The Inelasticity of Meat Consumption?

Zach Freitas-Groff*  
Stanford University

Carl Meyer  
Stanford University

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The End of Meat Is Here

If you care about the working poor, about racial justice, and about climate change, you have to stop eating animals.

NYTimes Opinion (05/21/2020)

Which brings us to meat-eating. Its extinction will, I believe, ultimately come. And be largely market-driven, as well. Science will find dietary substitutes that can be produced at infinitely less cost and effort. At which point, meat will become a kind of exotic indulgence, what the cigar (of Cigar Aficionado) is to the dying tobacco culture of today.

– Charles Krauthammer (National Review 05/08/2015)
Motivation

Snapshot: Few Americans Vegetarian or Vegan

Gallup (08/01/2018)

America’s Obsession With Cheap Meat

Meat-eating is part of the American identity, a tradition that underlies efforts to keep slaughterhouses open despite coronavirus outbreaks.

NYTimes Opinion (05/15/2020)
Motivation

Per Capita Meat Consumption USA

Per Capita Meat Consumption World

Source: ourworldindata.org/UN Food and Agricultural Organization (FAO)
- **Research Question**: Have recent cultural shifts and technological innovation increased meat avoidance?

- **Conceptual Framework**: Briefly sketch a model identifying economic and social drivers of meat consumption.

- **Empirical Strategy**: Document 15-year trends in grocery purchases in the National Consumer Panel; implement event studies around exposure to novel substitutes, media events, and changes in residence.

- **Results**: Trends suggest some growing meat avoidance and acceptance of alternatives with potential social drivers.
Conceptual Framework

Consumer maximizes (adapted from Hestermann, Le Yaouanq, Treich (2020)):

$$\max_c U(c) - pc - wec$$

where

- $c$ denotes a consumption vector consisting of animal product $c_{\text{animal}}$ and plant-based product $c_{\text{plant}}$
- $p$ denotes a price vector consisting of prices $p_{\text{animal}}$ and $p_{\text{plant}}$
- $e$ denotes vector of perceived externalities generated by consumption, and weight $w$ is the weight placed on externalities by the consumer.
Data

- **Consumer Panel Data – NielsenIQ**
  - Representative panel of U.S. households (40,000-60,000 each year)
  - Information on demographic and geographic variables
  - Purchasing behavior from 2004-2019 (currently)

- **Retail Scanner Data – NielsenIQ**
  - 35,000-50,000 participating stores covering > 50% of total sales volume of US grocery and drug stores
  - Weekly product data from 2006-2019 (for now)

- **Label Insight – NielsenIQ**
  - Data from machine-scanned product labels: ingredients, detailed categories, animal welfare claims (not currently using), and more for subset of the data
Classifying and Aggregating

Classify subsample using data from Label Insight. Count as animal products:
- Products with a matching ingredient
- Products in a relevant category (e.g. Deli - Turkey) without ingredients
- Substitutes identified by category and ingredient check

For products not in the subsample, impute the likelihood of being a given product type (e.g. chicken) based on category.

Count products with over a 50% chance of being a certain product type.

Weighted average across households by month:
- Quantity purchased (money, ounces) divided by household size
- Budget share
- Indicator for any purchased
The rate of meat and animal product avoidance appears to be rising.

An important complication for our data is that there has been a broad trend toward eating out more.

- Our setting: just grocery data
- Restaurant meals typically emphasize meat.

However, budget shares show that some consumers are spending less of their grocery budget on meat (and some more).

Data are consistent with growing meat avoidance and an offsetting trend on the intensive margin.
Trends: Households Not Purchasing Meat/Animal Products

Consumers Not Buying Meat or Animal Product

- Meat
- All Animal Products

Percent of Consumers

Month

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Trends: Monthly Meat Purchases Overall

- **Monthly Meat Product Purchases Overall**
  - Chart showing trends from 2005 to 2020.

