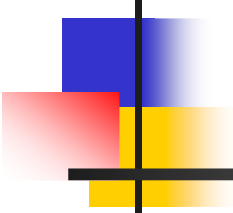


The case for keeping Ontario's coal-fired power plants



Ross McKittrick, Ph.D.
Associate Professor of Economics
University of Guelph

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Outline

1. Current Toronto air quality
2. Does CBA really support closure?
3. Impacts of Lambton & Nanticoke on Ontario air & health
4. Economic impacts of closure
5. Conclusions



Digression

- Thunder Bay and Atikokan
 - Essential to regional economy
 - No effect on Southern Ontario air
 - No rationale for their closure



1. Toronto Air Pollution Trends

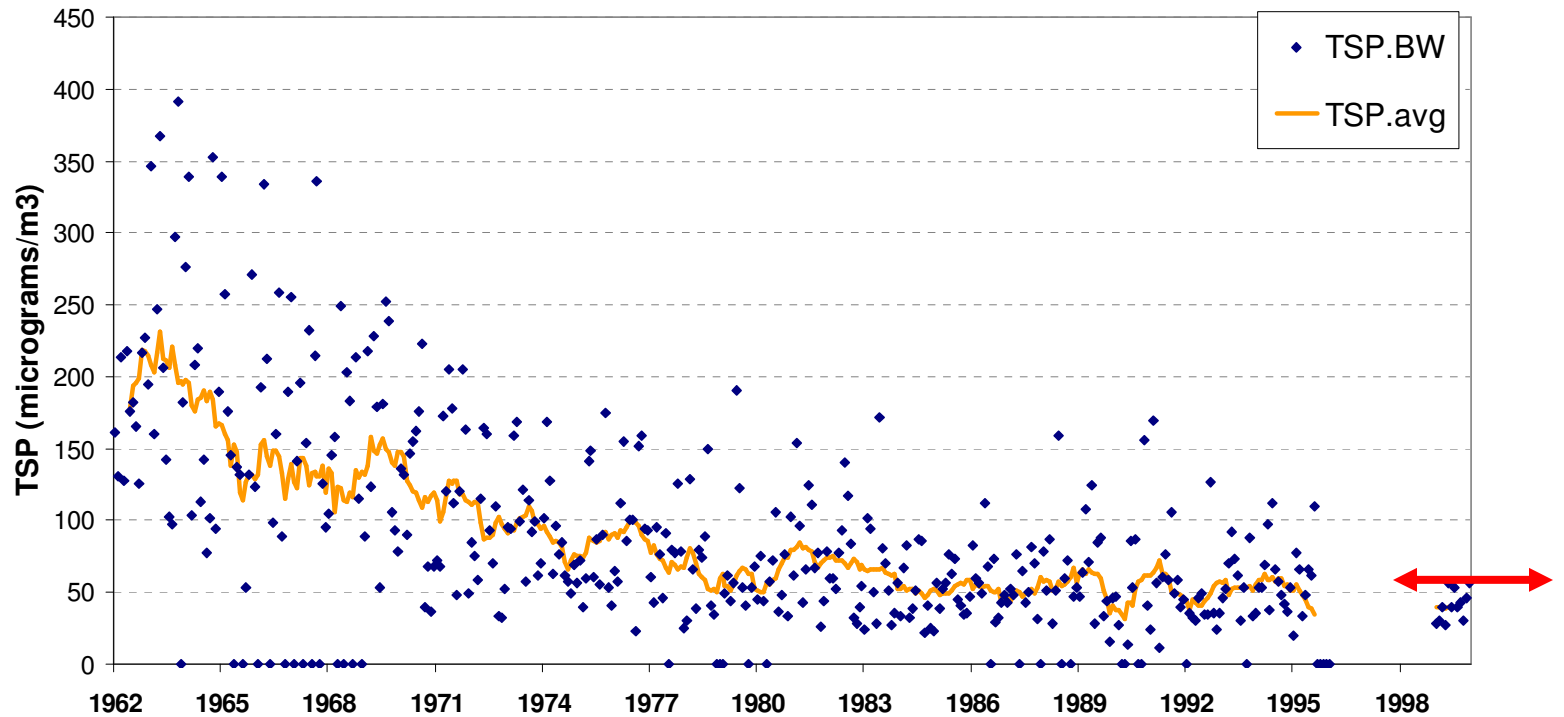
- Notes:

