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Ranking and measuring the dynamics in the reasons-for-buying selected produce

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Abstract

Aim of study: Individual purchasing behaviour depends on economics, psychology, marketing and sensory science. Given that the list of reasons-for-buying is almost unlimited, we have defined 14 pre-set descriptors thought to entail the more important attributes when make buying decisions within a food group of selected fruits and vegetables.

Area of study: We have used a United States buyer data base of over 175,000 observations.

Material and methods: Each household was asked to rank their first, second, and third most important reasons for buying, within the set of descriptors. The overriding goal was to gain insight into the attributes and change over time. Using empirical models, the relative importance of the attributes is shown and forecasted for a decade beyond 2021.

Main results: Price and quality were expected to be the main drivers; however, the organic attribute is one requiring significant changes in the production, inspection, distribution and marketing policies, hence considering future expectations for organics is particularly important.

Research highlights: Preferences for organics have grown, but what are the expectations a decade from now? Will that interest remain so for many years to come?

Additional keywords: preferences; fruits and vegetables; consumer; behaviour; models.

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Introduction

Consumer preferences are studied from many perspectives, extending from food safety to individual behaviour while drawing from disciplines including economics, psychology, marketing, and sensory science (Harker et al., 2003). Although it is usually possible to identify categories that capture the essence of preferences, there is always randomness and change over time. The literature on discrete choice and product differentiation provides considerable insight into the selection process (Anderson et al., 1992), as it is shown in the following statement: *consumer chooses the single option that yields the greatest utility, while from the viewpoint of the outside observer (here firms), utility is described as a random variable reflecting unobservable taste differences* (Anderson et al., 1992). In many instances, those taste differences can be observed and often knowing those attributes is fundamental to many food policies, from regulations to marketing. As an example, if the *country-of-origin* attribute is important, then, product labelling or some form of traceability is needed (Verbeke & Ward, 2006). Another example is the *organically grown* attribute, which sets in motion numerous regulations and pres-

entation requirements that may influence consumers' preference for organic products (Briz & Ward, 2009). Given the bundle *X,* representing goods x_1–x_k, each potential buyer has a preference set reflective of his or her utility for the bundle. That utility is based on the state of knowledge, understanding, and stability (or risk) of the assumed product attributes. Some attributes are well defined for the product, whereas other attributes take a range of values by the very nature of the good or are defined through regulations, production differentiation, or presentation. If the attributes are defined as a_1–a_j, then theoretically, there is a mapping where $U(x_1–x_k) \sim U(a_1–a_j)$, in which each x may entail a subset of the a's, or even some of the a's could be unique to a specific x. Attempts to draw the link between the actual x and the underlying attributes range from the traditional classification of goods by search, experience and credence attributes (Nelson, 1970; Darby & Karni, 1973), to intrinsic and extrinsic cues (Szibillo & Jacoby, 1974; Caswell et al., 2002), differences between food values and attributes (MacFadden, 2001; Lusk & Briggeman, 2009), and experimental approaches with auction and laboratory experiments (Lusk & Shogren, 2007; Combris et al., 2009) all attempt to draw the linkage between the actual x and the underlying attributes.

This linkage is not just theoretical in that national and international food policies often focus on the attributes more than just the goods. Grades, standards, food safety, labelling, identifications, packaging, timing, etc. are all examples of attributes that can be linked back to the consumption decisions. That linkage back to the buying decision or individual behaviour depends on economics, psychology, marketing and sensory science (Harker et al., 2003). As such, one person's reasons-for-buying would be expected to differ from another's and even change with time. It is feasible that a buyer does not even register a value for a particular attribute because that attribute is so well established that it never changes. For example, in a highly developed market a particular product is always available, and lack of availability may simply not register with the potential buyer.

With this background, the current study focuses on a bundle of fresh fruits and vegetables (produce) to determine why households purchase the selected products. Given that the list of reasons-for-buying is almost unlimited, this research defined 14 pre-set descriptors thought to entail the more important attributes cutting across the goods in the bundle. Using a United States (US) buyer data base of over 175,000 observations covering the months from May 2008 through December 2021, households were asked to rank their 1st, 2nd and 3rd choices for most important reasons-for-buying selected produce within the set of descriptors. The overriding goal is to gain insight into the attributes and change over time, and then provide inferences for food policies. The focus is on the *reasons-for-buying* rather than on the bundle, which is the focus of many of the food policy issues, such as food safety, trade, promotions, health, and obesity.

Material and methods

Methodology

Previous literature has often used contingent evaluation and conjoint analysis to measure consumer preferences (Moser et al., 2011). In these studies, consumers are presented with two cases: (1) product selection as a whole, and (2) product selection based on attribute factors such as price, taste, nutritional value and food safety. In both cases, consumers must rate their preferences towards the offered choices (Freeman, 1993; Baker & Crosbie, 1994; van der Pol & Ryan, 1996; Prato, 1998; Baker, 1999; Jaeger, 2000; Marks et al., 2003; Ernst et al., 2006; Darby et al., 2008, Villanueva et al., 2021; Richetin et al., 2022). The main difference and major advantage of this study is that there is a certainty that consumers have already purchased the product; it is not a hypothetical situation. For each household that made a purchase, it is known how they ranked their reasons-for-buying.

