Agriculture Producer's Willingness-to-Pay for Broadband Upload Speed

Research Update

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Use of Broadband In Agriculture

Connected Technologies in Row Crops

- **Planning**
  - **Yield Monitoring:** Combine-mounted monitors gather harvest data for business decisions.
  - **Precision Seeding:** Location-tagged field data can be uploaded into planning software to optimize planting decisions and placement.
  - **Micro-climate Monitoring:** Satellites or on-site weather stations can forecast local weather more accurately, avoid potential pest problems, and reduce crop loss by up to 80%.
- **Production**
  - **Connected Equipment Guidance:** Vehicles, including autonomous vehicles, use GPS to determine field boundaries for precise tending.
  - **Remote Diagnostics and Predictive Maintenance:** Connected hardware and software diagnose and even anticipate needs for repair.
  - **Variable Rate Applications:** Technologies apply precise, optimal levels of raw inputs.
  - **Field Scouting:** Drone imagery and software can collect nutritional and growth data used to calculate optimal inputs.
  - **Machine Learning and Visioning:** Connected camera and software can identify weeds, detect disease with 90% to 99% accuracy, and locate local pests.
- **Market Coordination**
  - **Storage Monitoring**: Temperature and moisture sensors can detect storage quality for harvested products, reducing crop loss and increasing sale price.
  - **Small Producer Coordination:** Web platforms connect farmers directly to buyers, allowing them to earn premiums for meeting specific quality standards.

Survey

Attribute	Levels
Price	$45, $75, $105
Reliability	Less Reliable, Somewhat Reliable, More Reliable
Upload Speed	3 Mbps, 10 Mbps, 50 Mbps
Download Speed	25 Mbps, 100 Mbps, 980 Mbps

In this section, we describe the attributes of an Internet plan: **Price, Reliability, Upload Speed,** and **download speed.** We also explain the how the last of three features may affect your production operations. You may find this information helpful when answering questions in the next section.

- **Price:** The total monthly fee you pay for Internet service before tax.
- **Reliability:** The probability that a product, system, or service will perform its intended function adequately for a specified period of time, or will operate in a defined environment without failure.
- **Upload Speed:** The rate that data is transferred from the user's computer to the Internet.
- **Download Speed:** The rate at which data is transferred from the Internet to the user's computer.

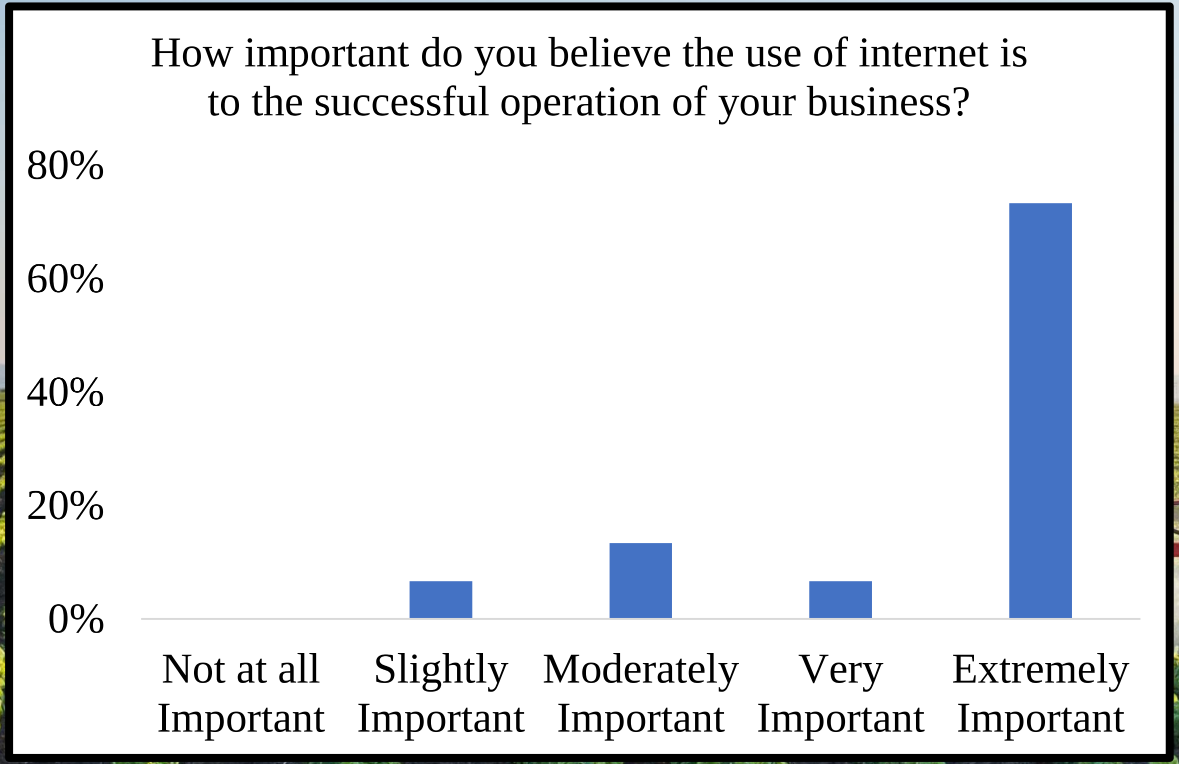
Survey

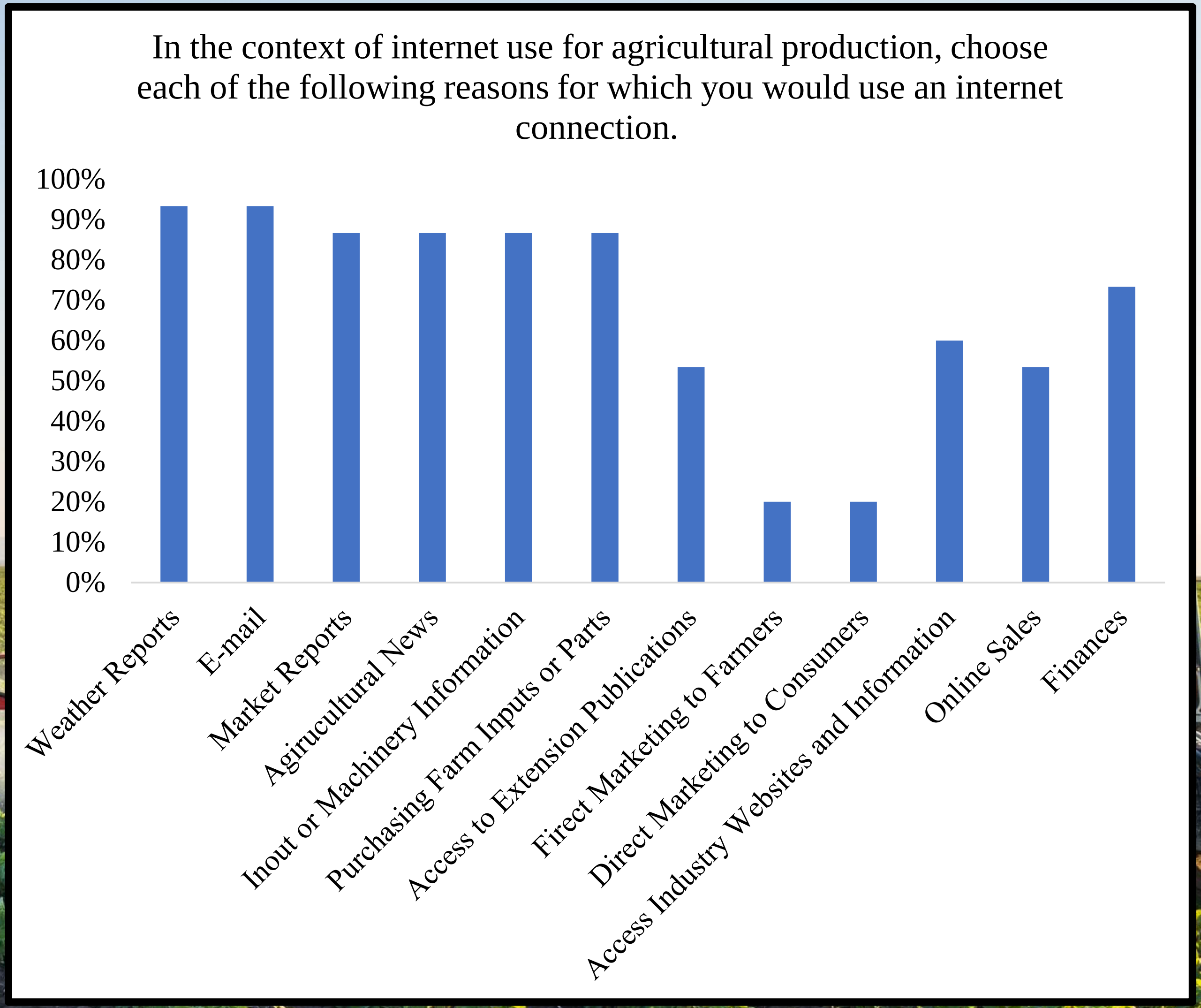
Which of the following internet connections do you prefer?

