.05) |
| Promotion | 0.01 |
| | (0.01) |
| Middle | 0.03 |
| | (0.03) |
| Rural | 0.04 |
| | (0.03) |
| Price:Middle | −0.01 |
| | (0.01) |
| Price:Rural | −0.01 |
| | (0.01) |
| Assort: Middle | −0.04* |
| | (0.02) |
| Assort: Rural | −0.10*** |
| | (0.02) |
| Promo: Middle | −0.01 |
| | (0.01) |
| Promo: Rural | −0.02 |
| | (0.01) |
| Panel obs | 22,266 |
| Time fixed effects | Y |
| Product category fixed effect | Y |
| Adj. $R^2$ | 0.82 |

**Note(s):** Standard errors: clustered by product category. Significance levels: *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$

**Source(s):** Authors' own work

### *4.2 PBAs in different product categories at different levels of urbanization*

Table 4 shows the results of the time-fixed effects regressions for each product category as specified in (2). Heteroskedastic robust standard errors have been computed to provide reliable inference.

Results confirm that the higher assortment of PBAs has a significant and positive association with the market share of PBAs across all categories, except for würstel, with the strongest correlation in frozen meat (1.159***). When looking at interactions with urbanization levels, results again show that while assortment positively correlates with PB market shares, its effectiveness is reduced as we move from urban to rural provinces. This is found in all product categories except for würstel, where interactions' terms are not significant. Regarding relative price, we find a significant main effect only for Meat (−0.081**) and Frozen meat (−0.080*). The negative coefficients imply that when the PB option becomes more expensive relative to its conventional counterpart, its market share in these categories declines. In our study we treat these coefficients as qualitative indicators of price sensitivity–that is, evidence that consumers adjust their purchasing in response to changes in relative prices–and they should not be mistaken for price elasticities of demand, which were not computed in our analysis. However, when interactions between relative price and urbanization are considered, these are found to be negative and significant for all categories except for würstel. This suggests that consumers in less urbanized areas are more responsive to changes in relative prices.

Regarding price-based promotions, only milk demonstrates a strong positive response to promotional activities (0.587***), while cured meat presents a significant but small positive correlation (0.001**). However, the negative and significant interactions between price-based

**Table 4.** Time fixed effects regression analysis of marketing levers on PBAs market share in Italian provinces by product category

| | Meat | Frozen meat | Cured meat | Würstel | Milk |
|---|---|---|---|---|---|
| Price | −0.081** | −0.080* | −0.000 | −0.000 | 0.074 |
| | (0.024) | (0.030) | (0.001) | (0.001) | (0.034) |
| Assortment | 0.281*** | 1.159*** | 0.167*** | 0.270*** | 0.248** |
| | (0.013) | (0.048) | (0.021) | (0.024) | (0.049) |
| Promotion | 0.014 | 0.010 | 0.001** | −0.000 | 0.587*** |
| | (0.009) | (0.006) | (0.000) | (0.000) | (0.069) |
| Middle | 0.154*** | 0.245*** | 0.004* | −0.001 | 0.315*** |
| | (0.023) | (0.023) | (0.001) | (0.002) | (0.038) |
| Rural | 0.166*** | 0.081 | 0.004** | −0.004 | 0.144*** |
| | (0.020) | (0.042) | (0.001) | (0.002) | (0.022) |
| Price:Middle | −0.044** | −0.069*** | −0.002 | 0.000 | −0.054** |
| | (0.011) | (0.011) | (0.001) | (0.001) | (0.013) |
| Price:Rural | −0.028** | 0.053 | −0.002** | 0.001 | −0.150*** |
| | (0.005) | (0.031) | (0.000) | (0.001) | (0.024) |
| Assort: Middle | −0.094** | −0.352*** | −0.059** | −0.015 | −0.139** |
| | (0.017) | (0.058) | (0.012) | (0.008) | (0.036) |
| Assort: Rural | −0.195*** | −0.440*** | −0.052* | −0.010 | −0.311*** |
| | (0.020) | (0.037) | (0.019) | (0.015) | (0.033) |
| Promo: Middle | −0.027** | −0.003 | −0.001* | 0.003 | −0.082** |
| | (0.006) | (0.007) | (0.000) | (0.006) | (0.017) |
| Promo: Rural | −0.039*** | −0.011* | −0.000 | 0.000 | −0.135*** |
| | (0.006) | (0.004) | (0.000) | (0.000) | (0.018) |
| Panel obs | 4,472 | 4,472 | 4,472 | 4,472 | 4,472 |
| Time fixed effects | | | Y | | |
| Adj. $R^2$ | 0.67 | 0.60 | 0.58 | 0.65 | 0.31 |

**Note(s):** Standard errors: clustered by year. Significance levels: *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$

**Source(s):** Authors' own work

promotion and urbanization for all categories except for würstel imply that price-based promotional effectiveness is reduced outside of predominantly urban contexts.

