# The Politics of Pollution:
# Party Regimes and Air Quality in Canada

## Ross McKitrick*

Department of Economics
University of Guelph
Guelph Ontario N1G 2W1
rmckitri@uoguelph.ca
(519) 824-4120 x52532

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## ABSTRACT

Environmental concerns often figure prominently in opinion polls. But do election outcomes actually affect the environment? I test the influence of the party in power on urban air pollution in 13 Canadian cities. The government's political stripe is not reliably associated with positive or negative effects on air pollution. Provincial parties on both the right and the left are associated with elevated levels of some air contaminants. Federal effects also go in contrasting directions. Overall it appears a change in government is unlikely to be a reliable predictor of changes in air pollution.

Key words: Air pollution, political parties, elections, environmental policy.

JEL Codes: Q51, Q58, D78

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## 1. Introduction

The mechanisms by which democratic societies implement environmental protection have attracted considerable attention in recent years. A common assumption is that major parties have identifiably different attitudes towards the environment and voters cast their ballots based in part on these differences. Much political commentary[1] equates conservative, or right-wing, parties with indifference or hostility to environmental protection, while liberal, or left-wing, parties are assumed to be more keenly protective of the environment. Some scholarly treatments have linked the environmental stance of political groups to their ideological preferences for free markets over state intervention, and other classic dividing lines in the liberal political tradition (McKenzie 2002, Henderson 1998). Either way these hypotheses create an expectation that there should be an observable connection between the type of political party in office and the current state of the environment. If environmental concern manifests as voter preference for a political party, and if the government of the day actually influences pollution levels, one would expect to find some relationship between that party's tenure in office and major indicators of environmental quality.

I test this hypothesis using data on five major air contaminant levels in thirteen Canadian cities over the interval 1974 to 1996. I focus on air pollution for three reasons. First, it is possible to obtain sufficient amounts of good quality, nation-wide, long-term data series to support the analysis. Second, key aspects of air quality are immediately perceived by the general population without the need for specialized scientific measurement. Third, there are longstanding policy mechanisms in place that allow policymakers to intervene to influence air pollution levels, so if

voters send a signal concerning air quality there is some chance it can be acted upon within a short time frame.

The results indicate that while there are signs of significant relationships between political parties and pollution levels, it is not simple enough to conclude that, for example, election of a Conservative government predicts worsening air quality, or that election of an NDP government predicts improving air quality. At the provincial level, both right- and left-wing governing party identifiers are associated with relatively higher levels of some pollutants (compared to the Liberal reference group). At the federal level the Progressive Conservative party was associated with a significant improvement in one air contaminant but a significant worsening of another. The notion that parties on the left are inherently "green" while those on the right are "grey" may be more caricature than reality, at least as regards air pollution.

Overall, to the extent that Canadians want to vote for environmental protection, this study suggests it is not obvious how to do so since the name of the party in power is not a reliable predictor of subsequent changes in air quality. These findings echo some US evidence that while the state of the environment is a matter of public concern, it does not tie in to party preferences in an election. Carter (2001) presents US survey evidence showing the environment is one of the top five current issues, yet only five percent of US voters regard the environment as decisively important for them in national elections. Fischel (1979) examined data from a referendum in New Hampshire concerning the opening of a new, potentially dirty pulp mill. Voters with higher than average income, a college education and a professional occupation tended to oppose the mill, while political party affiliation was an insignificant covariate. Kahn and Matsusaka (1997) examined voting data from California environmental initiatives (such as expanding parklands and tightening restrictions on pesticide use) over a period of twenty-four years and found that election outcomes and Democratic party membership totals were inconsequential to the explanatory power of the model. Based on data from the 1996 National Election Studies' survey, Guber (2001)

found that the environment does not shape voter preferences at the federal election level and is therefore weak as a political issue, though this may be due to the fact that the public perceives only small differences between candidates on environmental issues. Salka (2003) analyzed the determinants of voting behaviour in five US states and found that increased levels of environmental support are associated primarily with living in an urban centre and having a higher than average income and education level.

Canadian environmental regulation is briefly discussed in the next section. But government influence over environmental quality goes beyond simply passing laws. Day-to-day discretion about the stringency of enforcement can be just as influential, and decisions seem to vary over time and location. Within the United States there is evidence (Greenstone 2002, Becker and Henderson 2000) that firms have moved production out of so-called "nonattainment" areas— regions whose pollution levels exceed federal standards and which thereby trigger more rigorous standards and enforcement. However there is considerable discretion involved in designating a county as having "nonattainment" status, since many regions complying with all known standards received the designation, while many others in violation of the standards did not (Greenstone 2004). Deily and Gray (1991) found evidence that enforcement is tailored to the probability that a major employer in an economically-distressed region might go out of business. This result is echoed in the recent findings of Gray and Shadbegian (2004) that enforcement reflects, in part, variations in the perceived local shadow values of abatement. These findings suggest that the attitude of the individuals in government can affect current environmental conditions, even within the framework of a given set of pollution control laws. This, in turn, motivates the empirical question of whether the name of the party in power explains any part of the observed current air pollution levels.

