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Determining the Impact of State-Specific Signs and Labels on Tomato Marketing

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Determining the Impact of State-Specific Signs and Labels on Tomato Marketing

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Background

Florida is the largest supplier of fresh tomatoes in the U.S., accounting for nearly half of the total crop value. However, the evolving market conditions and trade relationship between the U.S. and Mexico are posing tremendous challenges to the industry. The data shows that both U.S. and Florida tomato production decreased dramatically from 2000 to 2012 (Fig. 1). During this period, tomato planted and harvested acreage also fell significantly.

In stark contrast to the shrinking domestic industry, the amount of tomatoes imported from Mexico (world) jumped from 1.3 (1.6) billion pounds to 3 (3.4) billion pounds. Mexican imports now account for 90% of the imported tomatoes (Fig. 2). Because of the excessive competition from Mexico, the farm gate value of Florida tomato industry slumped from $620 million in 2010 to $268 million in 2012 and the national value dropped from $1.4 billion to $0.86 billion.

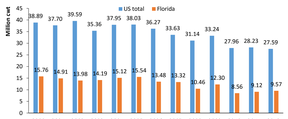

Fig. 1: US and Florida fresh tomatoes productions from 2000 to 2012
Source: USDA/NASS (2013)

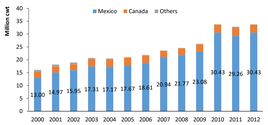

Fig. 2: Origins of US fresh tomatoes imports (Mexico, Canada, and others)
Source: U.S. Department of Commerce (2013).

Objectives

Provide the struggling industry with marketing information to boost consumer demand for local (Florida/US) tomatoes:

- determine consumer preference and estimate their willingness to pay on local tomatoes labeled with different country of origin information;
- examine the effect of three country of origin labeling (COOL) labeling strategies regarding to consumer's purchase of the Florida/US versus Mexican tomatoes;
- identify which, if any, of the labeling strategies would lead to increased willingness to pay from consumers for Florida/US tomatoes.

Survey Experiment Design

To determine the impact of different types of information on tomato COOL, we design and conduct a mall intercept experiment in Tampa (FL), Dallas (TX) and Baltimore (MD) in 2014. In the experiment, we observe participants' response to the displays of product origin in a setting that is similar to grocery stores. The survey design follows the guidelines of the open-ended Contingent Valuation Method (CVM) that the respondent is asked directly to provide a point estimate of his or her WTP for certain goods or services. The open-ended CVM allows us to determine consumer willingness to pay (WTP) for the U.S., Florida and Mexican tomatoes under the different scenarios.

The survey experiment had the following steps:

i. Screening questions: "an adult" and "primary grocery shopper"; and baseline questions on frequency and location of grocery shopping.
ii. participants were presented with two wooden baskets of tomatoes in a setting similar to what would be found in a real produce section of a store (same tomato but with different COOL).

Table 1. Three COOL scenarios in the survey experiment

Scenario	1st basket		2nd basket	
	Labeling Strategy	Tomato code	Labeling Strategy	Tomato code
1	US sticker	#599	Mexico stickers	#280
2	Florida sticker	#462	Mexico stickers	#280
3	"Grown in Florida" & US stickers	#828	Mexico stickers	#280

Survey Experiment Design (cont.)

iii. Participants indicated which basket of tomatoes they are most likely to purchase (**preference**) and how much they are willing to pay for both kinds of tomatoes (**WTP**) based on the given reference prices . They also clarified the reasons of their preferences of tomatoes.
iv. Then, participants were asked whether they noticed the different COOL of the tomatoes, what kind of information on the produce label they think is important, and their general consumption preference toward tomatoes from different production origins.
v. Demographics questions were answered by participants in the end of the survey. The staff members answered several questions about whether and how the participant touched the tomatoes during the experiment based on their observations.

Empirical Models

1. First, a **binary logistic regression** model is used to determine the elements which affect consumer's behavior of reading COOL information on tomatoes.

$$Originread = \alpha_0 + \alpha_1 Scenario + \alpha_2 City + \boldsymbol{\alpha_3 X} + \boldsymbol{\alpha_4 Demo} + \varepsilon_1$$

2. An **ordered logistic regression** is used to determine the factors, including latent preference, demographics, and reading COOL information that influence consumer choice of the tomatoes with various COOL.

$$Choice = \beta_0 + \beta_1 Originread + \beta_2 Scenario + \beta_3 City + \boldsymbol{\beta_4 X} + \boldsymbol{\beta_5 Demo} + \varepsilon_2$$

3. A **linear regression** is estimated with ordinary least square methods (OLS) to determine factors that impact consumers' WTP for Florida/US and Mexico tomatoes.