## 5. Robustness checks

Although the use of two-way fixed effects allows us to control for unobservable factors that remain constant within the same product category (Model 1) or within the same province (Model 2), as well as within the same year (time effects), a potential endogeneity problem remains. Specifically, omitted variable bias (OVB) may arise from unobserved factors that vary simultaneously across time and across units of observation–either product categories or provinces. A common approach to address such a problem would be to implement a two-stage least squares (2SLS) instrumental variables (IV) regression. However, recent literature in agricultural economics (Henningsen *et al.*, 2024) strongly discourages this approach unless a valid instrument is clearly identified. In our specific context, one possible approach would have been to use lagged explanatory variables as instruments, following the method previously used in a structurally similar study by Fornari *et al.* (2021). However, recent literature has increasingly discouraged the use of such instruments. In particular, Bellemare *et al.* (2017) caution against the use of lagged explanatory variables as instruments, as this identification strategy can lead to biased estimates and incorrect inference.

For these reasons, we preferred to rely on OLS estimates and then conduct robustness checks to validate the strength of our findings. First, we employed the Oster test (Oster, 2019),

a widely used method in recent empirical literature (e.g. Wuepper *et al.*, 2021; Kreft *et al.*, 2021; Knapp *et al.*, 2021; Finger and Möhring, 2022; Mayorga *et al.*, 2025). The test leverages observed selection on included variables ("observables") to assess the potential severity of OVB caused by unobserved variables.

To perform the Oster test, we had to specify a maximum hypothetical $R^2$ ($R^2_{max}$) – that is the $R^2$ from a hypothetical regression where the outcome is explained by the treatment, along with both observed and unobserved control variables- and then calculate a value of $\delta$ - defined as the degree of selection on unobservables relative to observables–for which the coefficient $\beta$ of interest is driven to zero. According to Oster (2019), a $|\delta|$ greater than 1 indicates that the potential influence of unobserved variables on the estimated results is likely to be limited. In our application, following Oster's (2019) recommendations, we set $R^2_{max}$, 1.3 times the $R^2$, of the estimated model and $\delta = 1$, the latter implying that selection on omitted variables is assumed to be equal to selection on included controls. The test is conducted on the model specified in Equation (1) on the three explanatory variables (Assortment, Price, and Promotion), results are shown in Table 5. All three variables reported a $|\delta| > 1$. Specifically, the $\delta$ for Price indicates that unobservables would need to be 1.53 times stronger than the observables to drive the estimated coefficient of price to zero. At the same time, the $\delta$ for Assortment and Promotion are 1.24 and 1.35, respectively.

**Table 5.** Oster test results

| | Price | Assortment | Promotion |
|---|---|---|---|
| Beta | 0 | 0 | 0 |
| Delta | 1.53 | 1.23 | 1.34 |
| $R^2$ max | 0.89 | 0.89 | 0.89 |
| *N* | 22,266 | 22,266 | 22,266 |

**Note(s):** We set the estimated coefficient to zero and estimate the degree of selection on unobservables relative to observables for which is driven to zero

**Source(s):** Authors' own work

Additionally, we conducted several robustness checks to verify the reliability of our estimates. First, we estimated the model specified in Equation (1) using the National Circana database, which aggregates sales data at the national rather than provincial level. The results obtained from this analysis were consistent with our main findings. Detailed outcomes of this robustness check are presented in Appendix 1 (Table A2). Furthermore, to validate our results from regressions specified in Equation (2), we applied the segmented approach to the national dataset and performed an analysis analogous to Equation (2). Again, these results confirmed consistency across provincial and national datasets, and the complete details can be found in Appendix (Table A3).