In Canada it is noteworthy that many federal initiatives on air quality, including the Canada-US Air Quality Agreement of 1991, and the subsequent Ozone Annex of 1996, are

implemented using voluntary, negotiated agreements with provinces. The Canadian Council of Ministers of the Environment plays a lead role in facilitating these agreements. This contrasts with the US Clean Air Act as amended in 1977, in which areas deemed to be out of compliance with federal standards face prescribed legal and financial penalties if they fail to get back into compliance. The Canadian preference for negotiated solutions is also observed at the provincial level, in which firms who self-report pollution violations are not automatically charged or fined, but in many cases are given an opportunity to return to compliance without penalty, or with only nominal penalty. A key factor that triggers inspection for a potential regulatory violation is the volume of public complaints concerning observed local pollution (Raymond and McKitrick 2002). The combination of discretionary regulation and reliance on citizen complaints gives rise to the possibility that observed levels of pollution reflect, at least in part, the attitudes of government officials and their political bosses, not just the contents of current law. For this reason, it makes sense to examine whether the observed levels of pollution appear to track changes in the political ideology of the government, either at the provincial or federal level.

Air pollution is, no doubt, an important environmental issue, and may be identified as such in public opinion surveys, but it appears unlikely that it is a decisive issue for voters in actual election outcomes. It could, alternatively, imply that it is *so* decisive that all parties have effectively converged over time on a single consensus position, so a change in government should not lead to a change in pollution levels. Evidence from splitting the sample into early and late periods shows that this may be true at the provincial level, but not at the federal level. And in neither the early nor late periods did the party patterns fit the left-right stereotype. In other words parties may have converged, but not from a starting point that fits a standard political grid.

**2. Environmental Regulation in Canada**

Environmental quality in Canada is controlled by all three levels of government and by the courts. The Constitution Act, like the British North America Act before it, does not specify jurisdiction for environmental quality, so it has been divided up incidentally to other areas that are specified (for reviews see Brubaker 1995, McKenzie 2002, Field and Olewiler 1995). Regarding water quality, for example, the federal government exerts jurisdiction via control over navigable waterways, offshore fisheries, transboundary agreements, crown land and so forth. Provinces assert jurisdiction based on constitutionally-specified control over natural resources and their supervision of municipalities, which, in turn, have responsibilities related to public utilities, conservation authorities and so forth. Courts get involved in if civil suits are filed involving pollution-related infringement of riparian rights.

Air quality is, likewise, governed by overlapping interests of all four agencies, though the federal and provincial governments have the primary role. The federal government has in recent decades focused on international initiatives (such as Canada-US Acid Rain control) and on facilitating interprovincial cooperation on common standards, while provinces themselves have the responsibility to establish air quality rules and enforce them. The framework of laws at the federal and provincial levels provide considerable room for discretion in enforcement and the provision of ad hoc exemptions or tightening of rules. Courts can also get involved if air pollution between neighbours constitutes a nuisance tort, but this sort of action has typically not played a dominant role in pollution control in Canada.

Table 1 lists the major environmental laws and treaties governing air quality in Canada. Note that, at the federal level, there were two periods of increased activism: the early 1970s under the Trudeau Liberals and the late 1980s under the Mulroney Conservatives. Similarly, it was under the Harris Conservatives in Ontario that new environmental protection legislation was introduced, including an environmental Bill of Rights and a new motor vehicle exhaust inspection/maintenance regime. However critics have pointed to the simultaneous cuts to the

enforcement budget of the Ministry of the Environment as a signal of a deeper indifference to pollution control (McKenzie 2002). These observations provide a preliminary hint that the history of legislation does not indicate any obvious equation between specific parties and environmental activism.

### 3. Data Sources and Methods

Summary statistics for all data are in Table 2. Air quality data showing monthly environmental conditions in thirteen cities from 1974 to 1996 were averaged to annual levels to match the economic data. Five common air contaminants were used, all reported as mean ambient concentrations for the period 1974 to 1996. Carbon Monoxide (CO) concentrations are in parts per million. Nitrogen Dioxide ($NO_2$), ground level Ozone ($O_3$) and Sulfur Dioxide ($SO_2$) are measured in parts per billion, Total Suspended Particulate (TSP) concentrations are measured in micrograms/m$^3$. The data were all obtained from Environment Canada's National Air Pollution Surveillance (NAPS) stations.[2] The thirteen cities monitored were Victoria, Vancouver, Edmonton, Calgary, Regina, Saskatoon, Winnipeg, Toronto, Ottawa, Hamilton, Quebec City, Montreal, and Halifax. Monthly means were taken over all the available stations operating in each city. Where no data were available in one or two monthly records the observations were linearly interpolated. If a year had four or more missing months it was dropped. Summary statistics for provincial dummies are shown to indicate the geographical distribution of the data, but the provincial dummies themselves were not part of the regression model (see below).