- Data from NAPS stations at
 - Bay & Wellesley (BW)
 - Queensway & Hurontario (QH)
 - Lawrence and Kennedy (LK)
- Monthly averages + 12-month MA
- Pre-1974 data from Ontario MOE
- NAAQS Lowest Desirable Standard



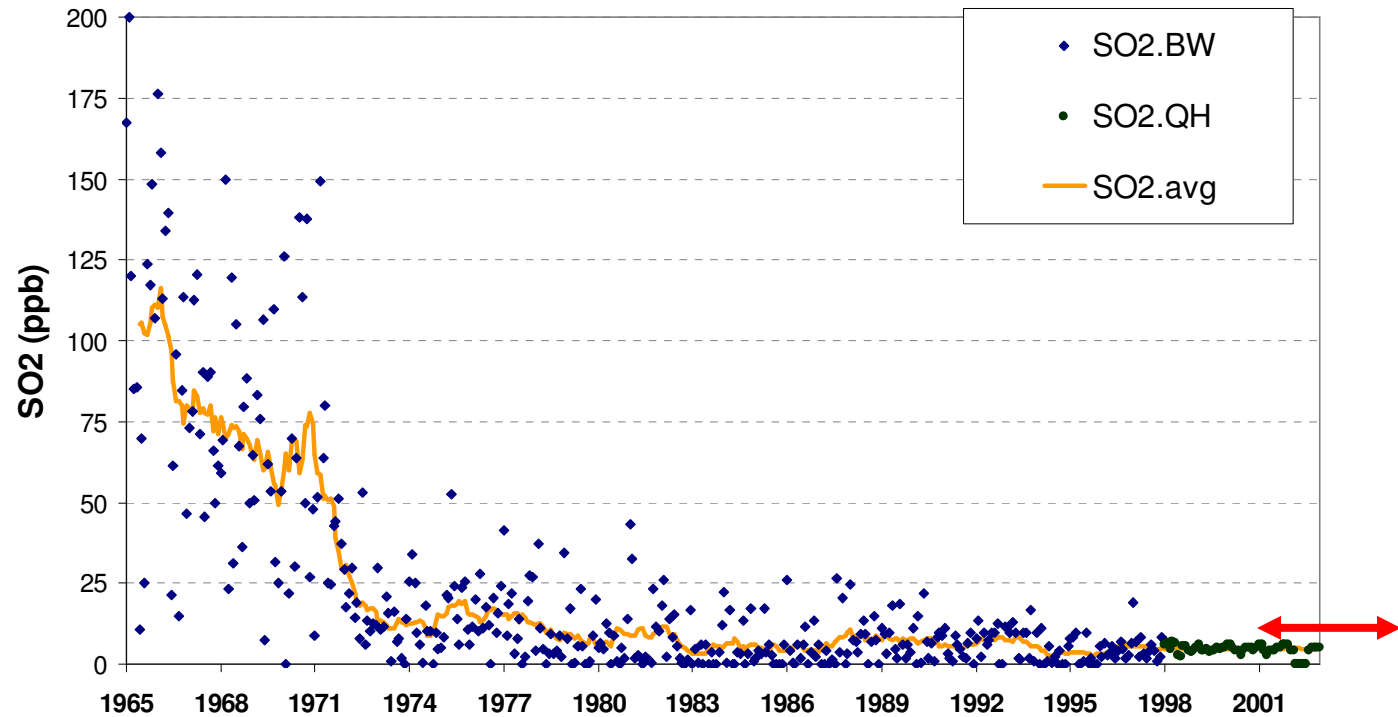
1. Toronto Air Pollution Trends

Toronto (Downtown) TSP levels (Micrograms/m3)