Option A		Option B		Option C
Price	$75	Price	$45	Niether A or B is preferred.
Reliability	More Reliable	Reliability	Somewhat Reliable	
Download Speed	25 Mbps	Download Speed	980 Mbps	
Upload Speed	50 Mbps	Upload Speed	10 Mbps	

16 Choice Sets from a full factorial of 81

Producer's Perception and Use of Broadband





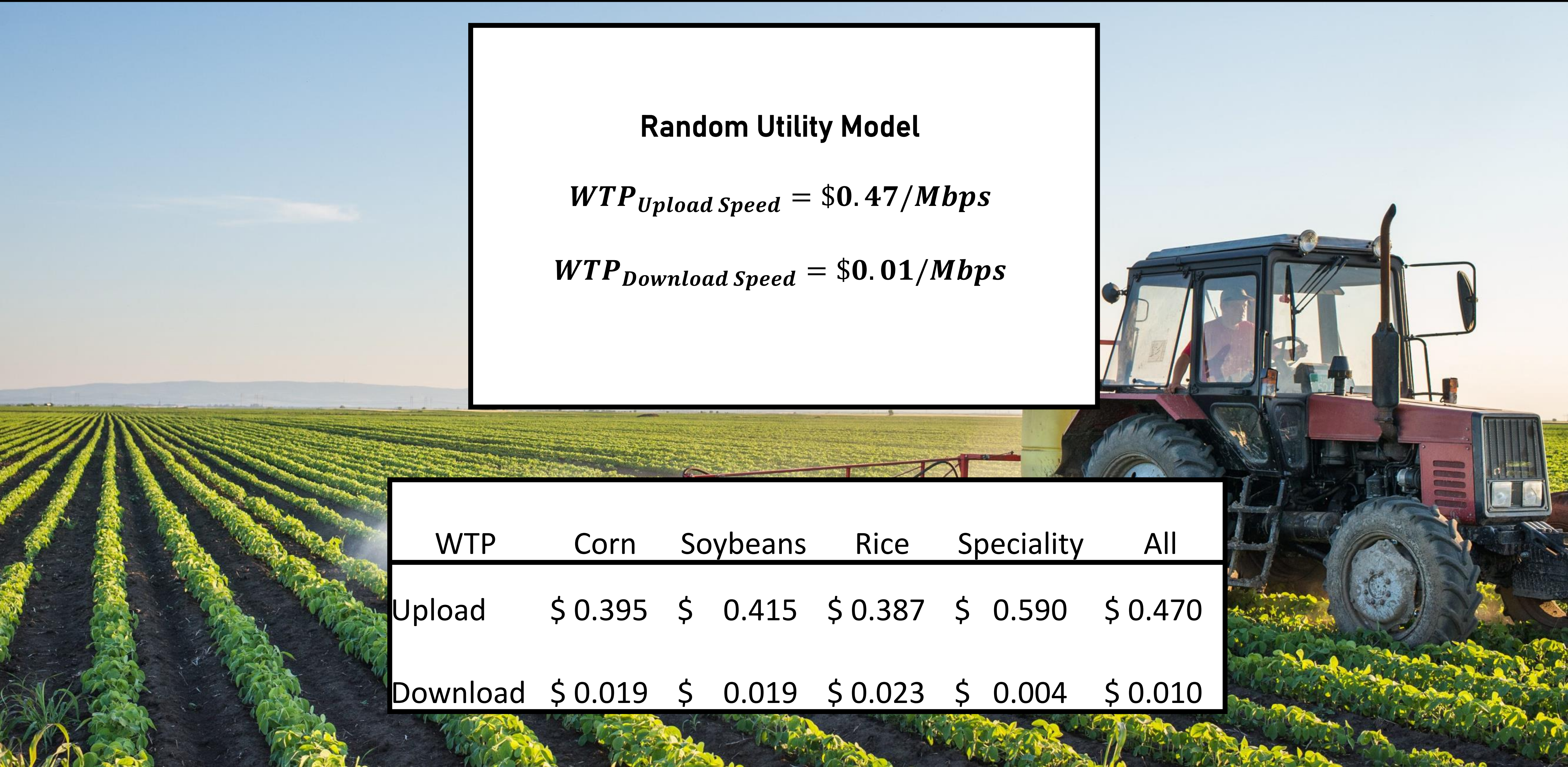
Discrete Choice Model

Random Utility Model

Conditional Logit Results		Pseudo R^2=0.259	
Variable	Coefficient	Std Err	p-value
Price	-0.0260	0.0054	0.000***
Download Speed	0.0003	0.0003	0.306
Upload Speed	0.0122	0.0053	0.022**
Less Reliable	0.2313	0.5233	0.658
Somewhat Reliable	0.7241	0.4711	0.124
More Reliable	2.5805	0.4812	0.000***
			N=47

$$V_{i,j} = \beta_1 Price_j + \beta_2 Upload\ Speed_j + \beta_3 Download\ Speed_j + \beta_4 Reliability_j + \varepsilon_{i,j}$$

Discrete Choice Model



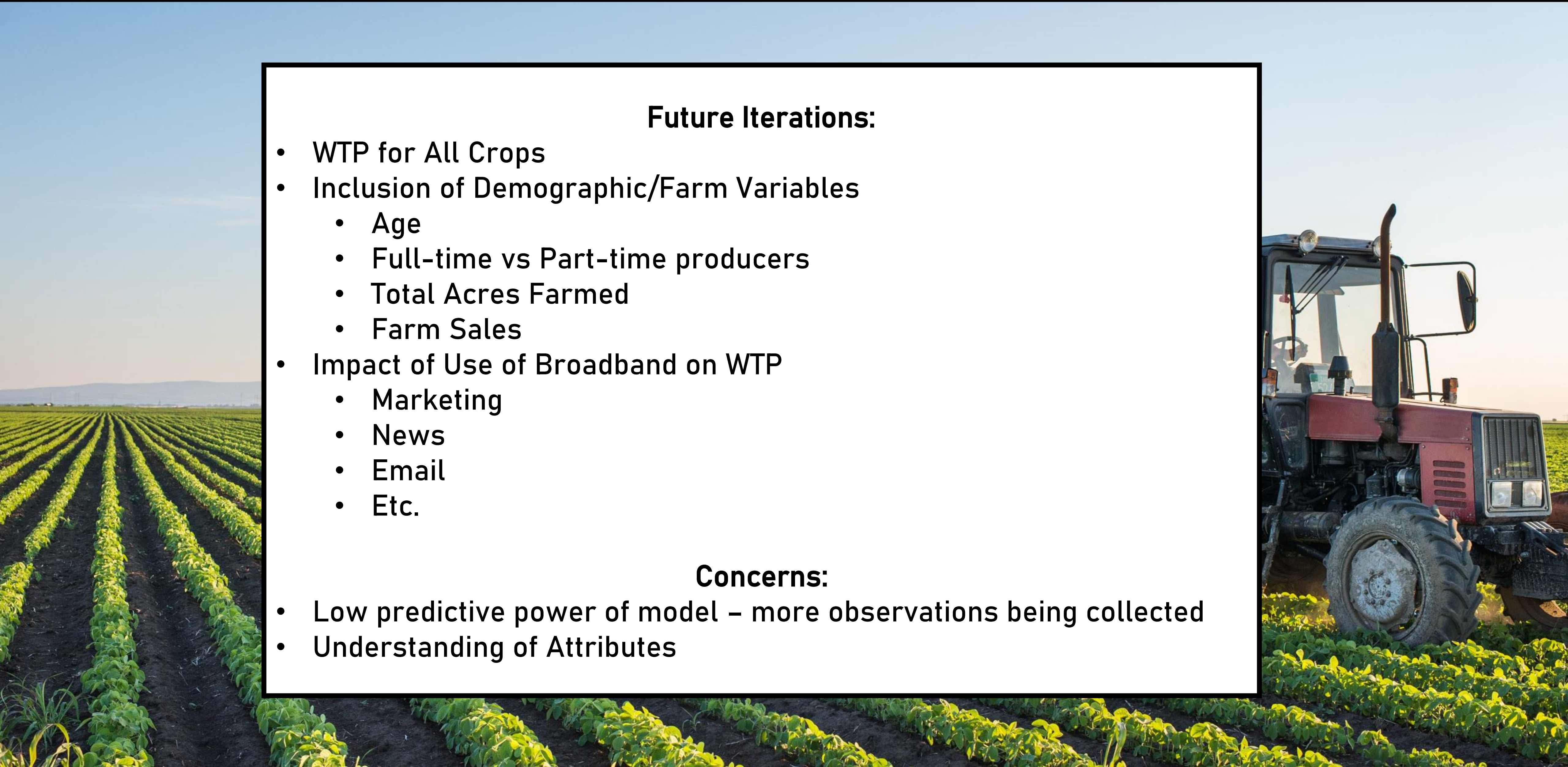
Random Utility Model

$$WTP_{Upload\ Speed} = \$0.47/Mbps$$

$$WTP_{Download\ Speed} = \$0.01/Mbps$$

WTP	Corn	Soybeans	Rice	Speciality	All
Upload	$ 0.395	$ 0.415	$ 0.387	$ 0.590	$ 0.470
Download	$ 0.019	$ 0.019	$ 0.023	$ 0.004	$ 0.010

Discrete Choice Model



Future Iterations:

- WTP for All Crops
- Inclusion of Demographic/Farm Variables
  - Age
  - Full-time vs Part-time producers
  - Total Acres Farmed
  - Farm Sales
- Impact of Use of Broadband on WTP
  - Marketing
  - News
  - Email
  - Etc.

Concerns:

- Low predictive power of model – more observations being collected
- Understanding of Attributes

I HOPE YOU ARE STAYING SAFE AMIDST THIS GLOBAL PANDEMIC!

