

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.

The Impact of Air Pollution on Comfort Food Purchases - Evidence from Retail Scanner Data

Linlin Fan
Penn State
lpf5158@psu.edu

Eric Zou
University of Oregon
ericzou@uoregon.edu

Jinglin Feng Penn State jpf5265@psu.edu

Douglas H. Wrenn Penn State dhw121@psu.edu

Selected Poster prepared for presentation at the 2022 Agricultural & Applied Economics Association Annual Meeting, Anaheim, CA; July 31- August 2

Copyright 2022 by Linlin Fan, Eric Zou, Jinglin Feng, and Douglas H. Wrenn. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.





The Impact of Air Pollution on Comfort Food Purchases - Evidence from Retail Scanner Data Linlin Fan¹, Eric Zou², Jinglin Feng³, Douglas H. Wrenn⁴

UNIVERSITY OF OREGON

-0.0103***

(0.0023)

Fatty acid

0.0076***

(0.0019)

Added sugars

-0.0113***

(0.0020)

HEI-2015 Component Scores

0.0029

(0.0034)

HEI-2015 Component Scores

HEI-2015 Component Scores

0.0014

Seafood and plant protein

-0.0079***

(0.0015)

Saturated fats

0.0064**

(0.0027)

1, 3, 4 Department of Agricultural Economics, Sociology, and Education, Penn State 2 Department of Economics, University of Oregon

Introduction

- Ambient air pollution is the biggest environmental health risk factor worldwide. In 2021, more than 4 out of 10 Americans (135 million people) lived with polluted air in the U.S.
- Sustained exposure to high levels of polluted air poses significant threats to human health and well-being, and these threats include but are not limited to significant rises in depression and anxiety
- Most studies focus on the adverse health consequences of air pollution, but little examined the air pollution's effects on consumers' food purchase behaviors
- Two sometimes competing mechanisms regarding the effects of air pollution on food purchases:
 - 1 Air pollution may raise people's health awareness, which could make consumers increase purchases of healthier foods
 - (2) Air pollution may stimulate purchases of unhealthy comfort foods by increasing stress

Objectives

- Examine the causal effect of air pollution on the purchases of comfort foods and the overall healthfulness of food purchases
 - * We presume that various levels of air quality affects consumers' food choices through mood

Data

- Food Sales Data: IRI retail scanner data (InfoScan) from years 2010 to 2018
- * Sample includes 5% randomly selected retailers that report weekly transactions at the individual store levels (2,563 stores)
- Nutrition Data: 2011-12 and 2013-14 USDA's FNDDS, SR-28, FPED and FPID
 - * Link nutrition datasets to the InfoScan using the USDA's Purchase to Plate Crosswalk (PPC)
- Air Pollution Data: U.S. EPA's Air Quality System (AQS) from years 2010 to 2018
 - * Adopt inverse distance weighting (IDW) to calculate a county's daily average PM2.5
 - ★ Obtain weekly average PM2.5 by averaging daily readings for each county

Instrumental Variables for Air Pollution

- 1 Weekly total number of thermal inversions or whether at least one inversion occurs
- Weekly total number of the wind direction falling into each 90-degree wind angle bin (Deryugina et al., 2019)

Methods

We fit a two-stage least squares (2SLS) regression:

$$(1) P_{ict} = \gamma_0 + \gamma_1 Z_{ct} + \gamma_2 W_{ct} + \beta_i + \sigma_t + u_{ict}$$

(2)
$$y_{ict} = \alpha_0 + \alpha_1 \hat{P}_{ict} + \alpha_2 \mathbf{W}_{ct} + \beta_i + \sigma_t + \varepsilon_{ict}$$

 P_{ict} : Weekly average concentrations of PM2.5 for store i in county c at week t (Standardized)

 Z_{ct} : Instrumental Variables (IVs)

 W_{ct} : A set of weather controls, including weekly average temperature and cumulative precipitation in county c y_{ist} : Log of sales of all products; Log of sales of nine types of comfort foods and one non-perishable goods (bottled water); Composite **purchase-based** HEI-2015 scores, and the 13 individual HEI components (Standardized)

