ICAE

Instituto Complutense de Análisis Económico

UNIVERSIDAD COMPLUTENSE

FACULTAD DE ECONOMICAS

Campus de Somosaguas

28223 MADRID

Teléfono 91 394 26 11 - FAX 91 294 26 13

Internet: http://www.ucm.es/info/icae/

E-mail: icaesec@ccee.ucm.es

---

# Documento de trabajo

## The Evolution of the pH in Europe (1986-1997) with Panel Data

E. Marín
T. Pérez-Amaral
A. Rúa
E. Hernández

No. 0007 Junio 2000

ICAE

Instituto Complutense de Análisis Económico

UNIVERSIDAD COMPLUTENSE

# THE EVOLUTION OF THE pH IN EUROPE 1986-1997, WITH PANEL DATA

**E. Marín[1] , T. Pérez-Amaral[2], A. Rúa[3] and E. Hernández[1]**

[1] Dpto. Física del Aire. Universidad Complutense
Facultad de Físicas
Avda. Complutense, s/n
28040 Madrid, SPAIN

[2] Dpto. Economía Cuantitativa. Universidad Complutense
Facultad de Económicas
28223 Somosaguas Madrid, SPAIN e-mail: teodosio@ccee.ucm.es

[3] Dpto. Métodos Cuantitativos. Universidad Comillas
C/ Alberto Aguilera 23
28015 Madrid, SPAIN, e-mail: rvieites@cee.upco.es

## ABSTRACT

The temporal evolution of pH values in precipitation over Europe during the period 1986-1997 is examined using panel data. The use of panel data techniques allows us to determine the temporal evolution of groups of stations rather than analysing the temporal behavior of each of them. The analysis reveals three different temporal patterns: Peripheral, Central and French. We find a significant increasing trend ($p < 0.00001$) in both Peripheral and Central Patterns. The annual increases are +0.057 pH-units $yr^{-1}$ and +0.022 pH-units $yr^{-1}$ respectively. However the French Pattern is characterized by a significant decreasing trend ($p < 0.004$) and the annual decrease is -0.022 pH-units $yr^{-1}$. The standard errors of panel data estimates are around 47% smaller than those of classical pooling and 32% smaller than aggregate time series regression. The use of panel data produces higher $R^2$ values than classical pooling and aggregate data. This technique takes into account the individual heterogeneity, allows a larger number of data points and improves the efficiency of the estimates. In general, the policies of governments to reduce pollutant emissions seem to be effective.

**Keywords:** pH; panel data; fixed effects; trend.

## INTRODUCTION

In the last 20 years, wet deposition of sulphur has decreased in Europe and North America as an effect of the efforts of the Governments to reduce $SO_2$ emissions (Butler and Likens, 1991; Lynch et al., 1995; Rodhe and Granat, 1984). Sulphur decline in wet deposition is associated with a decrease of the acid impacts on ecosystems. The objective of this paper is to estimate the possibly different temporal patterns for the pH in Europe from 1986 to 1997 and evaluate the effectiveness of emission control policies. To do this we use panel data techniques.

Panel data refers to the pooling of observations on a cross-section of sites, countries or individuals over several time periods (Baltagi, 1995). So this method uses time series and cross-sectional data in the same analysis to estimate the parameters of a model. This technique has been used mainly with economic data (Axelsson and Westerlund, 1998; Al-Qudsi, 1998; Garín and Pérez-Amaral, 1996, 1998, 1999, 2000; Hausman and Taylor, 1981; Mundlak, 1978). Panel data techniques possess several advantages over conventional cross-sectional or time-series analysis. Panel data techniques allow us to control the individual heterogeneity, giving more data points, increasing the degrees of freedom and reducing the colinearity among the variables which allows more efficient estimation. Panel data are better able to identify and measure effects that are simply not detectable in pure cross-sections or pure time-series data as well as to analyse more complicated models (Baltagi, 1995; Hsiao, 1986).

