RICE QUALITY PREFERENCES AND VALUE HETEROGENEITY IN SUB-SAHARAN AFRICA

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Research Update

Food Distribution Research Society Annual Conference

DIVISION OF AGRICULTURE
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BACKGROUND

- In low-income countries rice is traditionally purchased from an open bag
  - Difficult to differentiate the level of certain quality characteristics with the naked eye
- Weaknesses in the grades and standards system in low-income countries across Sub-Saharan Africa undermine the transparency of agricultural markets
- Rice consumption is increasing in Sub-Saharan Africa, yet the field of consumer preference and rice marketing has largely been unexplored

Source: Willy Mulimbi

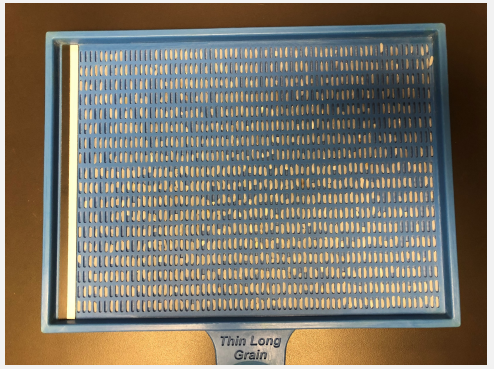
OBJECTIVES

1. Examine Rice Market Efficiency
   - Are quality attributes driving price?
   - Inefficient markets create problems for rice importers and poor consumers
2. Draw conclusions about consumer preference
   - Use availability in a functioning market as a signal demand exists
   - Allows rice marketing to be better tailors for each country's preferences

Source: Willy Mulimbi

DATA

1. Rice Collection
   - 363 rice samples purchased from open air markets
     - 103 from Democratic Republic of the Congo
     - 151 from Ghana
     - 112 from Mozambique
2. Rice Analysis
   - Analyzed in the University of Arkansas Food Science Lab using the SeedCount machine
     - Gives quantitative measures of quality traits



VARIABLES

- Information collected at purchase
  - Rice price per unit in domestic currency
  - Location purchased
  - Imported or Domestic
    - Only Ghana had domestic rice available
  - Parboiled
    - Only Ghana had non-parboiled rice
- Quality Variables
  - Average kernel length (mm)
  - Average kernel width (mm)
  - % Broken
  - Chalkiness
    - % Chalky
    - Chalk impact

METHODOLOGY

- Preferred model for DRC and Mozambique:

$$\log(Price) = \beta_0 + \beta_1 \log(Broken) + \beta_2 \log(Length) + \beta_3 \log(Width) + \beta_4 \log(Chalk\ Impact) + \varepsilon$$

- Preferred model for Ghana:

$$\log(Price) = \beta_0 + \beta_1 \log(Broken) + \beta_2 \log(Length) + \beta_3 \log(Width) + \beta_4 \log(Chalk\ Impact) + \beta_5 Parboiled + \varepsilon$$

  - Ghana model further segmented by imported and domestic rice
  - OLS estimates were tested for homoscedasticity and the heteroscedasticity consistent covariance matrix[1] was estimated when needed

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1-Long, J. S., & Ervin, L. H. (2000). Using Heteroscedasticity Consistent Standard Errors in the Linear Regression Model. *The American Statistician*,*54*(3), 217–224. https://doi.org/10.1080/00031305.2000.10474549

RESULTS

Impact of Rice Quality Variables on Price

Variable	DRC	Mozambique	Ghana (Total)	Ghana (Domestic)	Ghana (Imported)
Constant	3.023*** [1.146]	2.183* [1.158]	-1.249 [1.219]	-1.565 [2.814]	-0.810 (1.56)
Broken	-0.006 [0.028]	-0.094*** [0.034]	-0.082*** [0.022]	-0.136* [0.075]	-0.075** (0.030)
Length	1.362*** [0.420]	-0.034 [0.452]	1.417** [0.582]	1.419 [1.321]	1.383** (0.623)
Width	1.902*** [0.7111]	2.339*** [0.681]	0.590 [0.410]	1.072 [1.167]	0.116 (0.853)
Chalk	0.049*** [0.017]	-0.065** [0.026]	0.002 [0.001]	0.002 [0.003]	0.001 (0.002)
Parboiled	-	-	-0.303*** [0.076]	-0.280*** [0.096]	-0.353** (0.141)
R^2	0.279	0.416	0.304	0.363	0.233
Observations	149	98	150	96	54

***,**,* denote P<0.01, P<0.05 and P<0.1, respectively.
[] denote, robust standard errors, and () represent non-robust standard errors

RESULTS

- Democratic Republic of the Congo
  - Price is driven by average kernel length and width
  - Chalkiness is significant but has a minimal effect on price
    - 0.47% price difference between least and most chalky observation
  - Price is not a function of percent broken
- Mozambique
  - Price is driven by average kernel width but not length
  - Price is not a function of percent broken
- Ghana
  - Inefficiencies in market for broken rice
  - Imported rice is always priced higher than domestic rice regardless of quality

CONCLUSIONS

- Indifference to brokens could mean:
  1. Consumers are different to brokenness therefore they do not discount broken rice
     - If true, could open new markets for broken rice
  2. Markets are inefficient and are not pricing rice correctly based on its brokenness
     - Indicates the need for increased grading and standards
  - More research will need to be done to determine the reason
- In the United States we consistently struggle to find markets for broken rice.
  - Brokens end up being used for pet food and breweries for lower value

SUMMARY

- Our results suggest we may try negotiating with low-income countries governments to allow more broken rice to be imported because it appears that consumers are indifferent.
  - This would help alleviate food insecurity AND help American rice producers by distributing broken rice more efficiently.
- The results of this study can be used by rice importers and exporters who are trying to best segment the rice market in DRC, Mozambique and Ghana

THANK YOU!

QUESTIONS?

PROFITABILITY AND FINANCIAL EFFICIENCY OF SMALL-SCALE INDIGENOUS CHICKEN EGG PRODUCERS IN KENYA

James O. Bukenya and Sylvester Ndzovu

Research Session II:
Issues Affecting US and International Producers

2020 FDRS Virtual Annual Meeting (Oct. 13)

Introduction

- The Poultry Industry is one of the leading agricultural sectors in Kenya, contributing significantly to the economy:
  - ✓ In 2017, the total chicken population was 44.6 million, with indigenous chicken accounting for over 36.6 million.
  - ✓ Over 25,000 tons of poultry meat and 1.3 billion eggs are produced valued at $282 million (FAO, 2017).
- Poultry plays a vital role in the livelihoods of smallholder poultry farmers, contributing to HH incomes and wealth, insurance against shocks, food security, culture, religion, and tradition.