Lastly, we re-estimated the models from Equation (1) and Equation (2) using the absolute market share of PBAs as the dependent variable. The findings from this additional specification are also consistent with our main results (Tables 3 and 4 in the paper), and the detailed estimates are reported in Appendix (Table A4 and Table A5).

## 6. Discussion and implications

The literature has long focused on understanding and analyzing the mechanisms that lead consumers to orient their purchase and consumption choices, including those rooted in individual beliefs or preferences. Within this domain, one of the most closely examined topics concerns purchasing strategies and the responsible consumption of products (Fischer *et al.*, 2021). In seeking to identify the drivers of product consumption, scholars emphasize the need to determine what prompts changes in the decision-making process underlying shopping

habits. By pinpointing key marketing levers and quantifying their impact on specific consumer segments or purchasing contexts, we can more effectively interpret these emerging trends (Young *et al.*, 2010).

Researchers have already identified several individual characteristics that influence consumers' willingness to choose more sustainable products over conventional alternatives (McDonald *et al.*, 2012). While specific combinations of beliefs and values may differentially influence communication strategies and perceptions of product sustainability (Fischer *et al.*, 2021), significant gaps remain in the debate on how retail strategies influence consumer preferences for PBAs (e.g. Onwezen *et al.*, 2021; Kröger *et al.*, 2022). Although prior work has outlined the consumption values – namely: health, food safety, ecological concern, curiosity, novelty, prestige, and avoidance of guilt–that motivate individual consumption (Bhattacharyya *et al.*, 2023), far less has been done to quantify how these levers operate in real-world consumption settings within MGD (Sethuraman *et al.*, 2022).

In this study we contribute to the debate regarding the spread of PBAs investigating which are the retailer's marketing leverage that influence consumer's purchase choices. Findings reveal that store assortment significantly influences PBAs market share across all urbanization levels, with the strongest effect in rural areas, indicating that a broader variety of PBAs can lead to higher market shares where availability is typically lower confirming a previous literature finding that assortment is the main driver (Simonson, 1999; Gázquez-Abad and Martinez-Lopez, 2015; Hamlin, 2016; Fornari *et al.*, 2021).

Price-based promotional activities have a substantial effect in urban and intermediate areas, reflecting the competitive retail environment, while their effect is minimal in rural areas, possibly due to a smaller market size or less frequent shopping trips. Variations in the relative price levels of PBAs compared to conventional products generally do not drive significant changes in market share, suggesting that PB consumers might be more motivated by values than by price considerations.

However, in certain product categories, such as PB meat and milk, the relative price ratio has a stronger effect on consumer preferences, particularly in rural areas, suggesting that cost considerations are more critical for these consumers. Urban areas exhibit a higher market share for PBAs compared to rural and intermediate areas, aligning with the trend that urban consumers are more open to trying new products and adopting PB diets. Intermediate areas also show a higher market share than rural regions but are less responsive to marketing strategies than urban areas.

Moreover, the analysis conducted across product categories helps situate our study both within the wider debate on the adoption of PBAs and in the discussion of the substantial differences that exist among these products at the category level. Italy's retail landscape mirrors the aggregate European diffusion of PBAs, yet it simultaneously magnifies the divide between categories that have attained mainstream penetration (i.e. "PB Meat Alternatives" or "PB Frozen Meat Alternatives") and categories that remain nascent (i.e. PB Würstel Alternatives or PB Cured Meat Alternatives) as described in Table 1. This pronounced contrast positions Italy as a natural testing ground for retail interventions that can subsequently be transferred across the EU market context (Good Food Institute, 2024a, b).

Our category-specificity-lens are indispensable because key determinants of adoption vary systematically across product classes. Empirical price scans reveal that the premium over animal counterparts diverges sharply between different categories, implying distinct own-price elasticities and parity thresholds (Siegrist *et al.*, 2024). Likewise, consumer-centered studies show that health and environmental motives dominate evaluations of PBAs, whereas sensory experiences vary significantly between PB product categories (Waehrens *et al.*, 2023). Given the increasingly granular focus of consumption-side research, we considered it essential to deliver an equally fine-grained examination of the specific revealed marketing levers. In store retail marketing communication strategies evidence indicates that shelf integration, flyer promotions, and private-label strategies exert heterogeneous effects across categories, underscoring the need for differentiated marketing-mix designs (Good Food Institute, 2024c).