MISSISSIPPI STATE UNIVERSITY
COASTAL RESEARCH & EXTENSION CENTER

I AM

BEN POSADAS

AN EXTENSION AND RESEARCH MARINE ECONOMIST

POTENTIAL OF POND GROW-OUT OF SOFTSHELL BLUE CRABS

Benedict 'Ben' Posadas, Ph.D.
Mississippi State University
Coastal Research and Extension Center
Mississippi-Alabama Sea Grant Consortium

https://coastal.msstate.edu/marine-economics

ACKNOWLEDGEMENT

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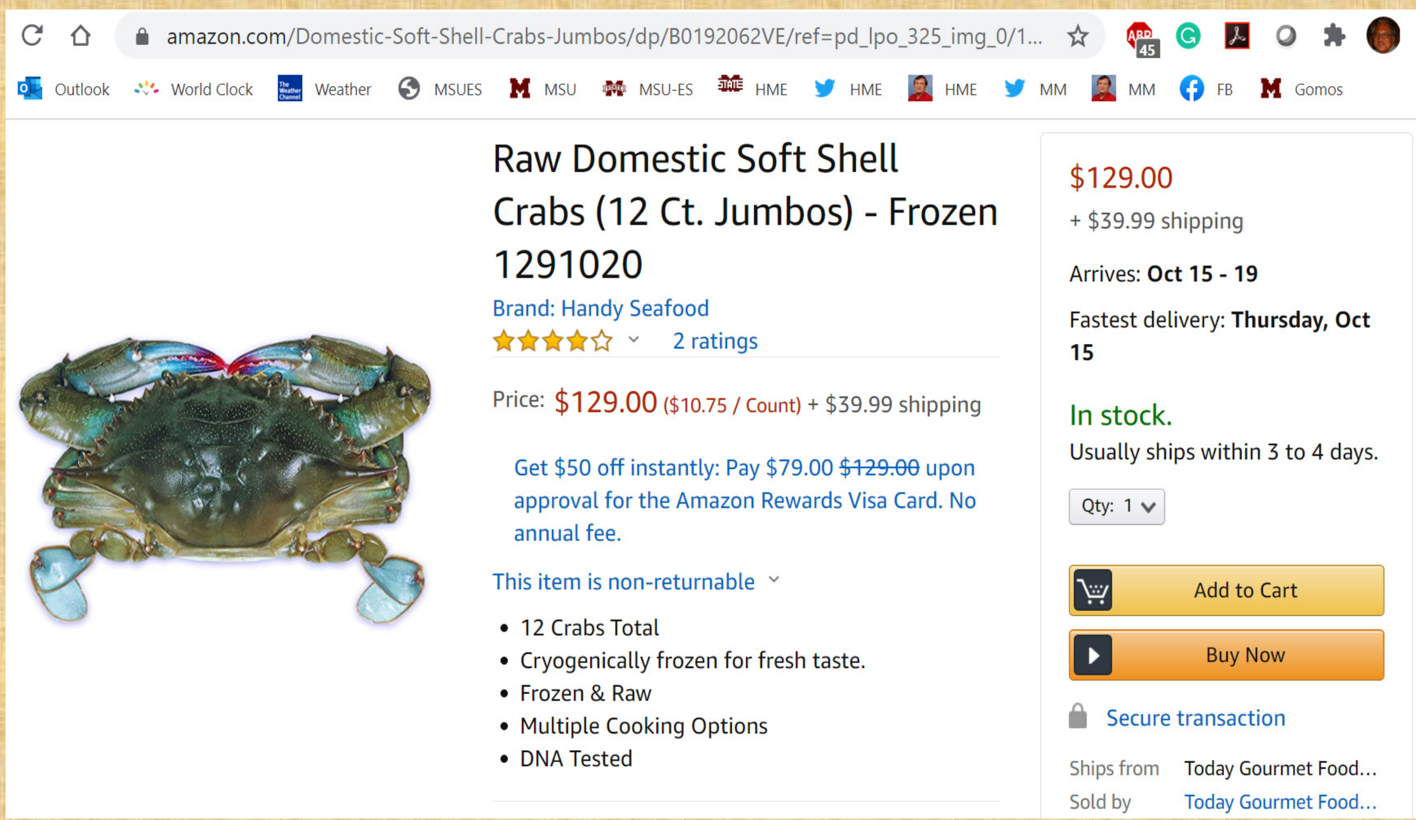
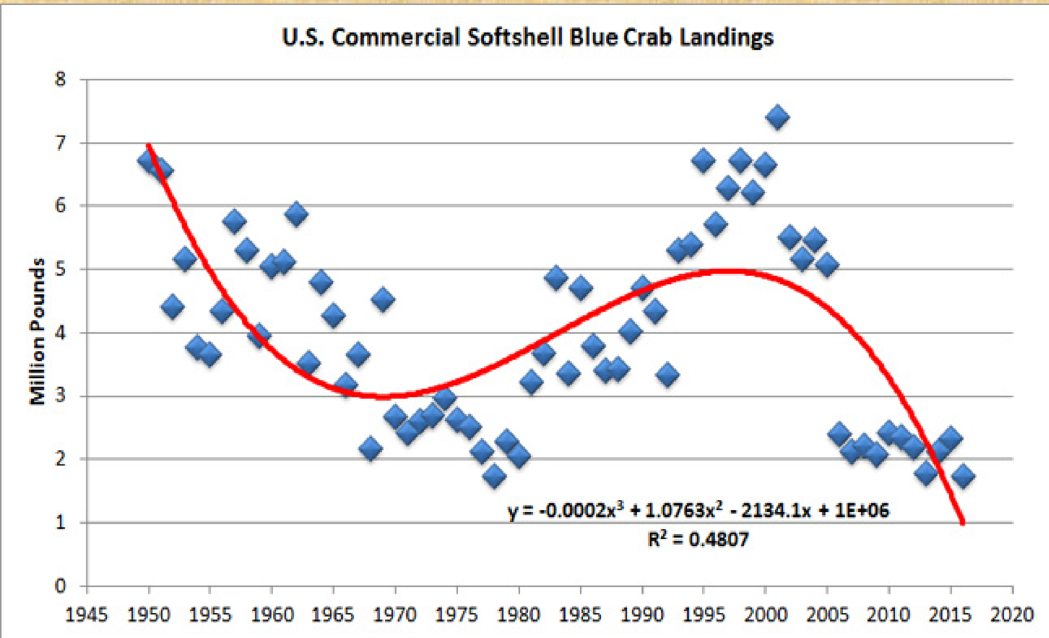
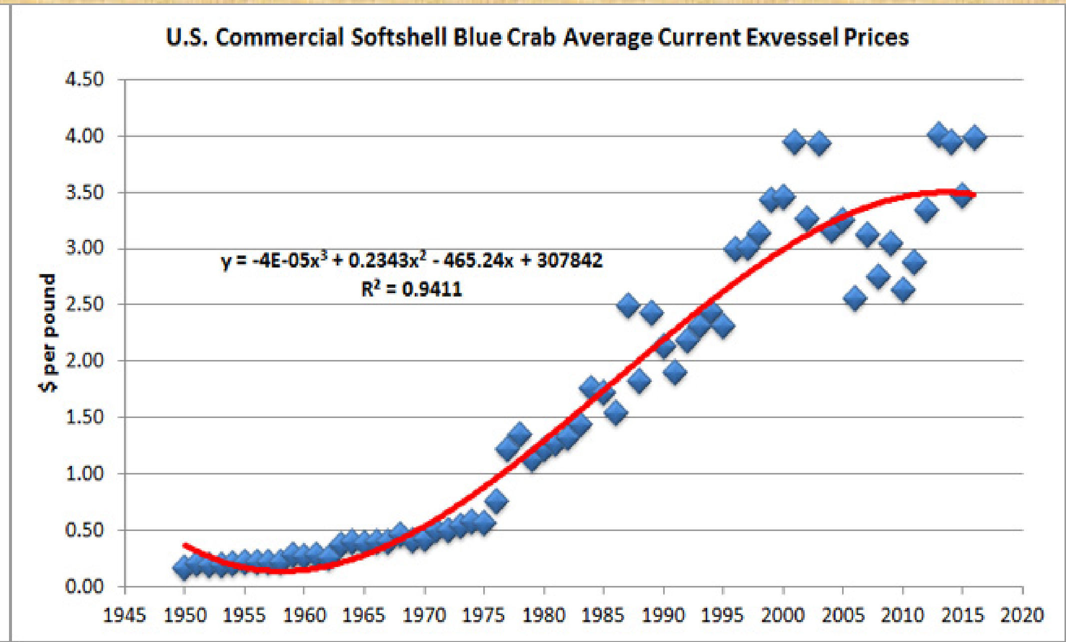
GOOGLE SEARCH – "SOFT BLUE CRABS"



THIS IS ONE OF THE RESULTS THAT I GOT WHEN I DID THE GOOGLE SEARCH.