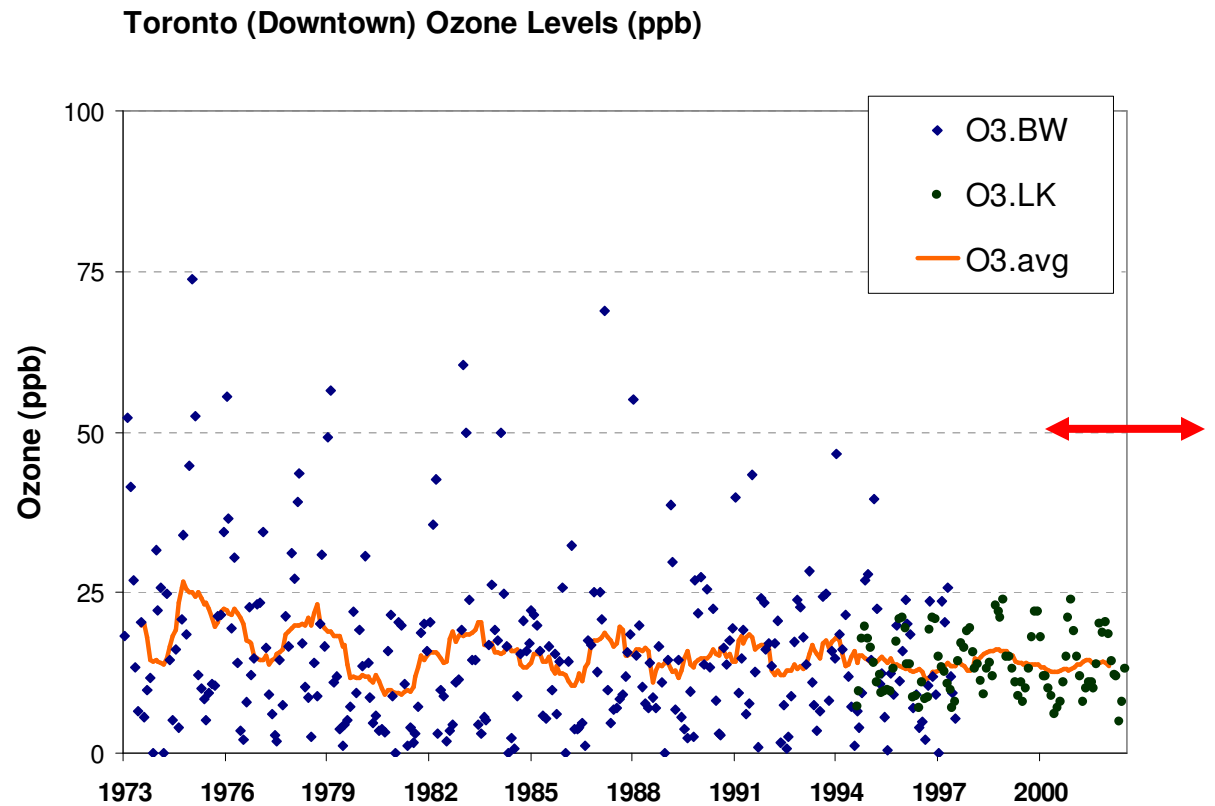


1. Toronto Air Pollution Trends

Toronto (Downtown) Sulphur Dioxide Levels

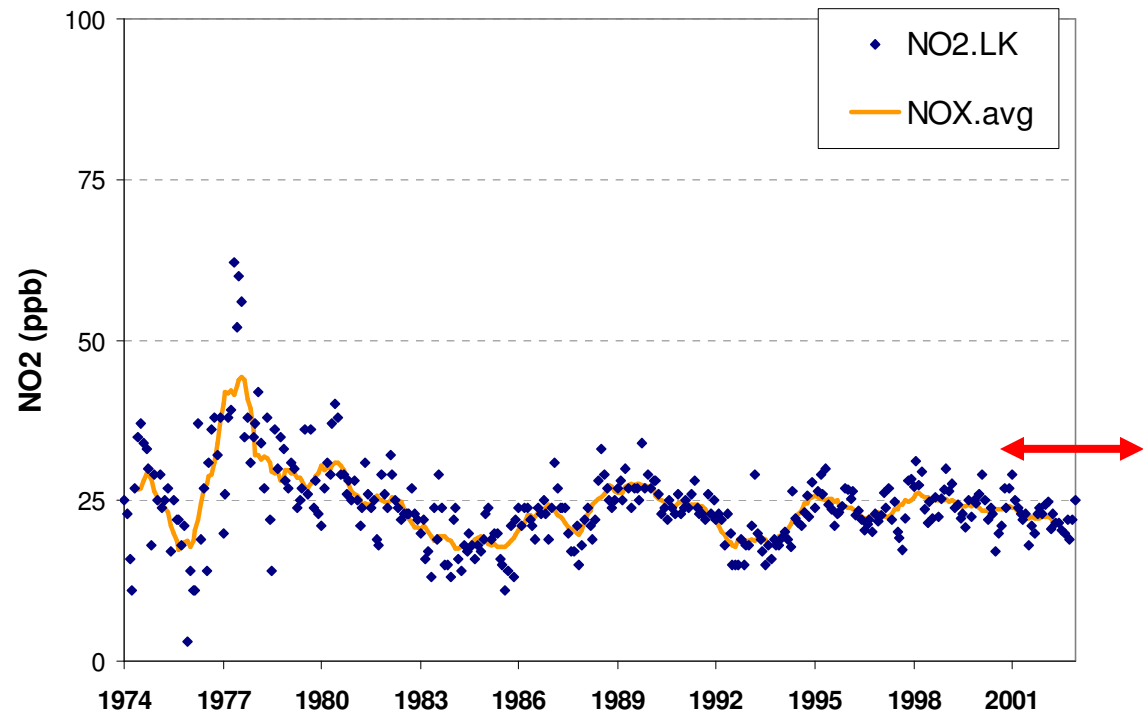


1. Toronto Air Pollution Trends



1. Toronto Air Pollution Trends

Toronto (Downtown) NO2 levels (ppb)



1. Toronto Air Pollution Trends

- More smog than ever? No, just more warnings
 - AQI developed in early 1990s
 - AQI = maximum of 6 (scaled) contaminant readings
 - Smog advisories only began in 1993
 - System revised in August 2002 to include PM_{2.5}, including sulfate aerosol
 - Had today's system been in place in 1960s and 1970s, smog advisories would have been common all year; today's would seem infrequent by comparison



2. Does CBA really support closure?

- Ontario 2005 CBA on closing the coal plants

Annualized Costs (\$2004 Millions)

	S1	S2	S3	S4
Financial Costs	\$985	\$2,076	\$1,529	\$1,367
Health Damages	\$3,020	\$388	\$365	\$1,079
Environmental Damages	\$371	\$141	\$48	\$356
TOTAL COST	\$4,377	\$2,605	\$1,942	\$2,802

DSS05

- 4 Scenarios (S1=Base Case) (S2=All Gas) (S3=Nuclear/Gas) (S4=Retrofit)
- On financial basis, coal wins (S1, S4)
- Only by adding in giant health effects do S1, S4 drop to bottom

Current Generator Characteristics

Generating Plant	Unit	Emission Controls	Output (TWh/yr)
Lambton	1	LNB, ESP	1
	2	LNB, ESP	1
	3*	LNB, ESP, FGD, SCR	3.25
	4*	LNB, ESP, FGD, SCR	3.25
Nanticoke	1	LNB, ESP	1.925
	2	LNB, ESP	1.925
	3	LNB, ESP	1.925
	4	LNB, ESP	1.925
	5	LNB, OFA, ESP	2.45
	6	LNB, OFA, ESP	2.45
	7*	LNB, SCR, ESP	2.75
	8*	LNB, SCR, ESP	2.75

