

**Consumer preferences and willingness to pay for  
environmental attributes of food products:  
A conjoint study of maple syrup in the United States**

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# Outline

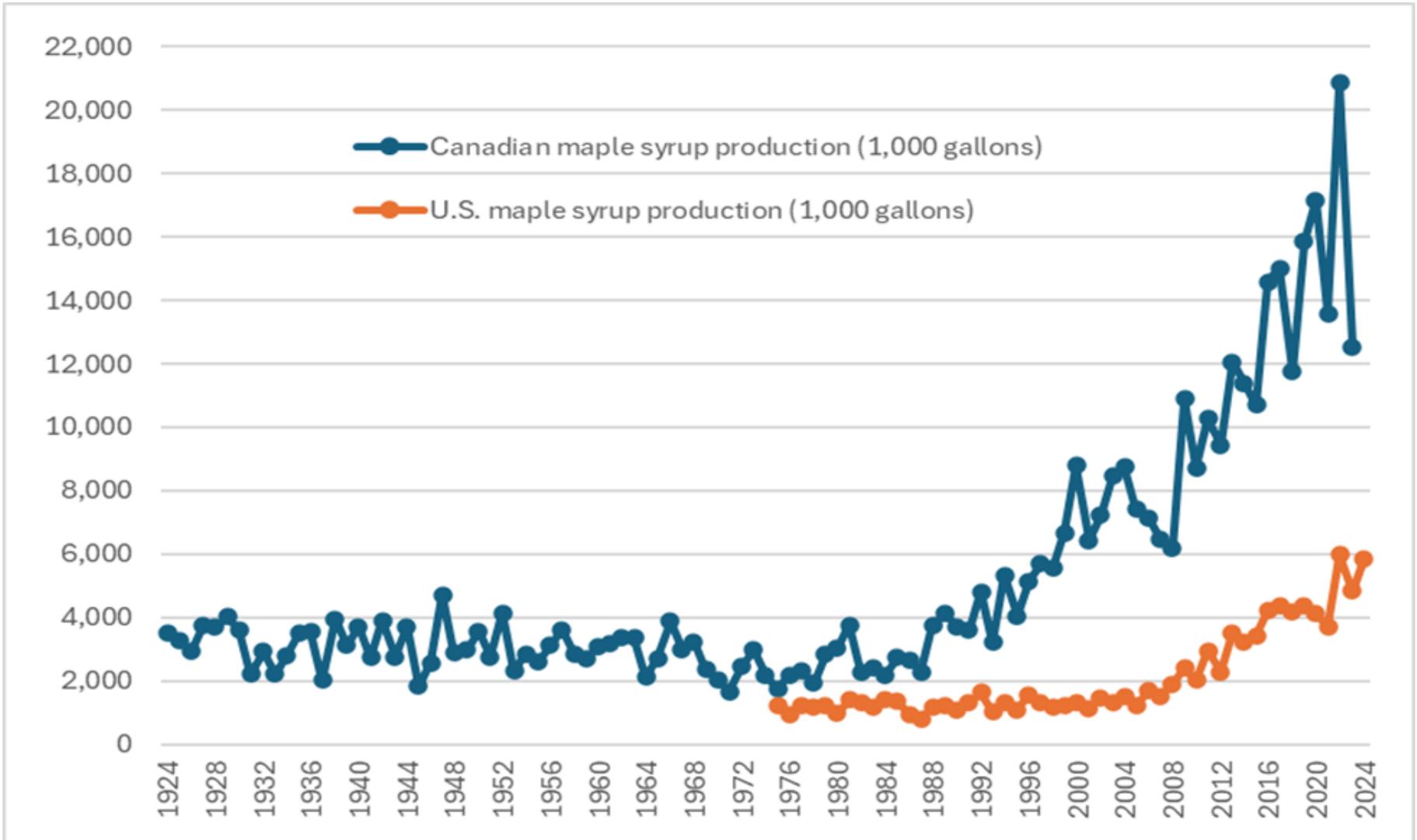
- Background
- Research objectives
- Methods and data collection
- Empirical findings
- Conclusions and recommendations
- Research in progress

## Background:

- Maple syrup: *A sweet liquid gold!*
- A natural sweetener produced from the boiling and condensation of sap extracted from maple trees
- Predominately produced in Eastern Canada and the Northeastern United States.