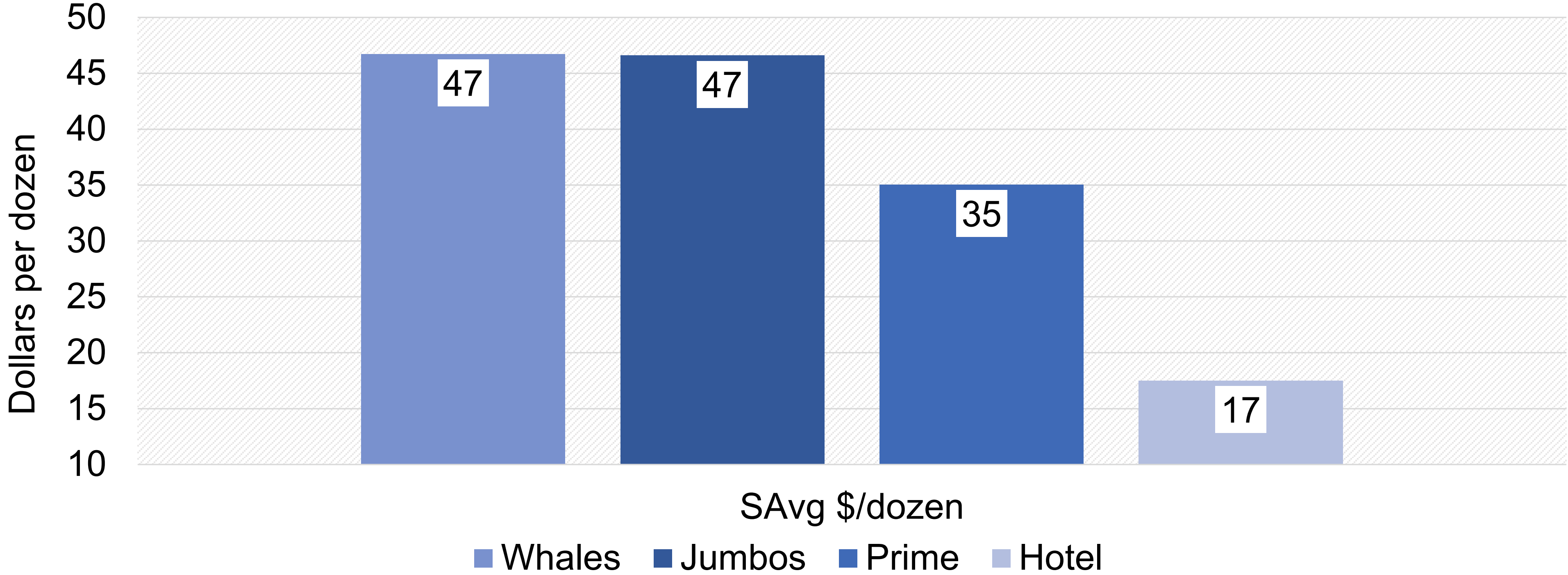
THE ANNUAL COMMERCIAL SOFTSHELL BLUE CRAB LANDINGS (IN MILLION POUNDS) AND AVERAGE EXVESSEL PRICES ($/LB) IN THE UNITED STATES ARE SHOWN BELOW.





The annual U.S commercial landings hovered at its lowest around TWO MILLION POUNDS lately while dockside prices averaged over $3.50 per pound.

BLUE CRABS, SOFTSHELL, PER DOZEN, FOB M-A SINCE 2018



2020 ECONOMIC IMPACTS ON U.S. BLUE CRAB MARKETS.
https://youtu.be/ZVUTzykRrWg

THESE MARKET CONDITIONS AND SUPPLY CONSTRAINTS PROVIDED AN ECONOMIC OPPORTUNITY FOR ENTERPRISING RESEARCH SCIENTISTS, SEAFOOD DEALERS, AND EXTENSION SPECIALISTS.

PROJECT PARTNERS

- **University of Southern Mississippi**, Ocean Springs, MS – **blue crab hatchery and nursery and pond grow-out**
- **North Carolina Sea Grant Program** –
- **Carteret Community College**, Carteret, NC – **blue crab hatchery and nursery, pond grow-out**
- **Carteret Seafood Company**, Beaufort, NC – **pond grow-out, shedding facility, storage, and marketing**
- **Mississippi State University**, Coastal Research and Extension Center, Biloxi, MS – **aquaculture economics and marketing**

ABSTRACT

Economic simulations are useful in guiding decision-making concerning the planning and managing pilot demonstration softshell blue crab ponds grow-out experiments to maximize harvests and improve profitability. The potential costs and benefits of the decision are weighed in advance before implementing any planned changes. In making these simulations, the current information and data on softshell blue crab production are used. The North Carolina model in pond preparation and the Mississippi data on stocking and survival were combined to create a hypothetical blue crab farm. The key assumptions include three crops per year and four, quarter-acres ponds. The stocking density is at first set at 2,000 juvenile crabs per pond and then raised to 3000, 4000, and 6000 juveniles per pond. Survival rates are initially pegged at 50 percent. Economic simulations initially considered the cost of juvenile crabs as being produced by private hatcheries and nurseries as this new industry starts to emerge. In the initial stages of industry development, critical state and federal assistance are provided to enable the emerging industry to take off. Additional simulations cover the impacts of increasing survival rates and growth rates. There are always trade-offs between stocking densities, survival rates, and growth rates. These relationships are sometimes muddled by the presence of predators, and the incidence of aquatic diseases. These situations are handled by adding a risk and uncertainty component. These are two sides to interpreting the simulation results. High juvenile prices increase pond growers' production costs. Expensive juveniles restrict the expansion of grow-out operations. On the other hand, high potential earnings encourage the hatchery and nursery owner/operator to grow his business. Finally, simulation results of production costs are compared to long-term variability in the wholesale prices of blue softshell crabs in the Mid-Atlantic U.S. markets.

POND GROW-OUT SYSTEMS

COASTAL NORTH CAROLINA

- Newly-built ponds
- Quarter acres
- Three feet water depth
- Brackish water
- Inlet canal
- Water pump

INLAND MISSISSIPPI

- Existing ponds
- Quarter acres
- Three feet water depth
- Zero salinity
- Artificial salt
- Water well and pump

COASTAL PONDS: BEAUFORT, NORTH CAROLINA

- Privately-owned
- Newly-built ponds
- Quarter acres
- Three feet water depth

- Brackish water
- Inlet canal
- Water pump

INLAND PONDS: LYMAN, MISSISSIPPI

- State-owned
- Existing ponds
- Quarter acres
- Three feet water depth
- Zero salinity
- Artificial salt
- Water well and pump

