# Demand for Food Attributes Linked to Production Practices during COVID-19: Evidence from a Large Sample of U.S. Carrot Buyers

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# CAIL

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## Introduction

•Carrots are a popular vegetable, and organic carrots are also widely available. However, the demand for organic carrots has received relatively little attention in the literature.

•Fresh-cut fruits and vegetables are becoming widely available in developed countries. However, limited research exists on the demand for fresh-cut products.

•COVID-19 has caused uniquely profound and far-ranging shocks to food markets, including shocks to income, employment, where meals are consumed, and choice of grocery shopping channels. According to consumer theories, macroeconomic effects (e.g., recessions) and shopping environment changes (emerging grocery shopping) could affect the demand parameters in food consumption. However, those factors rarely have been considered in the literature of food demand estimation.

•Demand parameter estimates used for policy evaluations have come from existing studies. To obtain an appropriate estimate from an existing study, the sample used has to represent the population of analyzed policies. However, the samples of the existing studies often have come from different periods, regions, and demographics compared to the population under the evaluated policies. Little research has been conducted on this topic.

•Surveys have been used to estimate demand parameters. Web-based surveys are becoming widely available, the costs of accessing respondents have substantially fallen. Although web-based surveys usually do not have surveyors who guide and explain survey questions to respondents, most existing surveys reported in the literature use substantially complicated questions eliciting willingness to pay.

## Objectives

•Estimate the willingness to pay for organic carrots over non-organic carrots
•Estimate the willingness to pay for fresh-cut carrots over full-sized carrots
•Explore whether the willingness to pay estimation results change before and during COVID-19
•Explore whether simple willingness-to-pay questions provide reasonable demand parameter estimates, using large web-based surveys


**Photos of fresh-cut carrots used in surveys**

## Methods

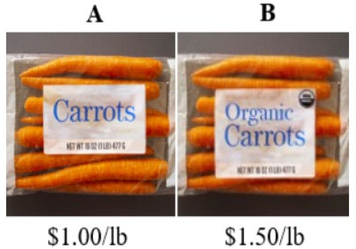
### *Survey Instrument*

•Single binary choice questions (Bishop and Heberlein 1979; Arrow et al. 1993; Carson and Groves 2007)
•We also conducted multiple choice questions which are not reported in this poster.
•Online surveys (Gao and Schroeder 2009; Waterfield, Kaplan, and Zilberman 2020)
•A series of surveys from carrot consumers across the United States
•The same survey was distributed seven times: December 2019 – January 2020, March – April 2020, June 2020, August 2020, October 2020, January 2021, and March 2021
•The surveys were distributed by Google Surveys, an online survey platform
•In total, about 350,000 completed responses were obtained.
•Overall, the sample demographics are similar to those in the U.S. Census population.

### *Willingness to Pay Questions*

•We showed respondents a pair of pictures of two realistic carrot packages and asked the following question: Imagine you're shopping for carrots, and you see these two 1-pound packages. Which package, if any, would you buy?
•After first allowing the response, "I don't buy carrots," respondents faced three potential answers: Package A for $Z, Package B for $X, and Neither of these packages.
•The "Z" or "X" prices in the offered responses were: $1.00, $1.50, and $2.00 to reflect the common range of carrot prices in the U.S. market. We used a higher or equal price for baby versus conventional and organic versus conventional.
•Each respondent faced randomly one of the four carrot pairs: (regular full-sized, organic full-sized), (regular fresh-cut, organic fresh-cut), (regular full-sized, regular fresh-cut), (organic full-sized, organic fresh-cut)

Imagine you're shopping for carrots, and you see these two 1-pound packages. Which package, if any, would you buy?




I don't buy carrots

Package A for $1.00

Package B for $1.50

Neither of these packages

**An Example of Survey Question**

### *Econometric Strategies*

•Estimate willingness to pay parameters using dichotomous choice data (Hanemann 1984)
•Random utility framework; a linear indirect utility function
•The empirical specification follows a logit regression.

$$y_{i,t}^{org} = \alpha_0^{org} + \beta^{org} Bid_i + \alpha_1^{org} D_t + \alpha_2^{org} X_{i,t} + \eta_{i,t}^{org}$$

$$y_{i,t}^{freshcut} = \alpha_0^{freshcut} + \beta^{freshcut} Bid_i + \alpha_1^{freshcut} D_t + \alpha_2^{freshcut} X_{i,t} + \eta_{i,t}^{freshcut}$$


| | |
|---|---|
| $i$ | Denotes a respondent |
| $t$ | Denotes a period when the corresponding survey was done |
| $y_{i,t}$ | 1 if the organic (fresh-cut) carrot product is chosen; 0 if the non-organic (full-sized) carrot product is chosen |
| $Bid_i$ | Price difference between the two products |
| $D_t$ | A vector of period dummies: March 2020; June 2020; August 2020; October 2020; January 2021, March 2021 (The base is December 2019 – January 2020) |
| $X_{i,t}$ | Covariates include demographics (gender, age, and region), response characteristics (response time length), and characteristics of survey design (regular carrot price, location of regular carrot picture, whether two products are full-sized or fresh-cut when comparing organic and non-organic; whether two products are organic or non-organic when comparing full-sized and fresh-cut carrots). |
| $\eta_{i,t}$ | an error term that follows a logistic distribution |

## Preliminary Results: Median Willingness to Pay for Organic and Fresh-cut Attributes

**Median WTP estimates with 95% Confidence Intervals**

| Period | Organic attribute | | Fresh-cut attribute | |
|---|---|---|---|---|
| | Median WTP | C.I. | Median WTP | C.I. |
| | $/lb. | | | |
| **Dec 2019 – Jan 2020** | $0.20 | ($0.18, $0.22) | $0.56 | ($0.48, $0.63) |
| **March 2020** | $0.19 | ($0.17, $0.22) | $0.48 | ($0.40, $0.56) |
| **June 2020** | $0.22 | ($0.20, $0.25) | $0.49 | ($0.41, $0.57) |
| **August 2020** | $0.22 | ($0.19, $0.24) | $0.54 | ($0.46, $0.61) |
| **October 2020** | $0.23 | ($0.20, $0.25) | $0.48 | ($0.40, $0.56) |
| **January 2021** | $0.22 | ($0.19, $0.25) | $0.47 | ($0.38, $0.55) |
| **March 2021** | $0.21 | ($0.19, $0.24) | $0.49 | ($0.40, $0.57) |

**Note.** The margins of error are constructed based on a bootstrapping technique, with 1,000 draws.

## Preliminary Implications

•Median WTP for organic attribute is estimated to be positive but less than the market price difference (about $0.50/lb.)
•Median WTP for fresh-cut attribute is estimated to be positive and slightly bigger than the market price difference (about $0.40/lb.)
•The impact of COVID-19 on the median WTP estimates is not statistically significant.
•A large web-based survey using a very simple question provides plausible demand parameter estimates.