Ontario government data[3] show transportation is the main source of CO (85 percent) and $NO_2$ (63 percent) while just over half of current $SO_2$ emissions are attributed to smelters and petroleum refineries. Emissions related to motor vehicles can be expected to adjust rather slowly to changes in technological standards that only affect new cars. But other policies may have a more immediate effect, including road construction and maintenance, fuel taxes and policies that

facilitate (or inhibit) local economic growth in general. To the extent that governments take initiatives in these areas with the intent of influencing air quality it should be, in principal, detectable in this data set. Inspection and maintenance programs ("Drive Clean" in Ontario and "Air Care" in BC) were introduced in the mid-1990s and, even if they had some effect on urban air, it won't show up in these results since the data end in 1996. Ozone is not directly emitted by polluters but is a product of sunlight acting on natural and anthropogenic compounds (called ozone precursors) in the air, such as $NO_2$ and volatile organic compounds. Its chemistry is highly complex, and many difficulties remain in constructing models to explain its formation and transport (see, e.g. Stein, Lamb and Draxler 2000). The category "particulates" includes not just soot from smokestacks, but particles formed of every substance known to man, including viruses, bacteria, moulds, pollen fragments from thousands of flowering plants, insect fragments, wind-eroded dust from exposed soil and sand, and chemical compounds from all sources (Green and Armstrong 2003). While comparable data for Canada do not exist, US data show that as of 1998, industrial sources are dwarfed by natural sources and, surprisingly, residential wood-burning fireplaces.[4]

Overall, average ambient air pollution levels have decreased over time, with the exception of ozone. CO fell from an average across the thirteen cities of 1.3 ppm in the first half of the sample to about 0.8 ppm in the second half. $NO_2$ has also decreased over time, but not as rapidly, from an average of 24 ppb to just under 20 ppb. $SO_2$ concentrations fell from an average of 8.1 ppb to 4.5ppb. The regional changes were more pronounced since western cities had very low $SO_2$ levels to start with. In Ontario, Quebec and the Maritimes, the average monthly concentrations in the early part (1974-1985) of the sample were approximately 30 ppb, falling to between 5 and 10 ppb in the 1985-1996 interval. Western cities recorded early levels of about 10 ppb and later levels of between 2 and 5 ppb. TSP concentrations also fell sharply, from a national

mean of 70.2 μg/m$^3$ before 1985 to 45.1 μg/m$^3$ after. O$_3$ is the holdout: its national average was 16.4 ppb before 1985 and 16.8 after.

Election and incumbency data were obtained from www.canoe.ca in March 2003 as well as provincial election websites listed in Table 3. Other dummy variables include years, months and cities. The political variables were constructed as follows. First, a series of monthly dummies were formed. $NDP_{im}$ is a dummy variable that takes on a value of 1 if the provincial governing party for city $i$ at month $m$ is the New Democratic Party (or in Quebec the Parti Quebecois), and 0 otherwise. $PC_{im}$ is a dummy variable which takes on a value of 1 if the provincial governing party for city $i$ at time $t$ is Progressive Conservative or Social Credit, and zero otherwise. $FPC_m$ is a dummy variable which takes on a value of 1 for all cities if the federal government is Progressive Conservative, and zero otherwise. The Liberal party is the comparison group at each level. The statistics shown in Table 2 are for the annual averages of these monthly dummies.

The political party identifiers are imperfect measures of the ideological stance of a government, but the analysis proceeds on the assumption that they provide a reasonable representation of a government's relative stance on the political spectrum at each point in time. The Conservative-Social Credit grouping is not particularly controversial, but the NDP-PQ grouping might be considered a less obvious equivalence. There is a provincial Liberal party in Quebec, however the PQ did not formally align itself with a federal party until the formation of the Bloc Quebecois. Prior to that it shared some policies and personnel with the federal PCs, but these mainly concerned constitutional issues. On economic policy the PQ has tended to be to the left of the Liberals, hence it is paired here with the NDP.

A party's influence on pollution levels is not likely to be immediate. The monthly dummies were smoothed by taking a 36 month lagged moving average (the data were extended into the pre-sample period for the purpose) thus showing, for each month, the proportion of time that the party was in power over the previous three years. These variables were then averaged into

annual variables. A change from 0 to 1 requires a tenure in office of three entire years, which is long enough to have affected regulations and legislation (including tax rates). The variable also captures the continuing influence of a government for a while after it leaves office. These annual measures are denoted $LAGPC_{it}$, $LAGNDP_{it}$ and $LAGFPC_t$ and are referred to as the "regime" variables. Longer lags could be considered, but at increasing risk of attributing the effects of one government to its predecessor. The effect of decisions that only have influence four or more years after a party takes office are likely to be very difficult to measure under any specification, so in the present context I will confine attention to measuring a party's influence on a three-year time scale.

The variable $PGDP_{it}$ represents the annual real GDP per capita in each province $i$ in year $t$ reported in constant 1992 dollars,[5] and was scaled to thousands of constant dollars for each of the years 1974 to 1996. Its square is also included to capture any quadratic effects. The time trend was measured by using annual dummies, with the first one omitted as the reference year.

