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ENGAGING THE WORLD

Light whose fire?

The Gendered Impacts of Pollution on Labor Supply

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INTRODUCTION

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Introduction

- The impacts of air pollution have been studied across a multitude of disciplines;
- The precise quantitative impacts of air pollution have been subjected to much scrutiny;
- Air pollution also impacts each gender differently;
- Wildfires used as a source of exogenous variation in air pollution in this study.

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Introduction

- Female labor supply:
  I. Killingsworth and Heckman (1986); increase in female labor participation but secular decrease in hours worked. Inconsistency in literature over female labour wage elasticities
- Air Pollution Effects on Health:
  I. Deryugina et al.(2016); PM 2.5 pollution increases mortality, healthcare expenditure, and hospitalization.
  II. Peel et al.(2005), Spektor et al. (1991); Through deterioration in respiratory functions
  III. Chen et al. (2017); Also affects cognitive performance

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Introduction

- Air Pollution Effects on Labor Supply:
  I. Isen et al. (2016); Higher in-utero exposure can lower participation at 30 years old
  II. Hanna et al.(2015), Graf, Zivin and Neidell (2012); Lower SO2 levels increase labor force participation
  III. Montt (2018); There are gendered impacts of air pollution
  IV. Aragón et al.(2017); Effects greater for families with dependables
  V. Borgschulte et al.(2017) [in-progress]; Uses smoke plumes to identify the impact of pollution on mortality and labor force participation

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Introduction (continued)

- Biological Channels- Greater sensitivity to air pollution (Butter,2006)
- Social Channels- Greater duty of care for dependents

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DATA AND METHODOLOGY

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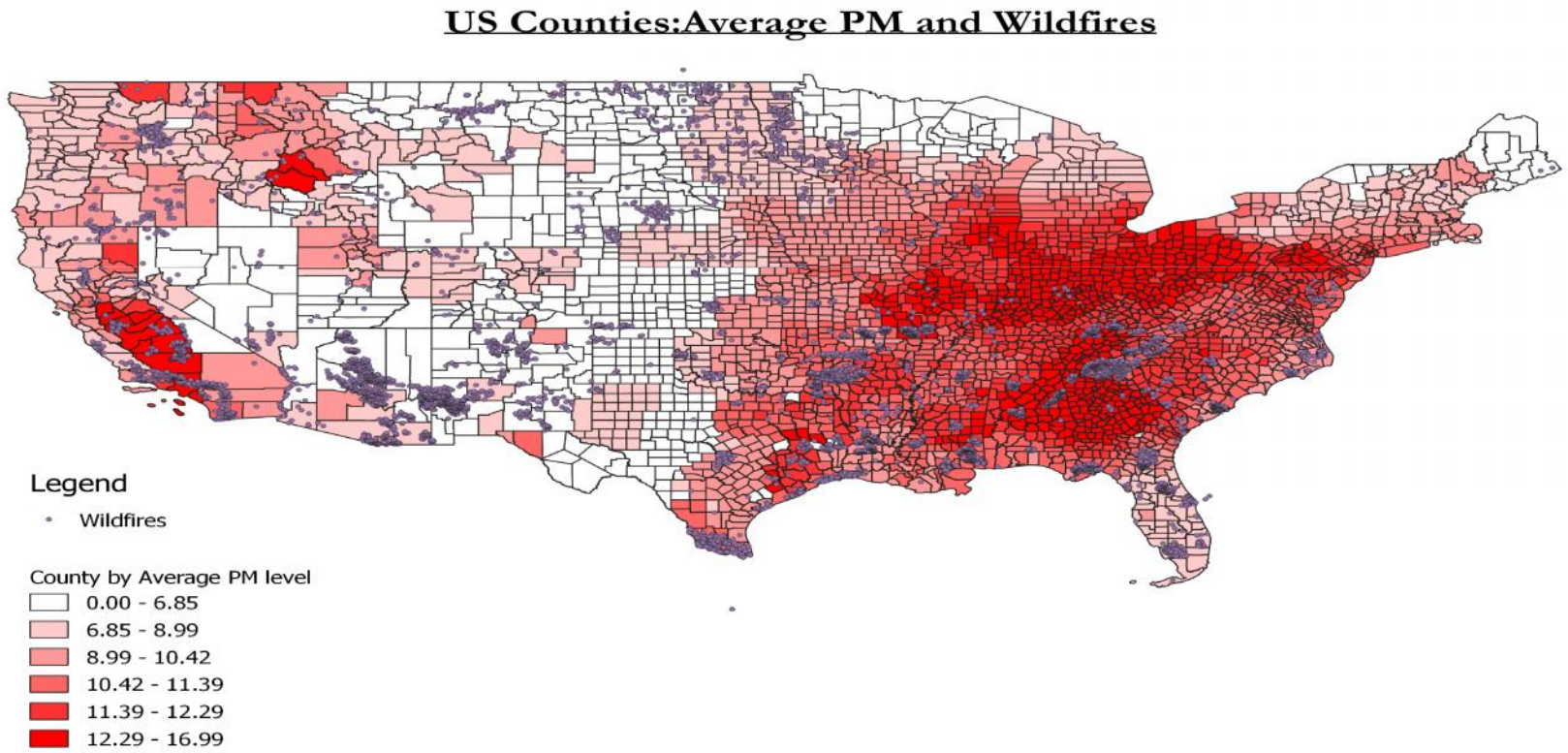
Data and Methodology