The use of least-squares linear regression site by site in the trend analysis for different pollutants is common (Arends et al., 1997; Dana and Easter, 1987; Hedin et al., 1987; Hedin et al., 1994; Lynch et al., 1995; Puxbaum et al., 1998; Rúa et al., 1998). In these cases it was assumed that the regression parameters were different for each site and the sites were independent. Panel data techniques provide a more efficient estimator than applying least squares to each site separately. In many cases, it is necessary to summarize individual relationships and make inferences about certain population parameters. To achieve this objective it is common to calculate the mean values over the slopes for different sites (Hedin et al., 1994; Puxbaum et al., 1998); the median values of the slopes (Leck and Rodhe, 1989) or the mean value of concentrations over different sites (Buishand et al., 1988; Rodhe and Granat, 1984, Rúa et al., 1999). In the latter case, the variability of the observations across all stations is lost. Alternatively, the panel data technique provides a method to obtain a single model which describes the entire group of individuals.

## DATA

The data used in this analysis were obtained from the European Monitoring and Evaluation Programme (EMEP) network. The chosen stations can be seen in Figure 1. All stations are remote and they belong to the EMEP network. In order to obtain the optimum number of stations, the analysis includes all available stations which provide at least 80% of the records for the period 1986-1997.

The EMEP stations have the following characteristics:

- They are located in rural areas.
- They are away from urban areas.
- They are located at least 40 kms away from industrial sources of pollutants.
- They are not situated in valleys, nor on mountain peaks.
- The setting of the station is not under strong winds.

The data that we analyze correspond to the annual average of the daily chemical analysis of the pH in precipitation from 1986 to 1997. In addition to the data from screening procedures employed by the individual countries, the Chemical Co-ordinating Centre has its own program for checking data quality and completeness (EMEP/CCC-

Note 2/94, 1994). The details of the network and the analytical protocols are given in Nodop et al. (1985).

## METHODOLOGY

The principal objective of this paper is to determine the different temporal patterns of the pH in Europe from 1986 to 1997. To achieve this, we apply panel data techniques. These techniques allow the estimation of different temporal patterns for the pH. Each pattern represents the temporal behavior of a group of sites and the regression parameters are estimated consistently and efficiently using panel data.

The initial difference between panel data and time-series or cross-section regression is that it has a double subscript on its variables (Baltagi, 1995),

$$y_{it} = \alpha_i + \beta' x_{it} + u_{it}, \quad i = 1,\dots, N \qquad (1)$$

$$t = 1,\dots, T$$

where i denotes the cross-section dimension, whereas t denotes the time-series dimension, $\alpha_i$ is a scalar, $\beta$ is $k\times 1$ vector of constants to be estimated, $\beta'$ is the transpose of $\beta$, $x'_{it} = (x_{1it},\dots, x_{kit})$ is a $1\times k$ vector of observations on the independent variables and $y_{it}$ is the observation of the dependent variable for individual i at time t. The error term, $u_{it}$, represents the effects of other factors that are not only peculiar to individual units but also to time periods. We assume that $u_{it}$ can be characterized by an independently identically distributed random variable with mean zero and variance $\sigma_u^2$. In equation (1) we suppose that slope coefficients, which characterize all temporal cross-sectional sample observations, are constant. The following models are respectively a restriction and three generalizations of model (1):

a) A restriction of (1): slope coefficients are constant and the intercepts are common for all individuals

$$y_{it} = \alpha + \beta' x_{it} + u_{it}, \quad i = 1,\dots, N \qquad (2)$$

$$t = 1,\dots, T$$

b) A generalization of (1): slope coefficients are constant, and the intercepts vary over individuals and time

$$y_{it} = \alpha_{it} + \beta' x_{it} + u_{it}, \quad i = 1,\dots, N \qquad (3)$$

$$t = 1,\dots, T$$

c) A generalization of (3): all coefficients vary over individuals

$$y_{it} = \alpha_i + \beta_i' x_{it} + u_{it}, \quad i = 1,\dots, N \qquad (4)$$

$$t = 1,\dots, T$$

d) A generalization of (4): all coefficients vary over time and individuals

$$y_{it} = \alpha_{it} + \beta_{it}' x_{it} + u_{it}, \quad i = 1,\dots, N \qquad (5)$$

$$t = 1,\dots, T.$$

To select the appropriate model the researcher must first analyse whether the coefficients for each individual site are equal or not. Then first, we test the homogeneity of regression slope coefficients and the intercepts simultaneously. The hypothesis of common slope and intercepts can be viewed as the unrestricted equation model (4) subject to (K+1) (N-1) linear restrictions:

$H_{01}: \alpha_1 = \alpha_2 = \dots = \alpha_N$

$\beta_1 = \beta_2 = \dots = \beta_N$

$H_{a1}$: not all intercepts are equal

not all slopes are equal

Second, we test the homogeneity of regression slope coefficients. The hypothesis of heterogeneous intercepts but homogeneous slopes can be viewed as an unrestricted equation model (4) subject to (N-1)K linear restrictions:

$H_{o2}: \beta_1=\beta_2=...=\beta_N$

$H_{a2}$: not all slopes are equal

Finally, we test whether or not the regression intercepts are the same. When $H_{o2}$ is accepted, one can also apply a conditional test for homogeneous intercepts,

$H_{o3}: \alpha_1=\alpha_2=...=\alpha_N$ given $\beta_1=\beta_2=...=\beta_N$

$H_{a3}$: not all intercepts are equal

The different tests are examined through the use of analysis of covariance. In this analysis an unrestricted equation model (4) is compared with the restricted equation models (1) and (2). Under the assumption that the $u_{it}$ are independently normally distributed over i and t with mean zero and variance $\sigma_u^2$, F tests can be used to test the restrictions postulated by models (1) and (2). The F statistic is the ratio of two terms: the numerator is the difference between the unrestricted residual sum of squares and the restricted residual sum of squares, divided by the number of restrictions under test; the denominator is the unrestricted residual sum of squares, divided by the number of degrees of freedom of its equation. The different F statistics and the estimators for each of the models are presented in Hsiao (1986).

Here we focus on model (1), the fixed effects model, which can be consistently estimated by ordinary least squares in the absence of correlation between the $\alpha_i$ and the regressors $\mathbf{x}_i$. The fixed effects model is an appropriate specification if we are focusing on a specific set of N sites and our inference is restricted to the behavior of this set of sites. Inference, in this case, is conditional on the particular sites that are observed (Baltagi,1995).

## RESULTS

It is interesting to note that this paper looks for a single model that represents the pH evolution for a group of stations.

To achieve this purpose we study whether we can use a unique model of pH evolution for all the European EMEP stations. The existence of a sole model would imply accepting the $H_{o1}$, $H_{o2}$ and $H_{o3}$ homogeneity hypotheses.

The empirical results give F statistics having a p-value of 0.00001 for each test, consequently the homogeneity hypothesis was rejected. The results suggest that the pH evolution in Europe can not be described with a single model. Therefore the EMEP stations are divided into groups, that were put together using cluster analysis (Gimeno et al., 1997; Rúa et al., 1999). The cluster analysis gave three station groups having a different pH evolution. These three groups characterize three patterns. Panel data techniques are used within each of the three patterns.

In the previous section we presented the following panel data models:

Model (1): constant slope coefficents and intercepts that vary over the stations,

Model (3): constant slope coefficents and intercepts that vary over stations and time,

Model (4): all coefficients vary over stations,

Model (5): all coefficients vary over stations and time.

In order to select the appropriate model we test the homogeneity of the regression parameters. First, we analyze whether or not slopes and intercepts are homogeneous across stations and time. This is $H_{o1}$ from the previous section. The *F* statistic has a p-value of 0.00001 for each of the three patterns so it is not appropriate to assume that slopes and intercepts are simultaneously homogeneous.

The second step is to analyse whether the regression slopes are the same. This is $H_{o2}$. This hypothesis is not rejected, with p-values of 0.62, 0.89 and 0.96 respectively, for the three patterns, so we assume that the regression slopes are the same for each pattern.