Category heterogeneity also bears further potential significance. Italy's Mediterranean-diet tradition is an interesting setting for PBAs consumption (Good Food Institute, 2024a, b). Generating category-specific demand elasticities within this cultural context, therefore, offers policymakers and retailers actionable guidance on price, price-based promotion and assortment strategies that respect "culinary heritage" while remaining scalable across the European Union, in country-specific or multi-country settings.

### *6.1 Theoretical implications*

The theoretical contribution of this study lies in addressing the existing gap in the literature by applying a revealed preference approach to analyze the influence of retail marketing levers on the demand for PBAs across different levels of urbanization.

Our use of a revealed preference approach, leveraging observed sales data, allowed us to build on the existing stated preference literature that examines consumer preferences for PB meat alternatives on the basis of a specific product–different attributes (e.g. Van Loo *et al.*, 2020; Caputo *et al.*, 2023). Rather than assessing preferences in a "vacuum", our study focuses on actual consumer responses to retail strategies, offering insights into how marketing levers, such as assortment, price, and price-based promotions, influence consumer choices across diverse geographic setting.

In fact, in line with recent calls for more in-depth research into how environmental and socio-demographic factors affect PB consumption (Saini *et al.*, 2024), this study explores the distinction between rural and urban markets, an aspect that has been underexplored in previous works. Most existing studies have treated consumer behavior toward PBAs as largely homogenous, failing to account for how geographic location and urbanization levels shape purchasing decisions. By distinguishing between rural, intermediate, and urban areas, this research reveals significant differences in how consumers respond to the retailers marketing levers.

Building on the contributions of Donato *et al.* (2024) and Saini *et al.* (2024), this study not only enhances our understanding of which marketing levers contribute most to consumer motivation to purchase PBAs but also extends the application of revealed preference data to the retail marketing context. Donato *et al.* (2024) emphasized the role of identity and cultural factors in promoting PBAs, while Saini *et al.* (2024) focused on consumer motivations and values driving PBAs consumption. This empirics-first approach complements their findings by showing that revealed preferences can point out insights into actual consumer behavior (Golder *et al.*, 2023), moving beyond hypothetical intentions and closer to the real factors driving PB market growth (Ford *et al.*, 2023).

In particular, we pursue this attempt by employing empirics-first research that uses panel-data in a "Better-Marketing-for-a-Better-World" topic (Van Heerde and Dekimpe, 2024). In fact, this study contributes to the evolving discourse on sustainable food consumption by integrating the role of retailers in influencing consumer access and choice. Retailers, through their control of product assortment, pricing, and promotional strategies, significantly influence the availability and visibility of PBAs, particularly in rural areas where access to diverse food options is more limited. This work highlights that while urban consumers may be more attuned to promotional efforts, rural consumers benefit more from expanded assortments, addressing a critical gap in understanding how market dynamics differ across rural and urban areas.

### *6.2 Managerial implications*

Our results suggest that assortment breadth generally has a strong positive association with the market share of PBAs, while relative price ratio and price-based promotions have more heterogeneous effects. While this may initially seem surprising, it aligns with prior research in speciality food markets, such as the gluten-free segment (Fornari *et al.*, 2021), and sustainable food consumption more broadly (Hoek *et al.*, 2011; Grunert *et al.*, 2014). Consumers in these

categories often exhibit relatively low-price sensitivity because their purchasing decisions are motivated by intrinsic factors, including health concerns, ethical values, and environmental considerations. In emerging markets like PBAs, where product innovation and value alignment are key, assortment variety becomes more critical than price-based competition (Michel *et al.*, 2021). These findings suggest that expanding and diversifying the assortment of PBAs could be a more effective strategy for retailers and manufacturers than relying solely on price-based promotions.