Introduction

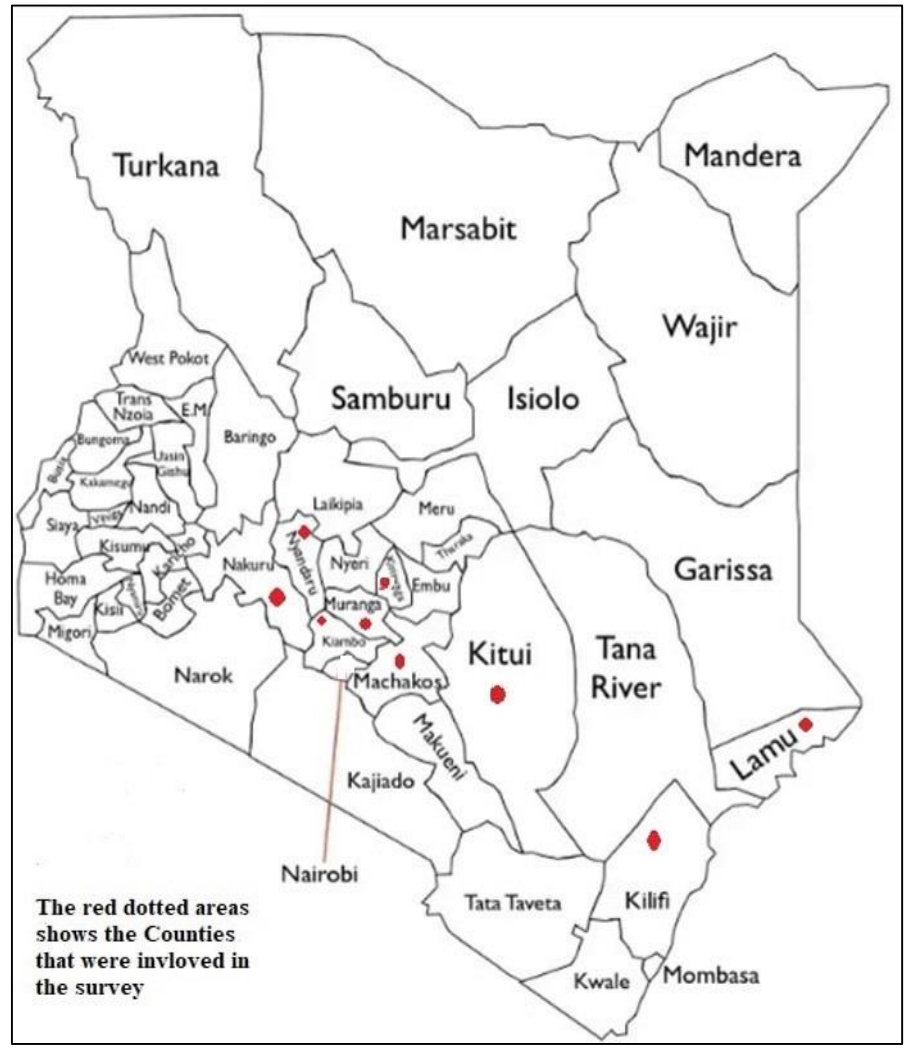
- Since poultry production is an important livelihood activity in Kenya, profitability and financial efficiency in its production are critical to the survival of small-scale farmers and for food security in the country.

- **Study objective**
  - ✓ To examine the profitability and financial efficiency of small-scale indigenous chicken egg farmers in Kenya.
    - Evaluate the revenue and cost structures of the small-scale indigenous egg enterprises.
    - Identify the constraints to small-scale indigenous egg production enterprises.

Data and Sampling Procedures

- Face-to-face survey of 522 smallholder poultry farmers selected from nine counties:
  - ✓ Kiambu, Kilifi, Kirinyaga, Kitui, Lamu, Machakos, Murang'a, Nakuru, and Nyandarua.
- Farmers were selected using a multi-stage sampling procedure, involving:
  - ✓ identifying a ward in each county
  - ✓ purposively selecting 4-communities from each ward, and
  - ✓ using snowball sampling to select up to 58 farmers from each county.

Project Study Area



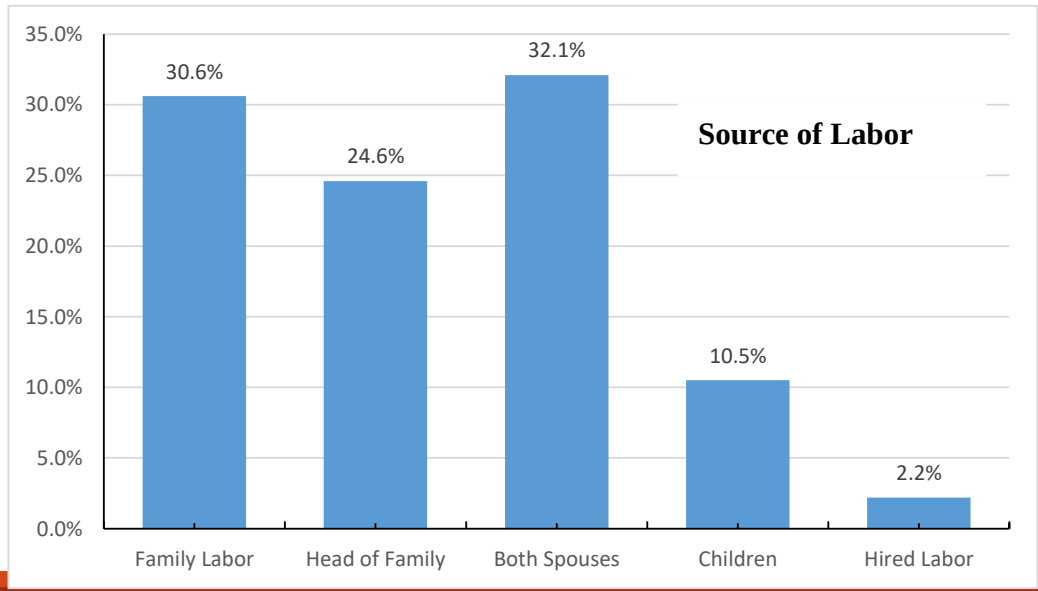
Survey Data and Sampling Procedure

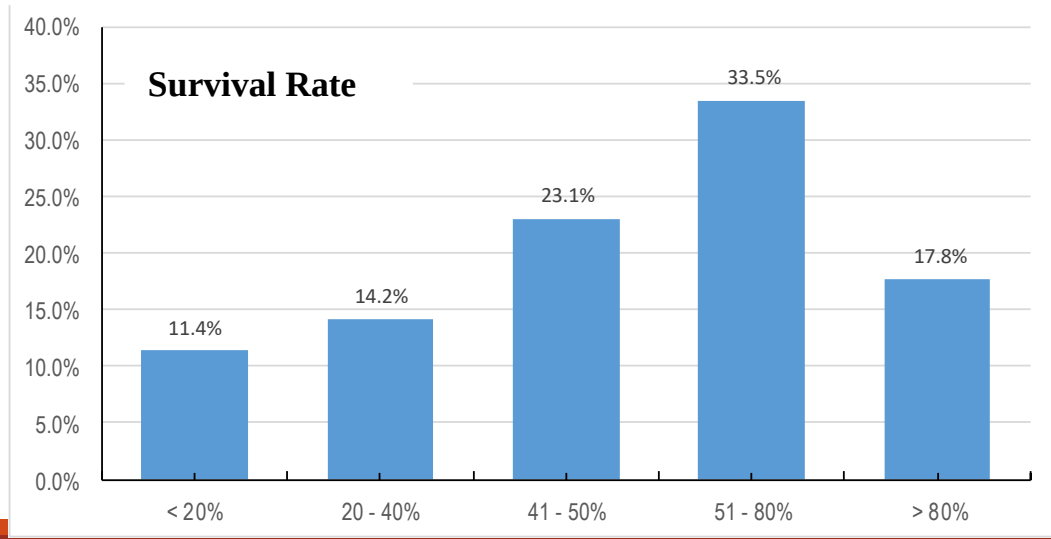
- The questionnaire was pretested in three sub-counties (Kasarani, Githunguri, and Makuyu) and the results used to fine-tune the final questionnaire.
- The survey was administered between May and July 2019.
- The questionnaire collected farm-level data, socio-economic, and demographic information of the farm operator.
- Of the 522 small-scale poultry farmers in the sample, 282 indicated rearing indigenous chicken for egg production and thus represent the sample size used for the analysis.

