

Socio-Economic Impacts of Increasing Alternative Protein Intake in the Diet

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Disclosures

- In past 5 years, paid consulting or grants from
 - Breakthrough Institute, Beef Cattle Research Fund, Cattlemen's Beef Promotion & Research Board, Corn Refiner's Association, Food Marketing Institute Foundation, Foundation for Food and Agricultural Research, Microsoft, National Pork Board, North American Meat Institute, United Egg Producers, United Soybean Board, USDA Office of Chief Economist, USDA Economic Research Service, USDA NIFA
- Speaking engagements
 - For a full list see: <https://jaysonlusk.com/speaking>

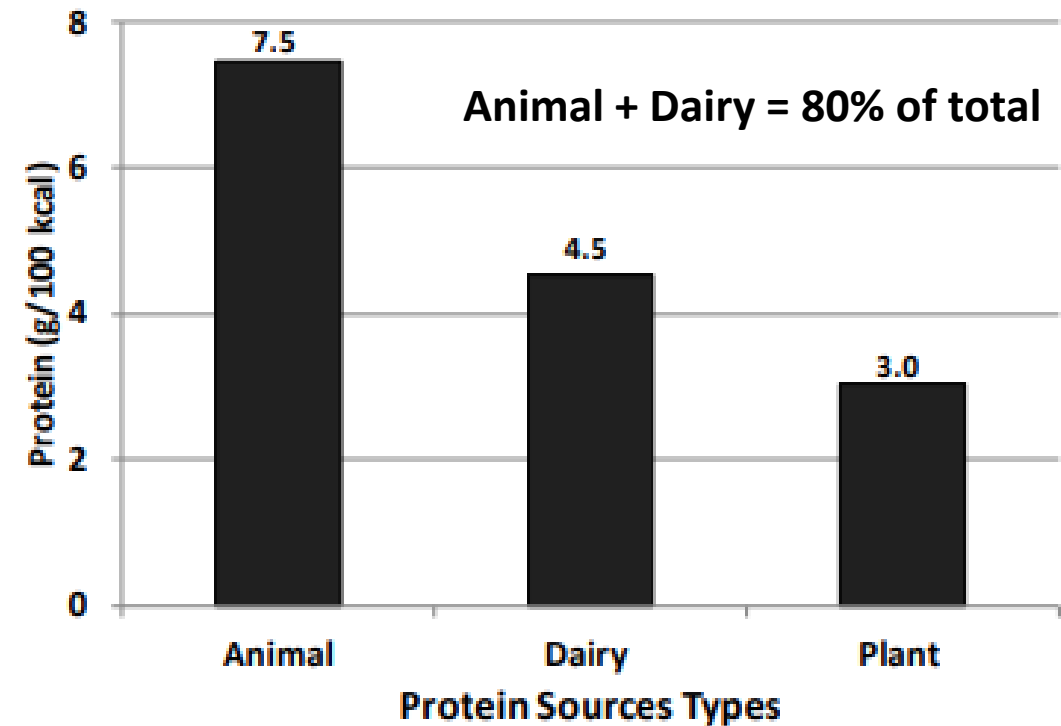
Sources of Dietary Protein for US Consumers

Top food sources of daily dietary protein from NHANES 2007–2010¹

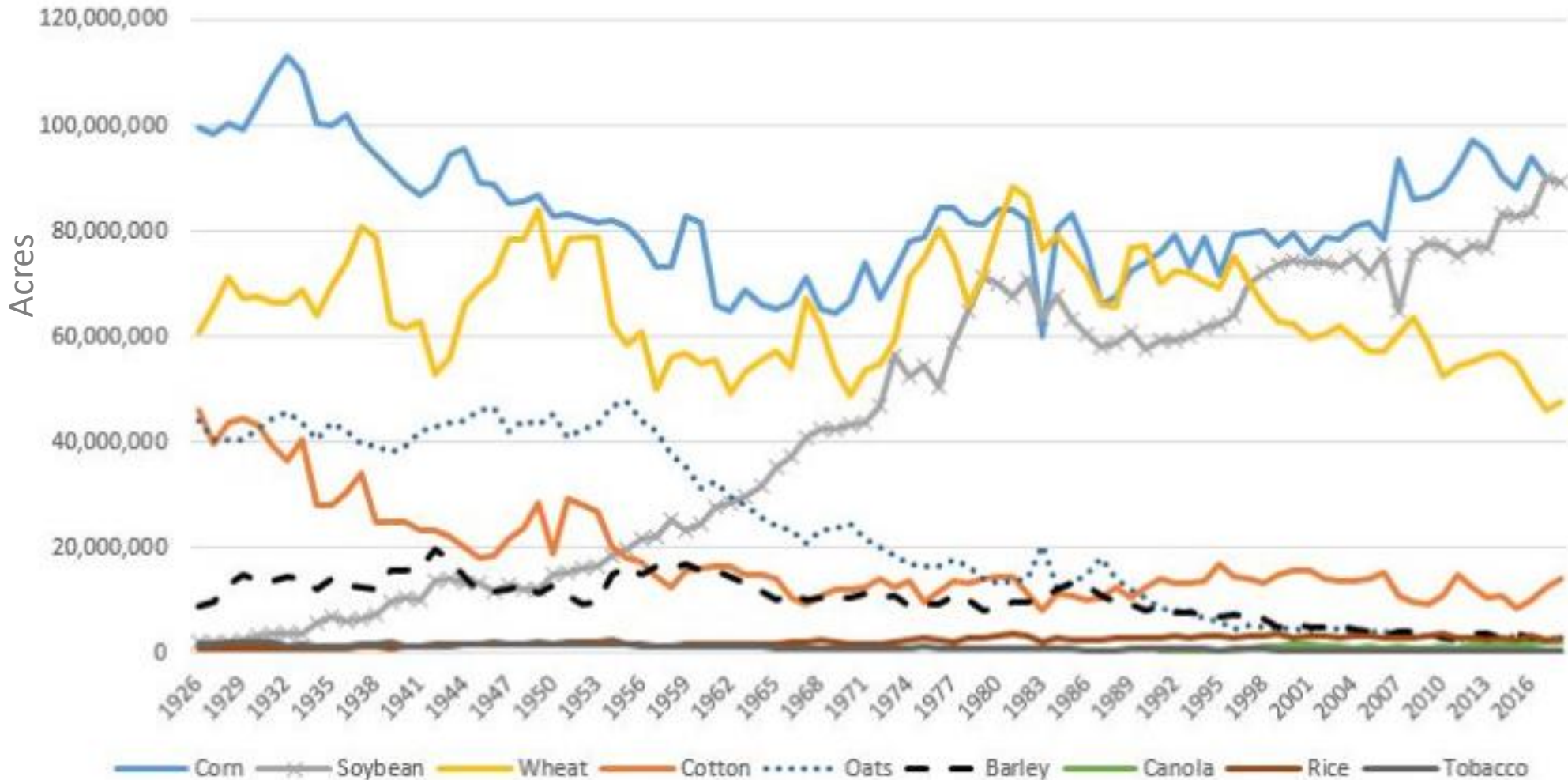
Food	Rank	Intake	
		Total protein	Intake ²
		%	g
Poultry	1	10.0	7.9 ± 0.3
Meats	2	9.5	7.5 ± 0.2
Mixed dishes—meat, poultry, fish	3	7.5	5.9 ± 0.2
Breads, rolls, tortillas	4	6.4	5.1 ± 0.1
Milk	5	6.4	5.1 ± 0.1
Cured meats/poultry	6	6.0	4.7 ± 0.1
Mixed dishes—pizza	7	4.8	3.8 ± 0.2
Cheese	8	4.8	3.8 ± 0.1
Mixed dishes—grain-based	9	4.4	3.5 ± 0.2
Mixed dishes—sandwiches	10	4.1	3.2 ± 0.2
Eggs	11	3.2	2.5 ± 0.1
Plant-based protein foods	12	3.2	2.5 ± 0.1
Seafood	13	3.1	2.4 ± 0.2

¹*n* = 17,386. The listed foods comprise ~73% of total daily protein intake (VL Fulgoni, unpublished observations, 2014).

²Values are means ± SEMs.