- **Monthly Meat Product Purchases by Type**
  - Chicken
  - Beef
  - Pork
  - Fish
  - Charts for each type from 2005 to 2020.
Trends: All Monthly Grocery Purchases

Purchases in Nielsen data:

Expenditure shares in USDA data:

Trends: Monthly Meat Purchases by Grocery-Purchase Bins

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Trends: Monthly Meat Purchases by Percentile

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Trends: Milk

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Trends: Monthly Animal Product Avoidance by Income

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Monthly AP Avoidance By Income (p.c. adj.)

- 1st Quartile
- 2nd Quartile
- 3rd Quartile
- 4th Quartile

Monthly Meat Avoidance By Income (p.c. adj.)

- 1st Quartile
- 2nd Quartile
- 3rd Quartile
- 4th Quartile

Share of Consumers

Month

2005 2010 2015 2020

0.03

0.025

0.02

0.015

0.01

0.005

0.005

0.01

0.015

0.02

0.025

0.03

2005 2010 2015 2020

0.08

0.07

0.06

0.05

0.04

0.03
Trends: Monthly Animal Product Avoidance by Education

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Monthly AP Avoidance By Education

- No College
- Some College
- Graduated College
- Post-Graduate Studies

Monthly Meat Avoidance By Education

- No College
- Some College
- Graduated College
- Post-Graduate Studies
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Trends: Monthly Animal Product Avoidance by Race

Adjusted

Monthly AP Avoidance By Race
Adjusted for Baseline

Monthly Meat Avoidance By Race
Adjusted for Baseline

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Share of Consumers Relative to Baseline

Month

2005  2010  2015  2020

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White

Black

Asian

Hispanic

Other

---

Share of Consumers Relative to Baseline

Month

2005  2010  2015  2020

---

White

Black

Asian

Hispanic

Other

---

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Trends: Monthly Animal Product Avoidance by Income

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Monthly Meat Purchases By Income (p.c. adj.)

- 1st Quartile
- 2nd Quartile
- 3rd Quartile
- 4th Quartile

2005 2010 2015 2020

Month

Weight

2005 2010 2015 2020

Month

Budget Share

2005 2010 2015 2020

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Trends: Monthly Animal Product Avoidance by Race

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Monthly Meat Purchases By Race

Monthly Meat Budget Share By Race
How elastic is meat consumption to one’s social surroundings (others’ consumption, attitudes, marketing, etc.)?

Useful as a bound of sorts on what a big push can do.

Find each panelist who moves from one Designated Market Area to another and study how purchases change as a function of the change in nearby consumers’ purchases.


- 60%-70% response to brand preferences (Bronnenberg et al. 2012)
- 0% response to nutritional health index (Allcott et al. 2019).
Movers: Meat Consumption Heatmap

Average Per Capita Meat Consumption in 2004

Average Per Capita Meat Consumption in 2019

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Estimate the following equation:

\[
(y_{it} - \bar{y}_{\ell_{\text{origin}}, t_i-1}) = \beta_{0,t-t_i}(\bar{y}_{\ell_{\text{dest}., t_i-1} - \bar{y}_{\ell_{\text{origin}}, t_i-1}} + \beta_{1,t-t_i}\bar{y}_{\ell_{\text{origin}}, t} \\
+ \beta_{2,t-t_i}(\bar{p}_{\ell_{\text{dest}., t_i-1} - \bar{p}_{\ell_{\text{origin}}, t_i-1}} + \alpha_{\text{birth decade}_i}) + \delta_i + \gamma t
\]

- \( t_i \) = year in which \( i \) moves.
- \( \ell_{\text{origin}} \) and \( \ell_{\text{dest.}} \) = origin and destination locations.
- Omit \( t = t_i - 1 \).
Estimate the following equation:

\[
(y_{it} - \bar{y}_{\text{origin},t_i-1}) = \beta_{0,t-t_i}(\bar{y}_{\text{dest},t_i-1} - \bar{y}_{\text{origin},t_i-1}) + \beta_{1,t-t_i}\bar{y}_{\text{origin},t} \\
+ \beta_{2,t-t_i}(\bar{p}_{\text{dest},t_i-1} - \bar{p}_{\text{origin},t_i-1}) + \alpha \{\text{birth decade}_i\} + \delta_i + \gamma t
\]

- \(y_{it}\) = outcome for person \(i\) in period \(t\).
- \(\bar{y}_{\ell,\tau}\) = average outcome in geographic area \(\ell\) in period \(\tau\).
- \(\bar{p}_{\ell,\tau}\) = average price in geographic area \(\ell\) in period \(\tau\).
- \(\delta_i\) and \(\gamma_t\) = unit and period fixed effects.