Moving to urbanization levels, the study suggests that retailers should adopt customized marketing strategies to boost the market share of PBAs, according to the geographic area of interest. In urban areas, where consumers are generally more variety seekers as well as motivated by health and sustainability factors (Hoek *et al.*, 2011; Apostolidis and McLeay, 2016), retailers should prioritize expanding PBAs assortments and engaging shoppers with promotional activities. Urban shoppers tend to be more responsive to discounts and offers, making the promotional lever an effective marketing strategy to increase PBAs' sales. Additionally, urban areas show higher demand for PBAs overall, so giving these products a privileged on-shelf visibility can intercept consumer interest and preferences (NielsenIQ, 2024). A balanced approach is preferable in intermediate regions, where consumers are moderately receptive to PBAs: targeted promotions might serve as a promising strategy to start capturing interest and building trust. Ensuring that PBAs are readily available and periodically promoted can help retailers to grow the demand. In rural areas, consumer responses to relative price differences are stronger, suggesting higher price sensitivity, and, if combined with low availability of PBAs, tends to generate barriers to adoption. Expanding the assortment could encourage consumers to try PBAs but an adequate pricing strategy cannot be missing, as rural consumers tend to be more price conscious. In this context, price-based-promotional efforts may have less effect. However, ensuring that affordable PBAs are consistently available can help drive gradual changes in consumption habits. On the other hand, differences across product categories are meaningful because they reflect the diversity of consumer motivations and barriers. For example, PB beverages are often adopted for health and convenience reasons, while meat substitutes are more closely associated with ethical and environmental concerns (Giacalone *et al.*, 2022). Recognizing these differences helps tailor marketing and retail strategies more effectively. In conclusion, to foster a wider acceptance of PBAs, retailers should differentiate the way they manage retail marketing levers according to different levels of urbanization; tailoring retail strategies is essential to better meet consumer needs and preferences.

## 7. Conclusions and research agenda

Three important findings emerge from our results. First, assortment depth is a significant variable in the promotion of PB meat alternatives; this evidence fosters the debate on the marketing levers that influence the market shares of alternatives and traditional product categories (Charlebois *et al.*, 2019; Beacom *et al.*, 2022; Elzerman *et al.*, 2022). Second, it shows that in the Italian context, the absolute value of consumption is mainly driven by urban areas, which are the main contributors to the growth of the market shares of PBAs. Third, price-based promotional activities are effective in predominantly urban and intermediate areas, while they have no effect in rural areas. These results have managerial implications. Retailers should employ differentiated strategies: in urban areas, focus on price-based promotions and expanding PBAs assortment to attract health-conscious and environmentally aware consumers, while in rural areas, ensure consistent supply and competitive pricing, enhancing product variety to cater to consumers with fewer options. In fact, a deep and diverse assortment of PBAs is crucial across all regions, particularly for categories like PB milk and frozen meat alternatives. In addition, the study concludes that retail marketing strategies, especially product assortment and price-based promotions, significantly influence PBAs demand across different urbanization levels. Urban areas are more responsive to price-based

promotions, while rural areas benefit more from increased assortment and stable pricing. As a consequence, retailers should tailor their strategies to maximize PBAs market share, considering regional consumer preferences and behaviors.

This study has limitations that suggest directions for future research in the field of PBAs. Firstly, our model does not account for product attributes that could drive category share increases. Including these variables in future analyses could be promising, especially as the PB segment is still in its early stages. Product innovation and communication efforts are expected to grow over time as tools for differentiation, coinciding with market penetration and increased competition (Grummon *et al.*, 2024). Additionally, while retailer characteristics such as store size or format could potentially influence consumer purchasing behavior toward PBAs, the dataset employed did not allow for a detailed segmentation by retailer type beyond broad categories. Preliminary analyses also did not reveal significant differences across these broad groupings. Future research could explore the role of retailer format more deeply, providing further insights into how different retail environments shape PBAs adoption. Finally, it is important to note that our analysis captures only price-based promotions among the broader set of promotional activities included in the marketing mix. Promotional actions such as advertising campaigns, free samples, point-of-sale materials, and loyalty programs were not recorded in the dataset and therefore fall outside the scope of this study. Future research should explore how a broader range of promotional activities affects consumer purchasing behavior for PBAs.

Our empirical research focuses on the Italian market, limiting the applicability of the results to this specific country. Extending our model to other countries with available Circana data would strengthen our evidence. Additionally, validating our hypotheses in diverse geographical regions would enhance the generalizability of the importance of assortment and urban consumption in sustaining PBAs sales, despite cultural, social, and economic differences.

Furthermore, we emphasize that although our identification strategy is sound–including fixed effects and robust to potential OVB- to identify robust associations–we explicitly refrain from making causal claims. Establishing causality would instead require a quasi-experimental design, such as analyzing the before-and-after effects of specific interventions–for example, the introduction of a targeted price promotion policy or a planned increase in the range of a specific product category.