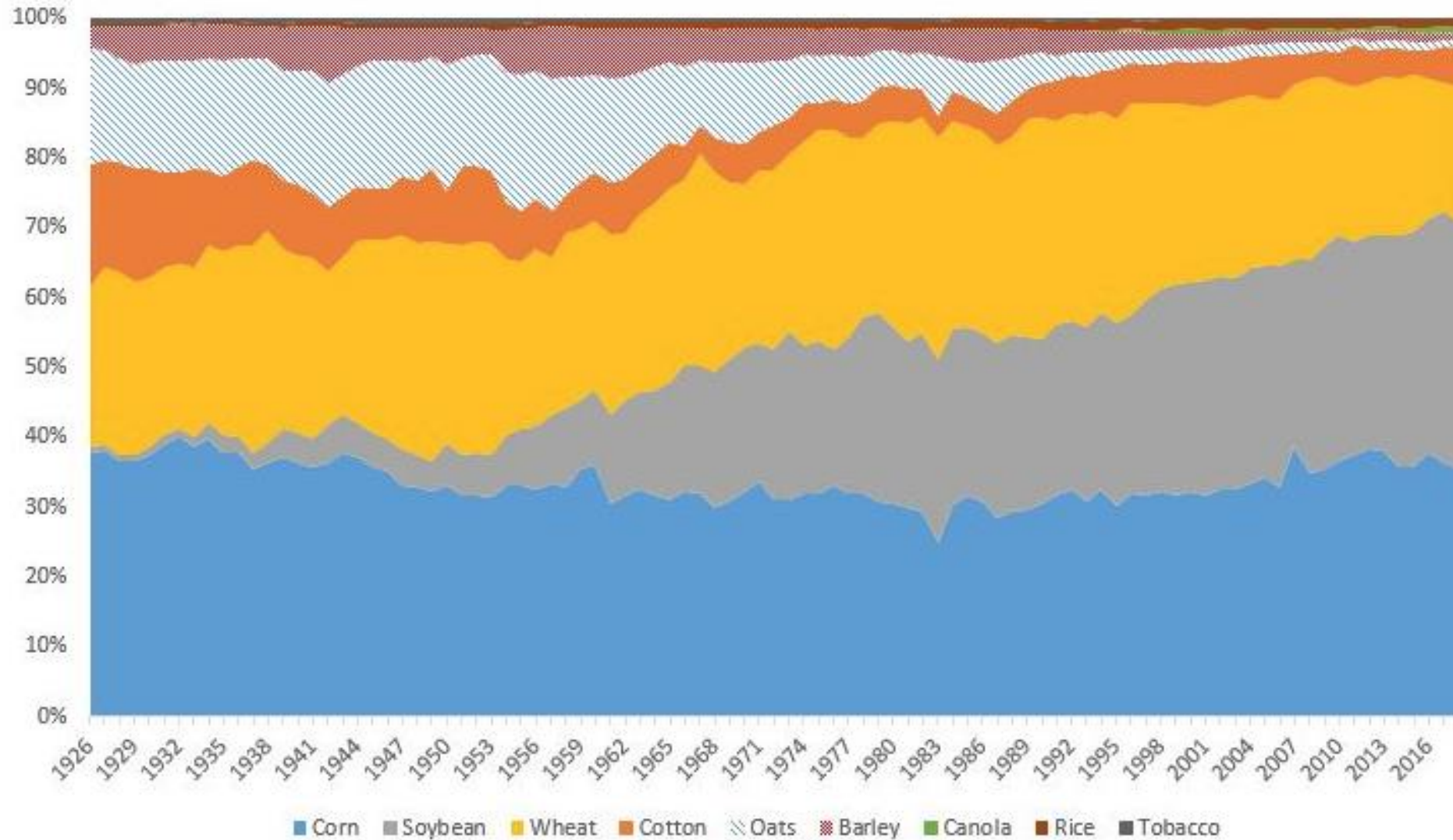


U.S. Planted Acres by Crop



- ~250 million planted acres total
- Less than 1% in fruit, veg, nuts
- Overall US Farmland
 - 45% pasture
 - 43% cropland
 - 8% woodland

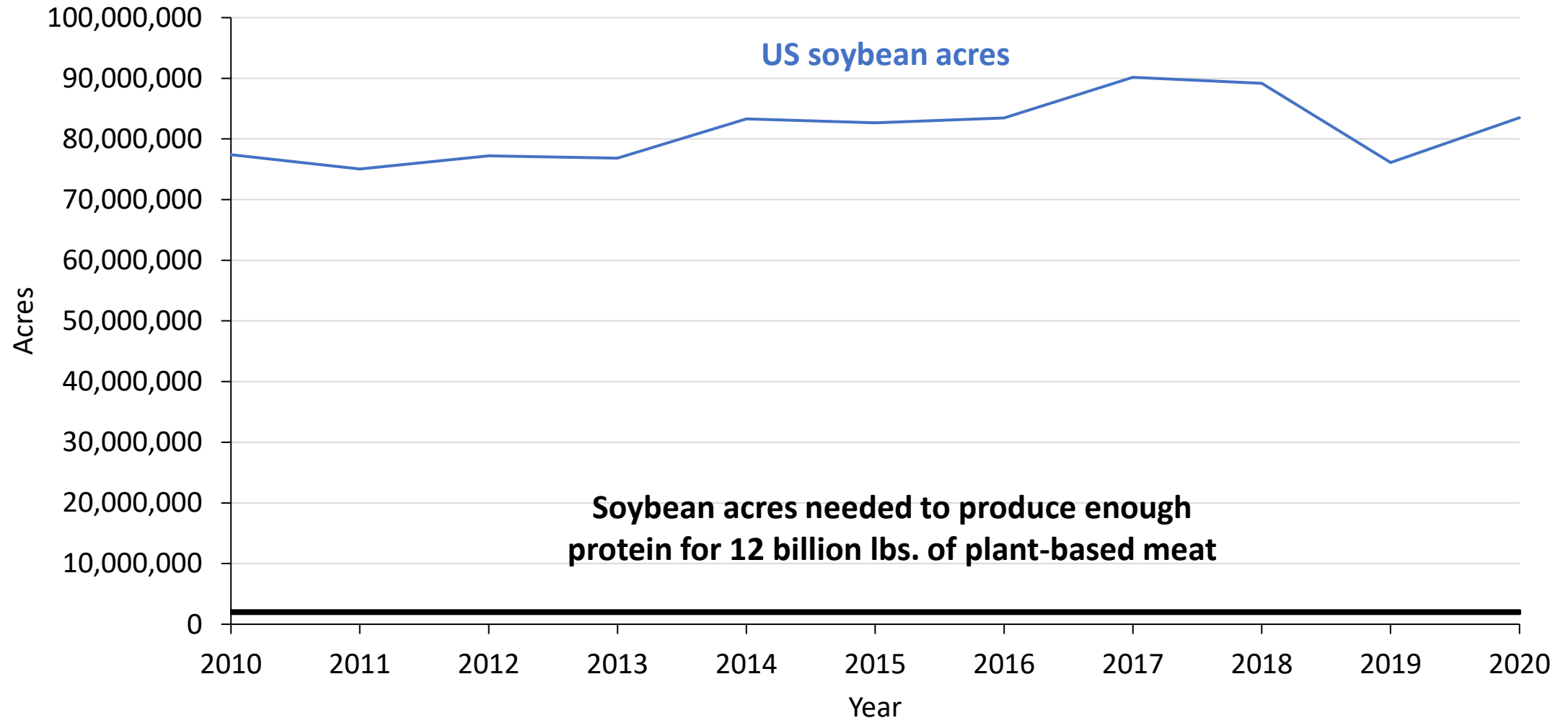
Composition of U.S. Planted Acres by Crop