 \hat{P}_{ict} : Predicted values from eq. (1)

 β_i : Store fixed effects (FEs); σ_t : Time FEs to control for seasonality and time trends

Preliminary Results

| | Soda | Hot cocoa | Candies/chocolates/ marshmallows/gum | | Ice cream/frozen desserts | dairy Other desserts, including pudding, mousse, gelatin, and parfait | Cookies and brownies | |
|--------------|--|-----------|---|-------------------------------|------------------------------|--|----------------------|-----------------|
| - | (1) | (2) (3) | | (4) | | (5) | (6) | |
| PM2.5 | 0.0054*** | 0.0050 | -0.005 | 1*** | 0.0039* | 0.0054*** | 0.0026* (0.0014) | |
| | (0.0016) | (0.0044) | (0.001 | 17) | (0.0023) | (0.0014) | | |
| | | Stor | es' Weekly Lo | g of Sales (\$) | of Different Comfort | Foods and Log of Total Sales (\$) | | |
| _ | Sweet bakery products, including cakes, pies, tarts, doughnuts, sweet rolls, and pastries (7) | | | muffins, pancakes, and waffle | | Savory snacks, including potato/tortilla/corn/other chips, crackers, corn nuts/snacks, popcorn, pretzels/snack mix | Bottled water | All products |
| - | | | | (8) | | (9) | (10) | (11) |
| PM2.5 | -0.0017 | | | 0.0037 | | 0.0034** | 0.0106*** | 0.0009 |
| | | (0.0017) | | | (0.0025) | (0.0014) | (0.0017) | (0.0012) |
| Observations | | | | | 782,965 | | | |

Stores' Weekly Log of Sales (\$) of Different Comfort Foods and Log of Total Sales (\$)

| | Overall HEI-2015 Score | | | | | |
|---|------------------------|------------------------|---------------------|------------------------------------|--|--|
| | (1) | (2) | (3) | (4) | | |
| PM2.5 | -0.0058** (0.0024) | -0.0086*** (0.0023) | -0.0034 (0.0026) | -0.0092** [*] (0.0023) | | |
| Store FE | X | X | X | X | | |
| Week of year FE | X | | | | | |
| Year FE | X | | | | | |
| Year-by-month FE | | X | | | | |
| Year-by-week FE | | | X | | | |
| State-year-month FE | | | | X | | |
| Regressions are weighted by total calories sold in each store-week? | | Ye | es | | | |
| Weather Controls | Yes | | | | | |
| Observations | 782,965 | 782,965 | 782,965 | 782,959 | | |

Discussion & Future Directions

A. Mixed results of the air pollution's effects on purchases of different types of comfort foods and for healthy and unhealthy components of the HEI

Greens and beans

-0.0078***

(0.0022)

Total protein foods

(0.0029)

Refined grains

0.0074

(0.0051)

0.0014

(0.0018)

Total Dairy

-0.0128***

(0.0025)

(0.0026)

PM2.5

- * Both mechanisms hold simultaneously? Or one is dominated by another for different individuals and for different air quality?
- Heterogeneous responses to air pollution among demographic subgroups
- * The same person may hold one mechanism for mild levels of air pollution, but switch to another when air pollution is severe
- * When the air quality was bad in the near past, the effect of air pollution may be mitigated by an adaption behavior
- B. Small effects of air pollution on comfort food sales and overall healthfulness of food purchases
 - * The effect in more polluted states might be offset by the effect in less polluted states?
 - * Repeat random sampling procedure:
 - 1 Draw another 5% sample from the more polluted states in the U.S. (e.g., CA, AZ, TX)
 - 2 Draw another 5% sample that contains grocery stores only
- C. Stock up foods in advance for future consumption if knowing bad air quality in the next couple of days or weeks?
 - * Include more non-perishable goods such as peanut butter, canned beans, dry pasta, etc.
 - Incorporate air pollution levels on a week leading up to and following the current-week air pollution levels

Disclaimer: This research is supported by the USDA National Institute of Food and Agriculture and Hatch Appropriations under Project #PEN04709 and Accession #1019915. The views expressed in this poster are those of the authors and should not be attributed to those of the USDA or IRI