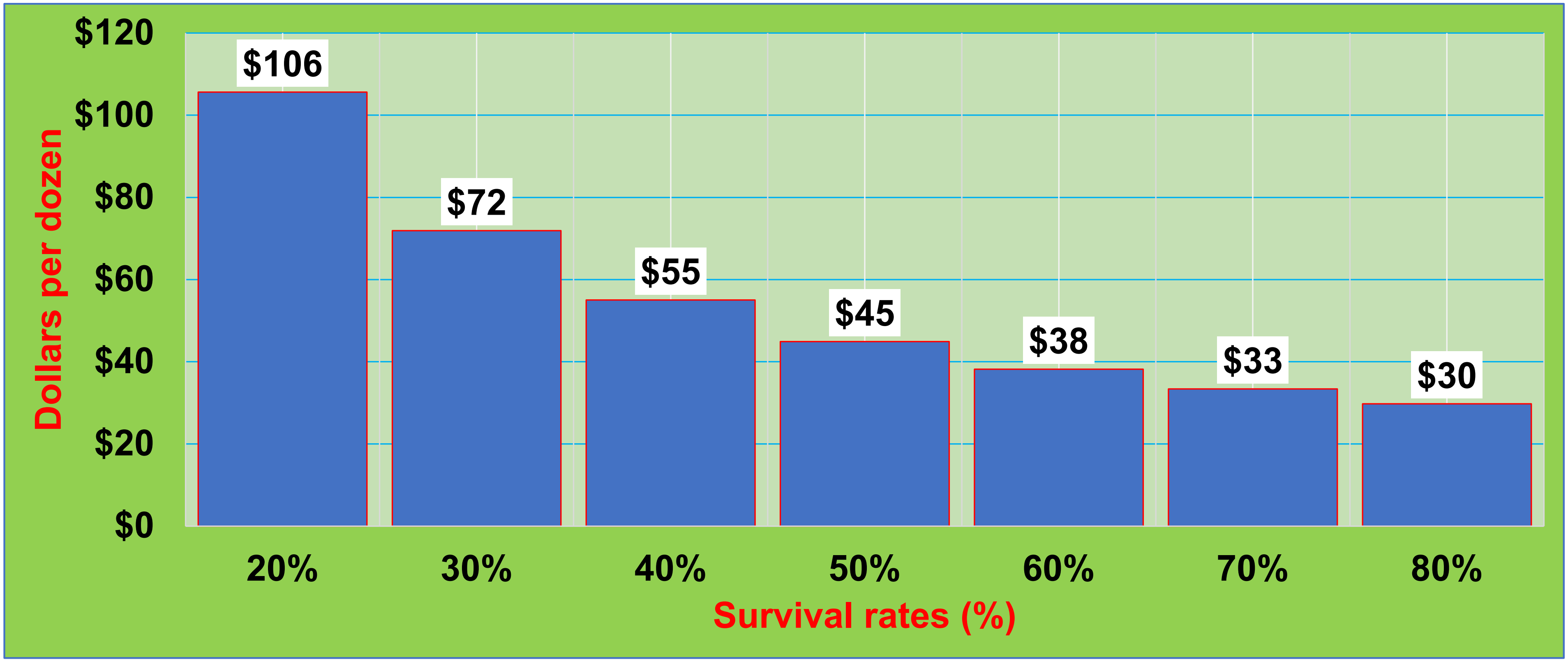
WATER PUMP AND DRAINAGE

AERATION EQUIPMENT

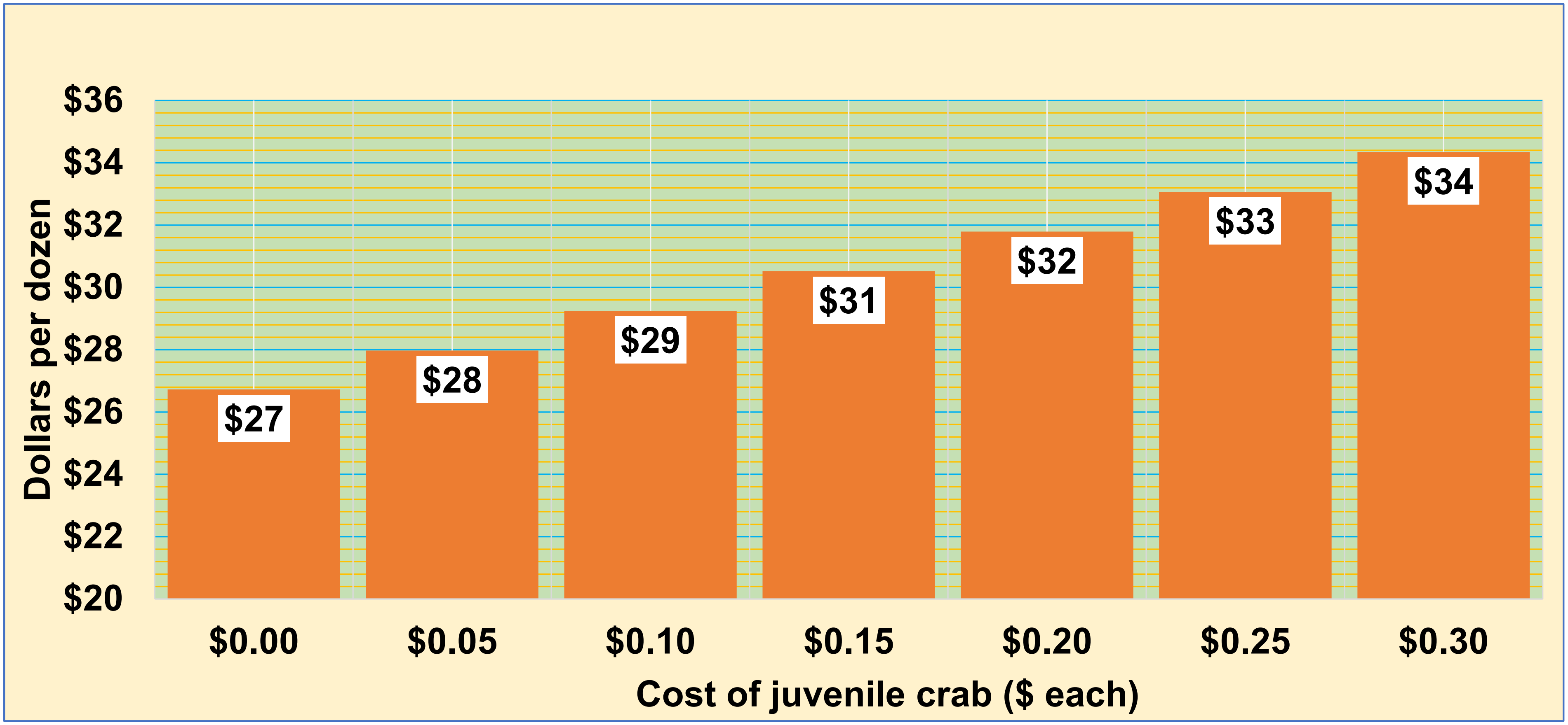
BLUE CRAB JUVENILES STOCKED IN PONDS

SOFT-SHELL CRABS HARVESTED AFTER 45 DAYS FROM STOCKING IN THE PONDS.

SENSITIVITY OF AVERAGE COST TO SURVIVAL RATE AT STOCKING = 2000 PER POND AND GROWTH RATE = 1.5 GRAM



SENSITIVITY OF AVERAGE COST TO COST OF JUVENILES AT STOCKING = 4,000 AND SURVIVAL = 50%.



SOFT SHELL CRABS, HOTELS

2020 Wholesale price per dozen.
$15 ≤ WP ≤ $24

"HOTEL" soft blue crabs are 4 - 4½ inches in length or 2.5 oz in weight.

There are 15 dozens per case.

2020 ECONOMIC IMPACTS ON U.S. BLUE CRAB MARKETS. https://youtu.be/ZVUTzykRrWg

SOFT SHELL CRABS, PRIME

2020 Wholesale price per dozen. $\$26 \leq WP \leq \$38$

- "PRIME" soft blue crabs are 4½ - 5 inches in length or 3.3 oz in weight.
- There are 12 dozens per case.

2020 ECONOMIC IMPACTS ON U.S. BLUE CRAB MARKETS. **https://youtu.be/ZVUTzykRrWg**

RESEARCH IMPLICATIONS

- **Private hatcheries and nurseries** – stable supply, lower costs
- **Stocking densities** – quantity, size, and timing
- **Managing survival and growth** – more than 50 percent and larger crab sizes
- **Feeds and feeding** – local supply and lower costs
- **Harvesting methods** – detecting shedders and more efficient

SUGGESTED CITATION

Posadas, Benedict C. 2020. **Potential of Pond Grow-out of Softshell Blue Crabs**. Presentation at the Food Distribution Research Society, 2020 Virtual Conference. (October 13, 2020).

https://www.fdrsinc.org/2020-virtual-conference/

2020 FDRS Virtual Conference

- Research Report
- Producer Issues and Decisions

Understanding Profitability of Georgia Blueberry Growers Adopting a Stochastic Approach

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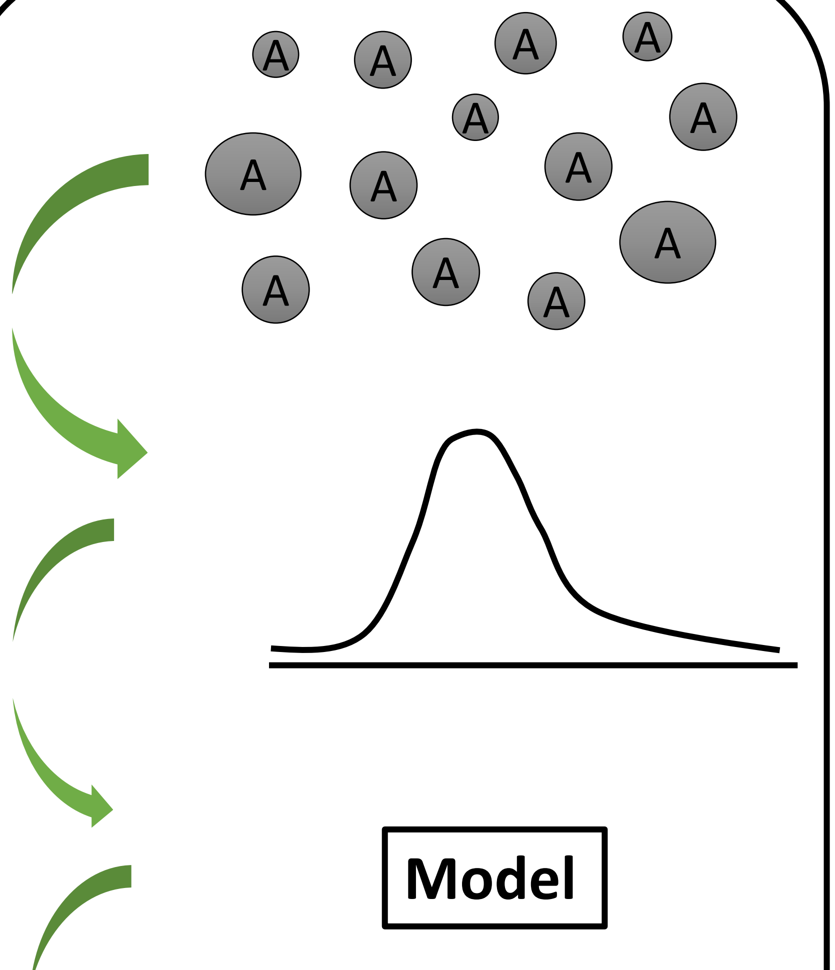
Now

- **Backgrounds**
- **Methodology**
- **Results and Discussions**
- **Summary and Conclusions**
- **Limitations**

Can we say...with 100%?

- head or tail flipping up the coin
- will there be any pandemic in 2025
- the price of the wheat next year
- about rainfall next week

Certainly not



$$\frac{\textbf{Favorable outcome}}{\textbf{Total outcome}}$$

Why stochastic approach in agriculture?

- Agriculture performs in varying environment
- Mercurial nature of production components as difficult to define
- Many inherent randomness and uncertainties in the agriculture
- Example: disease, weather, price, yield, pest, etc.
- Planning in an uncertain environment is risk

Motivation

Blueberry growers are facing price and yield alteration (Fonsah et al., 2007)

Both underestimation and overestimation of profit lead discomfort among farmers on investing in agriculture (Awondo et al., 2017)

A more sophisticated budget provides actual shape of profit and gears towards the expected returns

Objectives

Overall objective:

- Evaluate profitability of Georgia blueberry using Stochastic budget

Specific Objectives:

- Develop deterministic budget of Georgia blueberry for 2020
- Extend deterministic budget to stochastic budget
- Contrast two different budgets