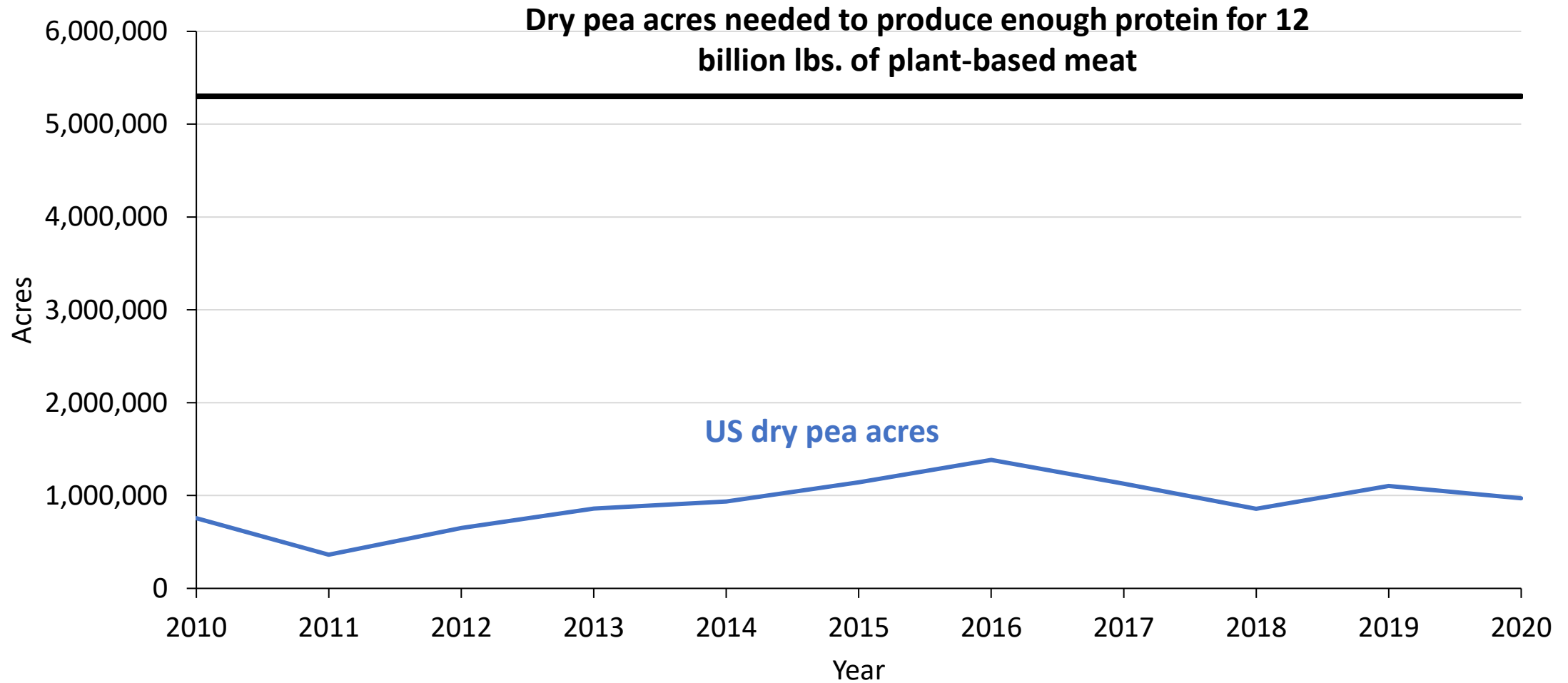
U.S. Agricultural Economy

- **2020 Total U.S. Farm Commodity Receipts = \$364 billion**
 - **\$165 billion of animal products (45%)**
 - **\$58 billion of feed grains (16%)**
 - About 45% of domestic corn use goes directly to animals
 - Another 20% indirectly reaches animals via distillers grains
 - **\$42 billion soybeans (11.4%)**
 - About 85% soybean meal goes to animals
 - **Other Protein Food Crops**
 - \$11.8 billion in food grains: wheat, rice, rye (3%)
 - \$11.2 billion in nuts: almond, pistachio, walnut, peanut, pecan, etc. (3%)
 - \$1.7 billion in dry beans, peas, and lentils (0.4%)

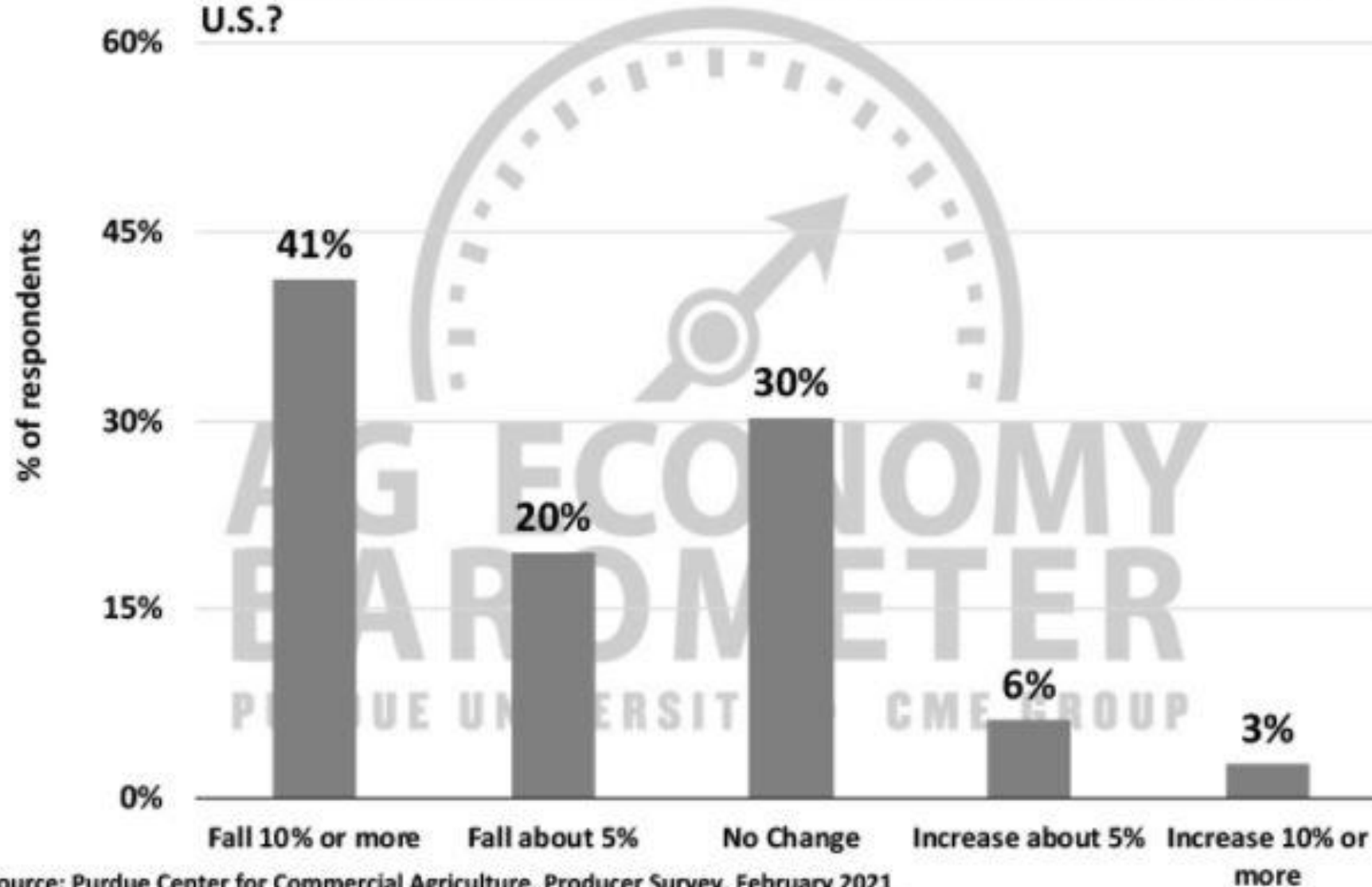
US Soybean Acres



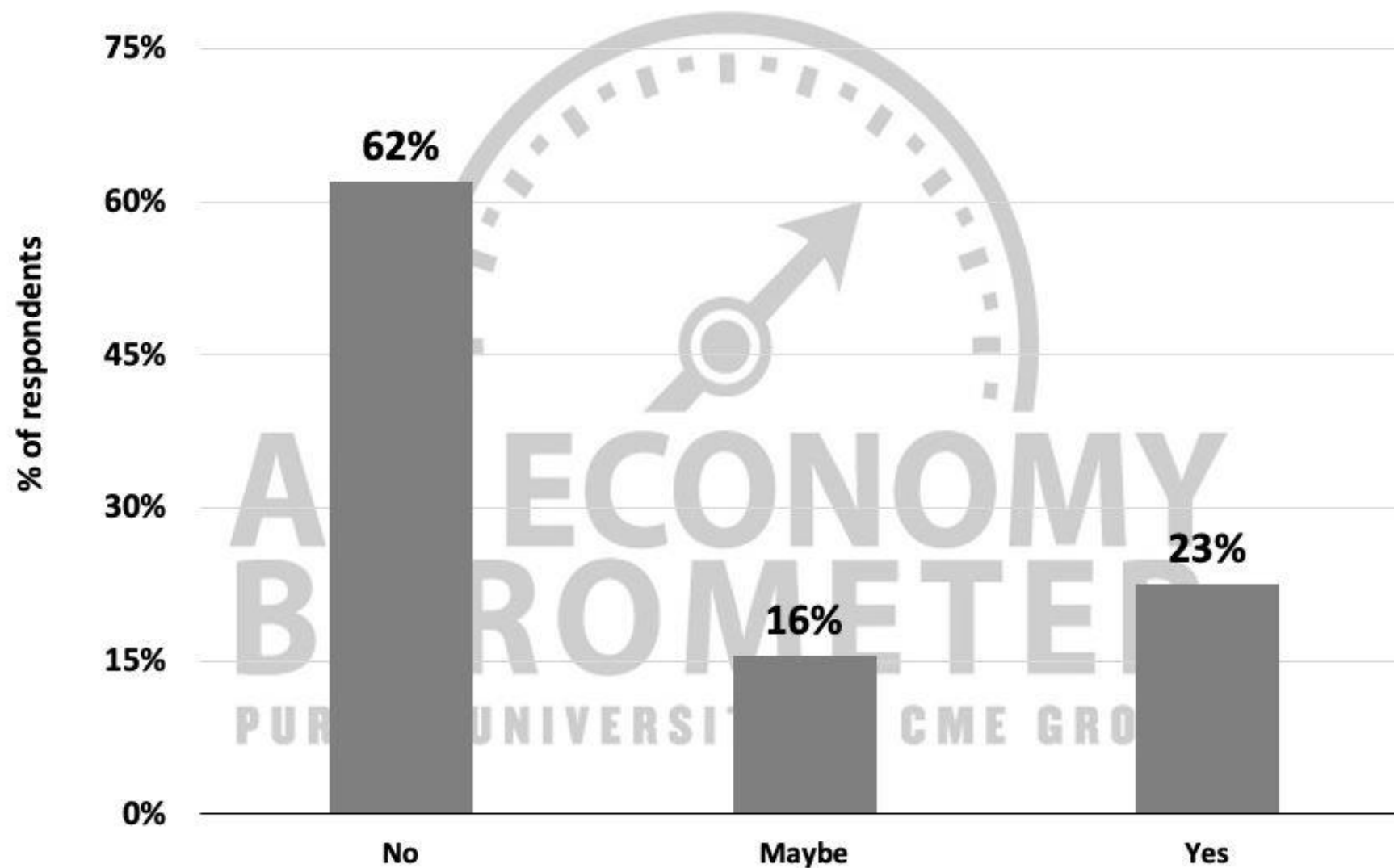
US Dry Pea Acres



If plant-based meat alternatives eventually have a market share that equals 25% of the overall market for animal and plant-based protein, what do you expect will happen to aggregate net farm income in the U.S.?