3. Impacts of Lambton & Nanticoke on Ontario Air

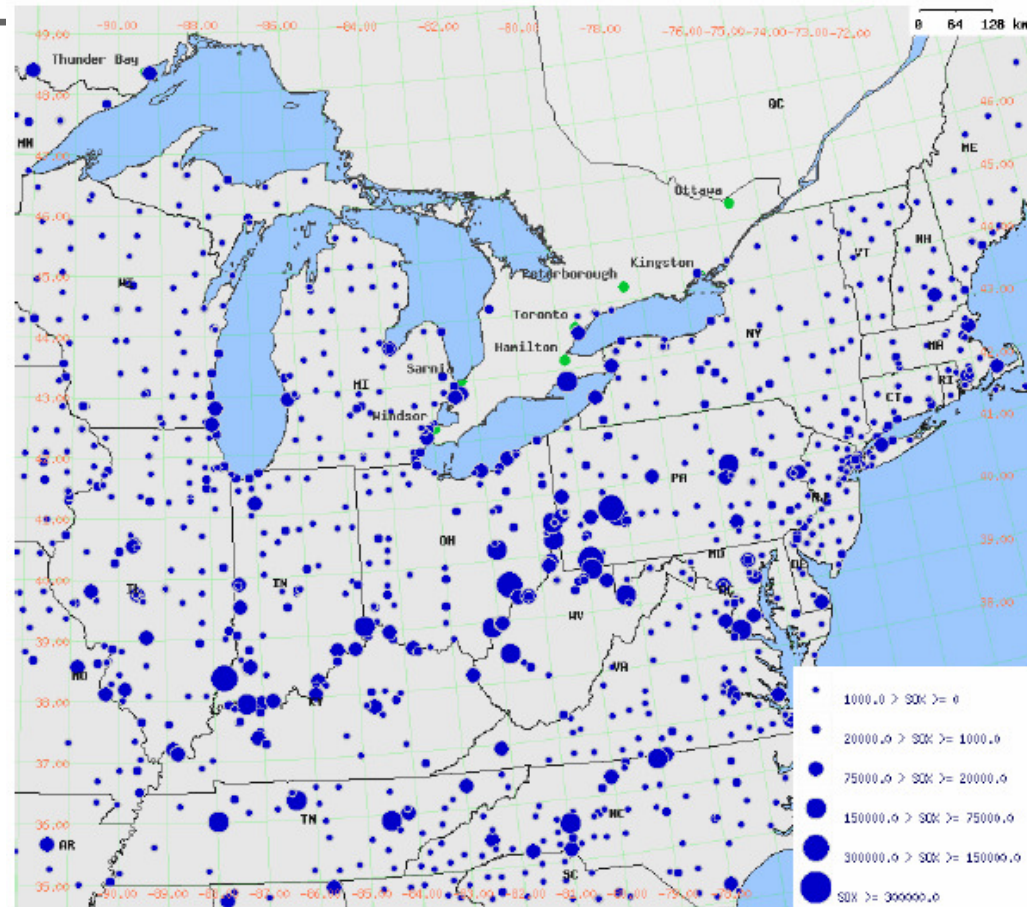


Figure A-4: Sulphur dioxide emissions from power plants shown as dots that vary in size according to their emission inventories
U.S. 1995 (with 2001 updates) and Canada 1999 Emission Inventories
(source: Ontario Ministry of the Environment)

3. Impacts of Lambton & Nanticoke on Ontario Air

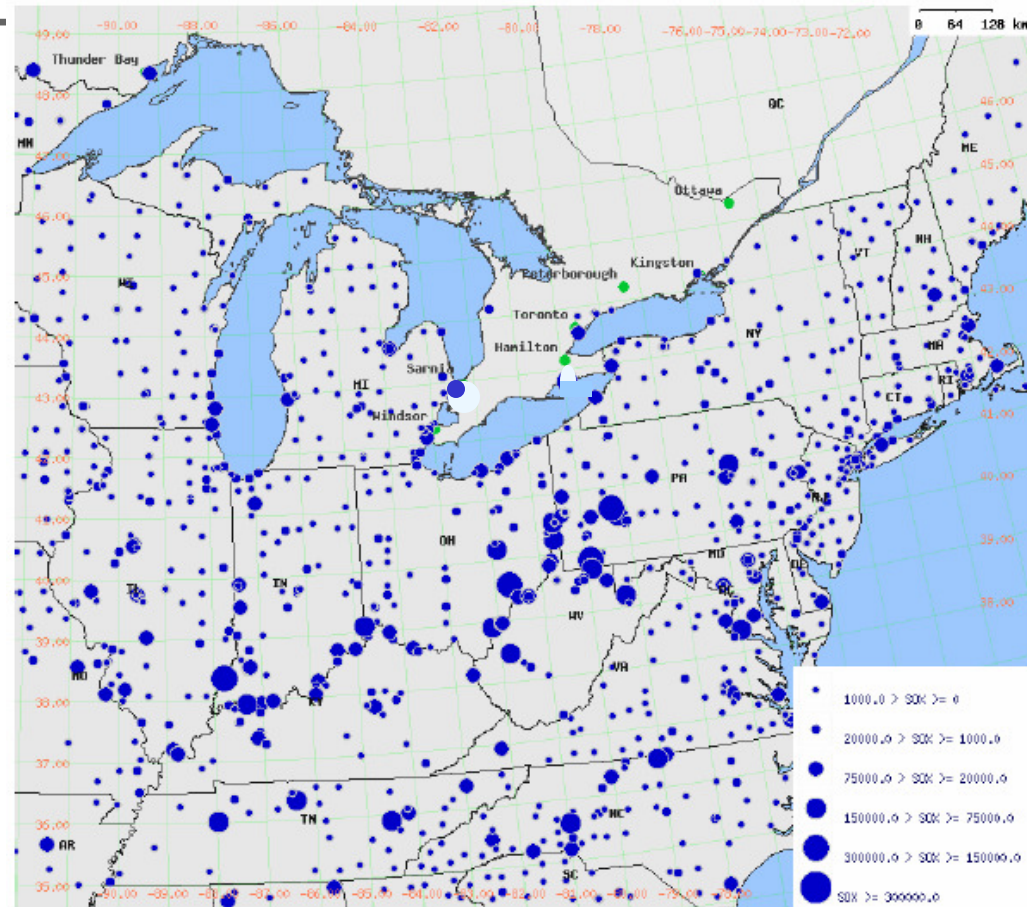


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3. Impacts of Lambton & Nanticoke on Ontario Air