Now

- Background
- **Methodology**
- Results and Discussions
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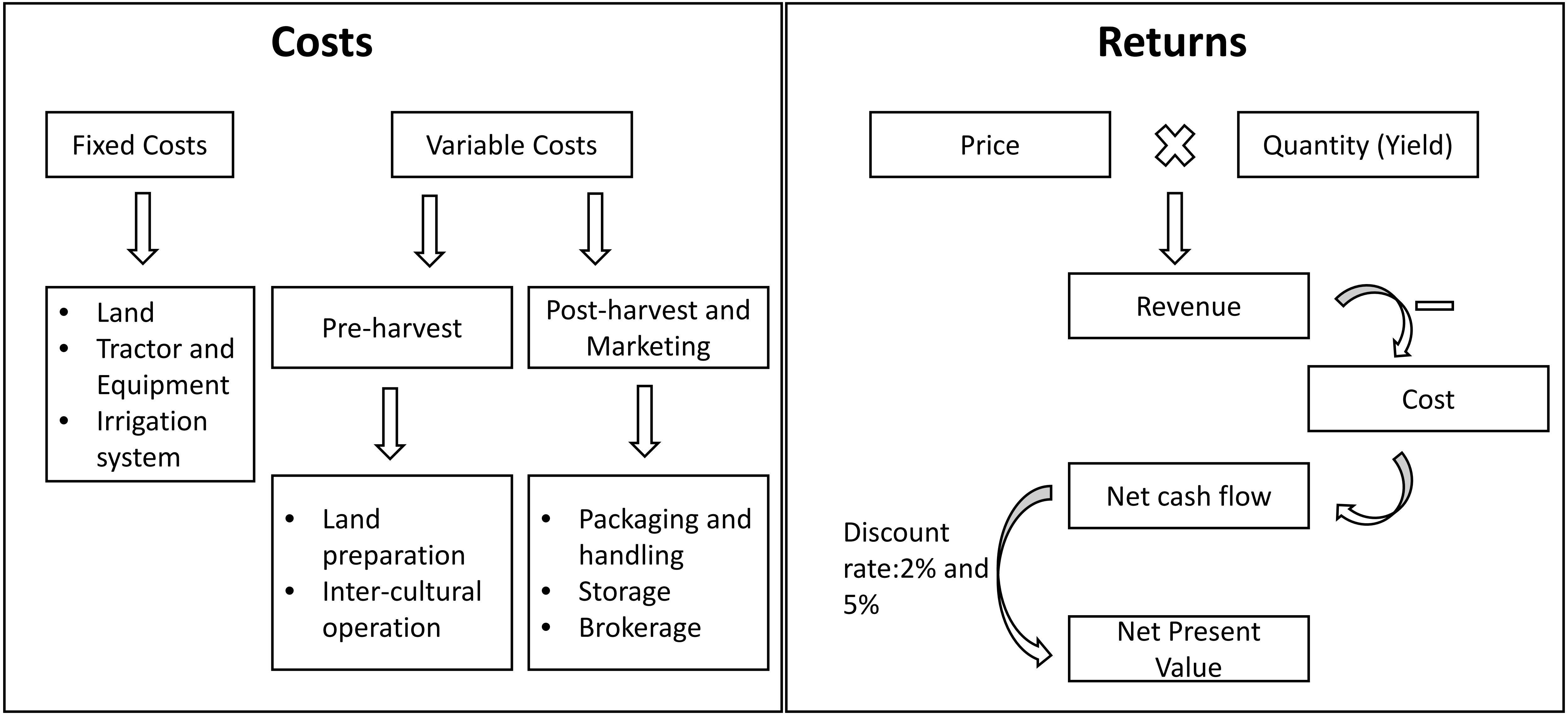
- Limitations

Deterministic budget: Components



Deterministic budget: Data

- Primary and Secondary data
- Input recommendations & prices - UGA extension team & agricultural vendors
- Machinery & equipment costs - AAEA Task Force on Commodity Costs & Returns
- Yield/acre and price/lb. - multiple meetings and focused group discussion with growers, county agents and blueberry growers

Stochastic budget: Data

- A survey questionnaire: email (Qualtrics survey) and personal meet
- Total of 40 responses: 35 from personal meet and 5 via Qualtrics survey
- Time-series blueberry price and yield data
- Monte Carlo simulation using triangular distribution
  - Minimum, maximum and the most-likely yield
  - Minimum, maximum and the most-likely price

Now

- Background
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Deterministic budget

Table: Net cash flows of growing blueberries in Georgia for 15 years, 2020

Year	Yield (lbs./acre)	Price ($/lb.)	Return ($/acre)	Total Cost ($/acre)	Net Cash Flow ($/acre)
1	0	3	0	9,796.72	-9,796.72
2	1,615	3	4,845	6,859.77	-2,014.77
3	3,800	3	11,400	11,401.92	-1.92
4	6,650	3	19,950	17,598.47	2351.53
5	6,650	3	19,950	17,598.47	2,351.53
6	6,650	3	19,950	17,598.47	2,351.53
7	6,650	3	19,950	17,598.47	2,351.53
8	6,650	3	19,950	17,598.47	2,351.53
9	6,650	3	19,950	17,598.47	2,351.53
10	6,650	3	19,950	17,598.47	2,351.53
11	6,650	3	19,950	17,598.47	2,351.53
12	6,650	3	19,950	17,598.47	2,351.53
13	6,650	3	19,950	17,598.47	2,351.53
14	6,650	3	19,950	17,598.47	2,351.53
15	6,650	3	19,950	17,598.47	2,351.53

Full production year

NPV at discount rate of 2% = $12,128.70/ acre

NPV at discount rate of 5% = $7,187.17/ acre

Stochastic Budget

Significant variation in the blueberry prices and yields among growers

Table: Summary statistics of expected maximum, minimum and most likely yield and price of blueberry growers in Georgia, 2020.

	Mean	Standard Deviation	Minimum	Maximum
Minimum yield	3,456.76	1,980.40	900.00	8,000.00
Most likely yield	6,459.46	2,514.90	2,000.00	12,000.00
Maximum yield	10,910.81	4,415.87	4,000.00	20,000.00
Minimum price	1.42	0.98	0.20	4.00
Most likely price	2.39	1.25	0.65	5.00
Maximum price	4.04	1.92	1.00	7.50

Note: Yield in lbs. per acre and price in dollars per lb.

Results and Discussions

Fig: CDF of NPV of producing blueberries

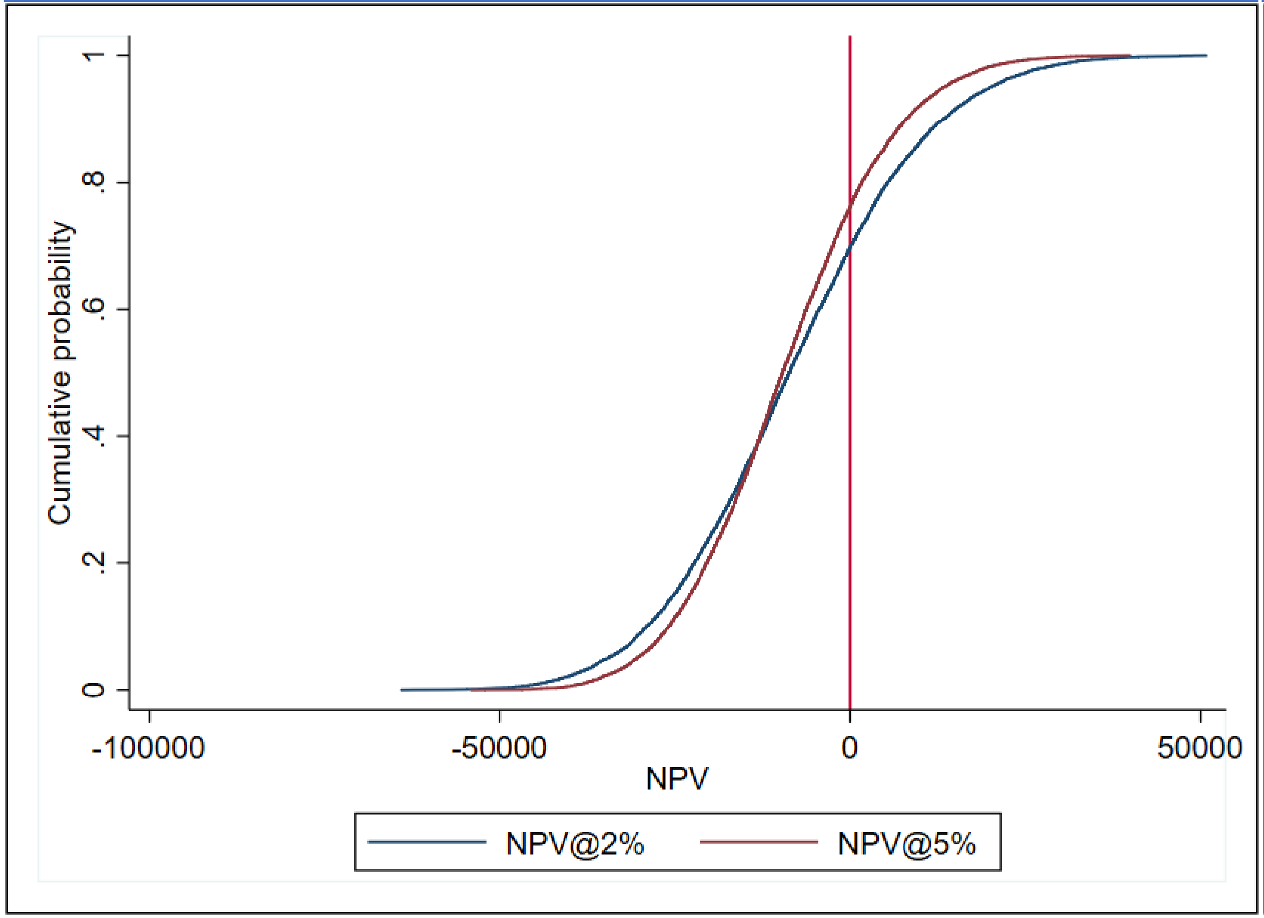
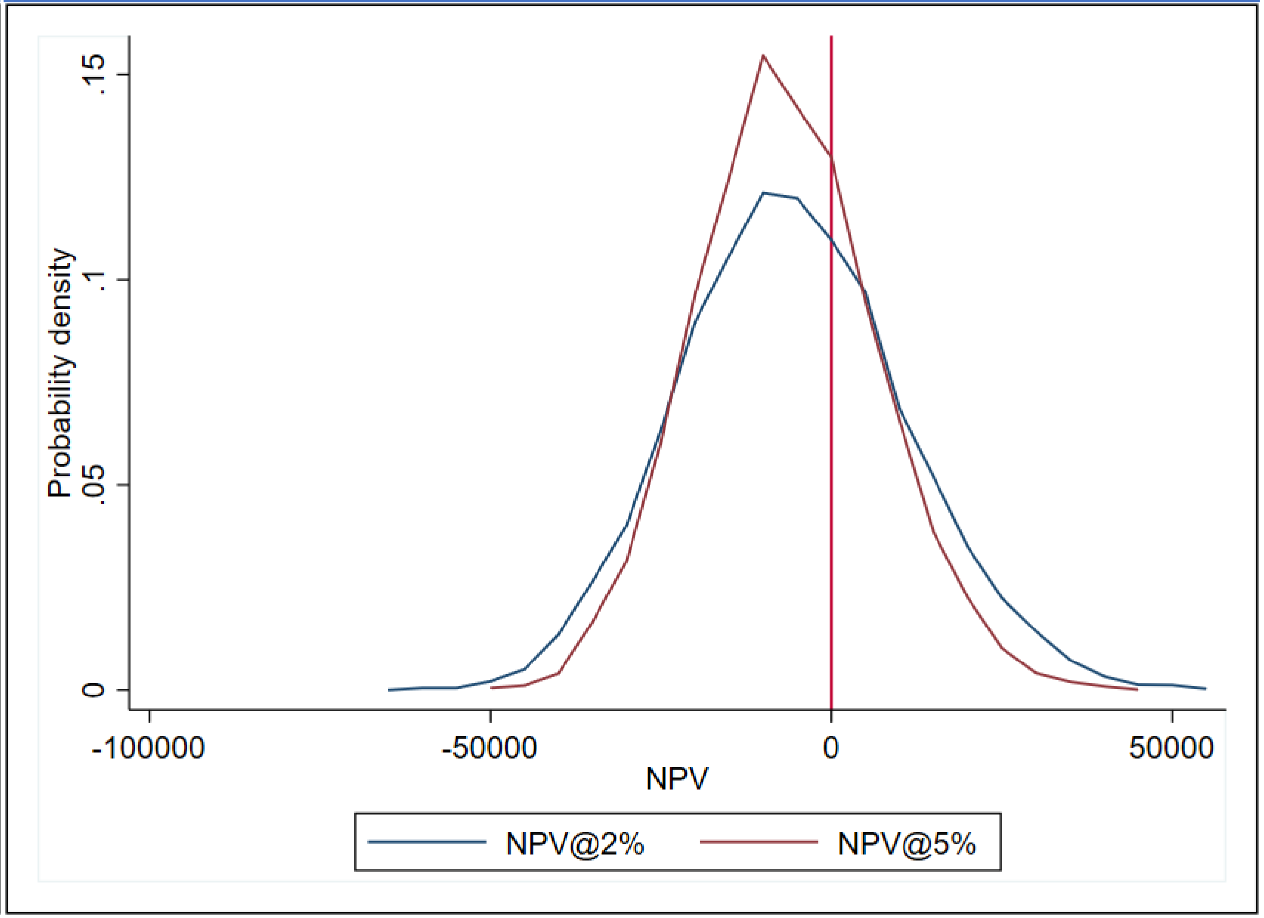