Survey Responses:

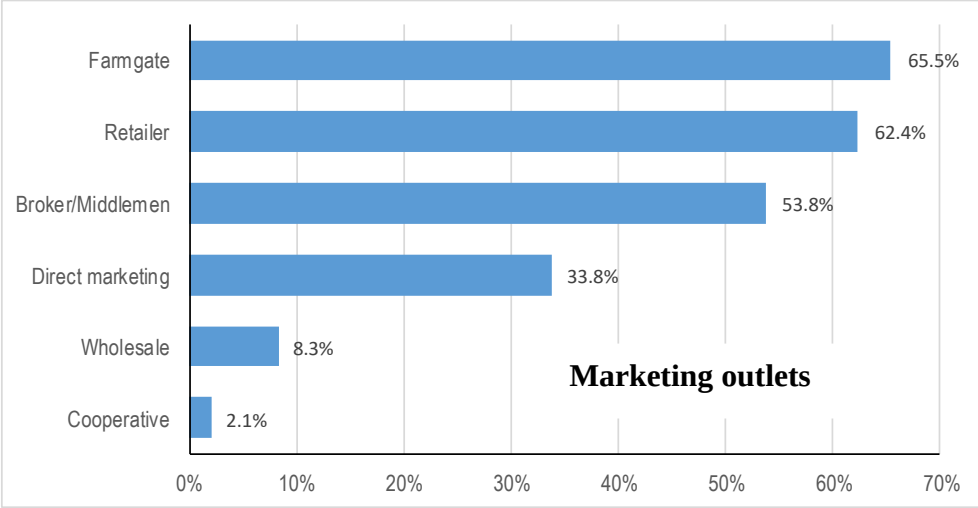
Flock Size and Method of Production

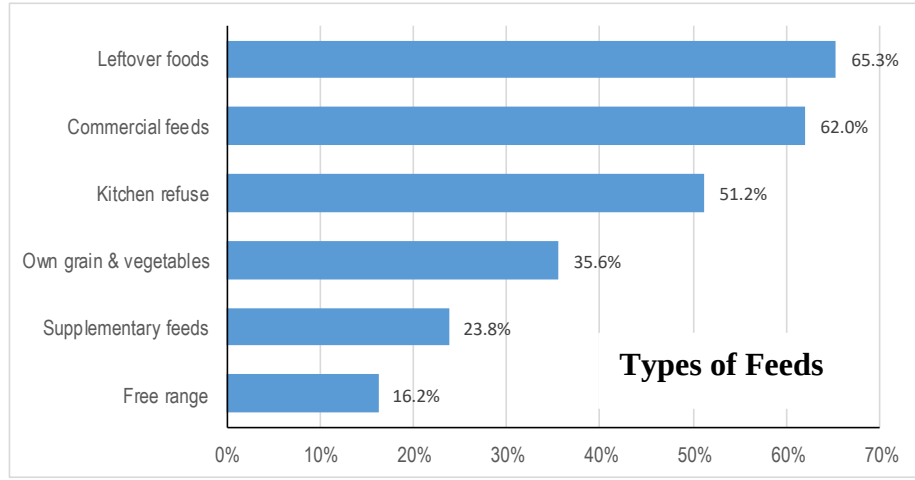
	Intensive production	Complete free-range	Semi free-range	Total
1-50	1.0%	11.7%	13.0%	25.7%
50-100	26.7%	8.3%	19.0%	54.0%
100-200	6.3%	4.7%	1.0%	12.0%
Above 200	3.0%	0.0%	5.3%	8.3%
Total	37.0%	24.7%	38.3%	100.0%





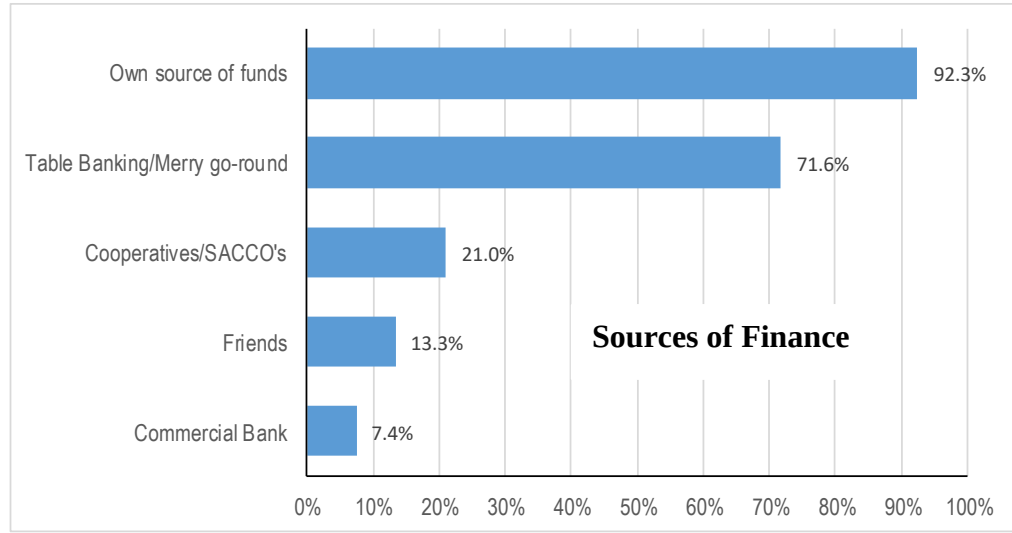
Survey Responses:





Production Inputs other than Feeds

Variable	Frequency	Percent
Veterinary drugs	233	82.6
Vaccines	180	63.8
Feeding items	162	57.4
Water	132	46.8
Chemicals	80	28.4
Electricity	58	20.6



Measures of Farm Profitability and Financial Efficiency

Production Assumptions	Financial Performance	Profitability Measures
Small-scale enterprise with 200 birds flock	Net Farm Income from Operations	Net Farm Income
Utilizing family labour	Operating Profit Margin Ratio	Profit Margin
30-month production cycle	Operating Expense Ratio	
Egg production start at 23 weeks old	Depreciation Expense Ratio	
80% egg-laying rate	Farm Interest Expense Ratio	
20% mortality rate	Net Farm Income from Operations Ratio	
Operating capital ratio = 50:50 (personal: borrowed)	Gross Ratio	
7% interest rate on borrowed capital	Fixed Ratio	

