

Agricultural Fires and Cognitive Function: Evidence from Crop Production Cycles

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INTRODUCTION

In many countries, controlled burning continues to be a popular choice among farmers in many parts of the world to rapidly eliminate agricultural waste from the previous harvest and to clear the land for the next planting season. Because agricultural burning usually occurs across a large area, it can generate substantial greenhouse gas emissions and contribute to seasonal air pollution. Pollutants emitted from agricultural burning, such as very small particulates and polycyclic aromatic hydrocarbons can lead to severe respiratory illnesses and are carcinogenic (Chen et al. 2017). Understanding the impact of air pollution from agricultural fires on public health is vital to designing agricultural and environmental policy to enhance sustainable agricultural practices and improve public health.

OBJECTIVE

- Quantify the impacts of air pollution from agricultural straw burning on the cognitive function of adjacent populations in China.

METHOD

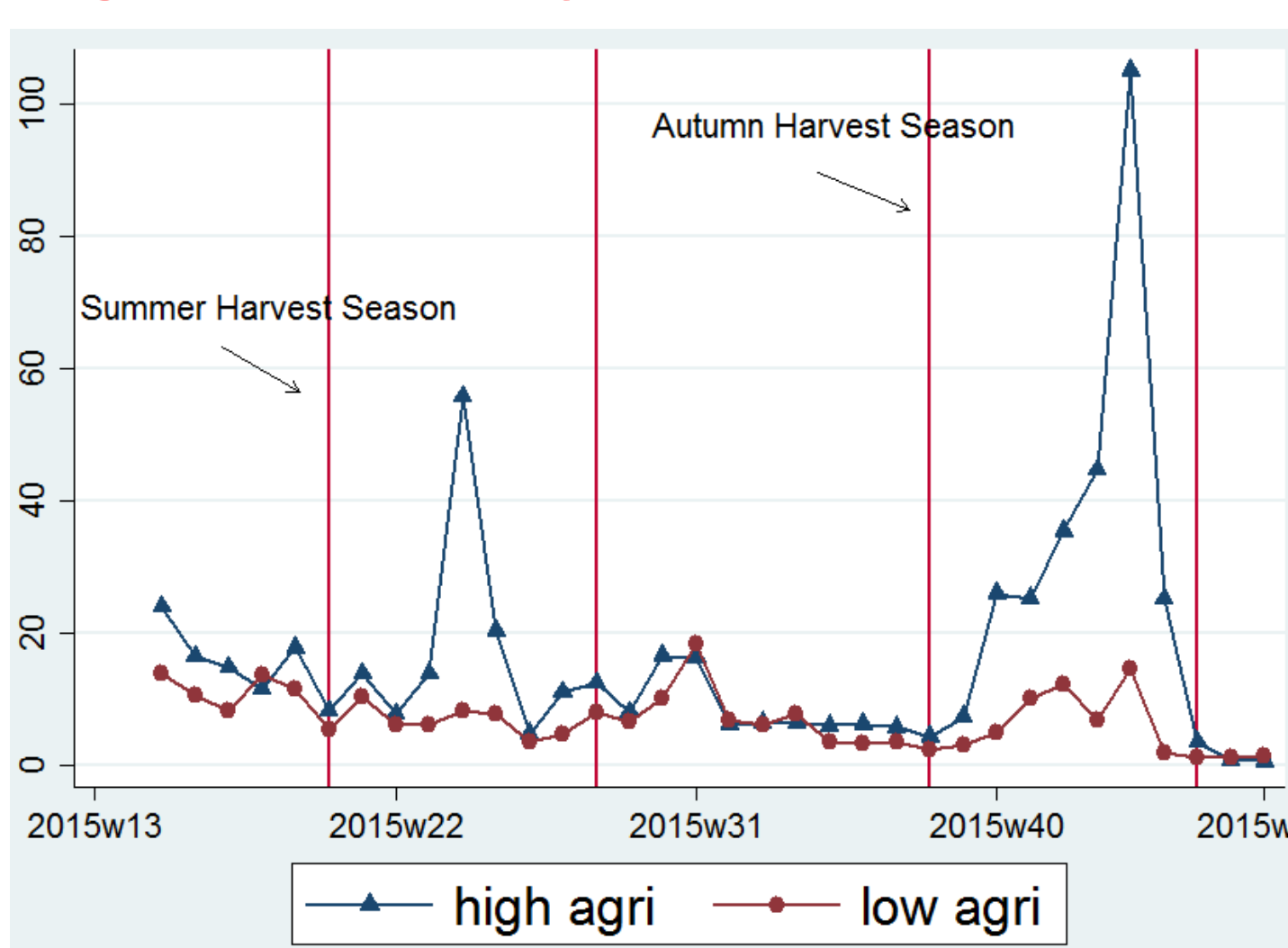
- Difference-in-differences model (high and low frequencies of fire points; in and out of autumn harvest periods)
- Individual fixed effects