Based on a large and demographically balanced household database, consumers were asked to rank their first, second and third choices among 14 pre-set product attributes (descriptors: advertising, appearance, aroma, colour, country-of-origin, freshness, organic, packaging, price, ripeness, size, store, quality, and others). Each household was asked to apply the ranking independently to each of the 17 fresh produces purchased within a two-week pre-set shopping period. Those produce were apples, artichokes, avocados, bananas, cantaloupes, cucumbers, grapefruits, honeydews, kiwis, mangos, oranges, papayas, pears, peppers, pineapples, pomegranates and watermelons. Participating households generally differed with reporting period. While the pre-set attributes (descriptors) could have been broader, a shorter, more practical list was selected so as not to overwhelm participants with too many entries on the list of options (Bennett & Blamey, 2001). The final set of preference attributes were chosen based on our understanding of the produce and the surveying company's long experience collecting data through household food purchasing diaries (MetrixLab, www.metrixlab.com).

Table 1 illustrates the specific wording of the ranking question and the set of attributes to be ranked. For each whole or cut/sliced fruit/vegetable purchased, the household ranked the first, second, and third most important factors impacting their decision to buy each produce. For each produce, households gave their rank according to their understanding of reasons such as freshness, etc.

The preference-ranking of the attributes in Table 1 is likely to vary by type of produce just like the intensity of the consumption should differ. The produce included in the dataset are shown in Figure 1 with the type of produce on the bottom axis and the percentage purchased of each produce on the vertical left axis. The bars in Figure 1 are listed in order of the percentages. For example, 50.5% of the households purchased bananas while only 7.4% bought papayas within a defined shopping period. Among these

Table 1. List of ranking descriptors or reasons for buying each fruit.

	First choice[1]	Second choice	Third choice
Price			
Color			
Size			
Organic			
Where it was grown			
Store specials			
TV/Radio/newspaper ads			
Freshness			
Packaging			
Quality			
Ripeness (firmness)			
Aroma			
Appearance			
Other			

[1] The question was the following: "When choosing whole and/or cut/sliced/peeled (fruit/vegetable name) in the past two weeks, what factors went into your decision? Please select the three most important factors"

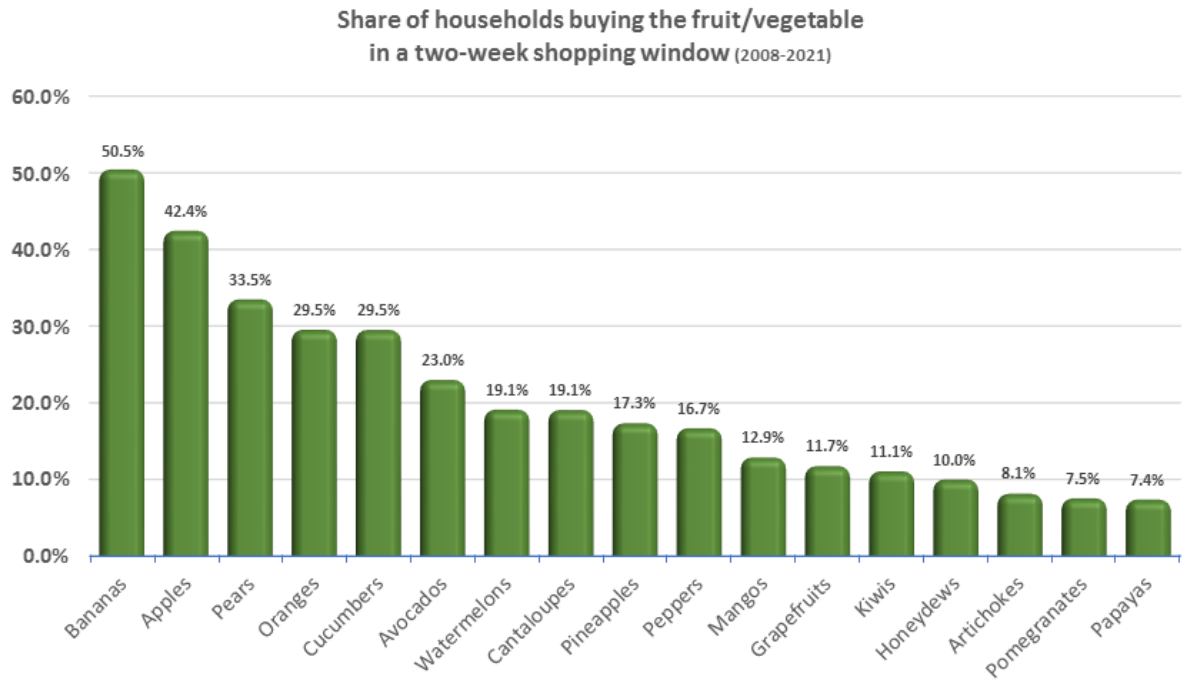

Figure 1. Percentage of household buying each of the produce.