- DSS/RWDI Reports (2003, 2005)
- Total contributions to O3, PM10:
 - < 1% of ozone
 - < 5% of PM10
 - Emission controls achieve ~75% of what closure would yield

REGION		Base Case				Emission Controls			
		Ozone		PM10		Ozone		PM10	
		DSS05	DSS03	DSS05	DSS03	DSS05	DSS03	DSS05	DSS03
Ottawa-Carleton RM	Approximate % Contributions from OPG	0.0%	0.0%	1.6%	1.6%	0.0%	0.0%	0.4%	0.3%
Durham RM		0.2%	0.4%	2.9%	2.8%	0.1%	0.1%	0.7%	0.6%
York RM		0.1%	0.2%	3.1%	3.1%	0.1%	0.0%	0.8%	0.6%
Toronto MM		0.2%	0.4%	3.2%	3.2%	0.1%	0.1%	0.9%	0.7%
Peel RM		0.1%	0.2%	2.9%	3.1%	0.0%	0.0%	0.8%	0.6%
Hamilton-Wentworth RM		0.3%	0.6%	4.7%	5.0%	0.1%	0.1%	1.3%	1.0%
Haldimand-Norfolk RM		9.9%	14.7%	11.2%	9.0%	5.2%	2.6%	3.5%	2.4%
Waterloo RM		0.1%	0.1%	3.3%	3.8%	0.0%	0.0%	0.9%	0.7%
Lambton County		2.2%	4.5%	4.8%	7.3%	1.4%	0.7%	2.0%	1.3%



3. Impacts of Lambton & Nanticoke on Ontario Health

- Three types of studies
 - Clinical
 - Model Selection
 - Model Averaging



3. Impacts of Lambton & Nanticoke on Ontario Health

- CLINICAL STUDIES
- **No support for health effects from PM at current ambient levels**
 - ...no form of ambient PM—other than viruses, bacteria, and biochemical antigens—has been shown, experimentally or clinically, to cause disease or death at concentrations remotely close to U.S. ambient levels. ...hundreds of researchers, in the U.S. and elsewhere, have for years been experimenting with various forms of pollution-derived PM, and none has found clear evidence of significant disease or death at relevant airborne concentrations.
 - GREEN AND ARMSTRONG (*Reg. Tox. Pharm.* 2003)
 - Overall, the clinical data does not lend much support to the observations seen in the epidemiology studies, particularly to the observations that high ambient particulate concentrations are associated with mortality within hours or a few days at most.
 - HEALTH CANADA (1997)
 - For the most part, people will not notice or suffer from any serious or lasting ill effects from levels of pollution that are commonly experienced in the UK, even when levels are described as 'high' or 'very high' according to the current criteria...Perhaps surprisingly, long term exposure to air pollution is unlikely to be a cause of the increased number of people now suffering from asthma in the UK.
 - COMEAP, UK (2000)



3. Impacts of Lambton & Nanticoke on Ontario Health

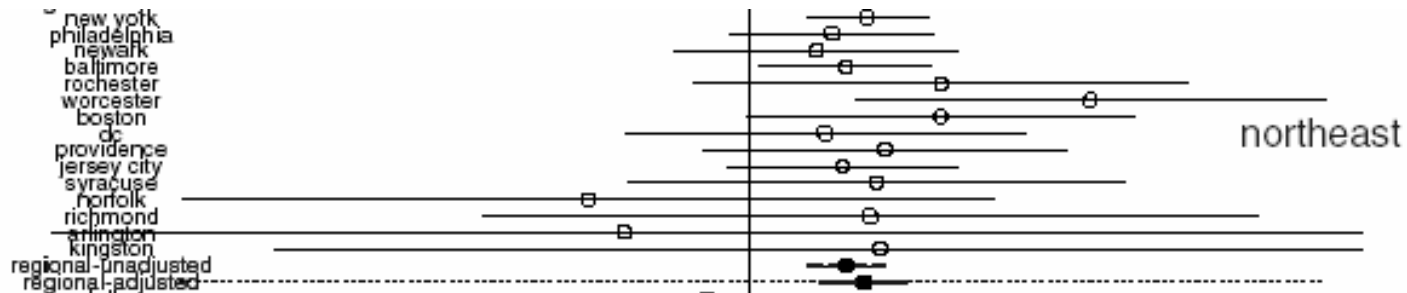
MODEL SELECTION (EPIDEMIOLOGY)