The present study considered the impact of COVID-19, with data from the first two observation years reflecting this crisis. During this period in Italy, MGD was not subject to temporary business closures due to lockdowns, although there were limitations on store overcrowding. The use of time fixed effects ensures that the results remain robust. Future analyses may further estimate reactive strategies in response to this shock, both for the players and the distribution (Dorcheh *et al.*, 2021; Hobbs, 2021).

In addition, our mono-channel analysis, based on MGD data, overlooks the multichannel nature of the PB market. Our current analysis excludes discounts to use real-sales data from Circana rather than estimated values. Further analysis should include specialty stores, food service, and online sales, as these channels significantly contribute to overall PBAs sales.

Future studies could further expand the marketing levers that significantly influence the increase in market share of the PBAs category compared to the conventional category, also considering sustainability attributes and their types, based on the sustainability claims present on the front of the packaging. This aspect has not yet been implemented in the present study due to the small sample sizes and the extensive use of estimates regarding these values in the selected PBAs categories. Further studies may also test these findings by considering a broader range of contextual variables not considered here as mentioned above. Integrating additional analyses on individual characteristics, such as purchase frequency and habits, multichannel behavior or green perceived (product) values, could provide a more comprehensive understanding.

## Appendix

**Table A1.** Summary statistics of the variables of the product category specific datasets

| | Statistics | Meat | Frozen meat | Cured meat | Würstel | Milk |
|---|---|---|---|---|---|---|
| MSHA | Mean (s.d) | 0.20 (0.08) | 0.23 (0.08) | 0.01 (0.00) | 0.01 (0.00) | 0.22 (0.08) |
| | Min–max | 0.04–0.50 | 0.07–0.57 | 0.00–0.01 | 0.00–0.03 | 0.07–0.67 |
| Price | Mean (s.d.) | 1.62 (0.22) | 1.61 (0.16) | 1.42 (0.15) | 3.12 (0.46) | 2.01 (0.21) |
| | Min–max | 1.06–2.54 | 1.21–2.41 | 0.91–1.97 | 1.77–5.30 | 1.48–3.39 |
| Assort | Mean (s.d.) | 0.60 (0.19) | 0.37 (0.06) | 0.03 (0.01) | 0.03 (0.02) | 0.87 (0.12) |
| | Min–max | 0.13–1.34 | 0.18–0.57 | 0.00–0.08 | 0.00–0.08 | 0.49–1.31 |
| Promo | Mean (s.d.) | 1.05 (0.50) | 0.91 (0.41) | 0.65 (0.46) | 0.73 (0.63) | 0.79 (0.30) |
| | Min–max | 0.11–5.06 | 0.03–4.09 | 0.00–4.66 | 0.00–6.02 | 0.17–4.90 |

**Source(s):** Authors' own work

**Table A2.** Two-way fixed effects analysis of marketing levers on PBAs market share in Italian provinces from the national dataset

| | Estimate |
|---|---|
| Price | −0.045 |
| | (0.051) |
| Assortment | 0.098** |
| | (0.023) |
| Promotion | −0.004 |
| | (0.008) |
| Panel obs | 62,290 |
| Time fixed effects | Y |
| Product category fixed effect | Y |
| Adj. $R^2$ | 0.73 |

**Note(s):** Standard errors: clustered by group. Significance levels: *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$

**Source(s):** Authors' own work

**Table A3.** Time fixed effects regression analysis of marketing levers on PBAs market share in Italian provinces by product category from the national dataset

| | Meat | Frozen meat | Cured meat | Würstel | Milk |
|---|---|---|---|---|---|
| Price | −0.380*** | −0.045* | −0.002 | −0.0009*** | −0.053 |
| | (0.027) | (0.015) | (0.001) | (0.0001) | (0.037) |
| Assortment | 0.031* | 0.067*** | 0.023*** | 0.003 | 0.133** |
| | (0.011) | (0.001) | (0.002) | (0.003) | (0.026) |
| Promotion | −0.037** | 0.006 | 0.000 | 0.000 | 0.000 |
| | (0.007) | (0.004) | (0.000) | (0.000) | (0.008) |
| Panel obs | 7,119 | 7,119 | 7,119 | 7,119 | 7,119 |
| Time fixed effects | | | Y | | |
| Adj. $R^2$ | 0.81 | 0.63 | 0.62 | 0.23 | 0.80 |