All pollution measures were standardized to a mean of zero and a unit variance. The coefficients thus measure the number of standard deviations by which pollution levels change in response to a unit change in the right hand side variables (e.g. the emergence of a party regime).

Parameter estimation was done in STATA Release 8. City dummies were included in all models to capture fixed effects due to persistent variations in the industry mix, as well as local meteorological conditions, elevation, etc. that can affect pollution dynamics. Some locations (especially in Southern Ontario) receive a persistent pollutant load from the US Northeast and Midwest, and these are not affected by Canadian political or economic events, so the fixed effects coefficients provide some control for this. Since the data are annual, seasonal effects did not need to be removed.

A test for serial correlation in a panel setting (Wooldridge 2002) was applied to all models. In almost every case the null of no serial correlation was rejected and an AR1 correction was applied.

Five models, one for each air contaminant, were implemented used the 13-city data panel (indexed $i = 1,...,13$). The models used a two-stage procedure as follows. Feasible GLS (see, e.g., Davidson and MacKinnon 2004) was used to estimate a fixed effects model including city and year dummies. This estimation does not yield an $R^2$ value but the simple correlation between observed and predicted values of the dependent variable is shown in the Tables. The model was implemented in two stages, with the federal PC variable, which only varies annually, introduced in the second step.

$$Y_{it}^j = \alpha_0^j + \sum_{t=2}^{23} \phi_t^j D_{it} + \sum_{c=1}^{11} \theta_c^j C_{it} + \alpha_1^j LAGPC_{it} + \alpha_2^j LAGNDP_{it}$$

$$+ \alpha_3^j PGDP_{it} + \alpha_4^j (PGDP_{it})^2 + e_{it}^j \tag{1a}$$

$$\phi_t^j = \beta_0^j + \beta_1^j LAGFPC_t + v_t \tag{1b}$$

where $Y_{it}^j$ stands for the five air contaminant panels $j = 1,...,5$, the $\alpha_q^j$'s are estimated slope coefficients, $D_{it}$ is a matrix of dummy variables denoting the year $t$, $C_{it}$ is a matrix of dummy variables denoting city $i$, the $\phi_t^j$'s and $\theta_c^j$'s are the associated year/city coefficient vectors, $e_{it}^j$ is the GLS residual and $v_t$ is the residual from the regression of the year dummies on $LAGFPC_t$. The variance-covariance matrix in (1a) allows for between-group heteroskedasticity and within-group (panel-specific) first-order serial correlation. In (1b) an AR(1) correction was applied except where testing showed no serial correlation of errors. There is some debate about the need

for weighting observations in second-stage regressions like (1b) (e.g. Dickens 1990), to control for heterogeneity of variance and group size across panels. In this case the groups (years) are all very nearly the same size so weighting by group size is not important. Weighting by the inverse of the standard errors on the $\phi_t^j$ was tried and did make a difference in a few cases. Since this can indicate inefficiency due to groupwise heteroskedasticity this weighting was applied for (1b) in all models. Results without the weighting are available on request.

The data set combines city and provincial data and hence there is reason to be concerned about a possible downward bias in standard errors in (1) due to provincial grouping effects. Moulton (1990) proposes the following simple formula for approximating the potential bias in standard errors:

$$b = (1 + (m-1)\rho)^{\frac{1}{2}} \qquad\qquad (2)$$

where $b$ is the factor by which the true standard errors exceed the estimated values, $m$ is the average group size and $\rho$ is the average correlation of error terms across groups. In the data set used herein there are 13 cities in 7 provinces, so $m = 1.86$. If, on average, the errors within groups share a correlation of 0.1, (2) would imply that standard errors are about 4 percent too small, and the 95% critical value for a $t$-statistic should be 2.04. In the main results shown below (Table 4), the significant political coefficients all have $t$-statistics of 2.16 or higher. This would still be significant even if the mean correlation of errors across groups were over 0.2. The worst case ($\rho = 1$) would imply a 95% $t$-statistic of 2.67. The results below will be presented assuming the conventional critical value applies ($t > 1.96$) but readers should note the potential variance bias.

## 4. Results

*4.1 Political Effects on Pollution, 1974 – 1996*

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Table 4 reports the results for equation (1). In all the results tables, variables that are significant at the 5% level are in **bold**. The coefficients for the Federal PC dummy variable (second block) are from (1b), while the other coefficients and the diagnostics in the first block are from (1a). The row labeled Pr(Prov=0) denotes the joint significance of the provincial political identifiers.

The first thing to note is that each pollutant yields a unique set of parameter estimates. While the term "air pollution" is often taken to mean one thing, in reality it consists of numerous compounds of differing provenance, each of which has its own relationships with the underlying economic activity and policy environment. It is important in empirical research to examine the whole portfolio of air contaminants, not just to generalize from the examination of one type on its own. The income variables yield two Kuznets curve-style upside-down U's ($NO_2$, TSP) and one U-shaped path ($SO_2$); the other income paths are insignificant.