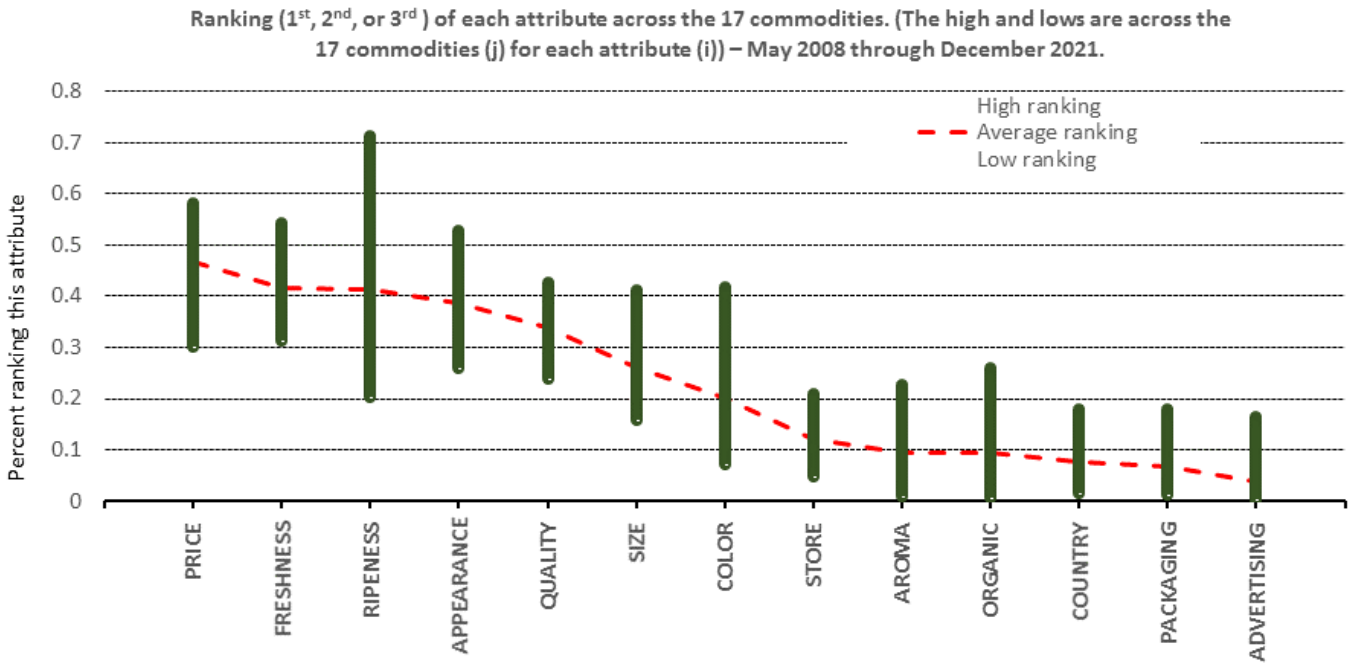

Figure 2. Ranking of the preference drivers across commodities**.**

products, 58% to 69% of surveyed households participated in the preference-ranking of the produce they purchased. By necessity, in the subsequent analyses only those rankings were included in the reason modelling.

Modelling the ranking

A few households across all the produce simply did not participate in the rankings, hence they were eliminated from the buying households.

Let "i" denote the preference descriptors (a's) (Table 1) and "j" reference the commodity (produce) (Fig. 1), then for produce "j" there were NR_j household buyers of "j" (e.g., H_j) who did not rank any of the attributes. Combining 1st, 2nd, and 3rd rankings (scores), "i" now represents a ranking for product "j" that was purchased. Let RR_{ij} be the number of household buyers of "j" who ranked the reason "i" using the combined scoring. Then $R_{ij} = RR_{ij} / (H_j\text{-}NR_j)$ or the percent of buyers of "j" who give a 1st, 2nd, or 3rd place ranking of attribute "i'.

In Figure 2, those rankings are arranged from the highest to lowest average rankings across the preference drivers. For each bar there is a high, low, and average, with that range occurring across the produce. The highest driver on average is price, followed by freshness, ripeness, appearance, quality, size, and colour. Those remaining are all in the lowest echelon of preference drivers. Almost 50% ranked price in either 1st, 2nd, or 3rd place and close to 20% ranked price in 1st place. While not shown, a plot ranking just the 1st place is similar in patterns to the combination of all three rankings in Figure 2.

Clearly, R_{ij} depends on the commodity and attributes. Given the extended time period since 2008, it may be that the importance of some of the attributes changed over time within each commodity. For example, organic produce during the period 2008-2021 has gained considerable public exposure. While that driver appears to be relatively small in Figure 2, its importance may have evolved over time.