Production Cost

* represent information drawn from secondary sources

Expenses	Average cost of Production	% Share of Cost	
Variable Expenses:			
Day-old chick	20,000.00		1.20
Feeds	1,373,440.00		82.57
Water	50,000.00		3.01
Brooding*	9,000.00		0.54
Drugs and Vaccines	5,000.00		0.30
Veterinary services	3,000.00		0.18
Transportation*	30,000.00		1.80
Total Variable Cost	**1,490,440.00**	$13,621	**89.60**
Fixed Expenses:			
Housing	100,000.00		6.01
Equipment	6,650.00		0.40
Interest on Loan (KSh. 833649) @ 7%*	58,355.43		3.51
Depreciation	7,998.70		0.48
Total Fixed Cost	**173,004.13**	$1,581	**10.40**
Total Expenditure	**1,663,444.13**	$15,202	**100.00**

Measures of Farm Profitability and Financial Efficiency

	Returns	
Gross Income	Khs. 1,971,200	$18,032
Gross Margin	Khs. 480,760	$4,398
Net Farm Income from Operations	Khs. 307,756	$2,815
Operating Profit Margin Ratio	0.125	
Production Efficiency = ATR/ATC	1.19	
Percent Profit	18.50	
Operating Expense Ratio	0.81	
Depreciation Expense Ratio	0.004	
Interest Expense Ratio	0.030	
Net Farm Income from Operation Ratio	0.156	
Gross Ratio	0.84	
Fixed Ratio	0.09	

Constraints to Production

Variable	Frequency	Percent
Limited capital	208	73.8
Long chicken maturity	173	61.4
Lack of market	170	60.3
Infection and diseases	166	58.9
Expansive balanced feeds	130	46.1
Insufficient advisory services	102	36.2
High mortality	101	35.8
Unreliable veterinary services	87	30.9

Conclusions

- From the study, small-scale indigenous chicken egg farmers in the study area are profitable, as indicated by the gross margin (Ksh. 480,760) and net farm income from the operation (Ksh. 397,756).
- However, they are far from being efficient in the use of financial resources, as indicated by the operating expense ratio, the average farm was operating within the marginal efficiency level.
- The cost structure indicated that feeds, day-old chicks, transportation and water were the most important cost items accounting for 89% of the total production cost.
- The major constraints include inadequate finance, long chicken maturity cycle, and lack of markets.

Impacts of Drought on Tribal Economies

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FDRS 2020 Virtual Conference

October 13, 2020

Background

- Negative impacts of drought on agriculture
  - Hatfield et al., 2011; Fisher et al., 2012; Kuwayama et al., 2018
  - Crop losses, damage to pasture/range, reduced plant growth
  - Particularly concerning in arid Southwest

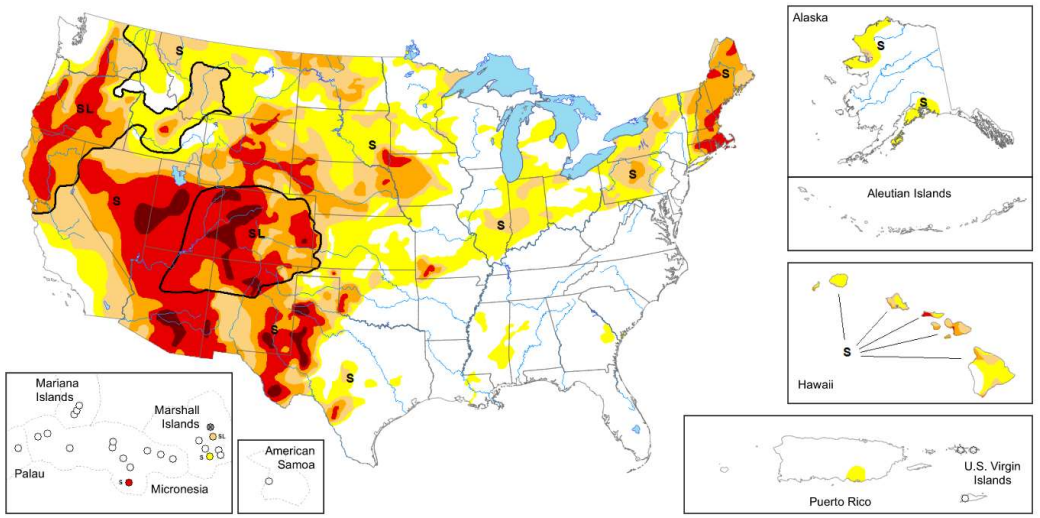
- U.S. Drought Monitor

Map released: October 8, 2020

Data valid: October 6, 2020

Intensity:

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought



Background

- Native American population
  - Plagued by poverty above U.S. average at 11.8% (Akee et al., 2015; Davis et al., 2016)
  - Agriculture an important source of livelihood (Deol and Colby, 2018)
    - Share of jobs in agricultural and mining industry above U.S. average at 1.8%
  - Agriculture also important to native culture and traditions

- Unique challenges of tribes in drought management
  - Water rights settlement and exercise of rights
  - Lack of resources and expertise
  - Pollution of water resources
  - Collaboration with government and other stakeholders

Research Questions

1. What is the impact of drought on agricultural sectors on southwest reservations?
   - Sectors selected for the study: cattle, hay

2. What is the overall economic impact of drought on southwest tribal economies?
   - Total impact due to drought affecting cattle and hay sectors directly

- Past studies examined economic impacts of drought on agricultural sectors, but not in tribal economies specifically
  - E.g. Pérez and Hurlé, 2009; Bauman et al., 2013; Howitt et al., 2014

Data

- County-level data for reservation counties (N=34)
  - Counties in Arizona, Nevada, New Mexico, Utah
  - Reservation areas of each county only
- Period: 1981-2016 (T=36)

- Cattle inventory, including calves – USDA NASS
- Hay yields, including alfalfa – USDA NASS
- Palmer Drought Severity Index (PDSI) – Cooperative Institute for Climate and Satellites, North Carolina
  - Compiled using temperature and precipitation data
  - Range from -10 (very dry conditions) to +10 (very wet conditions)

Summary Statistics

Variable	Definition (measurement)	Obs.	Mean	St. dev.	Min	Max
$Cattle$	Cattle inventory, incl. calves (head)	1,194	44,464	55,099	100	410,000
$\ln Cattle$	Natural log of cattle inventory	1,194	10.20	1.09	4.61	12.92
$HayYield$	Hay yields, incl. alfalfa (ton/acre)	972	4.44	1.58	0.90	10.00
$\ln HayYield$	Natural log of hay yields	972	1.43	0.35	-0.11	2.30
$PDSI$	PDSI value	1,224	-0.34	2.61	-5.27	7.40
$DryDur$	Duration of dry conditions (count of consecutive years, if PDSI<-1.9)	1,224	0.57	1.03	0.00	6.00
$WetDur$	Duration of wet conditions (count of consecutive years, if PDSI>1.9)	1,224	0.43	1.03	0.00	6.00

Notes: PDSI between -1.9 and 1.9 is considered “near normal” condition, according to the National Weather Service, Climate Prediction Center.