# Canadian and U.S. maple syrup production (1,000 U.S. gallons)



## Background:

- A very special and significant agricultural sector in the region with economic, cultural, environmental and community values

### In Canada:

- Provided about 12,600 full-time jobs in 2022
- Contributed about C\$1.13 billion to the GDP
- Generated about C\$235 million in tax revenue

### In the U.S.A.:

- An annual production value of \$150 to 200 million
- Direct, indirect and induced economic contributions
- Lifeline of many producers and rural communities

## Background:

- The industry is facing many challenges in both nations
  - Climate change → increased yield and production volatilities
  - Sour market conditions
    - Downward trends in producer prices (especially in real terms)
    - Competition from other syrups (e.g., corn syrup)
    - Changing consumer preferences
  - Policy interventions and effectiveness:

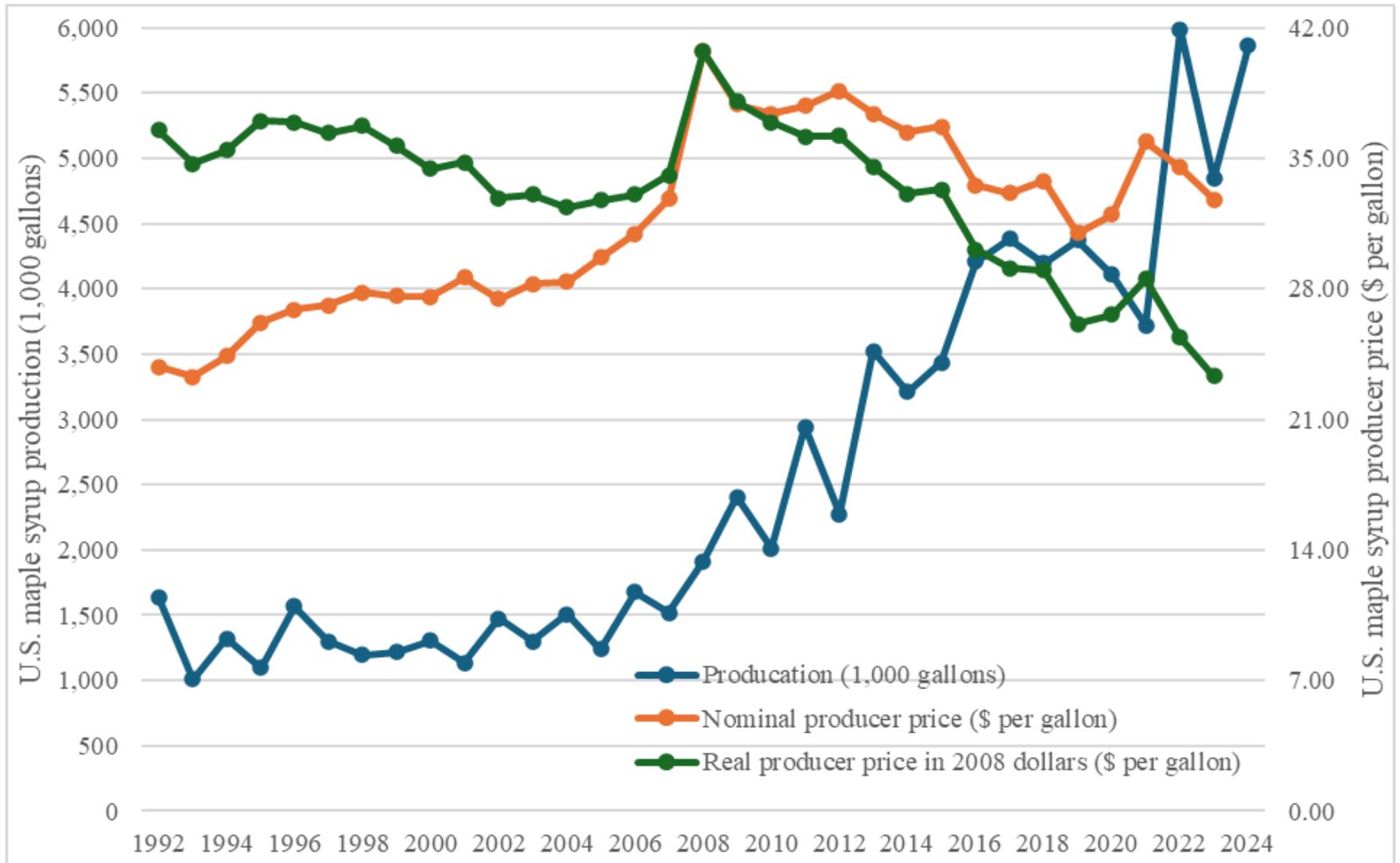
In Canada:

Quebec Maple Syrup Producers Association: Sets and implements production quotas and manages the “global strategic reserve” system since 2004.

In the U.S.A.:

Limited policy interventions

# U.S. maple syrup production and producer price 1992 -- 2024



## **Background:**

- The industry desperately needs information on
  - Consumer preferences and WTP
  - Potential opportunities for adding value to maple syrup
  - New markets (e.g., China and Japan)
- There are limited studies in the literature

## Research objectives:

To assess consumer preferences for maple syrup and its major attributes (e.g., product origin, organic certification, bird-friendly practices, climate-friendly practices, and container material),

To estimate consumer willingness to pay (WTP) for key maple syrup attributes based on their tradeoffs with price, and

To derive recommendations for increasing consumer demand for maple syrup and enhancing the economic viability of maple syrup producers



# Research methods and data collection:

## Methods for assessing consumer preferences and WTP:

- Contingent valuation (CV), conjoint analysis (CA) and choice experiment (CE)
- Major method for this study: CA

## Conjoint analysis (CA):

- What is CA?
- How does it work?
- Major applications:
  - Product development and modifications
  - Pricing strategies
  - Market segmentation
- Major procedures (next slide):

# Research methods and data collection:

## Major procedures of a CA:

### 1. Select attributes and their levels

- a) Identify key product attributes
- b) Define possible levels for each attribute

### 2. Construct and select profiles

- a) Potential combinations of attributes and levels
- b) Select a manageable number of profiles (e.g., orthogonal design)

### 3. Develop a survey and collect data

- a) Create a survey with profiles for respondents to rate or rank
- b) Conduct the survey

### 4. Estimate part-worth utility models

- a) To link the rating or ranking score to consumer utility from each product profile
- b) OLS, WLS, etc.

### 5. Calculate the relative importance (RI)

- a) Determine how much each attribute influences overall choice
- b) For the whole sample or by groups

### 6. Estimate EEI and WTP

- a) EEI (expenditure equivalent index):
- b) WTP

# A conjoint study of maple syrup in Vermont:

- Survey development
- Pre-test
- Conducted in December 2024 via the Front Porch Forum
- 3,183 respondents across Vermont
- Attributes and their levels: 240 possible profiles

| Attribute                  | Levels                       |
|----------------------------|------------------------------|
| Origin                     | Vermont, Other US, Canada    |
| Organic Certification      | Yes, No                      |
| Bird-Friendly practices    | Yes, No                      |
| Climate-Friendly practices | Yes, No                      |
| Container Material         | Glass, Plastic               |
| Price                      | \$12, \$14, \$16, \$18, \$20 |