If you are offered a contract to grow a crop that will be used in the production of a plant-based meat alternative, would you be interested in pursuing it?



Source: Purdue Center for Commercial Agriculture, Producer Survey, February 2021

Cost of Producing 1 Gram of Protein for Retail Consumption

Commodity	Retail Cost of Protein (\$/gram)
<i>Crops</i>	
Corn	\$0.017
Soybeans	\$0.010
Wheat	\$0.026
Peanuts	\$0.010
<i>Livestock and Livestock Products</i>	
Hogs	\$0.034
Cattle	\$0.033
Broilers	\$0.014
Milk	\$0.045

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- But, consumers care about more than cost and are willing to pay more to keep meat vs. any other food category in their diet

Change in weekly food expenditures from converting from an average meat eater to ...

- **partial vegetarian = +\$39.67/week**
- **full vegetarian = -\$19.28/week**



CONSUMER FOOD INSIGHTS

Demographic Category
All
Region
Education
Income
Age
Race
Sex

How often have the following statements about common shopping and eating habits applied to you in the last 30 days?

Shopping and Eating Habits

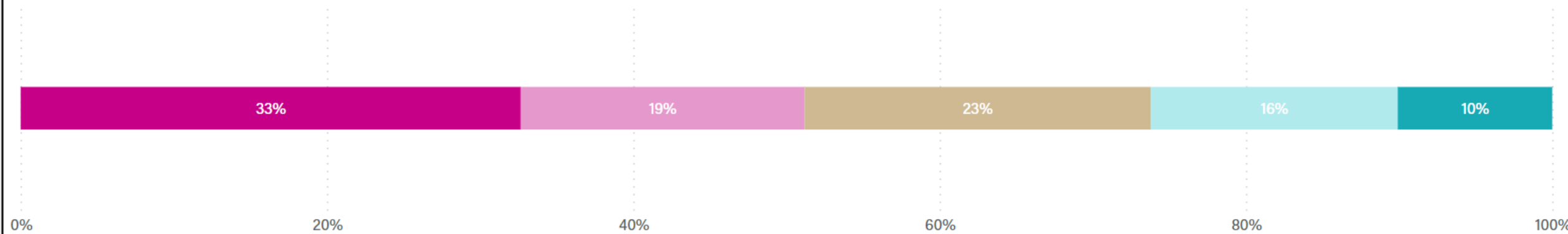
Chose plant-based proteins over animal proteins

Survey Month

All

Frequency Chart

● Never ● Rarely ● Sometimes ● Often ● Always





CONSUMER FOOD INSIGHTS

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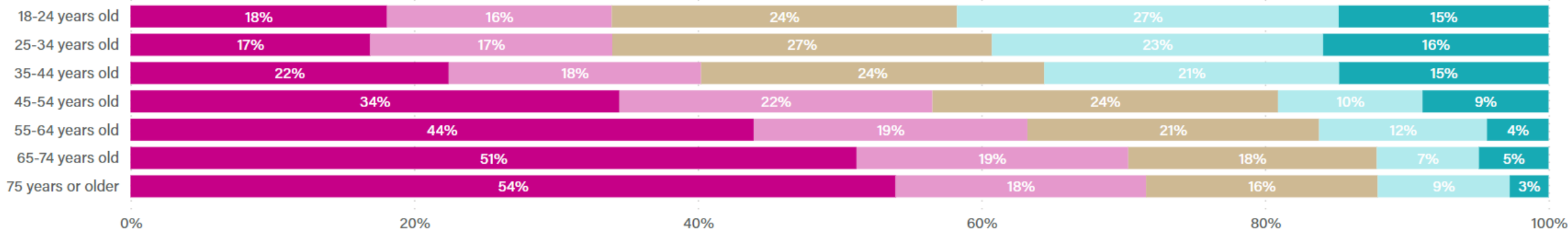
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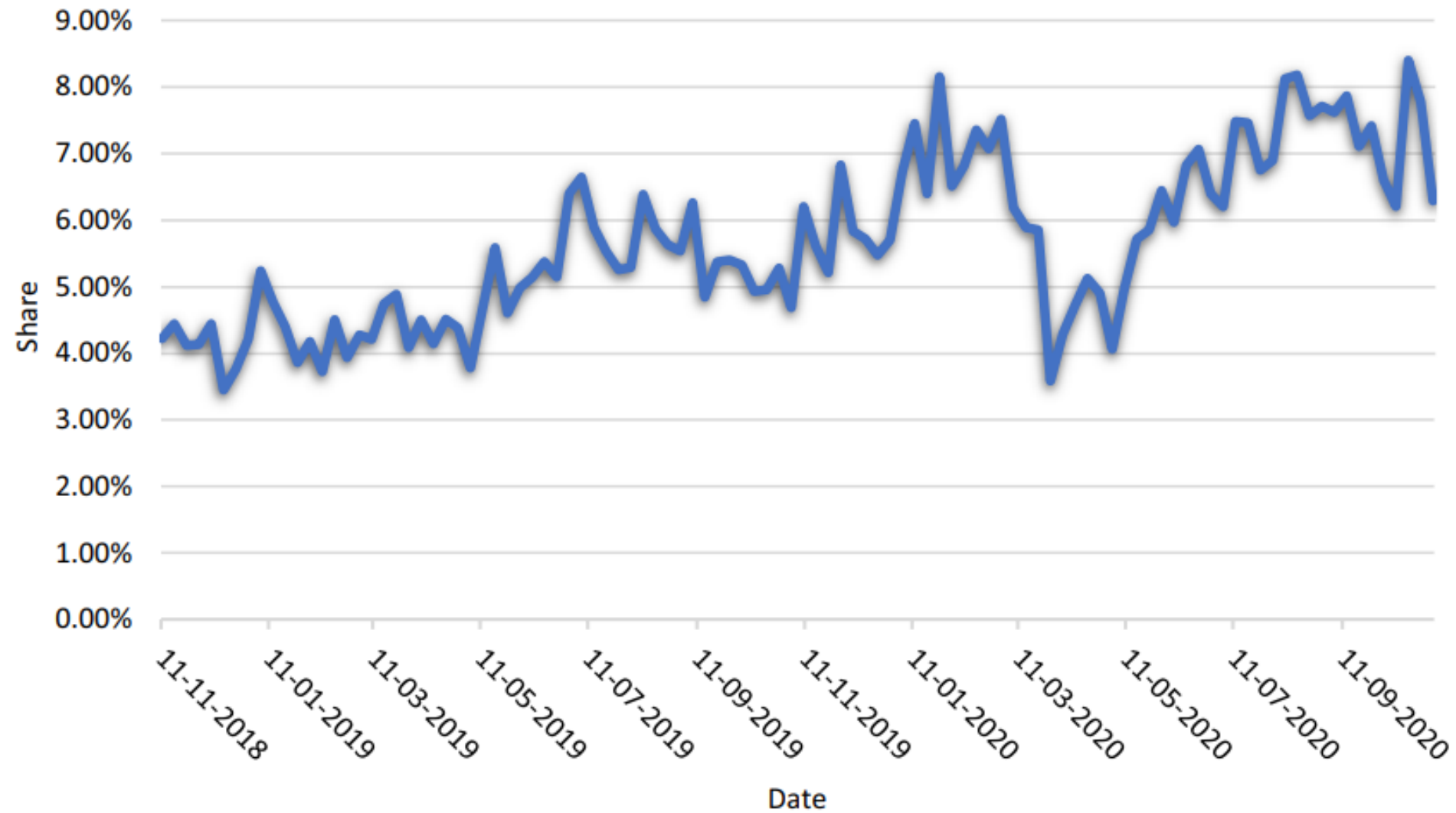
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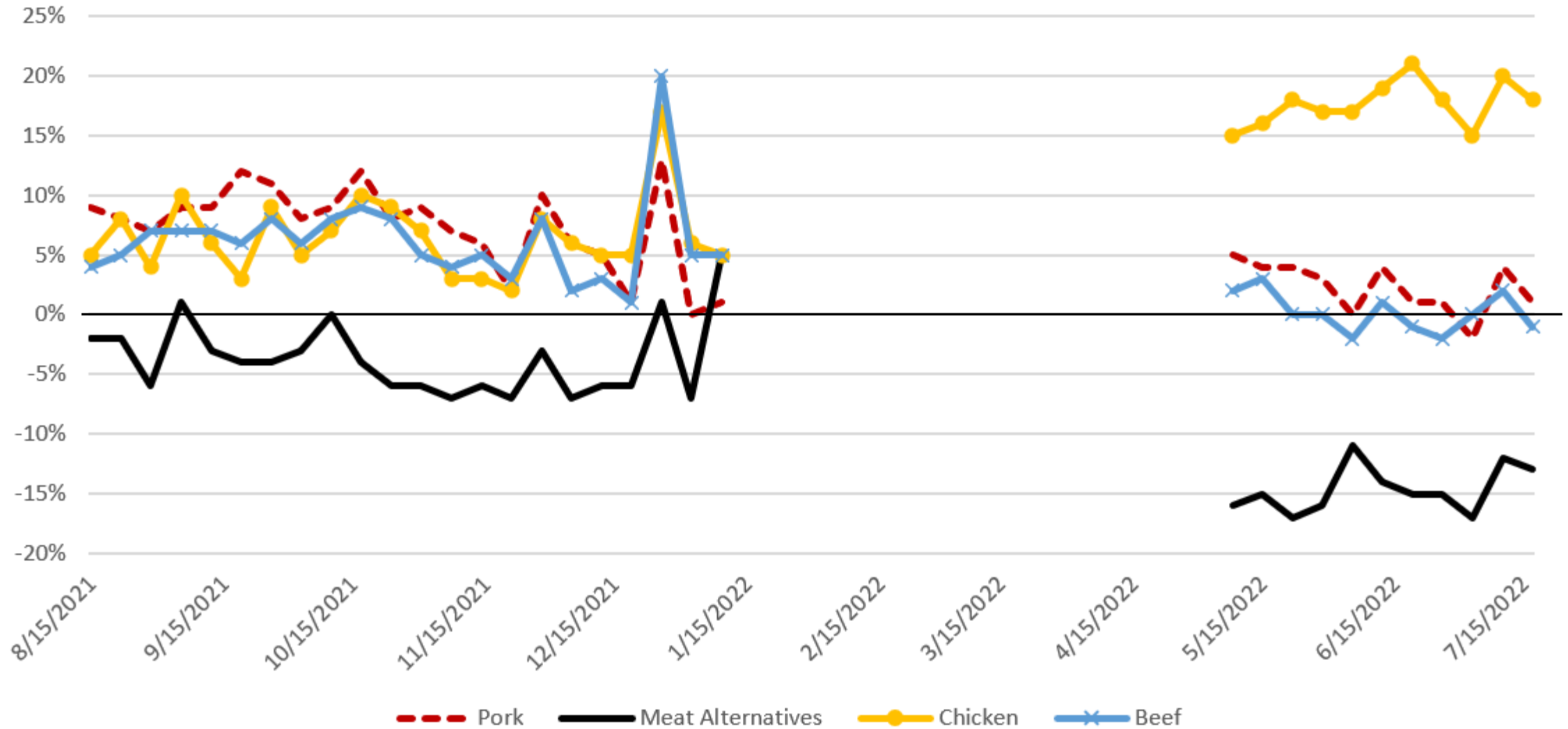