Key assumption: Within-individual trends identical except for timing relative to move.
Movers: Cow and Pig Meat

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Movers: Substitutes

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Relevant Events: Overview

- Which changes affect consumers’ animal product purchases or avoidance?
  - Introduction to plant-based meat
  - Introduction to plant-based milk
  - Undercover investigations and pet adoption (appendix)

- Estimate the following equation:

\[ y_{it} = \beta_{t-i} + \delta_i + \gamma_t \]

- \( t_i \) = month of the event
- \( \delta_i \) and \( \gamma_t \) = unit and period fixed effects

- Identifying assumption is similar to before. Eventually, switch to synthetic DID.
- Note that a propensity score matching approach yields quite different results but appears quite poorly identified.
Relevant Events: First Beyond/Impossible Purchase

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Relevant Events: First Plant-Based Milk Purchase

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Milk Purchases vs. First Purchase of Plant-Based Milk

Meat Substitute Purchases vs. First Purchase of Plant-Based Milk
Percentiles and the extensive margin suggest a potential rise in meat avoidance.

Meat purchases appear to respond significantly to something in one’s surroundings.

Substitutes and news events might have some effects but face important confounders; current results not particularly robust.

Some indication that those who respond substitute away from chicken, fish, pork, and milk more than beef.
Further analyses:
- Ice cream and/or yogurt substitutes
- Separate investigations’ impacts by animal species
- Improved price elasticities

Improve events analysis using synthetic differences-in-differences.
- Potentially implement structural model.
  - Learning model á la Bronnenberg and Dubé (2016).
Thank you!
Include same graphs as above with different classification for what counts as meat and milk
One mention of animal welfare or rights ever in a top-5 economics journal, in a footnote (Blackorby, Bossert and Donaldson 1995)

Substantial research in agricultural economics (e.g. Norwood and Lusk 2011)
  ▶ WTP for animal welfare (Allender and Richards 2010, Clark et al 2017)
  ▶ Effects of various policies (Malone and Lusk 2016, Mullally and Lusk 2018)
  ▶ Surveys and experiments on consumer behavior (Norwood 2018, Paul et al. 2019)

Recent work on directly incorporating animal welfare in economics (e.g. Fleurbaey and Van der Linden 2018) and related empirical work (Treuch 2021, Espinosa forthcoming)
Data on individual animal product consumption based on self-reports (Peacock 2018)

Recent interest in how introduction of plant-based meat alternatives (PBMAs) changes consumption behavior

- Zhao et al. (2022) use Nielsen data to study demand for PBMAs based on an almost ideal demand system model.
- Cuffey et al. (2022) use Nielsen data to study how consumption changes around the first purchase of PBMAs.
Trends: Meat Purchases (Shares)

Monthly Meat Product Budget Share, Overall

Monthly Meat Product Budget Share, by Type

- Chicken
- Beef
- Pork
- Fish
Trends: Meat Budget Share

Monthly Meat Product Budget Share, Overall

Meat Budget Share by Percentile
Trends: Meat Substitutes (Shares)

- Consumers Buying a Meat Substitute by Month

- Monthly Meat Substitute Budget Share
Trends: Milk (Shares)

Monthly Milk Budget Share

- Milk
- Milk Substitute

Percent of Dollars Spent

Month:
- 2005
- 2010
- 2015
- 2020
Trends: Monthly Animal Product Avoidance by Income

Monthly AP Avoidance By Income (p.c. adj.)
Adjusted for Baseline

Monthly Meat Avoidance By Income (p.c. adj.)
Adjusted for Baseline
Trends: Monthly Animal Product Avoidance by Education

Monthly AP Avoidance By Education Adjusted for Baseline

- No College
- Some College
- Graduated College
- Post-Graduate Studies

Monthly Meat Avoidance By Education Adjusted for Baseline

- No College
- Some College
- Graduated College
- Post-Graduate Studies
Trends: Monthly Animal Product Avoidance by Race