DATA

- China Health and Nutrition Survey (1997-2006)
- NASA fire points (2000-2016)

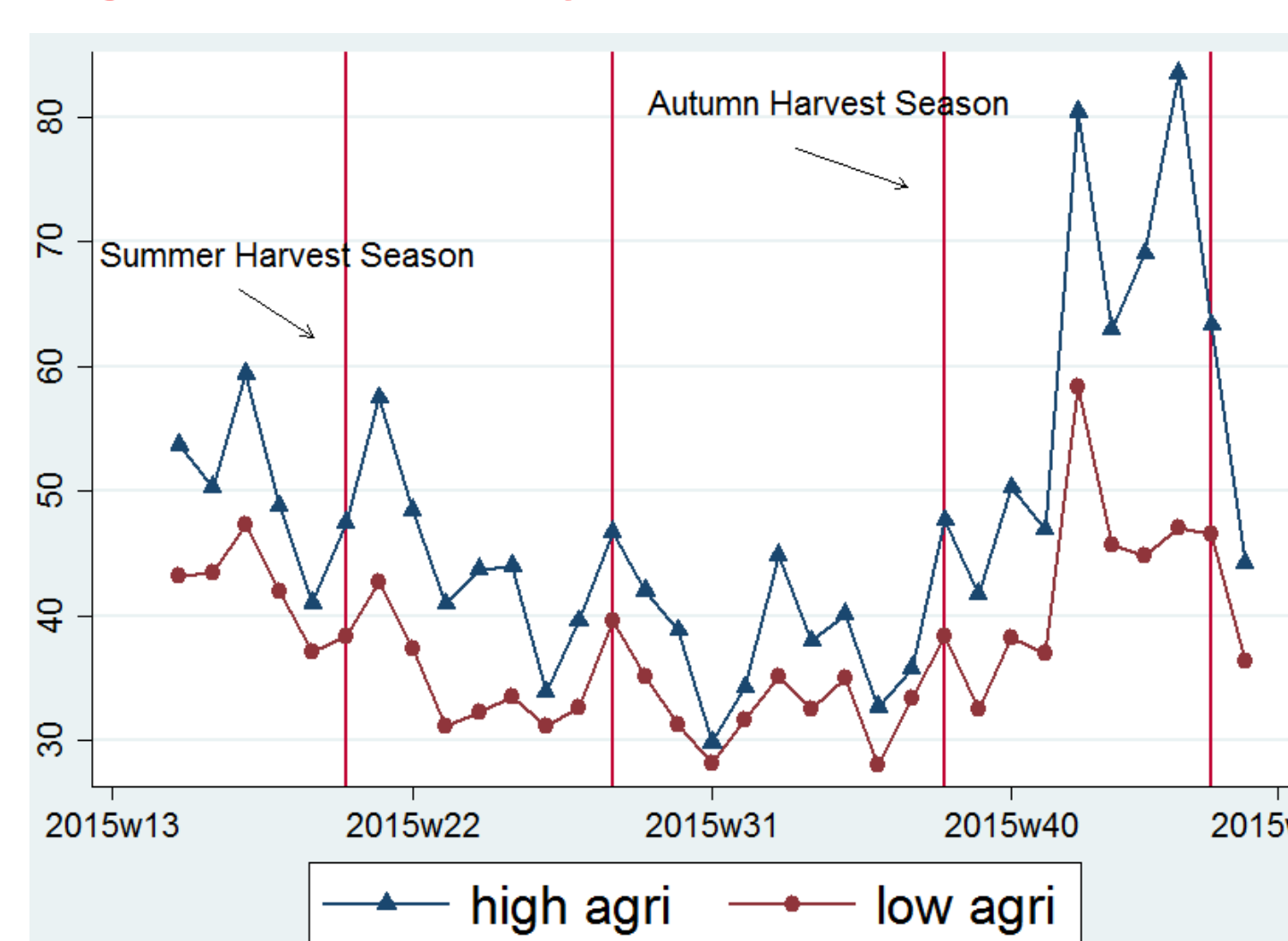
EMPIRICAL RESULTS

Figure 1. Weekly Fire Points in 2015