Define YEAR as the actual year (e.g. say 2021) and COM_j a binary variable depending on which "j" is referenced from 1 to 17 produce. A simple model follows in Eq. (1) with:

$$R_{ij} = \alpha_{0i} + \delta_i YEAR + \sum_{j=1}^{16} \alpha_{ij} \left(COM_j - COM_{17} \right) + \sum_{j=1}^{16} \beta_{ij} \left(COM_j - COM_{17} \right)(YEAR) \quad (1)$$

COMs are dummy variables denoting the 17 produce and the model is arbitrarily normalized on COM_{17}. Percentages can differ by reason "i", commodity "j" and/or by YEAR. A change in YEAR is one (i.e., ΔYear=1), hence any yearly change in reasons is defined as:

$$\Delta R_{ij} = \delta_i + \beta_{ij} \text{ for } 0<j\leq 16 \text{ and } \Delta R_{ij} = \delta_i - \sum_{k=1}^{16} \beta_{ik} \text{ for } j=17 \quad (2)$$

While Figure 2 shows the relative importance of the preference drivers, the most interesting trend is the change in the importance of the preference drivers since the markets are dynamic in terms of both the produce attributes and the consumers evaluating those attributes. If $\Delta R_{ij}=0$ there is no change in the preference drivers as set forth in Figure 2. Whereas $\Delta R_{ij}\neq 0$ then either a positive or negative change can be attributed to common trends for the reason assuming $\delta_i\neq 0$ and $\beta_{ij}=0$. For the opposite with $\delta_i=0$ and $\beta_{ij}\neq 0$ then any change in the rankings (i.e., preference drivers) is attributable solely to the commodity. A practical application can be illustrated with country-of-origin (COOL). Suppose $\delta_i>0$ and $\beta_{ij}=0$ and "i" is for COOL, then country-of-origin is increasing in importance across all of the commodities. Whereas, with $\delta_i=0$ and $\beta_{ij}>0$ for again "i" being COOL, any gain in the importance of COOL depends on the commodity being considered since β is tied to the commodity with the "j" subscript. This concept is useful since marketing, promotions, trade, production practices and distribution can play important roles in household perceptions and knowledge of many of those preference drivers listed in Table 1.

All coefficients from Eq. (1) for the 13 attributes are estimated and reported in Table S1 [suppl]. Beside each vector of coefficients are the corresponding t-values with the R^2 values listed at the bottom of the table. In the next section we present the results by developing an insightful way to draw inferences about the preference drivers rather than discussing each equation.

Preference dynamics

Factors driving preferences have degrees of importance as seen in Figure 2. Yet, amidst evolutions in marketing, media availability and overall awareness, it is most likely that the preference drivers are dynamic (i.e., they change in importance over time). When one or more preference drivers have existed for some time, it is possible that households become use to the underlying attributes and lessen the intensity of one or more attributes. As an example, in mature markets, produce size may become standardized for a specific fruit. Consumers may become accustomed to always having a level of reliability in size and do not register concerns when setting their preferences for size.

The potential for measuring any evolution in the driving factors was suggested with Eqs. (1) and (2) where:

$$\Delta R_{ij} = \begin{cases} \delta_i + \beta_{ij}, 0 < j \leq 16 \\ \delta_i - \sum_{k=1}^{16} \beta_{ik}, j = 17 \end{cases} \quad (3)$$

Recall that δ_i captures change over time for each i factor while β_{ij} measures the factor change by produce. In Figure 3, the preference drivers are first ranked based on δ_i ordered from the most negative trend to the highest positive change over time. Given each reason for buying (attribute), there is a bar showing the range of differences in the trends across the produce first listed in Figure 2. For those bars always above the zero, there is a positive trend for all produce for a particular attribute.

Note that in Figure 2, price was consistently ranked as the most importance reason for buying (see Fig. 2) but trended down for most of the produce in the data set as seen with the third bar in Figure 3.

Results

Advertising, country-of-origin, quality, and organic attributes all show positive trends in importance across the produce in the data set. In contrast, ripeness, appearance, price, store, and size generally show negative trends for most of the produce. Consumption of organics is in the news almost daily and there has been considerable public and private efforts to expand the markets for organic produce. Figure 2 shows that organics rank low among the reasons for buying produce but the bar for organics in Figure 3 shows that organics have become increasingly important for every produce in the study. There was not one case where the importance of organics trended down. A similar pattern is seen for country-of-origin, with an overall low ranking in terms of reasons for purchasing but still a strong positive trend. Both results are not surprising given the emphasis on organic farming and the expansion of the international trade in produce, particularly between the United States and Central and South America. Quality ranked high and consistently grew over time across every produce in the analyses.