The final step is to test whether or not the regression intercepts are the same. This is $H_{o3}$. The null hypothesis is rejected with a p-value of 0.00001 for each of the three patterns. So, it is inappropriate to treat all regression intercepts as equal.

The tests suggest that Model (1) is preferred. We estimate Model (1) using the fixed effects technique where $\alpha_i$ are treated as fixed parameters. In that way we deal with the heterogeneity across stations through the use of station specific effects $\alpha_i$.

Table 1 summarizes these results: the existence of three different temporal patterns, named Peripheral, Central and French Pattern in this paper, for the evolution of the pH, the number of sites (N), the number of data points, the significance level for the homogeneity tests, the estimates of the fixed effects model, their significance levels, the t statistics and the $R^2$ values.

Figure 2 shows the geographical situation of the stations in each pattern. The results for the different patterns are as follows:

Pattern 1: Peripheral shows an increasing trend, significant at 0.00001 level. This pattern presents the largest annual change of pH with a value of +0.057 pH-units $yr^{-1}$ and is located in Spain, central Portugal, Hungary, Yugoslavia, eastern Sweden and Austria and northern Russia.

Pattern 2: Central reveals an increasing trend, significant at 0.00001 level. This pattern shows an annual change of +0.022 pH-units $yr^{-1}$. This is the most common pattern in Europe located in central Austria, the Czech Rep., Germany, Denmark, Finland, Norway, central and southern Sweden, Poland, Iceland, northern Italy, the United Kingdom, Switzerland and Russia.

Pattern 3: French exhibits a decreasing trend, significant at 0.004 level. It presents an annual change of -0.022 pH-units $yr^{-1}$. This pattern is located in France, Ireland and central Italy.

After that, we compare the results with those of classical pooling and aggregate time series regression for each temporal pattern. Table 2 shows the number of stations (N), the number of data points, the estimates obtained for the classical pooling regression analysis, their significance level, the t statistics and the $R^2$.

The differences are as follows: the precision of the slope coefficients, in the fixed effects model is better than in the classical pooling. In fact, the standard error of the slope for the Peripheral Pattern is 53% smaller than in the classical pooling. For Central and French Patterns it is respectively 62% and 25% smaller than in the classical pooling. This causes the difference in significance levels in the three patterns. These differences are also reflected in the t statistics. The t statistics in the fixed effects model are around twice as much as in the classical pooling. A great difference of $R^2$ values between this model and the fixed effects model can be appreciated. The $R^2$ is 0.10 for the three patterns, while in the fixed effects model the $R^2$ is between 0.50 and 0.88. This is because the fixed effects model takes into account the heterogeneity across stations, while the classical pooling does not.

Table 3 shows the number of stations (N), the number of data points, the estimates for the aggregate time series regression analysis, their significance level, the t statistics and the $R^2$ of the aggregate time series model.

This model assumes that the hypothesis of overall homogeneity $H_{o1}$ is accepted. The differences in the slope coefficients between this model and the fixed effects model are due to the neglected heterogeneity across stations. However, in this study the $H_{o1}$ hypothesis was rejected. So, the regression parameters obtained with the aggregate model will be biased and ignoring such parameter heterogeneity can lead to inconsistent and meaningless estimates of the parameters of interest (Hsiao, 1986).

It can be observed that the standard error of the fixed effects model is always smaller than in the aggregate time series. In Peripheral Pattern the standard error is 36% smaller than in the aggregate time series. In Central and French Patterns it is 40% and 19% smaller respectively than in the aggregate time series. So the fixed effects model estimates more efficiently the slope coefficients. Although the significance level obtained for the Central Pattern is similar, a difference can be appreciated between Peripheral and French Patterns. The major difference is found in the French Pattern. This pattern shows a non-significant decreasing trend while in the fixed effects model we find a decreasing trend, significant at 0.004 level. The t statistics are larger in the fixed effects model than in the aggregate model for the three patterns. Obviously, these differences are more marked for the French Pattern, which shows a t statistic almost three times larger using the fixed effects model. The $R^2$ in the fixed effects model is higher than in the aggregate model. The fixed effects model fits 15% better than the aggregate model in the Peripheral Pattern. This percentage is 4% for the Central Pattern and 40% for French Pattern. This is because the fixed effects model uses more data points than the aggregate time series model (around ten times more) and takes into account the heterogeneity.