In general the political coefficients are less than unity, indicating that even where an effect occurs it tends to change pollutant concentrations by less than one standard deviation, even if the party is in power long enough (three years) for its indicator variable to change from 0 to 1. Results for individual air contaminant types are as follows.

*Carbon monoxide (Column 1):* The provincial political variables are individually significant (NDP marginally) as well as jointly. Relative to a Liberal government, a shift to either the left (NDP) or the right (PC) is associated with higher urban CO levels, which derive mainly from motor vehicle use. The federal PC party however exhibits a significant negative effect, thought it is smaller at 0.21 standard deviations.

*Nitrogen dioxide:* Neither the federal nor provincial PC parties exert an identifiable effect, but a shift to the left (NDP) is associated with a significant rise in $NO_2$ levels of about half a standard deviation. The provincial political effects are jointly significant.

*Sulfur dioxide:* The provincial PCs are associated with higher $SO_2$ levels, while for the provincial NDP and federal PCs the effects are very small and insignificant. The provincial political variables are jointly significant.

*Total Suspended Particulates:* Neither the federal nor provincial political parties exert a significant effect.

*Ozone:* Neither of the provincial party variables show a significant effect individually or jointly, however the federal PC party is associated with significantly higher ozone levels.

Overall, there is evidence that associates the federal and provincial conservative parties with conflicting influences on CO air pollution levels (compared to the Liberal reference group), while the provincial party is also associated with relatively higher $SO_2$ levels and the federal party with higher ozone levels. On the other side of the spectrum the provincial NDP (or Parti Quebecois) parties are associated with higher CO and $NO_2$ levels. This tentatively suggests that the reference party (Liberals or equivalent) at the provincial level is most consistently associated with lower air pollution levels. However, from Table 2 we can see that the NDP and PC parties are in power at the provincial level for about 87 percent of the time in this sample, so even if these coefficients reveal a deliberate policy stance related to environmental quality, being the 'clean air party' does not seem to translate into much electoral success. At the federal level there is little to distinguish the parties: three of the five coefficients are insignificant and the other two have opposite signs.

*4.2 Have Parties Converged?*

One interpretation of the above results is that, despite the high level of interest in environmental quality when stated for the purpose of opinion polls, air pollution is not a decisive

factor in choosing how to vote. This would explain the conflicting pattern of party-based differences in many of the observed air quality levels, despite the view that parties to the left and right represent manifestly different environmental policy regimes. If a switch in governing party does not lead to predictably higher or lower pollution levels, it could suggest that major parties differentiate according to economic or social policies and simply allow environmental policy to follow as a secondary consideration.

But there is another, nearly opposite, interpretation. On some issues, parties do not differentiate positions precisely because the topic is extremely important. Canadian political parties have converged on support for publicly-funded health care, but that does not mean they would be indifferent to its abolition. On air quality the leading political parties all seem to favour slow, incremental improvements, with only small differences among parties in the desired rates of change. Perhaps this represents the emergence of a consensus view over time in light of strong public pressure, rather than indifference. If this is the case, one might expect to find more pronounced party differences in the earlier period of the sample, whereas by the later period those differences should disappear.

To test this, equations (1a-b) were re-run on subsamples spanning 1974-1988 and 1983-1996. The partial overlap allows for sufficient degrees of freedom in each sub-model. The results are in Tables 5 and 6. In the earlier interval the provincial political coefficients are clearly larger: five out of 10 have a magnitude above 0.75 and are significant whereas in the later interval all coefficients are below 0.75 and insignificant. Also four of the five contaminants indicate jointly significant provincial political effects in the first period, but in the second interval none are jointly significant. But at the federal level the opposite picture emerges. The coefficients are small and insignificant in the early period and are larger and more significant in the later interval. The late subsample suggests the federal PCs are associated with higher $SO_2$ and ozone levels but

(slightly) lower TSP levels. The very large $t$ statistic on the $SO_2$ coefficient drops to 5.14 without the use of weighted least squares.

The provincial effects in the early-sample picture match those in the whole sample in that they show the PC and NDP governments to be associated with relatively higher air pollution in three of five cases (compared to the Liberal control group), yet are in power 88 percent of the time. In the later period none of the differences are significant, and the PC and NDP parties are in power 85 percent of the time.

The evidence supports the hypothesis that there were sharper party differences at the provincial level in the earlier years of the sample, but such differences varied by pollutant and did not identify the left (here represented by the NDP) as reliably "green." At the federal level the PC regime was associated overall with more of one kind of air pollution but less of another, and if anything party differences were stronger in the more recent interval.

**5. Conclusions**

While there are some significant "party effects" in air pollution levels, they do not suggest a consistent pattern that reliably associates the political right or left in Canada with clean air. There is some indication that, at the provincial level, there was a historical connection between the "centre" (here represented by the reference Liberal group) and lower air pollution, but the effects appear to have more or less disappeared over time. At the federal level the PC party is associated overall with more of one pollutant but less of another, with no attenuation of the party effect over time.