Given that Figure 3 reflects a year-to-year change, one can take the same coefficients (δ_i and β_{ij}) and forecast the rankings of preference drivers over several years. The number of years is somewhat arbitrary, but 10 years should be long enough to give some indication of what attributes may or may not be important in a decade. In Figure 4 the rankings are plotted for 2021 and 2031, again using the models from Eq. (1) and estimates in Table S1 [suppl]. The second bar for each factor is the predicted rankings of reasons for buying in 2031. Most notably, the top preference drivers are still among the highest after 10 years but with

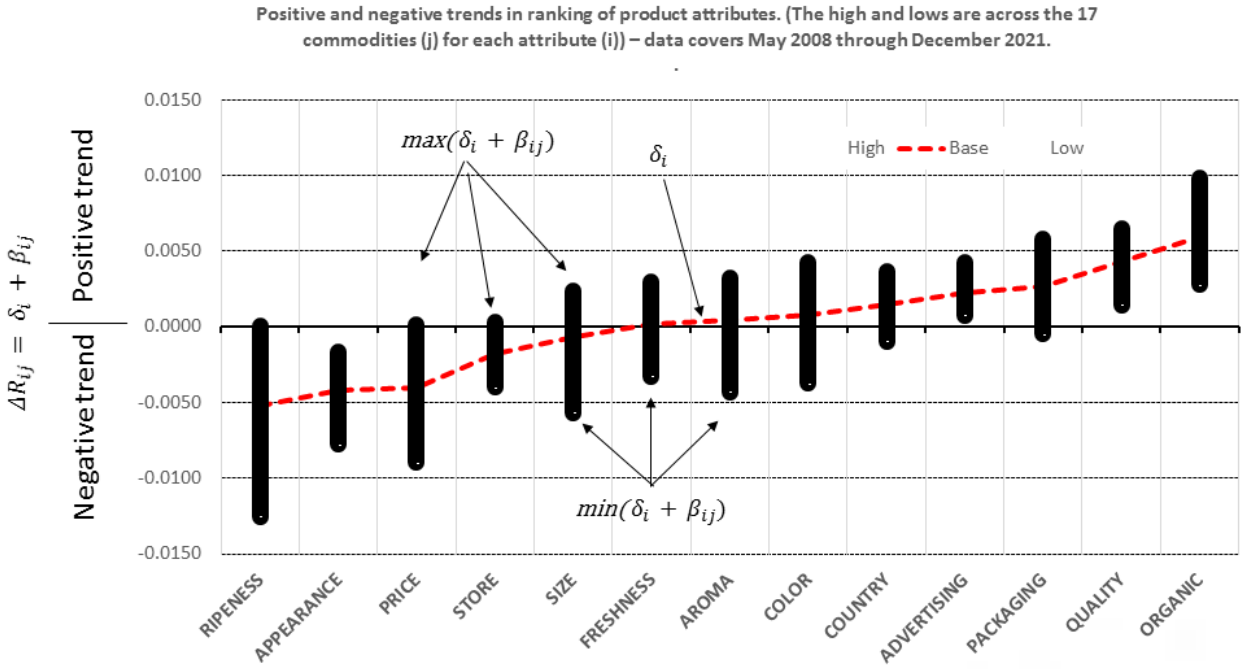

Figure 3. Trending in the preference factors influencing the reasons for buying.