Fig: PDF of NPV of producing blueberries



Expected NPV@2%: -$8,157/acre **Chance: 30.24%**

Expected NPV@5%: -$9,174/acre **Chance: 23.85%**

Comparison

Deterministic

Expected
NPV@2%: $12,128.70
NPV@5%: $7,187.17

248.70% at 2% discount rate

178.34% at 5% discount rate

Stochastic

Expected
NPV@2%: -$8,157
NPV@5%: -$9,174

Now

- Background
- Methodology
- Results and Discussions
- **Summary and Conclusions**
- Limitations

Summary and Conclusions

- Traditional assessment approach can underestimate and overestimate the real profitability scenario of farm crops.

- Better understanding of all the potential stochastic variables and proper definition of their distributions yield more accurate and precise estimates of the outcome variables.

- The approach used in this study can have pivotal outturn during the agricultural policy formation and analysis.

- **Direct implication in an individual farmer’s field.**

Now

- Background
- Methodology
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- Summary and Conclusions
- **Limitations**

Limitations

- No consideration of cost as a random variable
- Equally critical as output prices
- Considered price and yield show same distribution every year

Thank You

Questions and comments are welcome.

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PURDUE EXTENSION
Horticulture BUSINESS

The Adoption of Drying Value-Added Technologies in the Specialty Crop Industry

Ariana Torres, Ph.D.

Assistant Professor

Purdue University

Consumers demand differentiated products

- Consumers have lost trust on commodified food production (Lusk and McCluskey, 2018)

- Increasing demand for values-based and place-based foods
  - A shift towards smaller and specialty-good manufacturing
  - Consumer food and beverage spending is stagnant
  - National food brands are integrating local labels (Thilmany et al., 2019)
  - Start-ups and artisan brands (O’Hara et al., 2020)

- Still, there is a sizable budget-conscious consumer (bifurcation of food supply chain)
  - High consolidation among food manufacturers and national brands

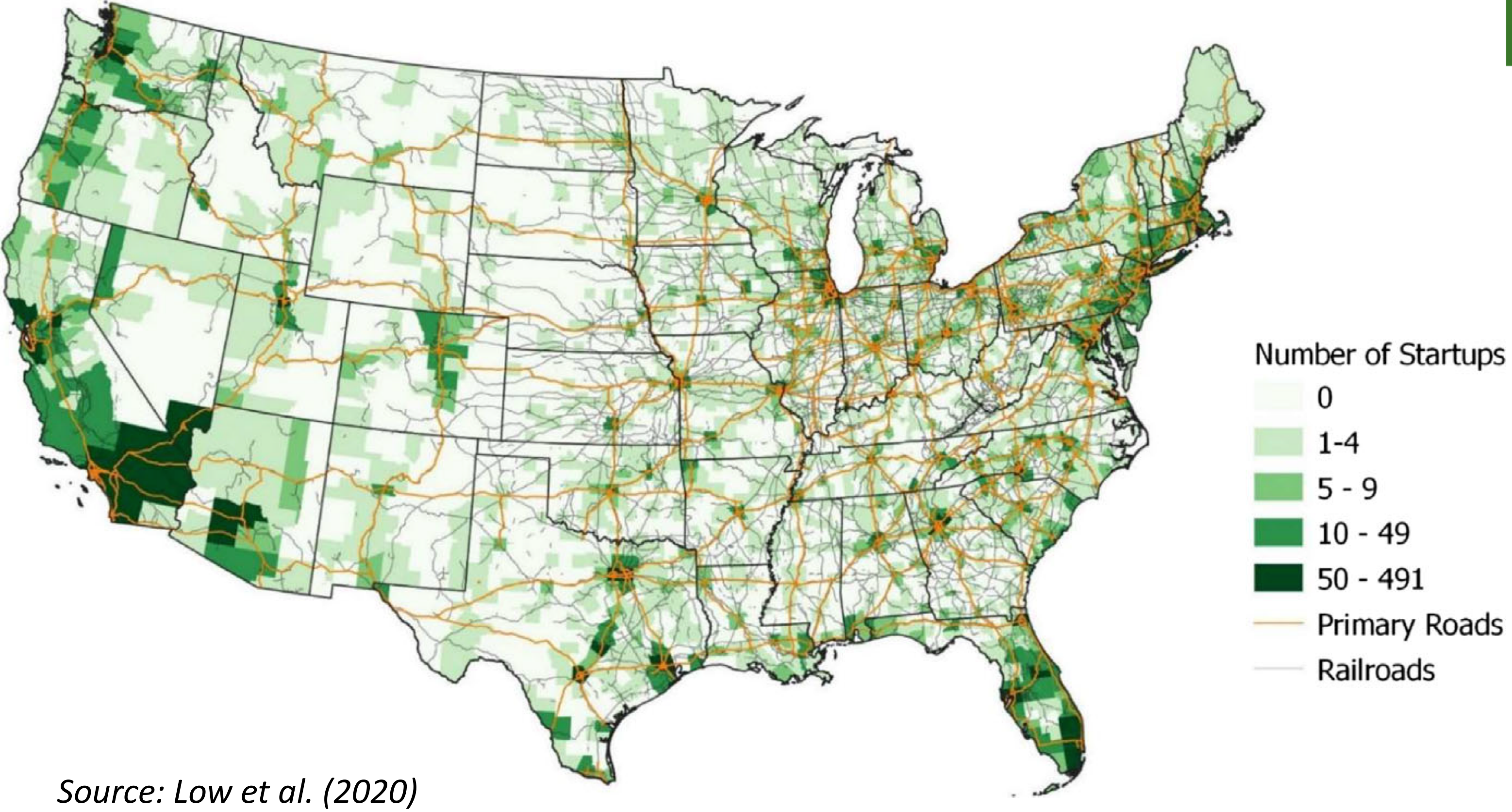
Values- and place-based food labels

- Labeling systems are getting better formulated across the agri-food supply chain

- **Origin**: local, state-specific, domestic
- **Production practices**: animal welfare, organic, chemical free
- **Nutrition and safety**: traceability, free-from *<dietary restriction>*

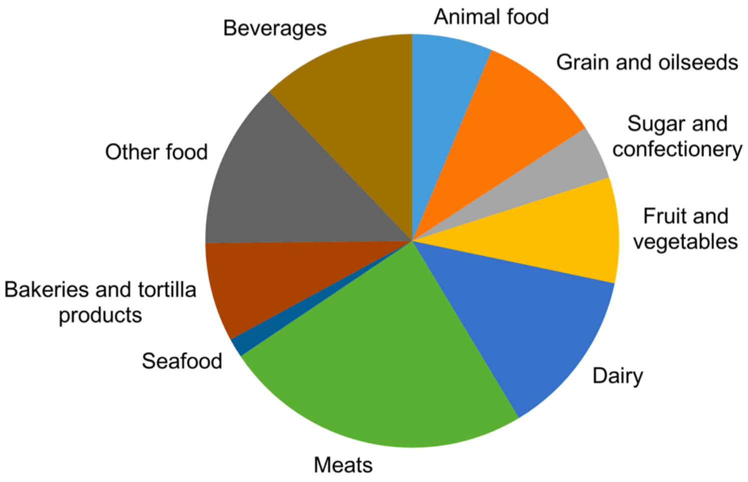
Value-added agriculture

- 33,523 farms sold over $4 billion in value-added products (2017 Census of Ag)
- Food manufacturing is the largest subsector in rural manufacturing (Lambert and McNamara, 2009)
    - Small local businesses tend to improve local economic, job, and community resilience growth (Rupasingha, 2017; Low and Brown, 2017)
- Supply of value-added foods is correlated with food entrepreneurship in local food systems (Low et al., 2020)
    - More convenient presentation of agricultural products
- Rural and small business development policies must be well informed (Lusk, 2017)



Source: Low et al. (2020)

Components of food and beverage manufacturing:
Sales, value of shipments, or revenue by industry, 2018
Meat processing is the largest single component of food and beverage manufacturing, with 24 percent of shipments in 2018



Source: Prepared by USDA, Economic Research Service, using data from U.S. Bureau of the Census, 2018 Annual Survey of Manufactures; data as of April 2020.