$$WTPD = \gamma_0 + \gamma_1 Originread + \gamma_2 Scenario2 + \gamma_3 Scenario3 + \gamma_4 City2 + \gamma_5 City3 + \boldsymbol{\gamma_6 X} + \boldsymbol{\gamma_7 Demo} + \varepsilon_3$$

In models 1, 2 3, where $\boldsymbol{X}$ is a vector of all possible latent preference variables and $\boldsymbol{Demo}$ is the vector of all demographic variables. *Originread* is a binary variable (1=consumer read the origin label, 2=otherwise). *Choice* is an ordinal variable (3=choose Florida/US labeled tomatoes, 2=no preference, and 1=choose Mexico tomatoes). *WTPD* is the difference of willingness to pay between Florida/US tomatoes and Mexico tomatoes, regarded as the premium that consumers are willing to pay for Florida/US tomatoes.

4. **Simultaneous equations** are conducted between the behavior of reading COOL and consumers' choice as well as the difference in WTP. Through running the simultaneous equations, the **endogenous variable** *Orginread* can be controlled so the estimated results are more valid and reasonable.

$$\begin{cases} Choice = \beta'_0 + \beta'_1 Originread + \beta'_2 Scenario + \beta'_3 City + \boldsymbol{\beta'_4 Z_2} + \varepsilon'_2 \\ Orginread = \alpha'_0 + \alpha'_1 Scenario + \alpha'_2 City + \boldsymbol{\alpha'_3 Z_1} + \varepsilon'_1 \end{cases}$$

$$\begin{cases} WTPD = \gamma'_0 + \gamma'_1 Originread + \gamma'_2 Scenario2 + \gamma'_3 Scenario3 + \gamma'_4 City2 + \gamma'_5 City3 + \boldsymbol{\gamma'_6 Z_3} + \varepsilon'_3 \\ Orginread = \alpha'_0 + \alpha'_1 Scenario + \alpha'_2 City + \boldsymbol{\alpha'_3 Z_1} + \varepsilon'_1 \end{cases}$$

The vectors of effective and valid latent preference variables $\boldsymbol{Z_1}$, $\boldsymbol{Z_2}$, and $\boldsymbol{Z_3}$ are screened and selected through stepwise processes for the above empirical models 1, 2, 3. Other important variables are forced to stay in the simultaneous equations.

The two above simultaneous equations are the main models in this analysis, based on the optimal latent variables $\boldsymbol{Z_1}$, $\boldsymbol{Z_2}$, and $\boldsymbol{Z_3}$ regressed by model 1,2 and 3.

Survey Results

Table 2. Consumers' stated choice of different labeled tomatoes, sorted by scenario and by city.

	By scenario			By city		
	1	2	3	Baltimore	Dallas	Tampa
Florida/US tomatoes	56.9%	57.6%	59.7%	59.8%	58.4%	55.9%
No preference	19.0%	11.9%	10.9%	14.4%	8.6%	18.8%
Mexico tomatoes	24.2%	30.5%	29.4%	25.8%	32.9%	25.4%
Sample Size	211	210	211	209	210	213

Table 3. Willingness to pay for Florida/US and Mexico tomatoes, sorted by scenario and by city (Unit: $/lb).

	Scenario 1		Scenario 2		Scenario 3	
	Tomato with the US sticker	Tomato with the Mexico sticker	Tomato with the Florida sticker	Tomato with the Mexico sticker	Tomato with the Florida sign plus US sticker	Tomato with the Mexico sticker
All city	1.88	1.55	1.81	1.63	1.68	1.50
Baltimore	2.05	1.68	1.81	1.56	1.77	1.47
Dallas	1.66	1.42	1.66	1.47	1.75	1.69
Tampa	1.96	1.56	1.94	1.85	1.50	1.33

Model Results

- Table 4: Parameter results of the binary logistic regression of consumers' behavior of reading tomato COOL information in the experiment.

Variable	Parameter Estimate	Standard Error	Pr > ChiSq
Intercept	−1.5211	0.7087	0.0318**
SC2	0.3465	0.2341	0.1388
SC3	1.0092	0.2338	<.0001***
City2	0.0176	0.2413	0.9419
City3	0.8486	0.2652	0.0014***
Size	−0.1787	0.0865	0.0388**
Firmness	0.2177	0.1302	0.0944*
Color	−0.2901	0.1276	0.0230**
COOL	0.2081	0.0753	0.0057***
SampleA	0.1375	0.0711	0.0531*
GLCOOL	0.8991	0.2395	0.0002***
GLdont	−0.8226	0.2378	0.0005***
preferUS	0.4281	0.2373	0.0713*
preferMX	0.8310	0.4504	0.0650*
preferFLL	−0.2616	0.2596	0.3135
preferOT	0.5736	0.3031	0.0584*
Age	−0.0248	0.00697	0.0004***
EBlack	0.3624	0.2089	0.0828*
Eaian	−1.2050	0.6062	0.0468**
Education	0.1558	0.0812	0.0548*
Children18	0.2277	0.0896	0.0111**
Touch	0.3276	0.1965	0.0954*

Number of Observations Used: n=632. Adj R-Sq: 0.3093
"*": Significant at 10%; "**": Significant at 5%; "***": Significant at 1%

- Table 5:Parameter results of the ordered logistic regression of consumers' stated choice of tomatoes from the first simultaneous equation system.