**Note(s):** Standard errors: clustered by year. Significance levels: *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$

**Source(s):** Authors' own work

**Table A4.** Two-way fixed effects analysis of marketing levers on PBAs market share in Italian provinces with absolute MSHA

| | Estimate |
|---|---|
| Price | −0.045 |
| | (0.051) |
| Assortment | 0.098** |
| | (0.023) |
| Promotion | −0.004 |
| | (0.008) |
| Middle | 0.018 |
| | (0.015) |
| Rural | 0.026 |
| | (0.021) |
| Price: Middle | −0.004 |
| | (0.004) |
| Price: Rural | −0.007 |
| | (0.005) |
| Assort: Middle | −0.025* |
| | (0.011) |
| Assort: Rural | −0.063*** |
| | (0.013) |
| Promo: Middle | −0.005 |
| | (0.006) |
| Promo: Rural | −0.010 |
| | (0.009) |
| Panel obs | 22,266 |
| Time fixed effects | Y |
| Product category fixed effect | Y |
| Adj. $R^2$ | 0.87 |

**Note(s):** Standard errors: clustered by group. Significance levels: *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$

**Source(s):** Authors' own work

**Table A5.** Time fixed effects regression analysis of marketing levers on PBAs market share in Italian provinces by product category with absolute MSHA

| | Meat | Frozen meat | Cured meat | Würstel | Milk |
|---|---|---|---|---|---|
| Price | −0.058** | −0.048* | −0.000 | −0.000 | 0.028 |
| | (0.016) | (0.017) | (0.001) | (0.000) | (0.024) |
| Assortment | 0.193*** | 0.705*** | 0.165*** | 0.264*** | 0.184*** |
| | (0.010) | (0.018) | (0.020) | (0.024) | (0.026) |
| Promotion | 0.009 | 0.010* | 0.001** | −0.000 | 0.088*** |
| | (0.005) | (0.004) | (0.000) | (0.000) | (0.011) |
| Middle | 0.106*** | 0.149*** | 0.004* | −0.001 | 0.111** |
| | (0.017) | (0.012) | (0.001) | (0.002) | (0.034) |
| Rural | 0.122*** | 0.045 | 0.003** | −0.003 | 0.330*** |
| | (0.014) | (0.027) | (0.001) | (0.002) | (0.043) |
| Price: Middle | −0.030** | −0.045*** | −0.002 | 0.000 | −0.021 |
| | (0.008) | (0.007) | (0.001) | (0.001) | (0.010) |
| Price: Rural | −0.026*** | 0.027 | −0.002** | 0.001 | −0.083** |
| | (0.003) | (0.015) | (0.000) | (0.001) | (0.016) |
| Assort: Middle | −0.065** | −0.194*** | −0.058** | −0.014 | −0.067* |
| | (0.013) | (0.025) | (0.012) | (0.008) | (0.023) |
| Assort: Rural | −0.128*** | −0.236*** | −0.051* | −0.009 | −0.179*** |
| | (0.017) | (0.021) | (0.018) | (0.014) | (0.020) |
| Promo: Middle | −0.018** | −0.004 | −0.001* | 0.002** | −0.047** |
| | (0.004) | (0.005) | (0.000) | (0.000) | (0.009) |
| Promo: Rural | −0.027*** | −0.010** | −0.000 | 0.000 | −0.080*** |
| | (0.003) | (0.003) | (0.000) | (0.000) | (0.008) |
| Panel obs | 4,472 | 4,472 | 4,472 | 4,472 | 4,472 |
| Time fixed effects | | | Y | | |
| Adj. $R^2$ | 0.68 | 0.59 | 0.58 | 0.65 | 0.31 |

**Note(s):** Standard errors: clustered by year. Significance levels: *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$

**Source(s):** Authors' own work

## Notes

1. Further information about the methodological aspects of Eurostat classification of urban and rural areas can be retrieved at: https://ec.europa.eu/eurostat/web/rural-development/methodology
2. In our study, the variable PROMOTION refers exclusively to price-based promotions, operationalized as the share of sales realized under a price reduction of at least 5% compared to the regular shelf price. Other forms of promotional activities, such as communication campaigns, free samples, or loyalty rewards, were not captured due to the nature of the scanner sales data at our disposal.

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