Framework

- Push vs. Pull
    - Diversification strategy (push effect)
    - Response to local consumer demand (pull effect) (Low et al., 2020)
- Downstream diversification
    - Vertical diversification (add value)
    - Horizontal diversification (access markets)
- USDA Value-Added Producer Grant
    - $37 million up to 2020
    - Increase yield, reduce cots, enhance product quality, protect health and environment
    - **Definition**: change physical state, enhance value, physical differentiation

Goals

- Categorize specialty crop farmers adoption of drying value-added technologies
    - Considering drying
    - Currently drying
    - Stopped drying
    - Never dried
- Investigate the drivers and barriers of adopting drying value-added technologies
    - Solar drying
    - Electric drying
    - Freeze drying
    - Open-sun drying

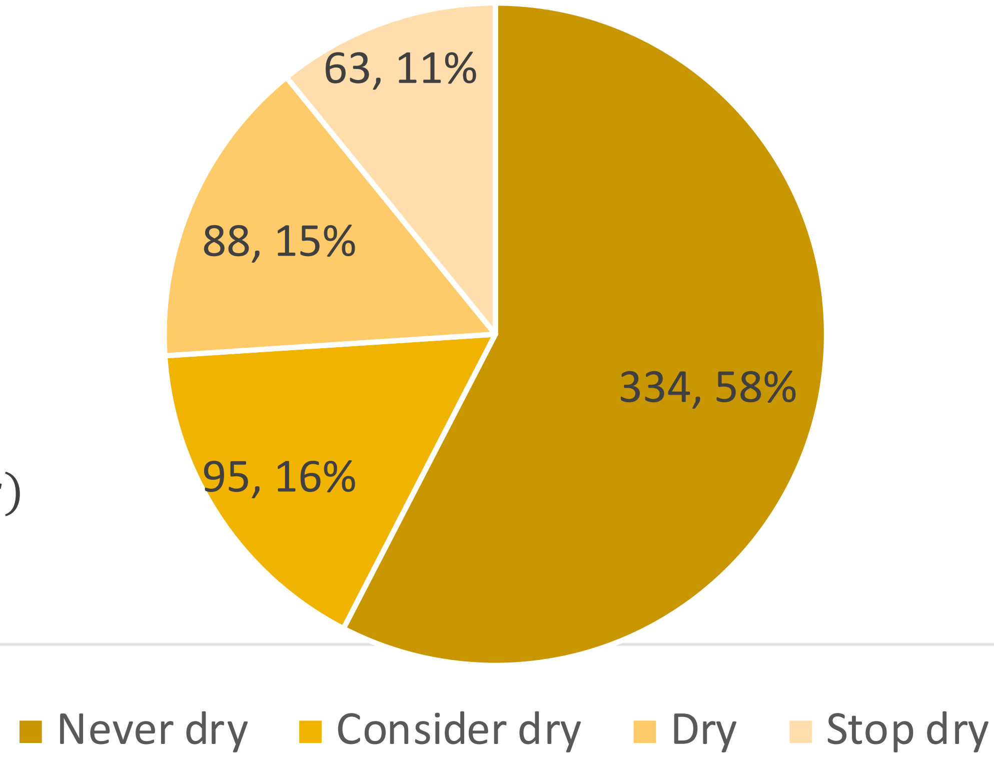
Data & Methodology

- 2018 web-based survey of 580 farmers in 32 states
- Means comparisons across farmers categories
- Ordered probit

$$y_i^* = X_i\beta + \varepsilon_i$$

$$\begin{aligned} y_i &= 0 \quad \text{if } y_i^* \leq 0 \\ y_i &= 1 \quad \text{if } 0 < y_i^* \leq \mu_1 \\ y_i &= 2 \quad \text{if } \mu_1 < y_i^* \end{aligned}$$

$$\Pr(Y_i = 1 | X_i = x) = \phi\,(\beta_0 + \beta_1 farmer + \beta_2 farm + \beta_3 networks)$$



	Never dried			Considering			Drying			Stopped		
	Mean	S.D.		Mean	S.D.		Mean	S.D.		Mean	S.D.	
female	0.28	0.45	BC	0.27	0.45	C	0.49	0.50	A	0.46	0.50	AB
nowhite	0.05	0.21	B	0.06	0.24	B	0.05	0.21	B	0.14	0.35	A
ncrops	9.99	11.83	B	17.83	15.35	A	23.02	16.29	A	20.17	16.56	A
onlydtc	0.22	0.42	B	0.27	0.45	AB	0.34	0.48	AB	0.44	0.50	A
onlywhole	0.26	0.44	A	0.16	0.37	AB	0.07	0.25	B	0.16	0.37	AB
mixed	0.25	0.43	B	0.44	0.50	A	0.44	0.50	A	0.29	0.46	AB
label	0.37	0.48	B	0.52	0.50	AB	0.61	0.49	A	0.66	0.48	A
Networks	0.17	0.38	B	0.36	0.48	A	0.45	0.50	A	0.38	0.49	A
Info farmers	0.85	0.36	B	0.96	0.21	A	0.90	0.30	AB	0.81	0.40	B
Barriers dry	2.07	0.76	B	2.08	0.49	B	2.35	0.49	A	2.09	0.55	B
Financial assis	0.49	0.50	B	0.56	0.50	AB	0.65	0.48	A	0.58	0.50	AB

- **Female** tend to dry specialty crops
- **Minority** farmers tend to stop drying
- **Crop diversification** is correlated with drying
- **Selling in local markets** is correlated with drying
- Farmers using **food labels** tend to dry
- **Networks** tend to motivate drying
- Need of **financial assistance** is higher for those drying

Results

Ordered probit

	Never dried		Considering		Drying		Stopped	
college	0.98		-0.27		-0.42		-0.29	
female	-2.92		0.79		1.26		0.87	
nowhite	-15.11	*	4.10	*	6.51	*	4.50	*
midwest	6.10		-1.66		-2.63		-1.82	
west	-0.19		0.05		0.08		0.06	
south	0.90		-0.24		-0.39		-0.27	
ncrops	-0.79	***	0.21	***	0.34	***	0.23	***
farmexp	-0.20		0.06		0.09		0.06	
perinc	0.26	***	-0.07	***	-0.11	***	-0.08	***
onlywhole	5.74		-1.56		-2.47		-1.71	
mixed	2.88		-0.78		-1.24		-0.86	
distance	-0.10		0.03		0.05		0.03	
label	-21.01	***	5.70	***	9.05	***	6.26	***
employees	0.03		-0.01		-0.01		-0.01	
totalland	0.00		0.00		0.00		0.00	
sole	6.43		-1.75		-2.77		-1.91	
partime	-0.76		0.21		0.33		0.23	
small	-12.13	*	3.29	*	5.22	*	3.61	*
large	4.28		-1.16		-1.84		-1.27	
csales	-6.90	**	1.87	**	2.97	**	2.05	**
cemploymen	-0.99		0.27		0.43		0.30	
postharvnet	-15.98	***	4.34	***	6.89	***	4.76	***
infoindus	6.48		-1.76		-2.79		-1.93	
infofarmer	-9.86		2.68		4.25		2.94	
infoext	-2.93		0.79		1.26		0.87	
successful	-5.10		1.38		2.20		1.52	
bdry	-11.91	***	3.23	***	5.13	***	3.54	***
finassis	-5.22		1.42		2.25		1.56	

- **Minority farmers** are more likely to dry and stop it
- **Horizontal diversification** can drive vertical diversification
  - Number of crops
  - Income from specialty crops
- **Labels** can help market value-added products
- Value-added is more common among **smaller operations**
  - Increase sales
- **Entrepreneurial networks** are major value-added incentives
- Barriers to dry are mainly perceived among those drying or stopped drying foods

Implications

- Networks are major drivers of adoption of value-added technologies among specialty crop farmers
    - Entrepreneurial farming ecosystems can pull farmers to add value, generate other sources of revenue, and off-season sales
    - Foster networks via events, demonstrations, tours

- In the presence of market bifurcation, adopting value-added technologies can help rural farmers access high-value markets
    - Increasing sales
    - Increasing labelling (marketing strategies)
    - Crop diversification

- Policies and incentives aiming to improve diversification of rural farms should look into
    - Market channels available for farmers
    - Size of operations
    - Diversification technologies available

- The fact that minority farmers are more likely to dry and stop drying tells us there is room for improvement on assuring long-term investments among farmers

- Cost and knowledge of food quality standards are important barriers to successfully add value to agricultural products

Thank you for your time

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