- Based on partial correlations between pollution and health measure, sometimes without controls for weather, economic factors etc.
- Generally small and inconsistent results, e.g. Domenici et al. *JASA* (2002)
 - 88 US cities
 - In 20 of 88, PM reduces mortality
- Recent reanalyses of Birmingham data have overturned previous findings of Schwartz

3. Impacts of Lambton & Nanticoke on Ontario Health

MODEL SELECTION (EPIDEMIOLOGY)

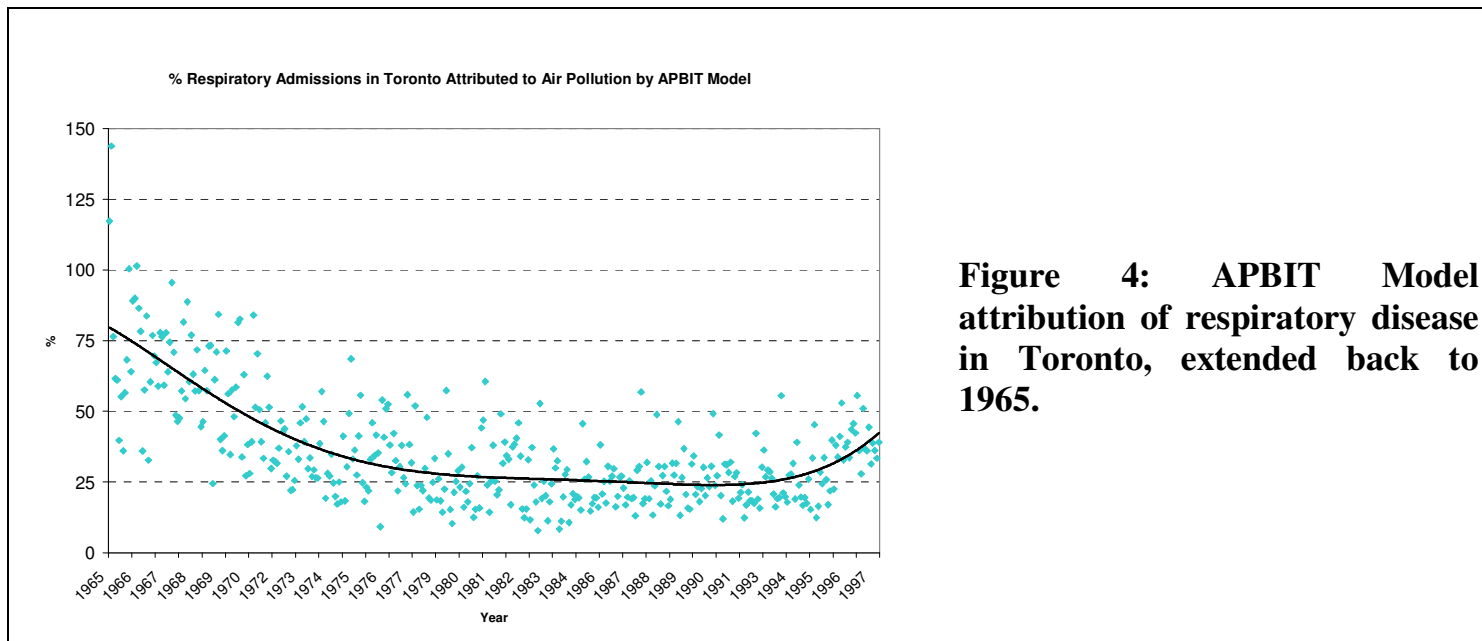
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- Recent reanalyses of Birmingham data have overturned previous findings of Schwartz