Monthly AP Avoidance By Race Adjusted for Baseline

Monthly Meat Avoidance By Race Adjusted for Baseline
Movers: Cow Meat, Independent vs. Dependent Variable

Effect of Change in Local Meat Purchases on Movers' Beef Purchases

Effect of Change in Local Beef Purchases on Movers' Meat Purchases
Effect of Change in Local Meat Purchases on Movers' Pork Purchases

Effect of Change in Local Pork Purchases on Movers' Meat Purchases
Movers: Chicken, Independent vs. Dependent Variable

Effect of Change in Local Meat Purchases on Movers' Chicken Purchases

Effect of Change in Local Chicken Purchases on Movers' Meat Purchases
Movers: Fish, Independent vs. Dependent Variable

Effect of Change in Local Meat Purchases on Movers’ Fish Purchases

Effect of Change in Local Fish Purchases on Movers’ Meat Purchases
Movers: Meat Substitutes, Independent vs. Dependent Variable

Effect of Change in Local Meat Purchases on Movers' Meat Substitute Purchases

Effect of Change in Local Meat Substitute Purchases on Movers' Meat Purchases
Movers: Milk Substitutes, Independent vs. Dependent Variable

Effect of Change in Local Meat Purchases on Movers’ Milk Substitute Purchases

Effect of Change in Local Milk Substitute Purchases on Movers’ Meat Purchases
Movers: Meat and Animal Product Avoidance

Effect of Change in Local Purchases on Movers’ Animal Product Avoidance

Effect of Change in Local Purchases on Movers’ Meat Avoidance

Effect of Change in Local Meat Purchases on Movers' Animal Product Avoidance

Effect of Change in Local Animal Product Avoidance on Movers' Meat Purchases

Effect of Change in Local Meat Purchases on Movers' Animal Product Avoidance

Effect of Change in Local Animal Product Avoidance on Movers' Meat Purchases
Relevant Events: First Beyond/Impossible Purchase

Pork Purchases vs. First Purchase of Beyond/Impossible

Beef Purchases vs. First Purchase of Beyond/Impossible
Relevant Events: First Beyond/Impossible Purchase

Chicken Purchases vs. First Purchase of Beyond/Impossible

Fish Purchases vs. First Purchase of Beyond/Impossible
Relevant Events: First Beyond/Impossible Purchase

Milk Purchases vs. First Purchase of Beyond/Impossible
Relevant Events: First Beyond/Impossible Purchase

Share Purchasing Meat vs. First Purchase of Beyond/Impossible

Share Purchasing Animal Products vs. First Purchase of Beyond/Impossible
Relevant Events: First Plant-Based Milk Purchase

Meat Purchases vs. First Purchase of Plant-Based Milk

Beef Purchases vs. First Purchase of Plant-Based Milk
Relevant Events: First Plant-Based Milk Purchase

Pork Purchases vs. First Purchase of Plant-Based Milk

Chicken Purchases vs. First Purchase of Plant-Based Milk
Relevant Events: First Plant-Based Milk Purchase

Fish Purchases vs. First Purchase of Plant-Based Milk

Effect (Ounces)

Month
Relevant Events: First Plant-Based Milk Purchase

Share Purchasing Meat vs. First Purchase of Plant-Based Milk

Share Purchasing Animal Products vs. First Purchase of Plant-Based Milk
Relevant Events: Undercover Investigation

Meat Purchases vs. News Investigation

Chicken Purchases vs. News Investigation
Relevant Events: Undercover Investigation

Beef Purchases vs. News Investigation

Pork Purchases vs. News Investigation
Relevant Events: Undercover Investigation

Fish Purchases vs. News Investigation

Milk Purchases vs. News Investigation
Relevant Events: Undercover Investigation

Share Purchasing Meat vs. News Investigation

Share Purchasing Animal Products vs. News Investigation
Relevant Events: Pet Adoption

Share Purchasing Meat vs. Pet Adoption

Share Purchasing Animal Products vs. Pet Adoption
Relevant Events: Pet Adoption