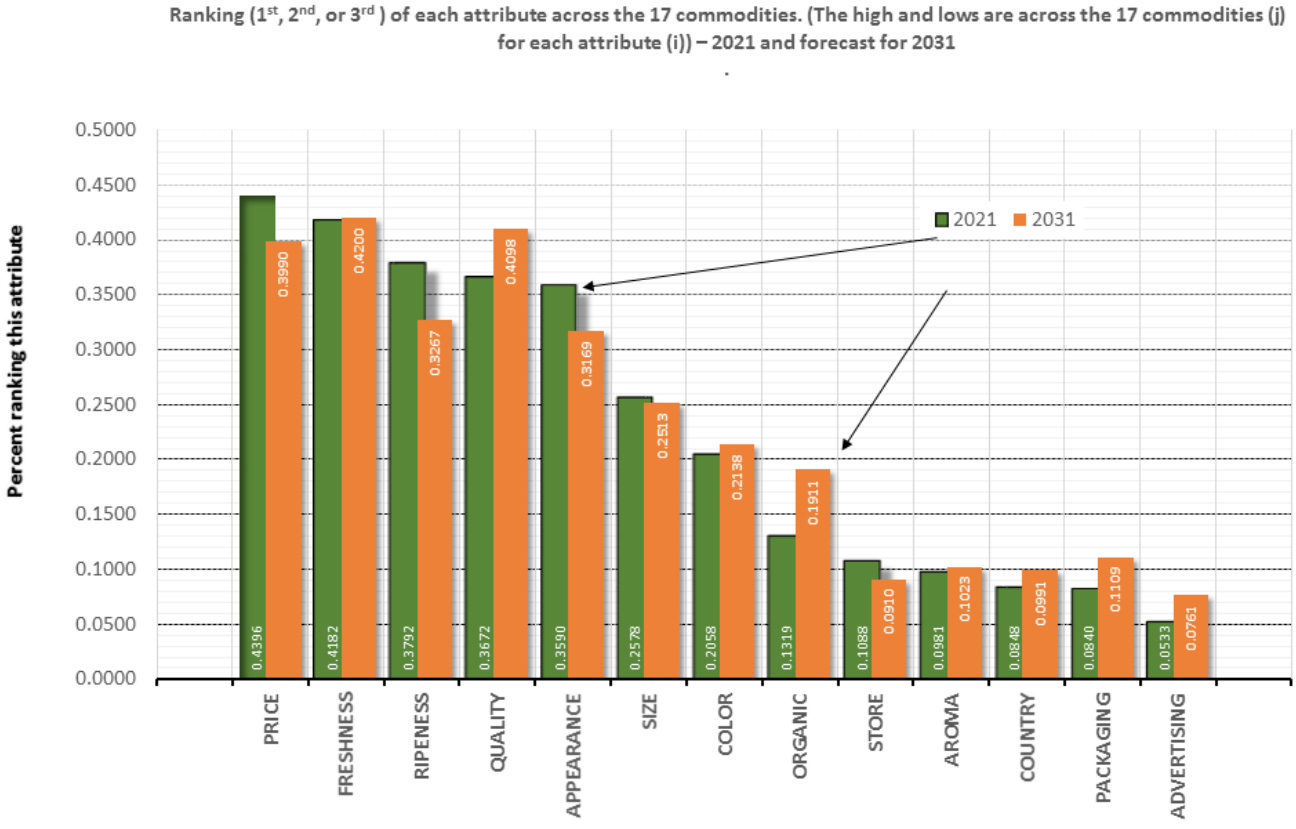

Figure 4. Importance of major preference drivers over time.

freshness and quality becoming the top preference factors in a decade. Colour remains essentially the same over the decade, while organics increased nearly 45%. This increase for organics was the largest among all changes, with a growth from 13 to 19%.

Discussion

Other studies support our findings about quality and price being highly relevant factors in shaping food preferences (Alavoine et al., 1990; Baker & Crosbie, 1994; van der Pol & Ryan, 1996; Baker, 1999; Lohr, 2000). Price, freshness, ripeness, quality, and appearance remain in the upper tier of important factors. Except for price, these attributes are supported through public and industry standards that give households assurance when buying. Freshness, ripeness, quality, and appearance are attributes most reflective of the internal characteristics for the produce and generally would be expected to be among the higher rankings.

Ripeness and appearance did decline while the organic attribute ranking rose substantially. These attributes are subject to regulatory standards and many regulations are commodity specific. Viewing some of the attributes changing over time cross the commodities is insightful when considering revisions in grades and standards regulations that may be commodity specific.

Figure 5 shows the changes in rankings for organics and ripeness across the 17 produce. In the left spider graph the lower plots are the rankings for organics by commodity in 2021 while the upper plots are the 2031 forecast. For all produce, the 2031 values are above the 2021 percentages, thus indicating the projected importance of organics across all the produce. This clearly indicates that public policy directed to organic issues can be broader than just for a few produces since the growth in organic importance is found in all of the produce included in the analyses. One can turn to the USDA Agricultural Marketing Service to see many of those policies related to organics (AMS-USDA, https://www.ams.usda.gov/grades-standards).

In direct contrast with organics, the importance of ripeness declined on average from 2021 to 2031 (see Fig. 5). Yet the right spider plots in Figure 5 shows that those declines are much more commodity specific. There is little difference in the ripeness ranking between 2021 and 2031 for cucumbers, watermelons, pineapples, oranges, peppers, pomegranates, and artichokes, contrasted with the remaining produce in Figure 5. Beyond the broader public grades and standards, policies may need to be more commodity specific. Note that ripeness is still among the more important reasons for buying with rankings always in the 30 plus percentage range.

Appearance and price attribute ranking declined (see Fig. 5) with the left spider plot in Figure 6 showing the appearance ranking forecast across the commodities. For nearly every commodity, the importance of appearance declined as seen with the 2031 spider plots being below the 2021. Cantaloupes, pomegranates, honeydews, and mangos reveal the least change. Note that the declines in ranking of appearance was usually under 5 percentage points. This broadly suggests that whatever policies and/or physical attributes contributing to appearance do not need major revisions.

Finally, in Figure 6, the right spider plot shows the ranking of price between 2021 and 2031 across the produce. While price ranking dropped between the years, most of the decline is found with mangos, honeydews, grapefruits, and kiwis. The other 2021 and 2031 points are very close.