Methodology

- Cattle – dynamic panel data model:
- $\ln Cattle_{c,t} = \beta_0 + \gamma \ln Cattle_{c,t-1} + \delta_1 PDSI_{c,t} + \delta_2 DryDur_{c,t-1} + \delta_3 WetDur_{c,t-1} + \beta_1 Trend_t + \upsilon_c + \varepsilon_{c,t}$

- Hay – panel data model (random effects):
- $\ln HayYield_{c,t} = \beta_0 + \delta_1 PDSI_{c,t} + \delta_2 DryDur_{c,t-1} + \delta_3 WetDur_{c,t-1} + \beta_1 Trend_t + \upsilon_c + \varepsilon_{c,t}$

- Total economic impacts: input-output analysis in IMPLAN

Results: Panel Data Models

	$\ln Cattle_t$		$\ln HayYield_t$	
	Coefficient	St. error	Coefficient	St. error
$\ln Cattle_{t-1}$	0.721***	0.146	-	-
$PDSI_t$	0.003*	0.002	0.004*	0.002
$DryDur_{t-1}$	-0.019**	0.007	-0.006	0.007
$WetDur_{t-1}$	-0.002	0.010	0.013**	0.005
Constant	8.939**	5.216	2.016	1.387
$Trend_t$	-0.003**	0.002	0.000	0.001
Number of obs.	1155		950	
Wald $\chi^2(5)$	196.49***		19.93***	

Notes: ***,**,* denote significance at 1%, 5%, and 10% level, respectively.

One unit decrease in PDSI:
- cattle inventory -0.3%
- hay yield -0.4%

One year of drought in the past:
- cattle inventory -1.9%
- hay yield no impact

Lagged impact of drought on cattle inventory, not on hay yields.

These results used to calculate impacts of drought scenarios.

Results: Drought Scenarios

Model	Scenario description	Total impact at *t*
Cattle	2-year drought: normal at *t-3*, PDSI decrease at *t-2* and stays the same at *t-1*, PDSI increase back up at *t*	-3.72%
Hay	Normal or dry at *t-1*, PDSI decrease by 2 units at *t*	-0.87%

These scenarios were used to calculate:

1. **Decrease in output** in a) cattle and b) hay sectors on each reservation
2. $ value of losses in a) cattle production and b) hay production on each reservation => **direct impacts of drought** on a) cattle and b) hay sectors
3. $ value of total economic losses for each reservation => **total economic impacts of drought**, driven by direct impacts in a) cattle and b) hay sectors

Results: Drought Impacts

	Cattle sector (Million $)	Hay sector (Million $)
	Uintah & Ouray	
Direct impact	3.243	0.257
Total impact	8.243	0.693
	Navajo Nation	
Direct impact	3.502	0.111
Total impact	8.212	0.387
	Tohono O'odham Nation	
Direct impact	1.805	0.089
Total impact	7.408	0.490

	Cattle sector (Million $)	Hay sector* (Million $)
	Remaining combined, Arizona (a)	
Direct impact	1.684	0.030
Total impact	3.478	0.078
	Remaining combined, Nevada (b)	
Direct impact	0.264	0.005
Total impact	0.589	0.017
	Remaining combined, New Mexico (c)	
Direct impact	0.691	0.010
Total impact	1.585	0.056

(a) Hopi, San Carlos*, White Mountain*; (b) Duck Valley*, Goshute*, Pyramid Lake, Washoe Tribe*;
(c) Acoma*, Jicarilla Apache, Laguna Pueblo*, Mescalero Apache, Zuni

Summary

- Droughts negatively impact cattle inventory and hay yields immediately in the same year conditions become drier
- Also, there is lagged effect of drought for cattle inventory, but not for hay yields
  - Reduced breeding stock results in smaller cattle inventory in the following years
- Large economic impacts of drought for reservations
  - Direct losses larger in the cattle sector, resulting in larger total economic impacts compared to the hay sector

Conclusions

- Droughts represent a serious threat to the tribal economies

- Need to improve ability of tribal governments and producers to monitor, prepare for, and respond to droughts:
  - Resources and training to recognize onset of drought
  - Develop and implement strategies for drought adaptation and mitigation
  - Water rights settlement and financial support to build infrastructure
  - Collaboration with researchers, policy makers, local/state governments

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U.S. FARMERS' PERCEPTION AND COMPENSATIONAL STRATEGIES AS A RESPONSE TO CHINA'S "ONE BELT, ONE ROAD" INITIATIVE

Yi (Fionna) Xie
Jon C. Phillips
Yuqi Hou

What is China's "One Belt, One Road" initiative?

- China's One Belt and Road Initiative was launched in 2013 by president Xi Jinping, it is a project that focuses on improving trade relationships, connectivity, and cooperation among the countries involved in this project.

One Belt, One Road is China's newest attempt to increase its influence around the world. It is the brainchild of Chinese President Xi Jinping and the country's "project of the century" that gets about 78 countries involved.

(Freund, C. and M. Ruta, 2018)

Goals of the initiative

This project is divided into two major parts- land and maritime routes. As seen in the map, the land route is based on the ancient Silk Road that connects China and Europe, while adding improvements such as railroads, paved highways, trading posts, oil and gas pipes. On the other hand, the maritime route will include various ports from China's southern coasts to the Mediterranean Sea, Africa, Southeast Asia, and Central Asia. (Freeman, 2016), (Ma, 2019)

Potential Impacts on US farmers

- Due to the One Belt, One Road Initiative, U.S. soybeans, pork, beef, and other agricultural products that depend on export to China face tremendous declines in agricultural exports.

- U.S. farmers who depend on exports may need to develop alternative sales channels (local and domestic channels).

Research Objectives

Examine the impact of the initiative on U.S. agricultural products trading strategies from the farmers' perspective. What are . . .

- US farmers' perception of the initiative and its impacts?
- US farmers coping strategies?
- Factors (farm and individual characteristics) that moderate their responses?

Research Plan

- Phase 1: Online Exploratory Survey (2020)
  - Small Scale Online Survey
  - US farmers