Variable	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	−0.007825	0.303387	−0.03	0.9794
SC2	−0.087207	0.122097	−0.71	0.4751
SC3	−0.158146	0.130296	−1.21	0.2248
city2	−0.068993	0.126151	−0.55	0.5844
city3	−0.195120	0.126640	−1.54	0.1234
Originread	0.492628	0.244964	2.01	0.0443**
Color	0.137895	0.055295	2.49	0.0126**
preferUS	−0.078023	0.128182	−0.61	0.5427
preferMX	−0.667956	0.244071	−2.74	0.0062***
preferFLL	0.230986	0.136483	1.69	0.0906*
preferOT	−0.067525	0.163508	−0.41	0.6796
ECaucasian	0.263867	0.105357	2.50	0.0123**
Education	−0.079685	0.042531	−1.87	0.0610*
Touch280	−0.346921	0.152453	−2.28	0.0229**
TouchUSFL	0.503246	0.151024	3.33	0.0009***
_Limit2.Choice	0.398701	0.039872	10.00	<.0001
_Rho	−0.135687	0.160307	−0.85	0.3973

Number of Observations Used: n=632
"*": Significant at 10%; "**": Significant at 5%; "***": Significant at 1%

Model Results (cont.)

- Table 6: Parameter results of the linear regression of consumers' willingness to pay for a premium for Florida/US tomatoes than for Mexico tomatoes from the second simultaneous equation system.

Variable	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	0.526567	0.296977	1.77	0.0762*
SC2	−0.206582	0.107654	−1.92	0.0550*
SC3	−0.215765	0.112239	−1.92	0.0546*
city2	−0.066247	0.109195	−0.61	0.5441
city3	−0.051987	0.108406	−0.48	0.6315
Originread	0.180450	0.202484	0.89	0.3728
Llocalstore	−0.147851	0.086548	−1.71	0.0876*
Lwarehouse	0.342576	0.191369	1.79	0.0734*
Lfarmermarket	−0.173357	0.102640	−1.69	0.0912*
Size	0.084085	0.039457	2.13	0.0331**
Freshness	−0.093470	0.054578	−1.71	0.0868*
Vineornot	0.057727	0.030966	1.86	0.0623*
preferMX	−0.352666	0.196976	−1.79	0.0734*
Female	0.154841	0.088115	1.76	0.0789*
Children18	−0.097164	0.039769	−2.44	0.0146**
Touch280	−0.328790	0.130942	−2.51	0.0120**
TouchUSFL	0.240007	0.127766	1.88	0.0603*
_Sigma.WTPD	1.060916	0.030130	35.21	<.0001
_Rho	−0.004567	0.125099	−0.04	0.9709

Number of Observations Used: n=632
"*": Significant at 10%; "**": Significant at 5%; "***": Significant at 1%

Conclusions

- The majority (>55%) of the participants chose Florida/US tomatoes rather than Mexico tomatoes or no preference.
- On average, consumers are willing to pay a higher premium for Florida/US tomatoes than they are for Mexico tomatoes under all COOL scenarios.
- The "Grown in Florida" sign plus US sticker effectively increases the probability of reading COOL on the tomatoes when consumers purchase fresh tomatoes, compared with other two COOL strategies including US stickers and Florida stickers.
- Different COOL strategies have no significant direct impact on consumer's choice of the tomatoes.
- Through applying simultaneous equations, it can be inferred that the strategy of labeling with the "Grown in Florida" sign plus US sticker is associated with consumer' choice of tomatoes indirectly via first attracting consumers to read COOL on the tomatoes, then the reading behavior could improve the probability of choosing Florida/US tomatoes.
- When it comes to WTP, the results are consistent with previous studies (e.g. Mabiso et al. in 2005) that consumers are willing to pay a premium domestic tomatoes such as the ones labeled with "Grown in the US".
- Furthermore, the results indicate that Florida sticker, and "Grown in Florida" sign plus US sticker strategies decrease the premium consumers are willing to pay for Florida/US tomato compared to Mexico tomatoes. Under these two COOL scenarios, there is a smaller difference between WTPs for Florida/US and Mexico tomatoes.

References and Acknowledgements

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