# 24 selected maple syrup profiles

| Product | Origin         | Organic | Bird Friendly | Climate_Friendly | Container | Price |
|---------|----------------|---------|---------------|------------------|-----------|-------|
| 1       | Other US       | Yes     | No            | No               | Plastic   | 14    |
| 2       | Canada         | Yes     | Yes           | No               | Glass     | 18    |
| 3       | Other US       | Yes     | Yes           | Yes              | Plastic   | 16    |
| 4       | Canada         | No      | No            | No               | Glass     | 14    |
| 5       | Canada         | No      | Yes           | Yes              | Glass     | 18    |
| 6       | Canada         | Yes     | No            | Yes              | Plastic   | 16    |
| 7       | Canada         | Yes     | Yes           | Yes              | Plastic   | 16    |
| 8       | Vermont        | Yes     | Yes           | Yes              | Glass     | 20    |
| 9       | Other US       | No      | No            | No               | Plastic   | 12    |
| 10      | Other US       | No      | No            | Yes              | Glass     | 16    |
| 11      | Vermont        | Yes     | No            | No               | Plastic   | 14    |
| 12      | Vermont        | No      | Yes           | Yes              | Plastic   | 16    |
| 13      | Vermont        | Yes     | No            | Yes              | Glass     | 18    |
| 14      | Other US State | No      | No            | No               | Glass     | 14    |
| 15      | Vermont        | No      | Yes           | Yes              | Glass     | 18    |
| 16      | Other US State | No      | Yes           | Yes              | Plastic   | 16    |
| 17      | Other US State | Yes     | Yes           | No               | Glass     | 18    |
| 18      | Canada         | No      | Yes           | No               | Plastic   | 14    |
| 19      | Vermont        | Yes     | No            | Yes              | Plastic   | 16    |
| 20      | Other US State | Yes     | Yes           | Yes              | Glass     | 20    |
| 21      | Vermont        | No      | No            | No               | Glass     | 14    |
| 22      | Canada         | Yes     | No            | Yes              | Glass     | 18    |
| 23      | Vermont        | No      | Yes           | No               | Plastic   | 14    |
| 24      | Canada         | No      | No            | No               | Plastic   | 12    |

## Empirical findings:

- Summary statistics
- Average rating for each of the 24 profile
- Regression model:  
$$R = f(6 \text{ attributes}) + e$$
- Part-worth utilities
- Relative importance of each attribute
- Estimation of the WTO