There are, no doubt, mechanisms of influence which simply cannot be captured by the empirical model presented herein. Some government initiatives may only begin to have an effect at a lag of more than three years, and the regression model used for Tables 4—6 is unlikely to capture these effects. The focus of this study is on the relationship between a type of government

and the approximately contemporaneous air quality, so it only serves as a test of more short-run mechanisms of influence.

The policy mix offered by parties seeking to govern represents their preferred tradeoffs over industrial growth, fiscal policy, labour market policies and other such matters. While parties state environmental positions during election campaigns that appear to diverge from one another, and while political commentary often asserts that environmental quality correlates with the political philosophy of the government, the data examined herein suggest that the political stripe of the government is not likely to be a reliable predictor the near-term evolution of air quality in general, though effects on specific types of air pollution may be connected with the party in power.

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| Jurisdiction | Legislation and Treaties |
|---|---|
| Federal | • Clean Air Act 1971 (superseded by CEPA)<br>• National Ambient Air Quality Objectives 1973-79<br>• UN Convention on Long Range Transport of Air Pollution 1979<br>• Canadian Environmental Protection Act (CEPA) 1988, 1999<br>• Canadian Environmental Assessment Act (CEAA) 1992<br>• Environmental Contaminants Act 1985 (superseded by CEPA)<br>• Canada Shipping Act 1985<br>• Railway Safety Act 1985<br>• Montreal Protocol on Ozone Depleting Substance 1987<br>• Canada-US Air Quality Agreement 1991<br>• UN Framework Convention on Climate Change 1991<br>• Motor Vehicle Safety Act 1993 (superseded by CEPA)<br>• Canada Transportation Act 1996<br>• Stockholm Convention on Persistent Organic Pollutants 2001<br>• Kyoto Protocol on Climate Change 2002 |
| Newfoundland | • Environment Act 1995 (superseded by EPA)<br>• Environmental Assessment Act 1990 (superseded by EPA)<br>• Waste Management Act 1998 (superseded by EPA)<br>• Environmental Protection Act (EPA) 2002 |
| PEI | • Environmental Protection Act 1988 |
| Nova Scotia | • Environmental Protection Act 1989 (superseded by Environment Act)<br>• Environmental Assessment Act 1989 (superseded by Environment Act)<br>• Environment Act 1994-95 |
| New Brunswick | • Clean Environment Act 1973<br>• Clean Air Act 1973, 1997 |
| Quebec | • Environment Quality Act 1972<br>• Regulation respecting the quality of the atmosphere 1979 |
| Ontario | • Environmental Protection Act 1971, 1990<br>• Environmental Assessment Act 1990<br>• Environmental Bill of Rights 1993 |
| Manitoba | • The Clean Environment Act 1968 (superseded by The Environment Act)<br>• The Environment Act 1988 |
| Saskatchewan | • Air Pollution Control Act 1975<br>• Environmental Assessment Act 1978<br>• Clean Air Act 1989 |
| Alberta | • Clean Air Act 1971, 1980 (superseded by EPEA)<br>• Environmental Protection and Enhancement Act (EPEA) 1992, 2000 |
| British Columbia | • Pollution Control Act 1967<br>• Environmental Management Act 2003<br>• Environment Management Act 1996<br>• Environmental Assessment Act 1996, 2002<br>• Waste Management Act 1996 |

**TABLE 1.** Some Canadian federal and provincial initiatives governing air quality.

| Variable | Definition | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|---|
| ndp | 0-1 monthly dummies averaged to annual | 299 | 0.304 | 0.461 | 0 | 1 |
| pc | level. ndp = provincial New Democrats, | 299 | 0.565 | 0.497 | 0 | 1 |
| fpc | pc = provincial Progressive | 299 | 0.435 | 0.497 | 0 | 1 |
| | Conservatives, fpc = federal PCs. | | | | | |
| | | | | | | |
| lagndp | As above, 3-year | 299 | 0.294 | 0.412 | 0 | 1 |
| lagpc | moving average to represent | 299 | 0.564 | 0.464 | 0 | 1 |
| lagfpc | long-term influence (regime) | 299 | 0.428 | 0.420 | 0 | 1 |
| | | | | | | |
| pgdp | Real per capita GDP (1992 \$,000) | 299 | 17.833 | 6.946 | 4.26 | 32.28 |
| | | | | | | |
| co | Carbon monoxide (ppm) | 254 | 1.054 | 0.512 | 0.12 | 3.72 |
| no2 | Nitrous Oxide (ppb) | 238 | 21.664 | 7.520 | 5.00 | 51.46 |
| so2 | Sulphur Dioxide (ppb) | 206 | 6.422 | 4.722 | 0.72 | 23.25 |
| tsp | Total Suspended Particulates (micrograms/m$^3$) | 289 | 57.951 | 23.855 | 17.66 | 141.29 |
| o3 | Ozone (ppb) | 255 | 16.592 | 3.517 | 7.75 | 27.83 |
| | | | | | | |
| bc | British Columbia | 299 | 0.154 | 0.361 | 0 | 1 |
| ab | Alberta | 299 | 0.154 | 0.361 | 0 | 1 |
| sk | Saskatchewan | 299 | 0.154 | 0.361 | 0 | 1 |
| mn | Manitoba | 299 | 0.077 | 0.267 | 0 | 1 |
| on | Ontario | 299 | 0.231 | 0.422 | 0 | 1 |
| pq | Quebec | 299 | 0.154 | 0.361 | 0 | 1 |
| ns | Nova Scotia | 299 | 0.077 | 0.267 | 0 | 1 |