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Data and Methodology

$$Pollution_{it} = \alpha_0 + \alpha_1 Z_t + \alpha_2 X_{it} + \theta_i + \lambda_t + u_{it} \quad (1)$$

$$Y_{it} = \beta_0 + \beta_1 \widehat{Pollution}_{it} + \beta_2 X_{it} + \gamma_i + \delta_t + \epsilon_{it} \quad (2)$$

- Z_t is a vector which contains the county level total acres burnt due to wildfires and total duration of wildfires as well as state-level total acres and duration;
- This is due to the pollutants from wildfires being spread across a state from the point of origin; this increases the strength of our instruments;
- Time and County level fixed effects are used;
- Errors are clustered at State level;
- Identification therefore comes through the use of the instrument.

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Data and Methodology

- Labor Data comes from the US Current Population Survey. The survey asks “How many hours did you work in the last week?” for primary respondent and other household members. Responses are aggregated at a county level for each month;
- Air Pollution Data for SO2 and PM2.5 comes from Environmental Protection Agency monitors. We calculate distance from county centroid to monitor using QGIS and employ inverse distance weighting to get county-level pollution measures for each month;
- Wildfires comes from the Federal Fire Occurrence Dataset which provides spatial data layers compiled from the records of the Bureau of Indian Affairs, Bureau of Land Management, U.S. Fish and Wildfire Service, National Park Service, and the U.S. Forest Service.

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RESULTS AND DISCUSSION

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Table 3 (Household Weighted mean of labor hours with wildfire dummy)

First Stage	Households with children		Households without children	
PM2.5	(1)	(2)	(3)	(4)
Total acres of wildfire	9.71e-06***	9.71e-06***	9.98e-06***	9.98e-06***
	(3.95e-07)	(3.96e-07)	(3.72e-07)	(3.72e-07)
Duration of wildfire	0.00113***	0.00113***	0.00104***	0.00104***
	(0.000390)	(0.000390)	(0.000382)	(0.000382)
Total acres (State average)	-3.27e-05***	-3.27e-05***	-2.56e-05***	-2.56e-05***
	(1.03e-05)	(1.03e-05)	(9.20e-06)	(9.20e-06)
Duration (State average)	-0.0103**	-0.0103**	-0.0111**	-0.0111**
	(0.00499)	(0.00500)	(0.00430)	(0.00430)
Wildfire dummy	0.281	0.281	0.321	0.321
	(0.267)	(0.267)	(0.263)	(0.263)
Temperature	0.00559	0.00560	0.000896	0.000900
	(0.0126)	(0.0126)	(0.0115)	(0.0115)
Unemployment rate	-25.63***	-25.63***	-12.87***	-12.87***
	(4.275)	(4.275)	(3.734)	(3.734)
SO2				
Total acres of wildfire	5.11e-07***	5.11e-07***	6.11e-07***	6.11e-07***
	(1.36e-07)	(1.36e-07)	(1.24e-07)	(1.24e-07)
Duration of wildfire	-6.13e-06	-6.00e-06	-9.30e-05	-9.28e-05
	(0.000141)	(0.000141)	(0.000195)	(0.000195)
Total acres (State average)	8.79e-06*	8.79e-06*	8.25e-06**	8.24e-06**
	(4.57e-06)	(4.57e-06)	(3.91e-06)	(3.91e-06)
Duration (State average)	0.00229	0.00229	0.00280	0.00280
	(0.00238)	(0.00238)	(0.00254)	(0.00254)
Wildfire dummy	0.170**	0.170**	0.190**	0.190**
	(0.0845)	(0.0845)	(0.0901)	(0.0901)
Temperature	-0.0293***	-0.0293***	-0.0285***	-0.0285***
	(0.00713)	(0.00713)	(0.00672)	(0.00672)
Unemployment rate	-19.99***	-19.99***	-11.87***	-11.86***
	(4.482)	(4.482)	(3.435)	(3.434)