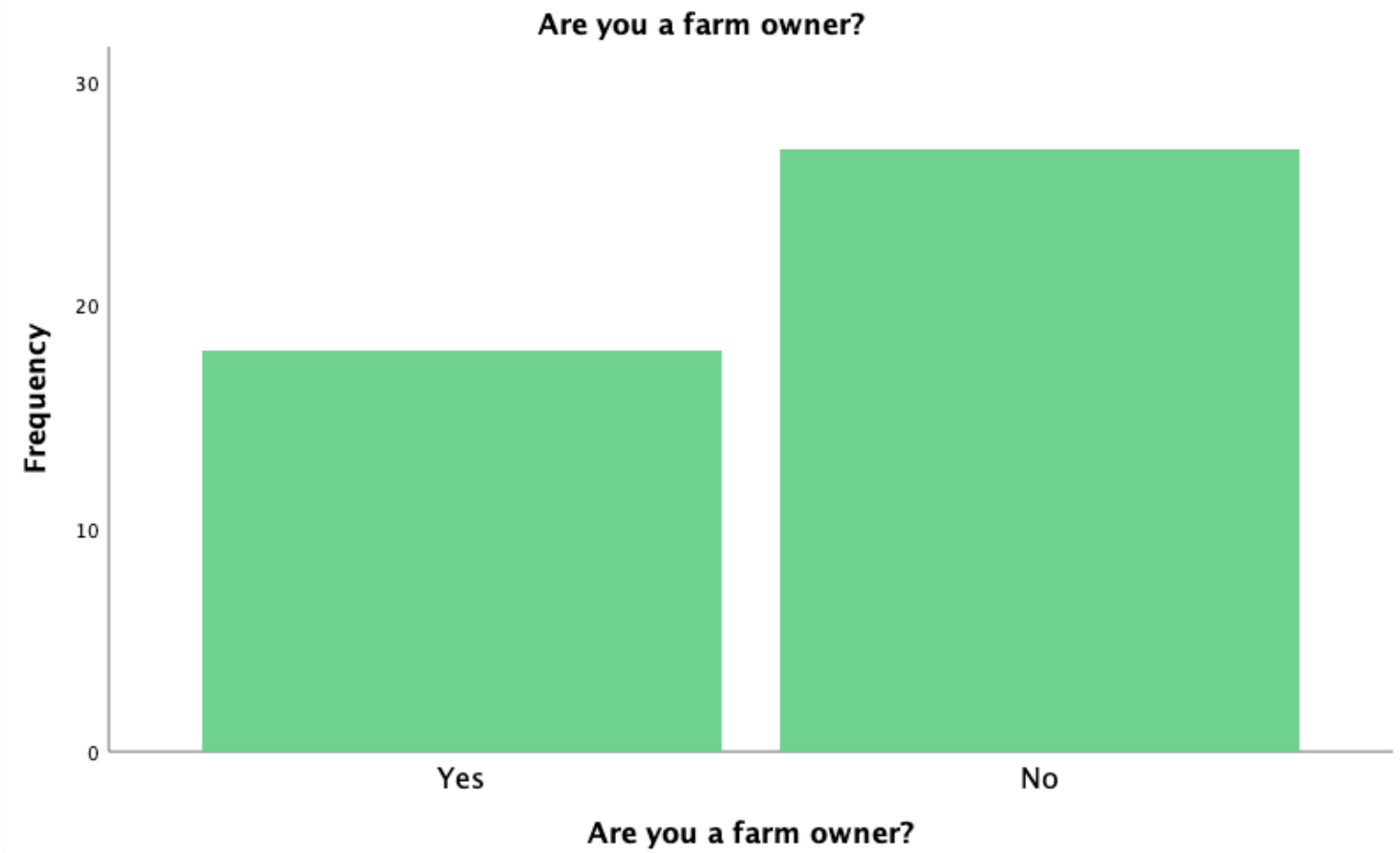
- Phase 2: Official Survey and interview (2021)
  - Large Scale Survey (mail/email surveys)
  - In-depth interview (qualitative)

Phase 1. Online Pilot (Exploratory) Survey Preliminary Results

- Sample: Prolific (survey website) participants
- Screening: agriculture as their employment sector
- 86 participated, 73 completed, 45 valid responses (pass attention check + work in the agricultural industry).

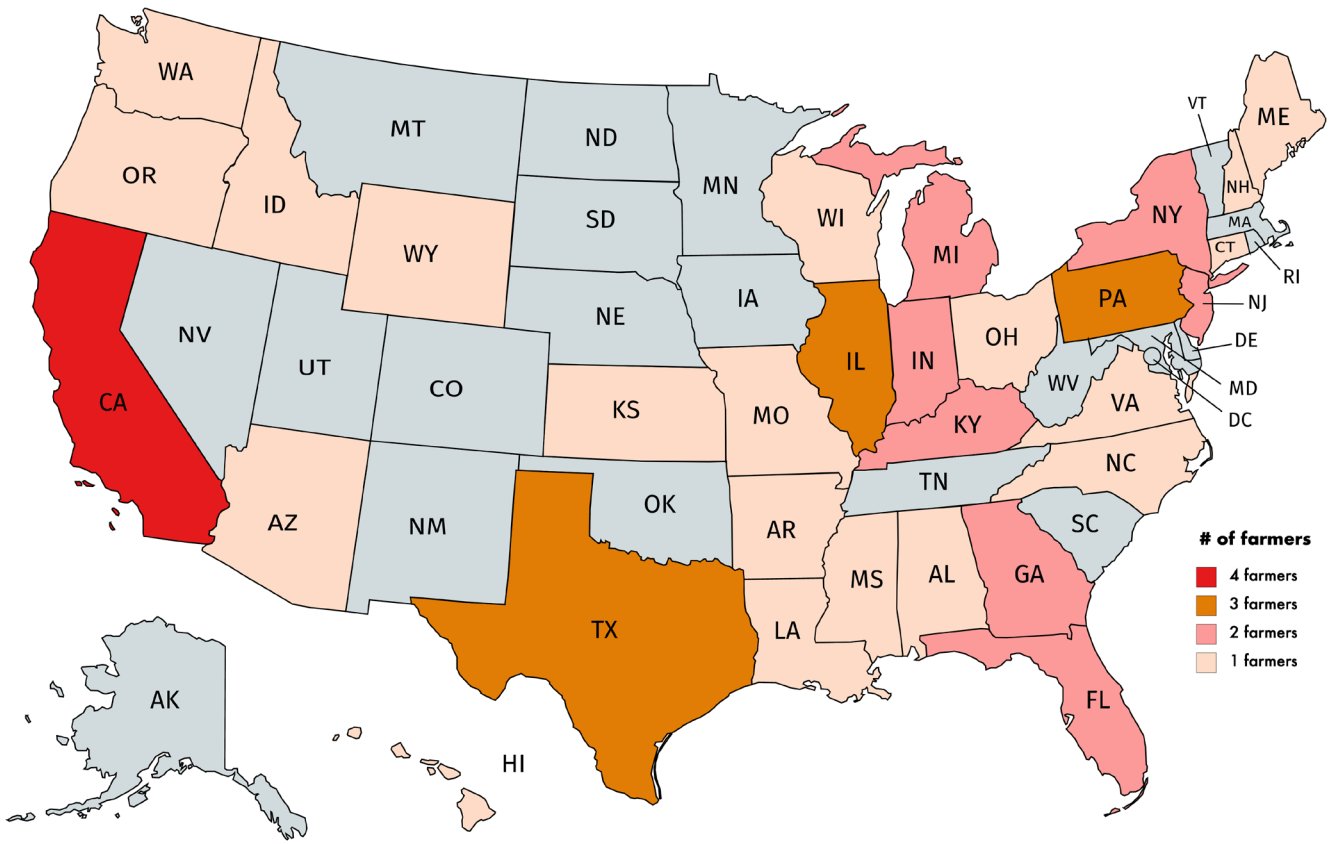
Phase 1. Online Survey – Descriptive Stats