3. Impacts of Lambton & Nanticoke on Ontario Health

- Perils of relying on selected correlations coefficients





3. Impacts of Lambton & Nanticoke on Ontario Health

MODEL AVERAGING

- Resolves problem of sensitivity of results to model selection by searching over all possible models
- Clyde (2000), Clyde and DeSimone-Sasinowska (1997); Koop and Tole (2004); Koop, McKittrick and Tole (2007)
- Results have uniformly shown epidemiological results do not hold up when model uncertainty considered
- E.g. Koop and Tole (2004) find zero effect of ozone levels on mortality after controlling for weather

3. Impacts of Lambton & Nanticoke on Ontario Health

MODEL AVERAGING

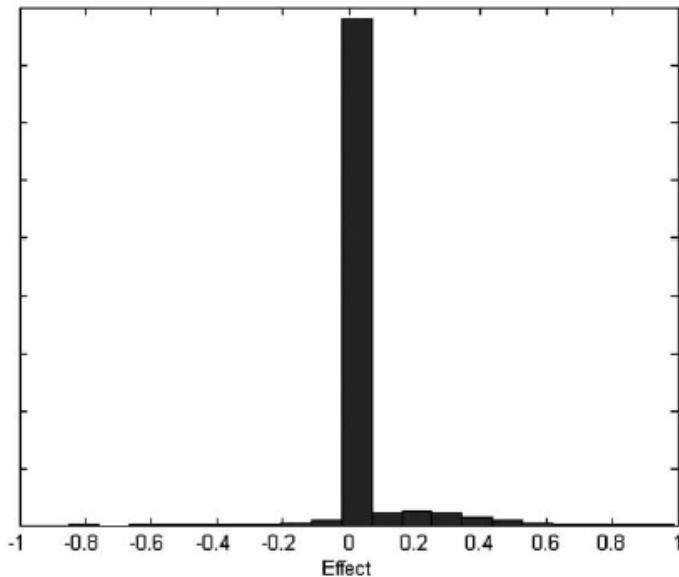


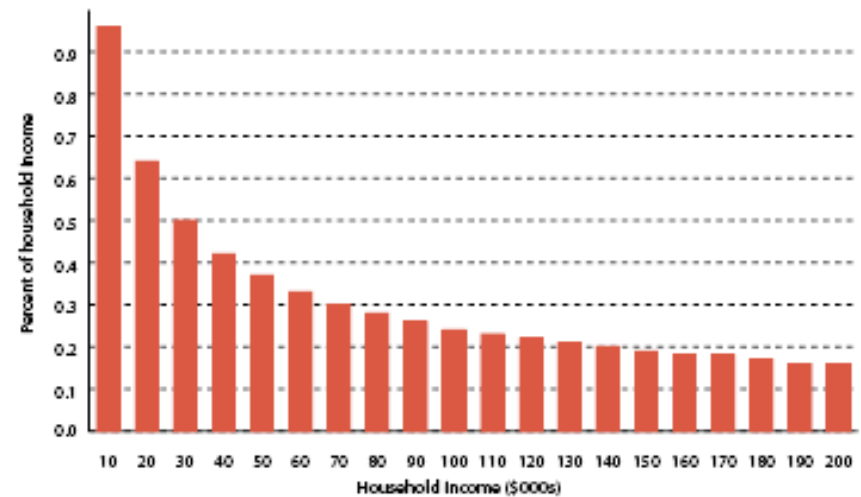
Fig. 1. Posterior of cumulative effect of O₃.

- Koop and Tole, *JEEM* (2004)
- Toronto Data on ozone and mortality

4. Economic Impacts of Closure

- Regressive cost distribution

Figure 3: Distribution of cost burden (% of household income) that will result from removing coal-fired plants from the electricity grid





4. Economic Impacts of Closure

GROWTH EFFECTS

- Growth and Electricity consumption
 - What causes what?
- If growth drives E-consumption then conservation can be done without stalling economy
- If E-consumption drives growth then conservation may stall economy
- Data:
 - Both cause each other (Ghali and El-Sakka, *En. Econ.* 2004)



Conclusion

- Air pollution effects on Ontario health have likely been overstated
- Even if it has an effect, air pollution today has fallen since 60s and 70s and generally meets NAAQO's
- Even if we want to go lower, shutting coal plants has minuscule effect; almost same as retrofitting
- But closing coal plants puts electricity supply at risk, may slow economic growth and leads to regressive cost increases
- Lambton and Nanticoke are a net benefit to Ontario and should keep running.