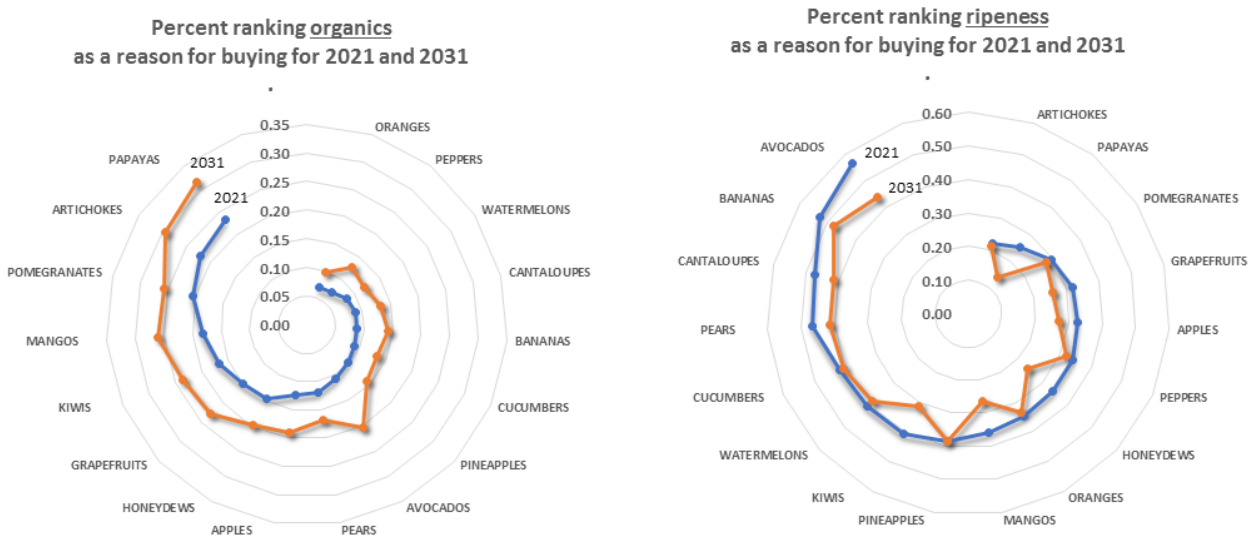

Figure 5. Changing in organics and ripeness rankings between 2021 and 2031 by produce.

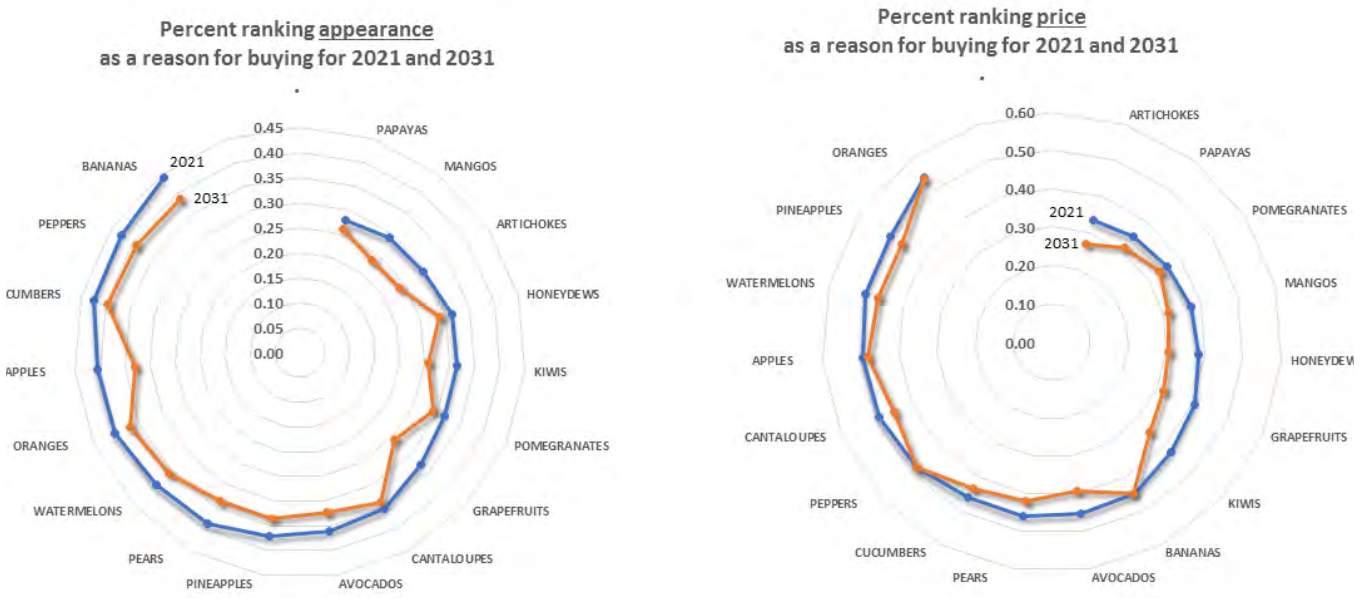

Figure 6. Changing in appearance and price rankings between 2021 and 2031 by produce.