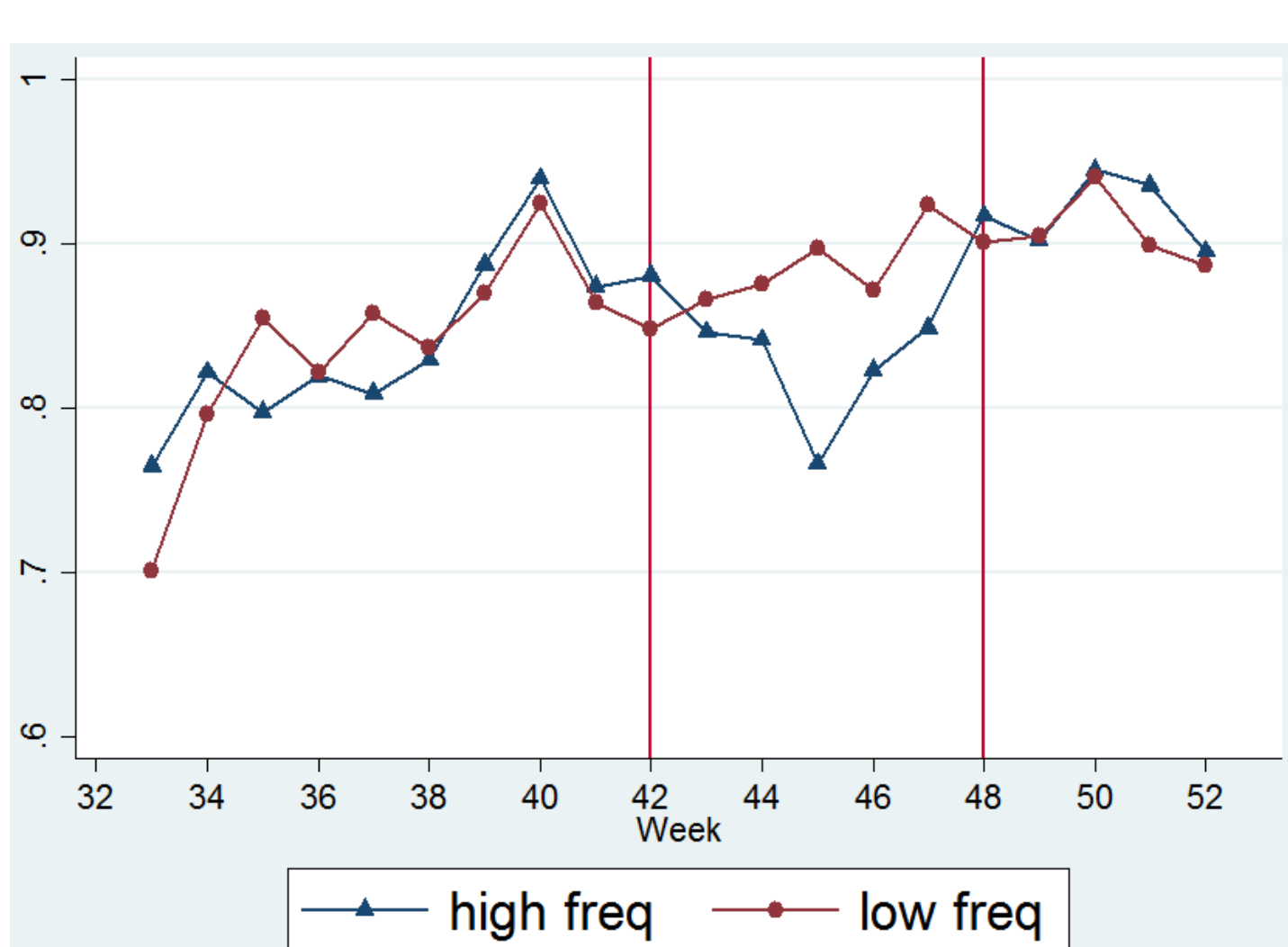
Notes: "high agri" and "low agri" are defined as areas where crop production is higher and lower than the average