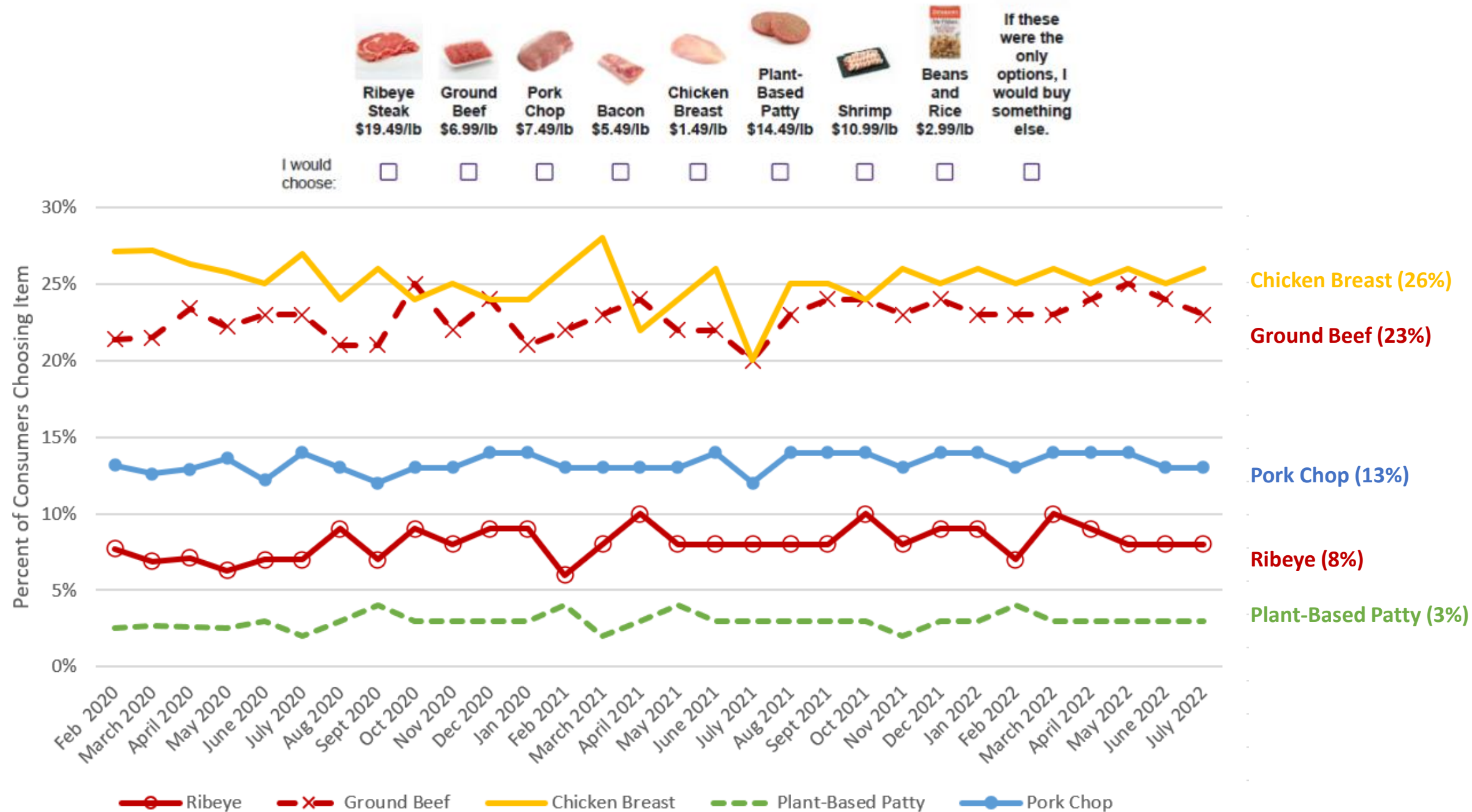
Market Trends for Plant Based Meat Alternatives