Both Figures 5 and 6 have been included to illustrate the potential need (or lack of) to explore reason-for-buying changes by commodity. Clearly, importance of organics has increased, and that interest is across the produce considered. It is an attribute that is valued by buyers of fruits and vegetables, not just unique to one or two produces. Within the U.S. agriculture regulatory system, policy via national standards and sometimes Federal Marketing Orders are instruments setting minimum standards that, in turn, impact many of the attributes included in this analysis.

So why are the previous results important? Buyers are the lifeblood of any produce market and their reasons-for-buying provide the signals of both successes and problems for moving commodities through the system from production to the final point of consumption. Bad consumption experiences can have lasting effects far beyond the initial experience. Confidence in terms of food safety, in produce messaging, produce availability, and consumer recourse (e.g., supplier liability) are key to building viable markets. As shown with the reason models, a limit set of attributes can capture most of the driving forces when making buying decisions. Most of these attributes fit into well-defined categories such as published reliable prices; visible attributes, attributes realized through experiment and habit; product labelling, and distribution of information. The United States system plays a limited to no-role in setting prices but provides data systems for price discovery. Having competitive marketplaces should provide the best way for assuring the true value (or price). Government regulations requiring the publishing of prices and price-per-unit at the point of buying are examples of public policy without setting prices. Similarly, federal minimum grades and standards for produce are intended to assure food safety and reliability in the produce entering the market channels (AMS-USDA, https://www.ams.usda.gov/grades-standards 2022).

As we have shown, the importance of some attributes are closely linked to the commodity itself. Many produce industries have tools and authority to set grades and standards exceeding the federal minimums. Box standards (packaging), inspection practices, traceability coding, and labelling are means for assuring quality and appearance as the produce flows through the distribution channels (Verbeke & Ward, 2006). Even labels on each fruit are frequently required to provide information on the country-of-origin (Mabiso et al., 2005; Zanoli et al., 2007). Many produce industries have federal or state authority to implement generic promotion programs (Forker & Ward, 1993; Ward, 2022). These types of programs are intended to enhance the overall demand for a specific produce through the authority to implement a generic program (Ward, 1997; 2022).

Even with rigid federal and industry regulations, potential buyer's exposure depends on the in-store practices of outlets. There is strong competition for in-store shelf space and well as in store storage and produce management practices. Poor management can directly affect many of the attributes first identified in Figure 2 such as appearance, ripeness, and quality. Note in Figure 2, the outlet or store selection was in the lower tiers of reasons for buying. Yet that ranking does not necessarily capture bad store produce management that potentially leads to problems with freshness, ripeness, quality and appearance.

Organics tend to stand out in the analyses with its substantial growth over time. A study of organics by Lohr (2000) states that taste, freshness, quality and food safety are the drivers of organic consumption; however, price premiums and country-of-origin will be determinants in the future. The positive trend for organics is consistent with what has been seen over the last several years. The USDA have carved out specific regulations relating to organics.

In the broadest sense, this growth is consistent with what was seen in a 2009 study by Briz & Ward that showed a growth in organics in line with increased consumer knowledge up to a certain limit, followed by a decline once a certain understanding about organics had been reached. Again, the policy issues are most apparent when judging the trade-off between investing in organics versus putting more emphasis on the higher ranked reasons for buying. Investments in advertising, promotions, packing and distribution of organics must be judged relative to costs and trade-off supporting the other attributes (e.g., organics versus general appearance). Clearly, the importance of organics impacting the reasons for buying are expected to grow as suggested in Figure 4.

These rankings and dynamics should have considerable usefulness for setting government food regulations, grade and standards; industry distribution and labeling policies; and marketing policies. There are potential limitations that need to be recognized. The model data are based on U.S. household and the degree that the results extend to other non-US markets is unknown, particularly to less developed markets. All rankings are from a list of pre-selected reasons for buying that provides clarity but risk omissions. Fresh produce generally has limited brand identification, so brand preferences were not in the reasons list. Our expectation is that branding should have little impact on our results, especially given the low ranking of COOL and packaging shown in Figure 2. Most households have some expectation about the produce(s), even if perceived as ugly or less appealing. Our attributes of appearance, colour, ripeness, and overall quality are based on rankings relative to those expectations for each produce.

Finally, the price of fruits and vegetables has been cited as a main driver affecting household buying decisions, as a reason why consumers do not eat more of these healthy foods. However, as this study has shown, the price effect on reasons-to-buy has declined over time but there are some produce that indicated positive trends for the price attribute. This suggests that there are cost and thus price issues unique to specific produce. In general, the government and industry have little to do with the actual prices but may play a role in issues that contribute to added costs such as regulations, limited competition, and transportation.

Supplementary material (Table S1) accompanies the paper on SJAR's website.

Data availability: Not applicable

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Authors' contributions: Ronald W. Ward: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. **Teresa Briz:** Conceptualization, Formal analysis, Validation, Visualization, Writing – original draft, Writing – review & editing. **Leonardo Ortega:** Conceptualization, Data curation, Investigation, Validation, Writing – review & editing.

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