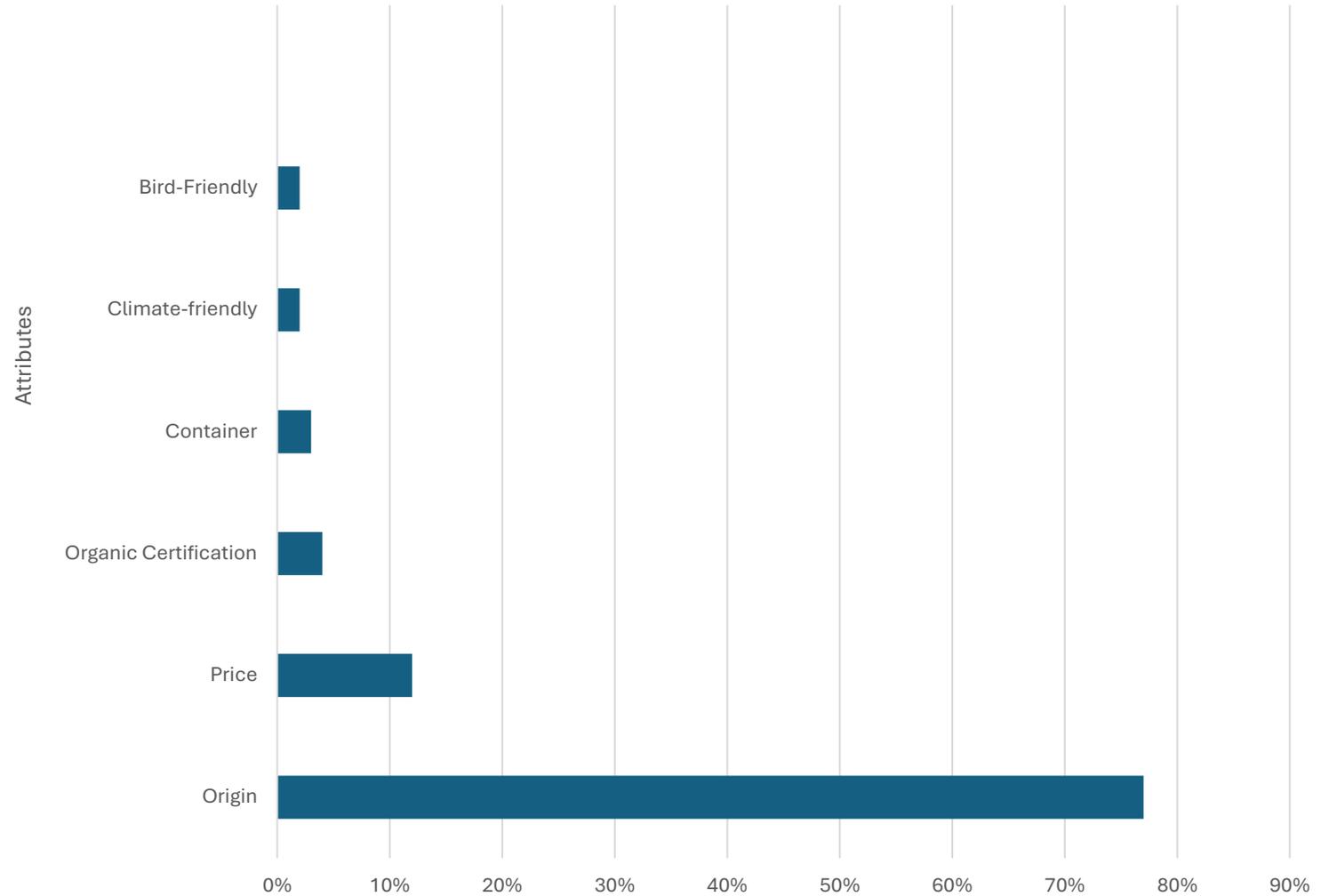
# Average rating of each profile

| Product | Origin   | Organic | Bird | Climate | Container | Price | Mean rating |
|---------|----------|---------|------|---------|-----------|-------|-------------|
| 13      | Vermont  | Yes     | No   | Yes     | Glass     | 18    | 5.28        |
| 15      | Vermont  | No      | Yes  | Yes     | Glass     | 18    | 5.12        |
| 11      | Vermont  | Yes     | No   | No      | Plastic   | 14    | 5.11        |
| 12      | Vermont  | No      | Yes  | Yes     | Plastic   | 16    | 5.07        |
| 19      | Vermont  | Yes     | No   | Yes     | Plastic   | 16    | 4.81        |
| 21      | Vermont  | No      | No   | No      | Glass     | 14    | 4.7         |
| 23      | Vermont  | No      | Yes  | No      | Plastic   | 14    | 4.55        |
| 8       | Vermont  | Yes     | Yes  | Yes     | Glass     | 20    | 4.28        |
| 24      | Canada   | No      | No   | No      | Plastic   | 12    | 3.7         |
| 9       | Other US | No      | No   | No      | Plastic   | 12    | 3.59        |
| 2       | Canada   | Yes     | Yes  | No      | Glass     | 18    | 3.25        |
| 5       | Canada   | No      | Yes  | Yes     | Glass     | 18    | 3.25        |
| 3       | Other US | Yes     | Yes  | Yes     | Plastic   | 16    | 3.13        |
| 7       | Canada   | Yes     | Yes  | Yes     | Plastic   | 16    | 3.09        |
| 1       | Other US | Yes     | No   | No      | Plastic   | 14    | 3.07        |
| 6       | Canada   | Yes     | No   | Yes     | Plastic   | 16    | 2.96        |
| 22      | Canada   | Yes     | No   | Yes     | Glass     | 18    | 2.93        |
| 17      | Other US | Yes     | Yes  | No      | Glass     | 18    | 2.88        |
| 18      | Canada   | No      | Yes  | No      | Plastic   | 14    | 2.87        |
| 4       | Canada   | No      | No   | No      | Glass     | 14    | 2.85        |
| 10      | Other US | No      | No   | Yes     | Glass     | 16    | 2.74        |
| 16      | Other US | No      | Yes  | Yes     | Plastic   | 16    | 2.7         |
| 20      | Other US | Yes     | Yes  | Yes     | Glass     | 20    | 2.47        |
| 14      | Other US | No      | No   | No      | Glass     | 14    | 2.13        |