Figure 2. Weekly PM2.5 in 2015



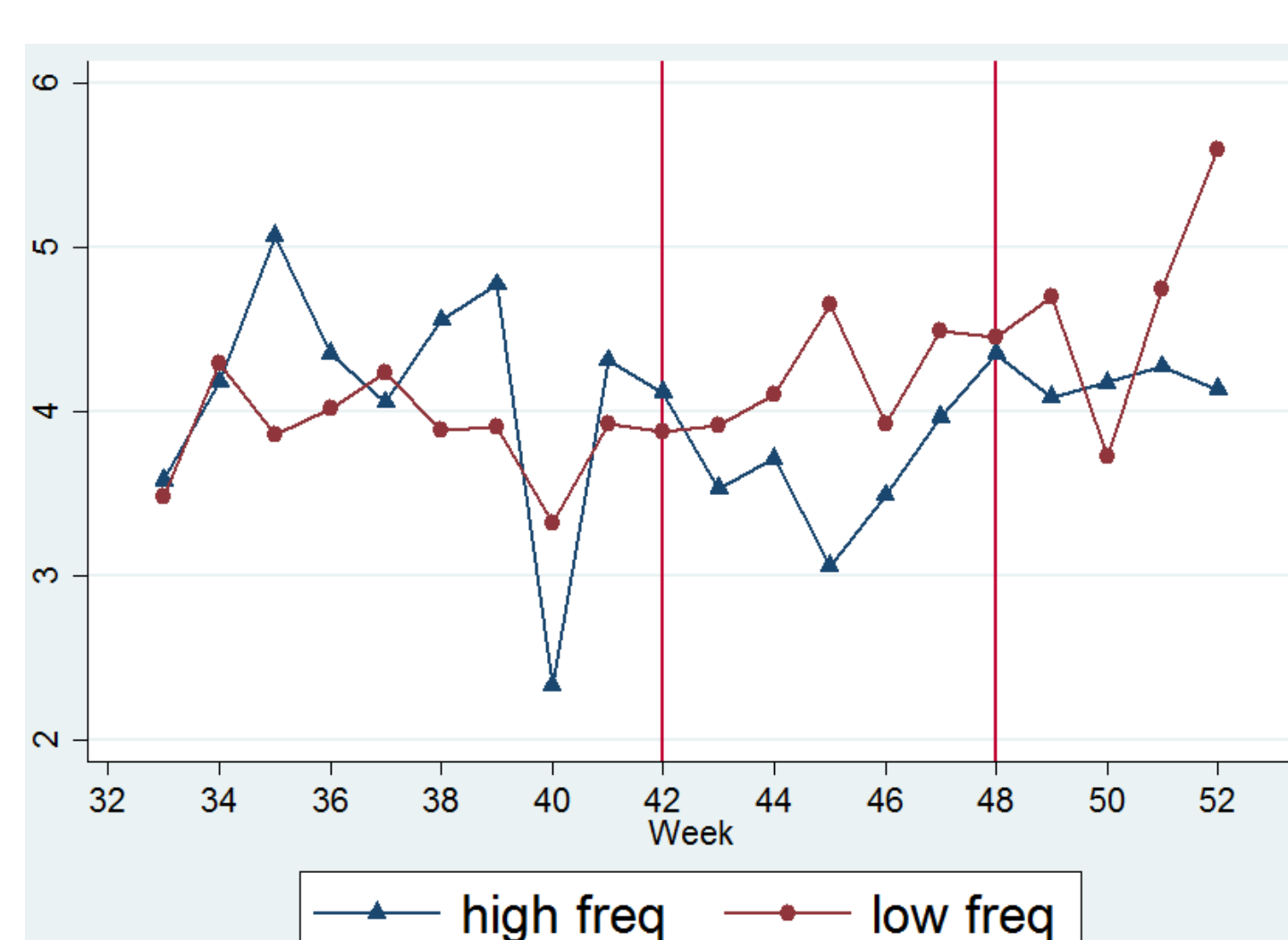
Notes: severe air pollution in counties with more straw burning during the autumn harvest season

Figure 3. Weekly Fire Points in 2015



Notes: "high freq" and "low freq" are defined as areas where the number of fire points is higher and lower than the average