- 18 farm owners.
- 27 farmers



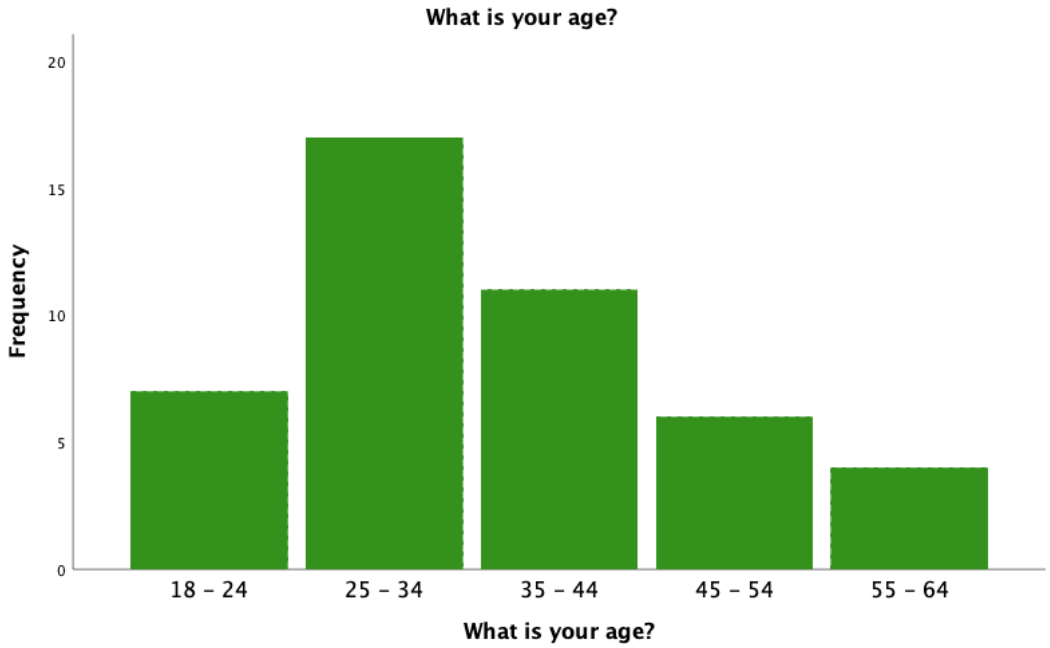
Phase 1. Online Survey – Descriptive Stats

- From 29 states

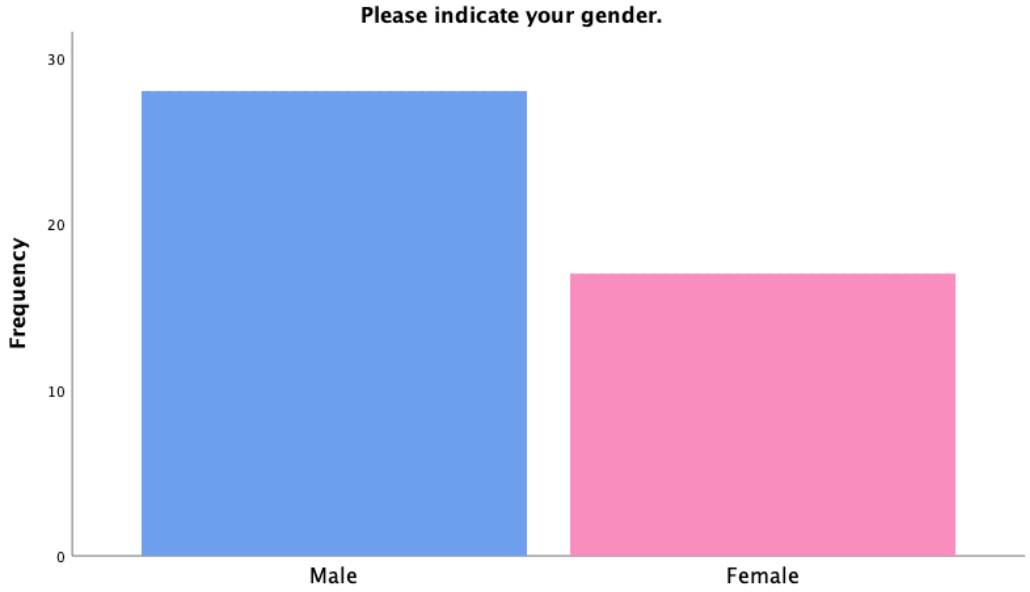


Phase 1. Online Survey – Descriptive Stats

Age



Gender



Phase 1. Online Survey – Descriptive Stats: Farm characteristics

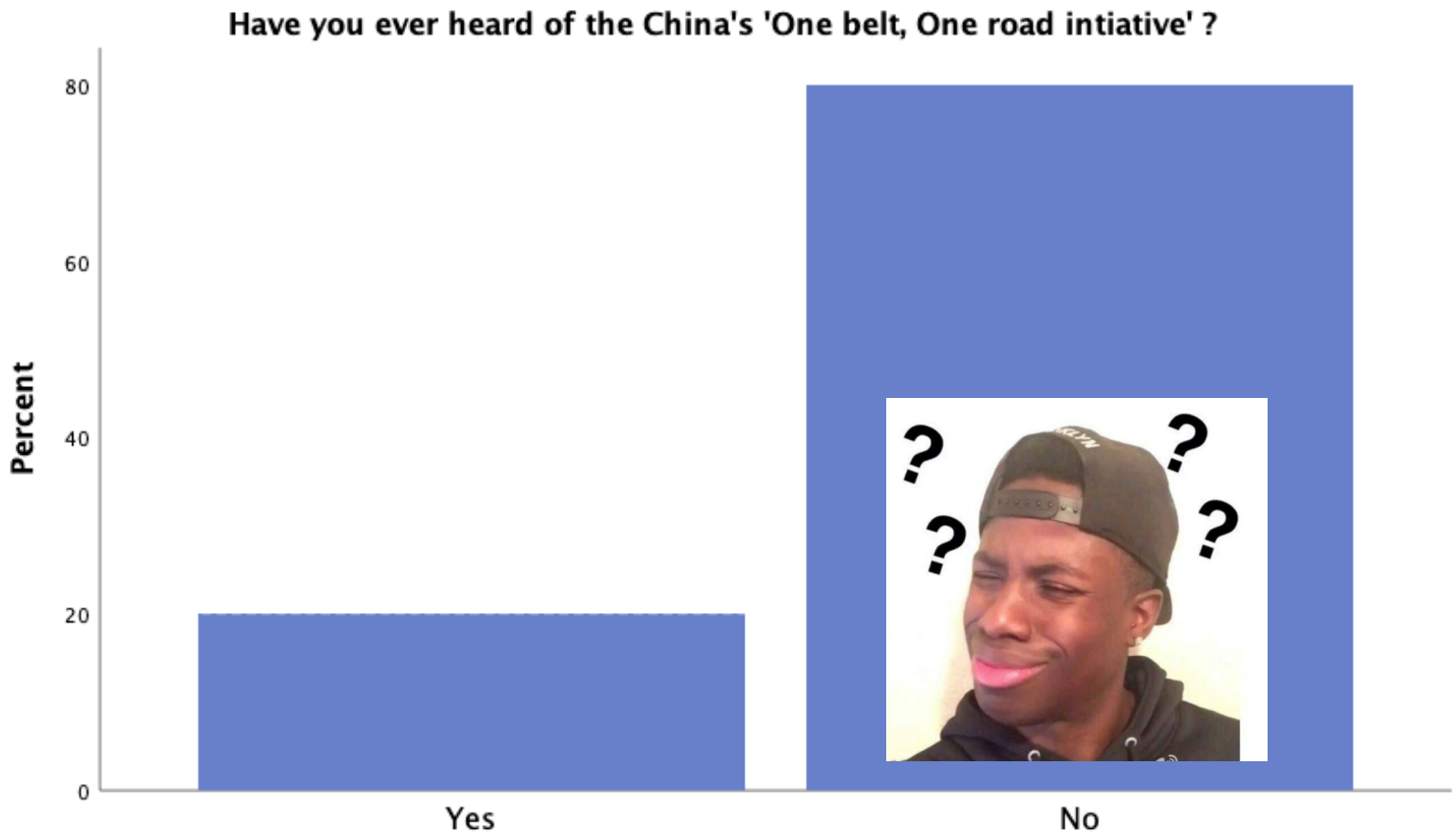
Employment	• Contractor 35.6% • Self-employed 64.4%
Farm type	• Noncommercial farm 70.6% • Commercial farm 29.4%
Agricultural Product	• Crop 60% (apple 6.7%, vegetable 37.8%, other 15.6%) • Fish farm 2.2% • Dairy 2.2% • Meat farm 6.7% • Poultry farm 6.7% • Combination of planting and breeding 22.2%
Farm labor	Mean=2.8 people, SD=1.2
Farm Size (in acres)	Mean=923.91, SD=2,535