# Part-worth utilities of each attribute level

| Attribute        | Level                      | Mean part worth | t-statistic |
|------------------|----------------------------|-----------------|-------------|
| Price            | Intercept                  | 3.628           | 13.093      |
|                  | 12                         | -0.456          | -1.652      |
|                  | 14                         | -0.532          |             |
|                  | 16                         | -0.608          |             |
|                  | 18                         | -0.684          |             |
|                  | 20                         | -0.76           |             |
| Origin           | Vermont                    | 1.809           |             |
|                  | Other US                   | -0.203          | -96.071     |
|                  | Canada                     | -1.606          | -86.93      |
| Organic          | Organic certified          | 0.11            |             |
|                  | Not certified              | -0.11           | -10.51      |
| Bird Friendly    | Bird friendly certified    | 0.046           |             |
|                  | Not certified              | -0.046          | -5.74       |
| Climate Friendly | Climate friendly certified | 0.053           |             |
|                  | Not certified              | -0.053          | -6.595      |
| Container        | Glass                      | -0.088          | 5.411       |
|                  | Plastic                    | 0.088           |             |

# Relative importance of attributes



# Estimated WTP

| Attribute                    | Average EEI Yes | Average EEI No | Relative WTP |
|------------------------------|-----------------|----------------|--------------|
| Organic                      | 3.03            | 2.94           | 1.03         |
| Bird                         | 3.03            | 2.94           | 1.03         |
| Climate                      | 3.26            | 2.66           | 1.23         |
| Container (Glass vs Plastic) | 2.90            | 3.07           | 1.06         |
| Vermont                      | 6.40            | 1.27           | 5.03         |
| Other US/State               | 0.99            | 3.98           | 0.25         |
| Canada                       | 1.55            | 3.70           | 0.42         |

- Consumers are willing to pay **2.8% more** for maple syrup produced with **bird-friendly practices**, as shown by the relative WTP of **1.028**.
- Consumers are willing to pay **403% more** for **Vermont-produced maple syrup** compared to syrup produced in other regions, with a relative WTP of **5.034**.