Figure 4. Weekly PM2.5 in 2015

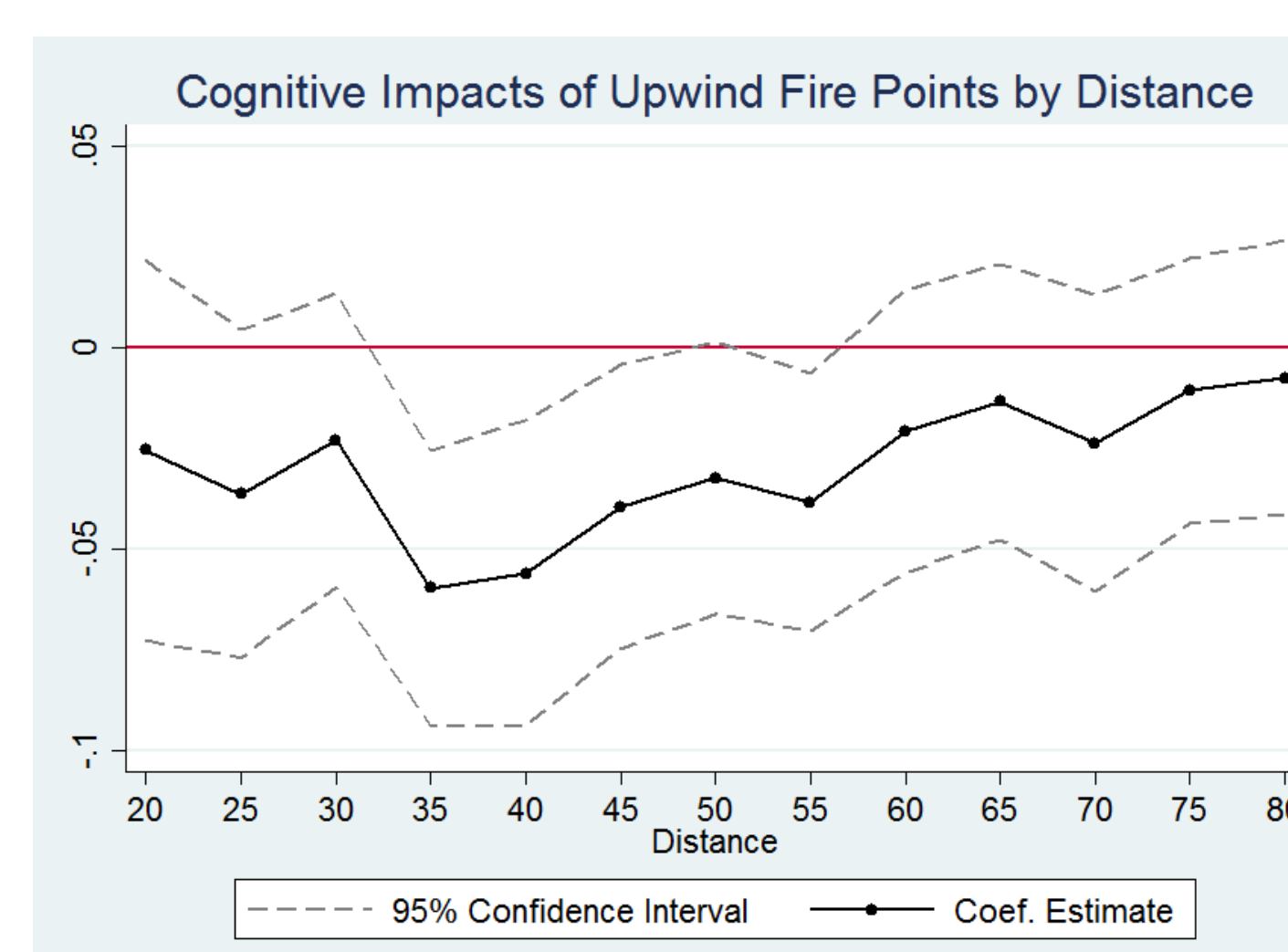


Notes: worse cognitive test scores in counties with more straw burning during the autumn harvest season