**TABLE 2.** Variable Names and Descriptive Statistics. Obs denotes number of available observations. There are 13 cities: Victoria, Vancouver, Edmonton, Calgary, Regina, Saskatoon, Winnipeg, Toronto, Ottawa, Hamilton, Quebec City, Montreal, and Halifax. The provincial dummies are shown to illustrate the geographic spread, but the regression model uses city dummies for controlling fixed effects.

| Province | Past election information source |
|---|---|
| British Columbia | www.elections.bc.ca/elections/electoral_history/toc.html |
| Alberta | www.electionsalberta.ab.ca/pastelections.html |
| Saskatchewan | Elections Saskatchewan was contacted via telephone for past election information. |
| Manitoba | www.elections.mb.ca/main/history/election_dates.htm<br>www.elections.mb.ca/main/history/premiers.htm |
| Ontario | www.electionsontario.on.ca/en/Results_and_Stats_en.html |
| Quebec | www.dgeq.qc.ca/information/tab_1867_elec2.fr.html |
| **Nova Scotia** | www.gov.ns.ca/elo/elections |

**TABLE 3.** Information sources for provincial election/government data.

| Variable | CO | NO2 | SO2 | TSP | O3 |
|---|---|---|---|---|---|
| ***Equation (1a)*** | | | | | |
| Provincial PC | **0.7803** | 0.2549 | **0.5541** | 0.1039 | 0.0658 |
| (*lagpc*) | **2.91** | 1.37 | **2.79** | 0.63 | 0.27 |
| | | | | | |
| Provincial NDP | 0.4513 | **0.4543** | -0.0231 | -0.0324 | 0.0237 |
| (*lagndp*) | 1.83 | **2.80** | -0.12 | -0.20 | 0.13 |
| | | | | | |
| GDP/capita | -0.0897 | **0.1638** | -0.1008 | **0.1436** | -0.0340 |
| | -1.12 | **2.55** | -1.63 | **2.16** | -0.38 |
| | | | | | |
| (GDP/capita)^2 | 0.0009 | -0.0018 | 0.0023 | -0.0020 | 0.0001 |
| | 0.61 | -1.47 | 1.77 | -1.54 | 0.04 |
| | | | | | |
| Pr(Prov=0) | **0.007** | **0.012** | **0.000** | 0.175 | 0.955 |
| | | | | | |
| N | 254 | 238 | 206 | 289 | 255 |
| Corr(Y, Y-hat) | 0.73 | 0.83 | 0.84 | 0.90 | 0.65 |
| Log-likelihood | -125.04 | -95.43 | -48.89 | -70.05 | -215.73 |
| | | | | | |
| | | | | | |
| ***Equation (1b)*** | | | | | |
| Federal PC | **-0.2122** | -0.0586 | 0.0512 | -0.0039 | **0.5607** |
| (*lagfpc*) | **-2.42** | -0.19 | 0.85 | -0.02 | **3.94** |

**TABLE 4. Regression results on full sample.** Notes: Variables defined in Table 2. t-statistics are shown under estimated coefficients. Constant and city dummies not shown. **Bold** denotes 5% significance level. The top coefficient group is estimated using (1a). Constants are not shown, nor are province dummies. Pr(Prov=0) is the prob-value on a Wald F-test that the provincial political party coefficients are jointly zero. Corr (Y, Y-hat) is the correlation between the observed and the predicted values from the GLS model (1a). The bottom block reports the slope coefficients from Equation (1b), which regresses the year dummies from (1a) on the federal PC regime variable.