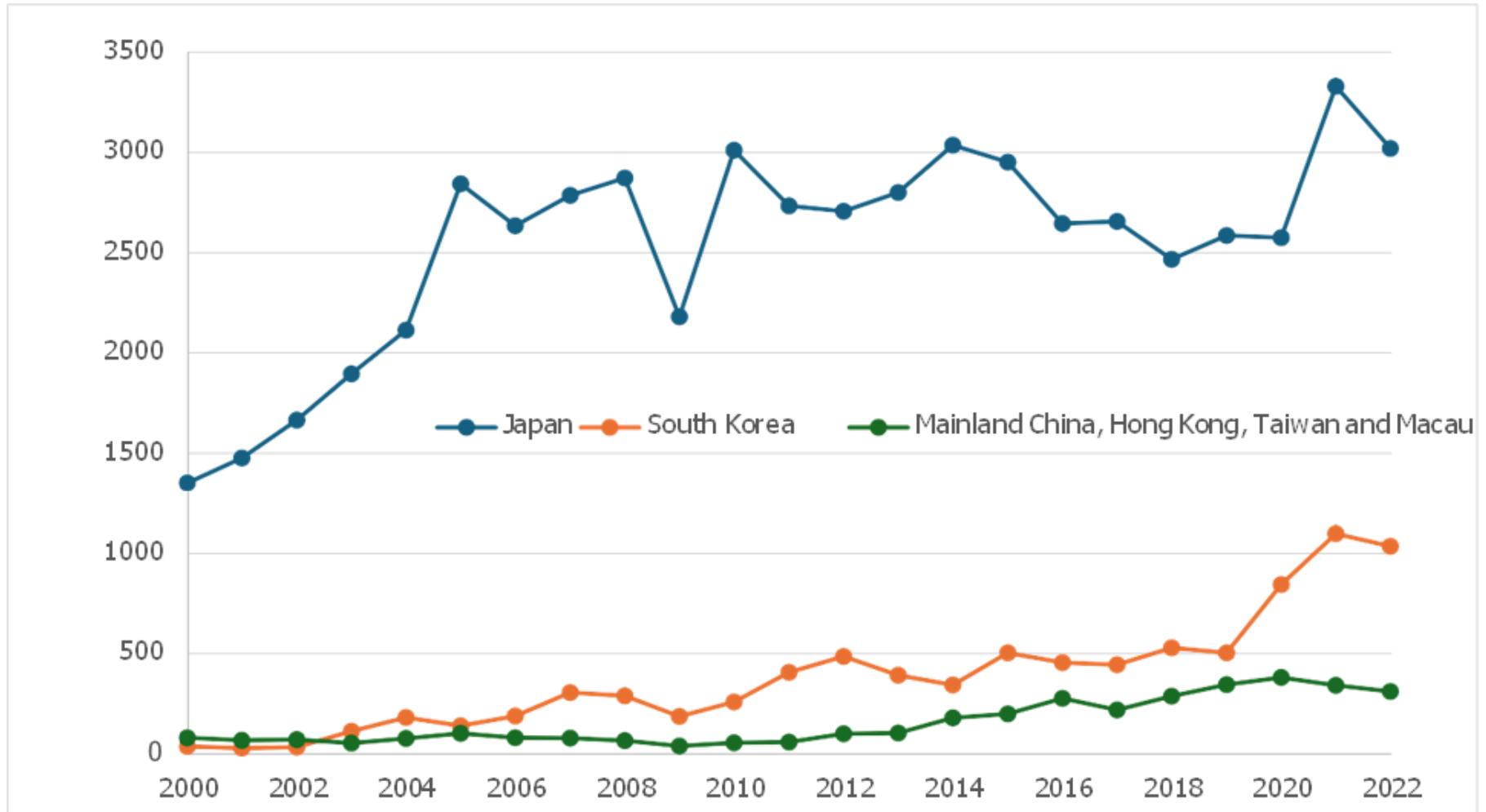
## Conclusions and recommendations:

- Product origin is the most important attribute: Consumers in Vermont place high importance on the production origin of maple syrup and they highly prefer maple syrup produced in the state.
- Price is important but less important than product origin.
- Vermont consumers are willingness to pay a premium for the environmental attributes although the WPT is pretty small.
- Impacts of demographic factors?  
Analysis is in progress

## Conclusions and recommendations:

- Charge a higher premium in Vermont for maple syrup produced in the state
- Develop more value-added maple syrup products (e.g., sports drinks)
- Introduce and promote maple syrup in new markets (e.g., CA, TX, China, Japan)
- More collaborative research

# Maple syrup import quantity of Japan, the Republic of Korea, and mainland China, Hong Kong, Taiwan and Macau, 2000 – 2022



## Research in progress:

- Consumer preferences and willingness to pay for maple syrup attributes in non-production regions (e.g., CA and TX)
- New maple syrup product development:
  - Sports drinks and other functional beverages
  - Maple syrup and Cannabidiol CBD ice cream and yogurt
- Market development and promotion in Japan and China
- Development of maple producer education programs



# Thank you and welcome you to visit Vermont!



**Bernie**  
2016