Phase 1. Online Survey – Descriptive Stats: Farm characteristics

Export	Yes 49%.
Invest in futures or options	Yes 11%
Marketing Channel (multiple choice)	• Direct Sale (to consumers) 42.2% • Cooperative organizations 8.9% • Market 37.8% • Online electronic platform 8.9% • Enterprise acquisition 8.9% • Other 4.4%

“Have you ever heard of the OBOR initiative?”

Yes 20%
No 80%



We then showed participants information about the initiative.

China's 'One Belt, One Road' Project

OBOR is a project that focuses on improving connectivity and cooperation among multiple countries in Asia, Africa, and Europe. OBOR's scope has expanded over the years to include new territories and development initiatives.

-Investopedia

China's "One Belt, One Road" (OBOR) initiative, started in 2013, aims to build stronger connections and trading relationships between China and countries along the "belt." The OBOR initiative is expected to facilitate the economic development of China and participating countries and build economic corridors along the "belt." The OBOR initiative involves about 78 countries including Russia, Iran, Turkey, Singapore, Malaysia, etc. The initiative benefits China as it increases its international influence and boosts domestic economic growth. Therefore, China announced investments of over US$1 trillion in infrastructure projects and plans to fund the participating countries by offering low-cost loans. While the initiative is favorable to China and the participating countries, it's seen as a threat to non-participating countries.

All participants read the neutral article about the OBOR initiative.

Farmers' Perceptions
China's 'One Belt, One road initiative':

is **distant** to me and my farm 4.91

has nothing to do with me and my farm 4.27

is **relevant** to me and my farm 3.56

2.87 is **beneficial** to me and my farm

Farmers' Perceptions

China's 'One Belt, One road initiative' make me feel:

"Uncertain"4.42

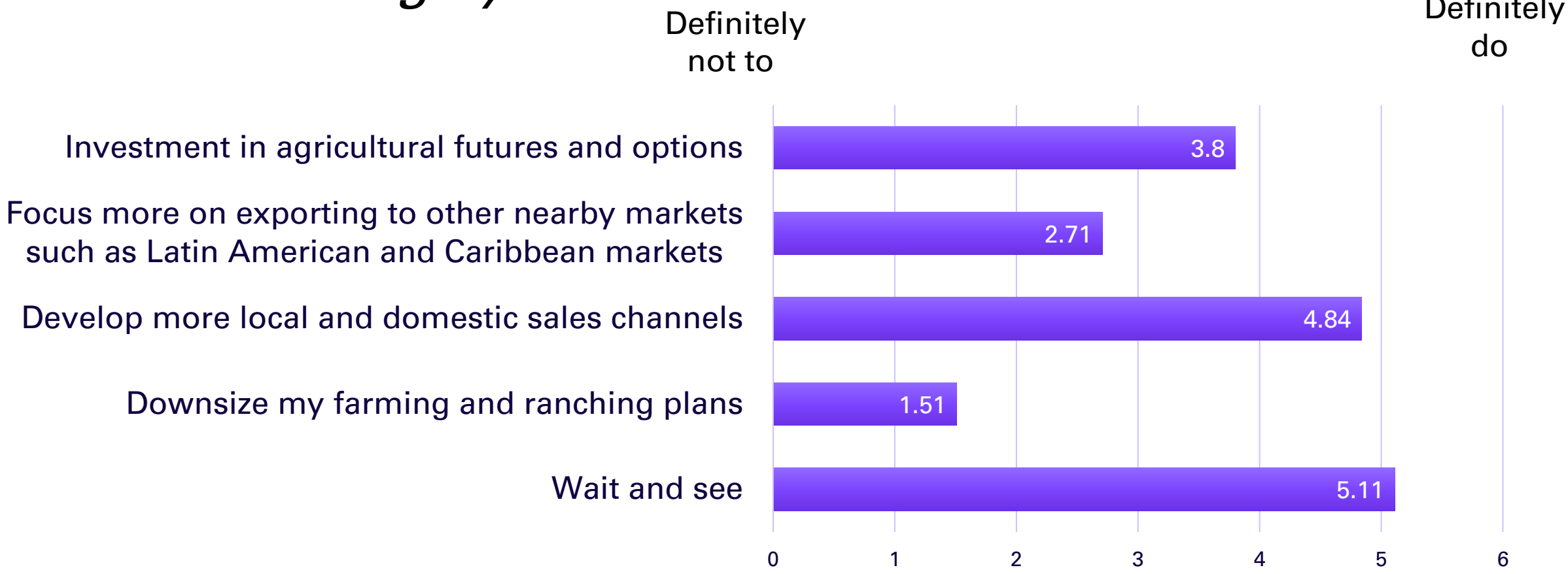
"Concerned"4.02

"Interested"4.38

"I don't like the initiative"4.18

Farmers' Future Plans

Knowing about China's One-belt-one-road initiative, do you intend to take any of these actions in the future to manage your farm?



Conclusions from pilot survey

- Most U.S. farmers are not aware of the initiative.
- U.S. Farmers perceive the initiative to be something “distant” and “irrelevant,” but “not beneficial” to them.
- U.S. Farmers feel “uncertain,” “concerned,” “dislike,” while “interested.”
- Most U.S. farmers would hold a “wait and see” position, but also would consider expanding their domestic and local channels to sell their product.

Next Step and Plan for Future Research

- Phase 2: Official Survey and interview (2021)
  - Large Scale Survey (mail/email surveys)
  - In-depth farmer interview (qualitative)

- Future research
  - Provide further evidence with secondary data
    - Annual Planting
    - Sales Channels
    - Distribution channels
    - Changes in local markets
    - Changes in contracts between farmers and supermarkets

References

- Freeman, C. (2016). The Maritime Dimension of “One Belt, One Road” in Strategic Perspective. *Remarks to a Center for Naval Analysis Workshop with the Rajaratnam School of International Studies.* Arlington, Virginia.
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- Ma, A. (2019). The US is scrambling to invest more in Asia to counter China's 'Belt and Road' mega-project. Here's what China's plan to connect the world through infrastructure is like. *Business Insider*, Nov. 11.