Novel Plant-Based Share of Ground Meat Sales



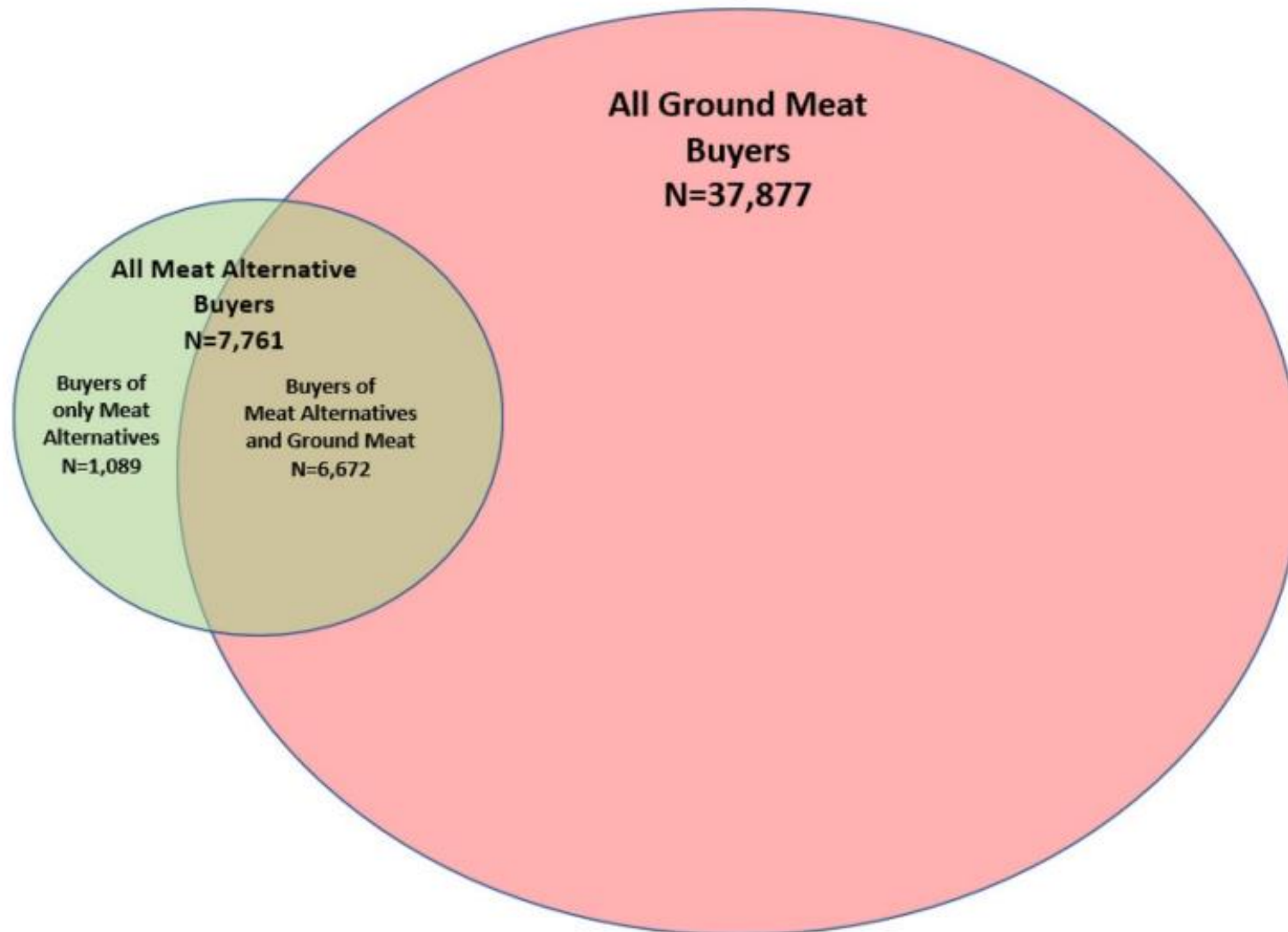
Year over Year Change in Retail Sales





To What Extent Do Plant-Based Meat Alternatives Substitute for Animal-Based Proteins?

All Ground Meat and Meat Alternative Consumers N=38,966



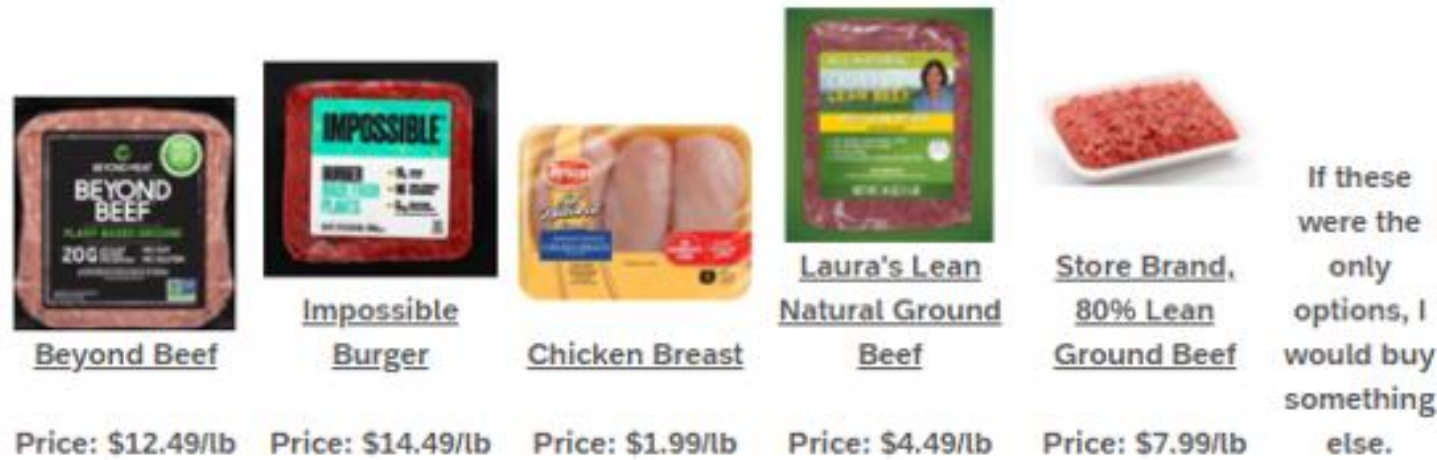
**Over a 2-year period from
Nov 2018 to Nov 2020**

- **20% of households bought a PBMA**
- **85% of PBMA buyers also bought ground meat**
- **After the 1st purchase of a PBMA, sales of ground meat increased**

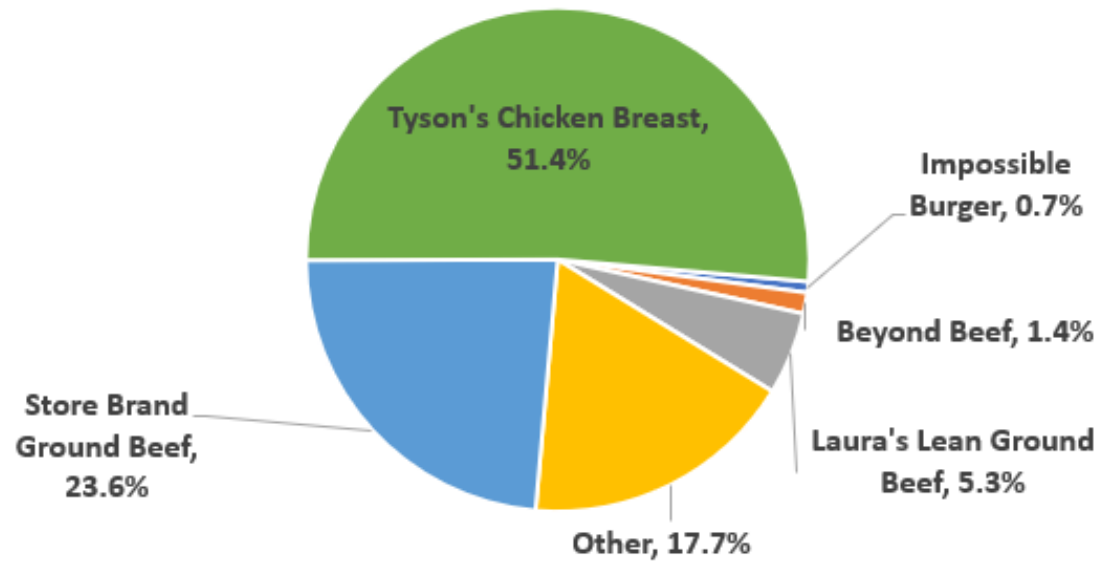
Which of the following would you purchase?

						If these were the only options, I would buy something else.
	<u>Beyond Beef</u>	<u>Impossible Burger</u>	<u>Chicken Breast</u>	<u>Laura's Lean Natural Ground Beef</u>	<u>Store Brand, 80% Lean Ground Beef</u>	
	Price: \$12.49/lb	Price: \$14.49/lb	Price: \$1.99/lb	Price: \$4.49/lb	Price: \$7.99/lb	
I would choose:	☐	☐	☐	☐	☐	☐

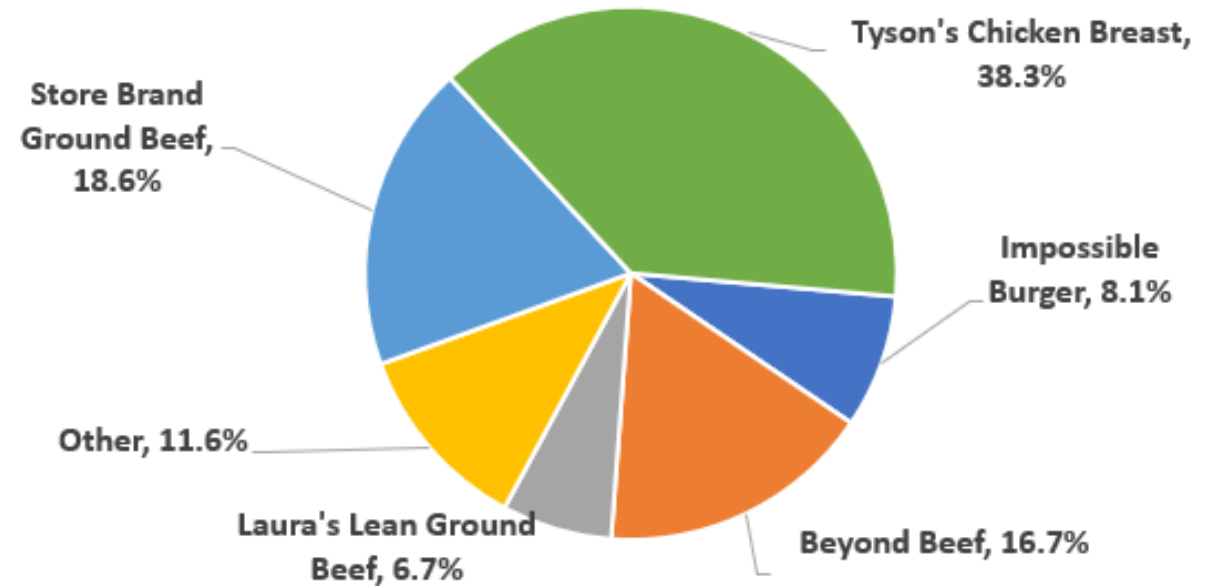
- Within-subject design
- Each respondent made 11 choice in each treatment
- Branded/Labeled Choice Experiment
- Price of each option varied at 3 levels; midpoints $\pm \$1.5$: \$9.99, \$11.99, \$4.49, \$6.99, \$5.49
- Near orthogonal fractional factorial design