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Second Stage				
Labor hours	Female	Male	Female	Male
PM2.5	-0.119*	-0.0638	-0.114**	-0.0264
	(0.0613)	(0.139)	(0.0517)	(0.178)
SO2	-0.317	-0.0316	-0.254	-0.109
	(0.375)	(0.266)	(0.329)	(0.277)
Temperature	-0.00986	0.0155**	-0.00874	0.0119
	(0.0112)	(0.00713)	(0.00952)	(0.00799)
Unemployment rate	-32.06***	-53.05***	-27.81***	-50.46***
	(8.562)	(7.761)	(5.252)	(5.237)
County FE	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes
Observations	37,940	37,939	39,379	39,374
R-squared[1]	-0.074	0.022	-0.044	0.019
Number of counties	341	341	342	342
Kleibergen-Paap rk Wald F statistic	9.762	9.759	12.394	12.374

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Standard errors are robust and clustered for at the state level. The Kleibergen-Paap rk Wald F statistic for all regressions show that the instrument is strong for 10% sample size and larger, but is a weak IV for 5% of the sample size.

[1]The negative R-squared is because the sum of residuals squared are less than the total sum of squares. These residuals do not come from a model that nests a constant-only model of y when using the xtivregress2 of STATA.

Table 4: Effect on Labor hours of both male and female by occupation

	Households with children							
Second Stage	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Occupation Category	administrative	engineering, science or technician related	physical labor intensive	service	administrative	engineering, science or technician related	physical labor intensive	service
	Female Labor hours	Female Labor hours	Female Labor hours	Female Labor hours	Male Labor hours	Male Labor hours	Male Labor hours	Male Labor hours
PM2.5	-0.0326	0.00681	0.417*	-0.246***	-0.212**	0.395	-0.0745	0.175**
	(0.190)	(0.0911)	(0.247)	(0.0699)	(0.104)	(0.256)	(0.149)	(0.0831)
SO2	0.239	-0.376	0.432	-0.942	-0.202	0.351	-0.515	0.0309
	(0.850)	(0.363)	(0.326)	(0.889)	(0.455)	(0.381)	(0.589)	(0.855)
Temperature	0.00673	-0.00481	0.0256	-0.0333	-0.000605	0.0276	-0.0155	0.00550
	(0.0394)	(0.0163)	(0.0499)	(0.0441)	(0.0259)	(0.0219)	(0.0291)	(0.0439)
Unemployment rate	28.58	-31.71**	-0.540	-40.66	-27.81*	-10.93	-42.15*	0.0705
	(33.75)	(12.73)	(30.59)	(28.75)	(14.58)	(17.89)	(22.38)	(22.33)
Income (Average)	0.121	-0.0701	0.0640	-0.0878*	0.0341	0.105**	-0.0102	0.0609
	(0.0778)	(0.0656)	(0.0803)	(0.0500)	(0.0485)	(0.0471)	(0.0493)	(0.0631)
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	18,249	18,001	11,171	18,706	18,377	17,633	17,144	18,679
R-squared	-0.008	-0.017	-0.032	-0.236	-0.049	-0.035	-0.028	-0.027
Number of counties	250	250	243	250	250	250	249	250
Kleibergen-Paap rk Wald F statistic	17.025	29.740	21.072	25.206	16.076	32.368	21.684	19.283

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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Possible Extensions

- Richer set of control variables – weather & traffic congestion, wind data;
- Daily data (possibly available for Canada);
- RD model with wildfires as the exogenous event and analysing years before and after.

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THANK YOU!

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