The $SO_2$ and $NO_2$ emissions are analysed next to explain the different patterns obtained in Europe. $SO_2$ and $NO_2$ are the most important contaminants producing a high increase of acidity in precipitations (EEA, 1998). For this reason an analysis of the inventories of $SO_2$ and $NO_2$ emissions has been performed for the years 1993 and 1997 (EMEP, 1999) in Europe.

The difference between the emissions in 1993 and 1997 for $SO_2$ and $NO_2$ is given in figures 3 and 4 for each pollutant. The dimensions of the cell in both figures are 150 Km × 150 Km. These diagrams illustrate the fact that the most important reductions are located in central and northern Europe. However, similar reductions are not detected in France. In fact, an increasing emission of $SO_2$ and $NO_2$ appeared in the west and a decreasing one in the east of France, although the decrease is smaller than in the countries in central and eastern Europe.

The behaviour of $SO_2$ and $NO_2$ emissions along with the decreasing evolution of the pH in France, that is different from the rest of Europe where the pH evolution is larger, suggests that the pH in France is basically influenced by local sources, the long-range transport having a minor influence. It would be interesting to evaluate the influence of long-range transport in France possibly through trajectory analysis, when the data are available.

## CONCLUSIONS

The temporal patterns of the evolution of pH in Europe have been investigated during the period 1986-1997 using cluster analysis and panel data techniques. The conclusions are as follows:

- Panel data techniques allow us to take into account the variability and heterogeneity of the data. It enables models to be created describing the characteristics of a group of sites. The models use data from each site without aggregation and increase the number of observations to estimate the parameters of the model.
- The models have smaller standard errors than those with aggregate data. So these estimates are more accurate and have higher significance levels than those of previous studies.

- Three different patterns of temporal evolution for the pH were found using the fixed effects model. In general central and northern Europe are characterised by an increasing trend. This trend is even steeper in southern Europe. However the sites located in France, central Italy and Ireland show a significant decreasing trend. These results are in agreement with the variation of $SO_2$ and $NO_2$ emissions for Europe. In general, the policies of governments to reduce pollutant emissions in Europe seem to be effective. However, this paper indicates the need of continuing with further analysis of these emissions, due to the fact that emissions are different from one country to another and these differences affect pH levels.
- Panel data techniques can further our understanding of the major trends of acid precipitation.

**Acknowledgements**

The authors thank the Spanish National Meteorology Institute for providing the data used and the Institute Carlos III for providing the chemical analysis of rainwater.

**References**

Al-Qudsi, S., 1998. The demand for children in Arab countries: Evidence from panel and count data models. Journal Population Economics 11, 435-452.

Arends, B., Baard, J., Ten Brink, H., 1997. Trends in summer sulphate in Europe. Atmos. Environ. 31, 4063-4072.

Axelsson, R., Westerland, O., 1998. A panel study of migration, self-selection and household real income. Journal Population Economics 11, 113-126.

Baltagi, B., 1995. Econometric Analysis of Panel Data. John Wiley & Sons, New York.

Butler, T., Likens, G., 1991. The impact of changing regional emissions on precipitation chemistry in the eastern United States. Atmos. Environ. 25A, 305-315.

EMEP/CCC-Note 2/94, 1994. Norwegian Institute for Air Research, Kjeller, Norway.

EMEP, 1999. Meteorological Synthesizing Centre-West (MSC-W).

European Environmental Agency (EEA), 1998. Europe's Environment: The Second Assessment. Copenhagen, Denmark.

Garín, T., Pérez-Amaral, T. 1996. Demand for international telephone traffic in Spain: An econometric study using provincial panel data. Information Economics Policy, 8, 289-315.

Garín, T., Pérez-Amaral, T. 1998. Econometric modeling of Spanish very long distance international telephone traffic. Information Economics Policy, 10, 2, 237-252.