Regular Meat Consumers (68% of all consumers)



Flexitarian, Vegetarian, etc. (32% of all consumers)

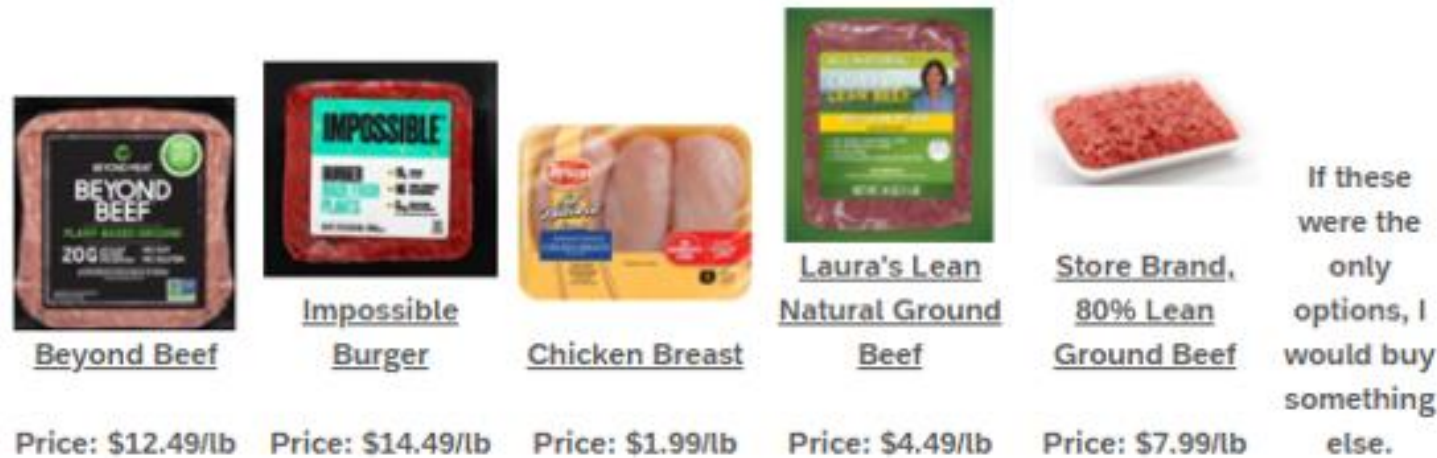


Market Share Simulations

	No Plant-Based	Beyond Enters	Change
Beyond Beef	0.0%	4.1%	4.1%
Impossible Burger	0.0%	0.0%	0.0%
Tyson's Chicken Breast	47.8%	46.2%	-1.6%
Laura's Lean Natural Ground Beef	8.8%	8.0%	-0.8%
Store Brand, 80% Lean Ground Beef	26.0%	24.7%	-1.2%
None/Other	17.5%	17.0%	-0.5%

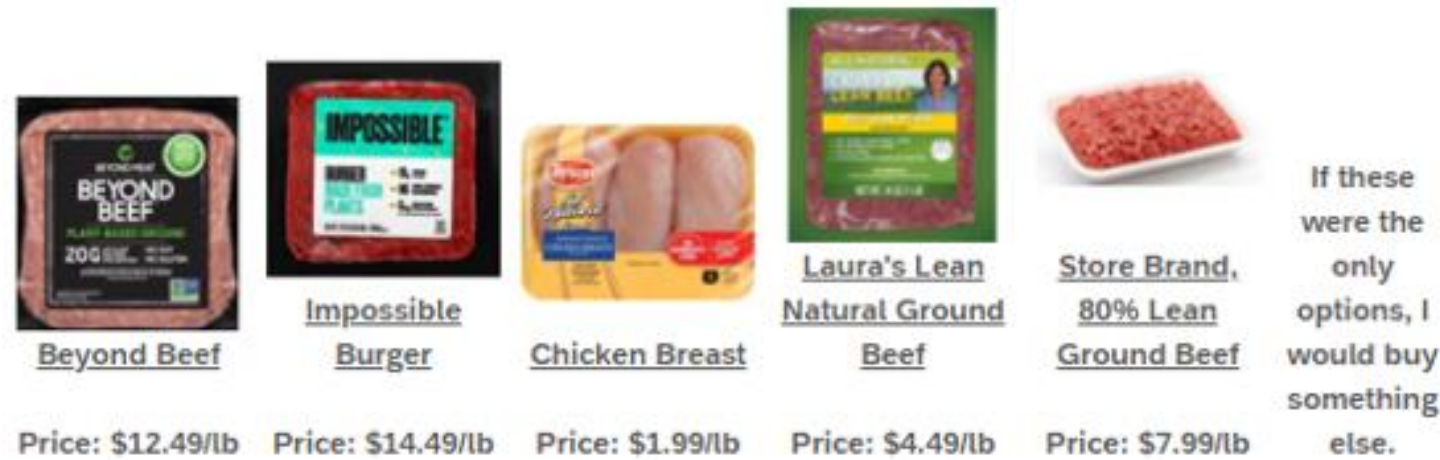
Market Share Simulations

	No Plant-Based	Beyond Enters	Beyond and Impossible Enter	Change
Beyond Beef	0.0%	4.1%	3.6%	-0.5%
Impossible Burger	0.0%	0.0%	2.7%	2.7%
Tyson's Chicken Breast	47.8%	46.2%	45.3%	-0.9%
Laura's Lean Natural Ground Beef	8.8%	8.0%	7.5%	-0.4%
Store Brand Ground Beef	26.0%	24.7%	24.1%	-0.6%
None/Other	17.5%	17.0%	16.8%	-0.2%



A 1% reduction in price of Impossible will cause ...

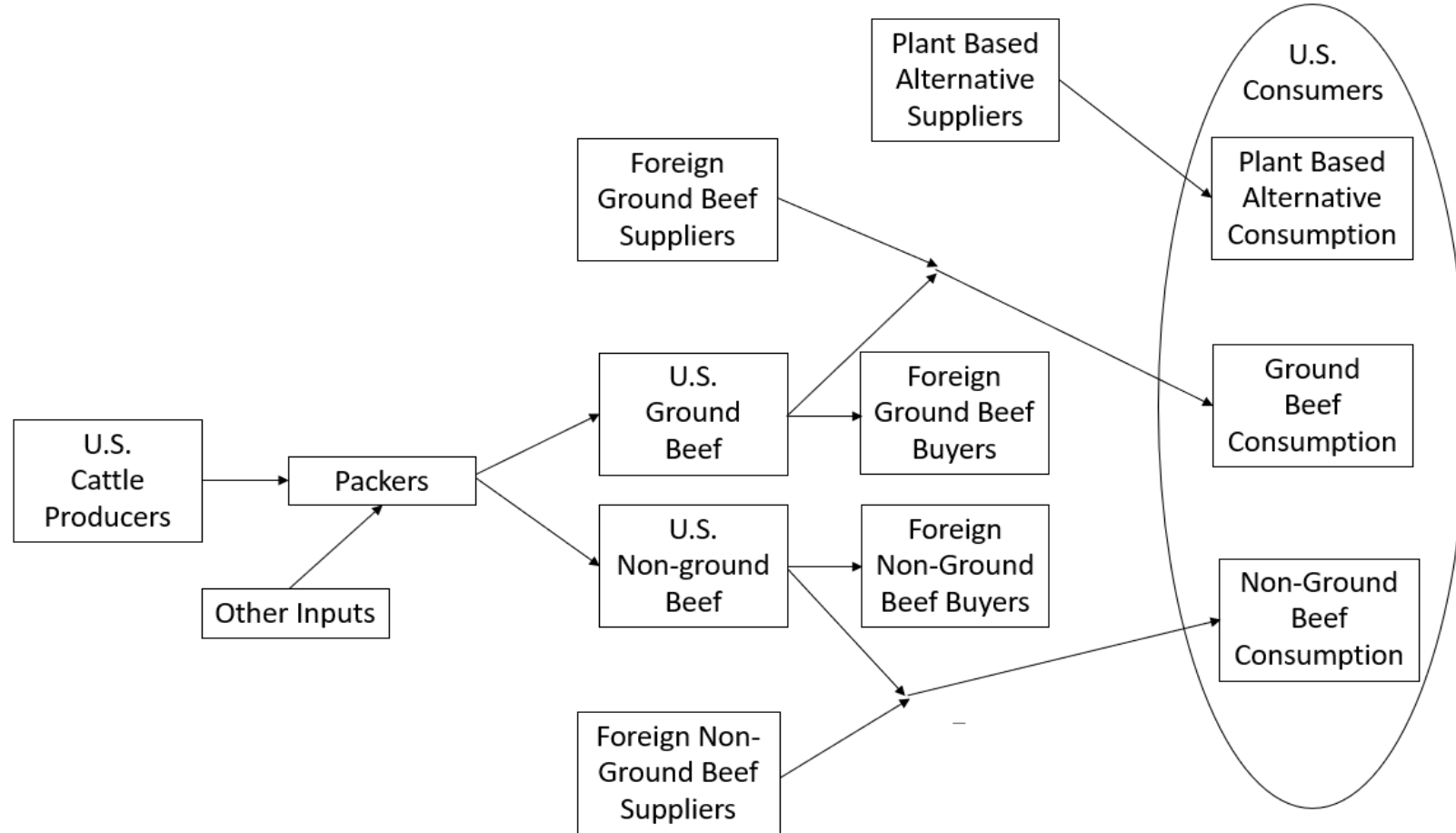
- **3.26% ↑ in Impossible**
- **0.35% ↓ in Beyond**
- **0.22% ↓ in Laura's Lean**
- **0.14% ↓ in Store Brand Ground Beef**
- **0.11% ↓ in Chicken Breast**



A 1% reduction in price of Store Ground Beef will cause ...