| Variable | CO | NO2 | SO2 | TSP | O3 |
|---|---|---|---|---|---|
| ***Equation (1a)*** | | | | | |
| Provincial PC | **1.8959** | **0.7692** | **1.2890** | 0.1539 | -0.0096 |
| (*lagpc*) | **4.46** | **2.25** | **5.12** | 0.69 | -0.02 |
| | | | | | |
| Provincial NDP | **0.9256** | **1.1142** | 0.2784 | -0.1931 | 0.1454 |
| (*lagndp*) | **2.48** | **4.97** | 1.28 | -0.87 | 0.50 |
| | | | | | |
| GDP/capita | -0.1555 | 0.0382 | **-0.2516** | **0.2609** | -0.0453 |
| | -1.22 | 0.37 | **-2.79** | **2.68** | -0.27 |
| | | | | | |
| (GDP/capita)^2 | 0.0039 | 0.0015 | **0.0069** | **-0.0051** | 0.0002 |
| | 1.40 | 0.66 | **3.16** | **-2.43** | 0.06 |
| | | | | | |
| Pr(Prov=0) | **0.000** | **0.000** | **0.000** | **0.009** | 0.760 |
| | | | | | |
| N | 162 | 145 | 125 | 193 | 158 |
| Corr(Y, Y-hat) | 0.80 | 0.87 | 0.89 | 0.89 | 0.63 |
| Log-likelihood | -103.04 | -83.29 | -38.73 | -58.64 | -153.01 |
| | | | | | |
| | | | | | |
| ***Equation (1b)*** | | | | | |
| Federal PC | -0.1784 | -0.1167 | -0.0327 | -0.4229 | 0.1649 |
| (*lagfpc*) | -0.59 | -0.25 | -0.30 | -1.02 | 0.50 |

**TABLE 5. Regression results on early sub-sample (1974 to 1988).** Notes: Variables defined in Table 2. t-statistics are shown under estimated coefficients. Constant and city dummies not shown. **Bold** denotes 5% significance level. The top coefficient group is estimated using (1a). Constants are not shown, nor are province dummies. Pr(Prov=0) is the prob-value on a Wald F-test that the provincial political party coefficients are jointly zero. Corr (Y, Y-hat) is the correlation between the observed and the predicted values from the GLS model (1a). The bottom block reports the slope coefficients from Equation (1b), which regresses the year dummies from (1a) on the federal PC regime variable.

| Variable | CO | NO2 | SO2 | TSP | O3 |
|---|---|---|---|---|---|
| ***Equation (1a)*** | | | | | |
| Provincial PC | 0.1216 | 0.0654 | 0.1328 | 0.1442 | -0.0604 |
| (*lagpc*) | 1.02 | 0.42 | 1.04 | 1.50 | -0.30 |
| | | | | | |
| Provincial NDP | 0.0956 | 0.1281 | 0.0465 | 0.1272 | 0.0943 |
| (*lagndp*) | 0.91 | 0.87 | 0.33 | 1.37 | 0.58 |
| | | | | | |
| GDP/capita | **-0.1940** | **0.1986** | **-0.2158** | 0.0124 | -0.0157 |
| | **-3.89** | **3.70** | **-3.46** | 0.29 | -0.20 |
| | | | | | |
| (GDP/capita)^2 | **0.0030** | **-0.0034** | **0.0037** | -0.0002 | -0.0011 |
| | **2.87** | **-2.92** | **2.70** | -0.24 | -0.68 |
| | | | | | |
| Pr(Prov=0) | 0.570 | 0.633 | 0.411 | 0.312 | 0.408 |
| | | | | | |
| N | 169 | 170 | 146 | 186 | 176 |
| Corr(Y, Y-hat) | 0.82 | 0.88 | 0.89 | 0.93 | 0.71 |
| Log-likelihood | 26.95 | 4.38 | 26.60 | 12.09 | -89.46 |
| | | | | | |
| ***Equation (1b)*** | | | | | |
| Federal PC | -0.0479 | -0.0639 | **0.3402** | **-0.0817** | **0.5706** |
| (*lagfpc*) | -1.53 | -1.68 | **7.20** | **-2.60** | **2.78** |

**TABLE 6. Regression results on late sub-sample (1983 to 1996).** Notes: Variables defined in Table 2. t-statistics are shown under estimated coefficients. Constant and city dummies not shown. **Bold** denotes 5% significance level. The top coefficient group is estimated using (1a). Constants are not shown, nor are province dummies. Pr(Prov=0) is the prob-value on a Wald F-test that the provincial political party coefficients are jointly zero. Corr (Y, Y-hat) is the correlation between the observed and the predicted values from the GLS model (1a). The bottom block reports the slope coefficients from Equation (1b), which regresses the year dummies from (1a) on the federal PC regime variable.

Lead Footnote

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[1] See, for example, "Crimes Against Nature" by R.F. Kennedy Jr., *Rolling Stone* December 11, 2003 http://www.rollingstone.com/features/nationalaffairs/featuregen.asp?pid=2154; "Kennedy's Crimes Against Fact" by J. Adler, *National Review* December 3, 2003, http://www.nationalreview.com/adler/adler200312030840.asp; also www.environment2004.org; "Movement Politics" http://www.junkscience.com/july00/sierra.htm, etc.

[2] The data were compiled and provided in spreadsheet form by Liv Fredrickson of The Fraser Institute in Vancouver.

[3] See Ontario (2003) and http://www.ene.gov.on.ca/envision/techdocs/4521e.htm#4.

[4] See http://www.epa.gov/ttn/chief/trends/index.html for these data.

[5] It is taken from Statistics Canada CANSIM II Provincial Economic Accounts Integrated Meta Data Base number 1902, catalogue no. 13-213.