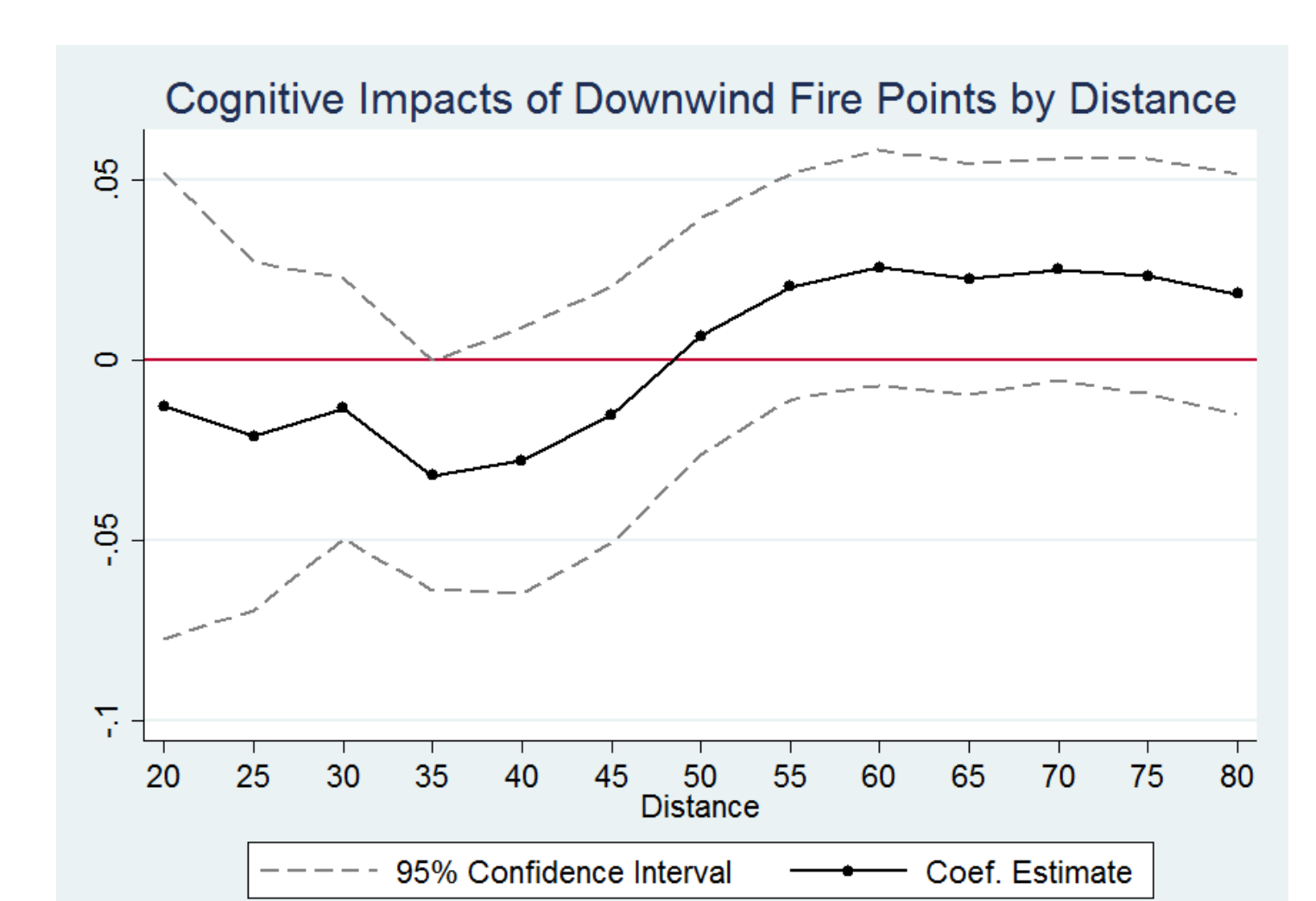
Table 1. The Impact of Straw Fire on Cognitive Function

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Cognition		Immediate Recall		Delayed Recall	
Fire × Harvest	-0.045** (0.010)	-0.044** (0.024)	-0.310 (0.105)	-0.281 (0.147)	-0.528*** (0.007)	-0.474** (0.021)
Observations	10,619	10,448	9,946	9,803	9,865	9,724
Control variables	No	Yes	No	Yes	Yes	Yes
Year and Week FE	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes

Cognitive Impacts of Upwind (Left) and Downwind (Right) Fire Points by Distance



Notes: This figure reports the cognitive impact of agricultural fire from surrounding counties in upwind directions within different distances



Notes: This figure reports the cognitive impact of agricultural fire from surrounding counties in downwind directions within different distances

CONCLUSIONS

Respondents (aged 55 and above) in counties with high frequencies of fire points have scores that are 0.044 lower (-5.1%) in a general cognition test, and recall 0.474 fewer objects (-11.8%) in the delayed memory test. The results are largely driven by the cohort aged 65.

We find significantly negative impacts of fire points on respondents living in downwind counties but not upwind counties. We also find that the impacts of agricultural fires are smaller when the fire points are from upwind counties that are farther away.

CONTRIBUTIONS

- Short-term air pollution exposure
- Cognitive function in developing countries
- Air pollution from agricultural production
- Aging population
- Climate change, wildfire and health

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