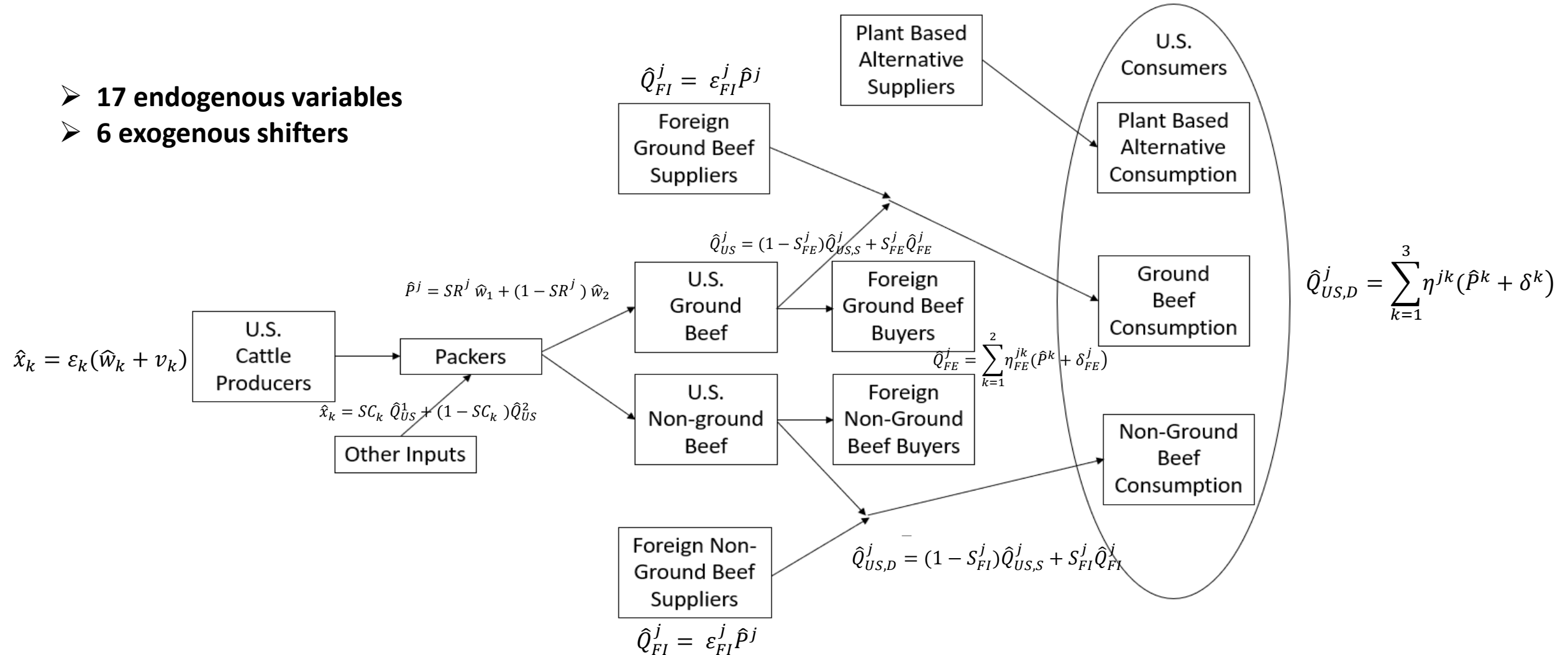
- **1.73% ↑ in Store Brand Ground Beef**
- **0.43% ↓ in Laura's Lean**
- **0.42% ↓ in Beyond**
- **0.35% ↓ in Impossible**
- **0.34% ↓ in Chicken Breast**

Cattle Production and U.S. Beef Consumption



Cattle Production and U.S. Beef Consumption

- 17 endogenous variables
- 6 exogenous shifters



Change in Outcome	Change in Price of Plant-Based Meat Alternative			
	-1%	-5%	-10%	-20%
<i>Quantity of US ...</i>				
Retail Ground Beef	-0.12%	-0.59%	-1.18%	-2.35%
Retail Non-Ground Beef	0.01%	0.06%	0.12%	0.23%
Retail Plant-Based Alternatives	2.31%	11.57%	23.13%	46.27%
Cattle	-0.01%	-0.07%	-0.15%	-0.29%
<i>Price of US ...</i>				
Retail Ground Beef	-0.05%	-0.24%	-0.48%	-0.95%
Retail Non-Ground Beef	-0.04%	-0.22%	-0.44%	-0.88%
Retail Plant-Based Alternatives	-1.00%	-5.00%	-10.00%	-20.00%
Cattle	-0.06%	-0.29%	-0.59%	-1.18%
<i>Quantity of ...</i>				
Imports of Ground Beef into U.S.	-0.05%	-0.24%	-0.48%	-0.95%
Imports of Non-Ground Beef into U.S.	-0.04%	-0.22%	-0.44%	-0.88%
Exports of U.S. Ground Beef to Foreign Countries	0.07%	0.35%	0.70%	1.39%
Exports of U.S. Non-Ground Beef to Foreign Countries	0.06%	0.32%	0.64%	1.28%
U.S. Cattle Producer Welfare (million \$/year)	-\$30.10	-\$150.40	-\$300.58	-\$600.27
U.S. Consumer Welfare (billion \$/year)	\$51.39	\$256.82	\$513.30	\$1,025.23
U.S. Cattle Slaughtered (1,000 head/year)	-4.86	-24.32	-48.63	-97.26
Foreign Cattle Slaughtered (1,000 head/year)	-2.50	-12.52	-25.03	-50.07

Wrap-up

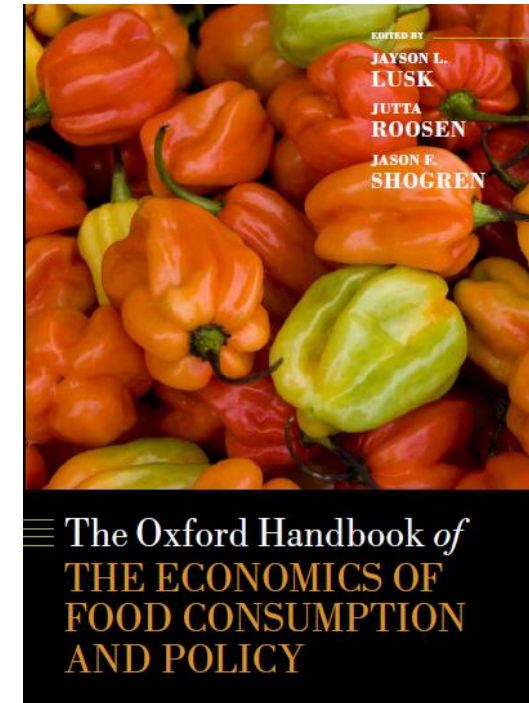
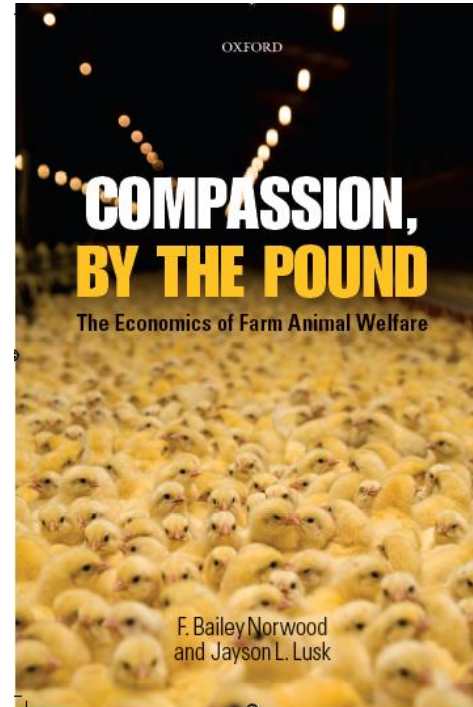
- **Current U.S. agricultural economy is heavily reliant on animal-based protein sources**
- **Alt-meat is growing the size of the pie of the “meat market” but is also causing some small substitution away from conventional alternatives**
- **Current cross-price elasticities between alt-meat and beef are low**
- **Demand growth for protein (animal and plant based) is likely much higher outside the U.S.**

HOW SCIENCE AND TECHNOLOGY
ARE SERVING UP SUPER FOODS
TO SAVE THE WORLD



Unnaturally Delicious

JAYSON LUSK



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