Garín, T., Pérez-Amaral, T. 1999. A model of Spain-Europe telecommunications. Applied Economics, 31, 989-997.

Garín, T., Pérez-Amaral, T. 2000. An econometric model for international tourism flows to Spain. Applied Economics Letters (in press).

Gimeno, L., Rúa, A., Hernández, E., 1997. Relationship between air pollutant emissions patterns and concentrations. Toxicol. Environ. Chem., 59, 189-197.

Hausman, J. A., Taylor., W. E. 1981. Panel data and unobservable individual effects. Econometrica, 49, 1377-1379.

Hedin, L., Granat. L., Likens, G., Buishand, T., Galloway, J., Butler, T., Rodhe, H., 1994. Steep declines in atmospheric base cations in regions of Europe and North America. Nature 367, 351-354.

Hsiao, H., 1986. Analysis of Panel Data. Cambridge University Press, Cambridge.

Leck, C., Rodhe, H., 1989. On the relation between anthropogenic $SO_2$ emissions and concentration of sulfate in air and precipitation. Atmos. Environ. 23, 959-966.

Lynch, J., Grimm, J., Bowersox, V., 1995. Trends in precipitation chemistry in the United States: A national perspective, 1980-1992. Atmos. Environ. 29, 1231-1246.

Mundlak, Y. 1978. On the pooling of time series and cross section data. Econometrica, 46, 69-85.

Nodop, K., et al. 1985. EMEP/CCC-Rep 2/85. Norwegian Institute for Air Research, Lillestron.

Puxbaum, H., Simeonov, V., Kalina, M., 1998. Ten year trends (1984-1993) in the precipitation chemistry in central Austria. Atmos. Environ. 32, 193-202.

Rodhe, H., Granat, L., 1984. An evaluation of sulfate in european precipitation 1955-1982. Atmos. Environ. 18, 2627-2639.

Rúa, A., Bourhim, S., Marín, E., Hernández, E., 1999. Characterising $SO_2$ and sulphate patterns in Europe: A cluster analysis. Toxicol. Environ. Chem. 71, 21-32.

Rúa, A., Gimeno, L., Hernández, E., 1998. Trends and seasonal variation of $SO_2$, $NO_x$, $SO_4^{2-}$ and $NO_3^-$ concentrations in the air of the Spanish EMEP stations. Toxicol. Environ. Chem. 65, 351-161.

Terry, M., Easter, R., 1987. Statistical summary and analysis of event precipitation chemistry from the MAP3S network, 1976-1983. Atmos. Environ. 21, 113-128.

## FIGURE CAPTIONS

Figure 1. Geographical location of measuring sites in Europe

Figure 2. Geographical situation of stations in each pattern for the pH.

Figure 3. Difference 1997-1993 of $SO_2$ emission inventories (1000 Tonnes).

Figure 4. Difference 1997-1993 of $NO_2$ emission inventories (1000 Tonnes).

Figure 1 Geographical location of measuring sites in Europe

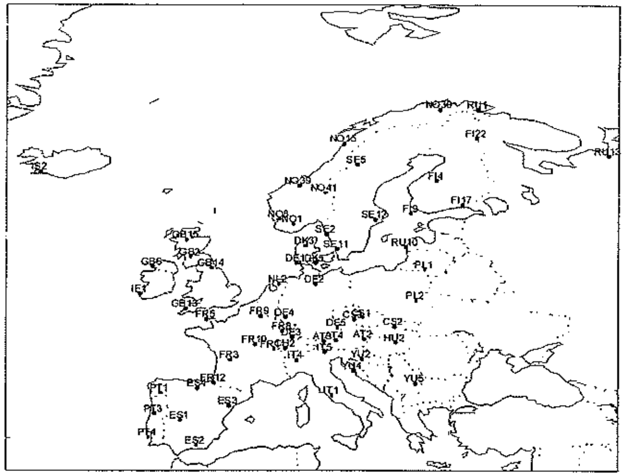

Figure 2 Geographical situation of stations in each pattern for the pH

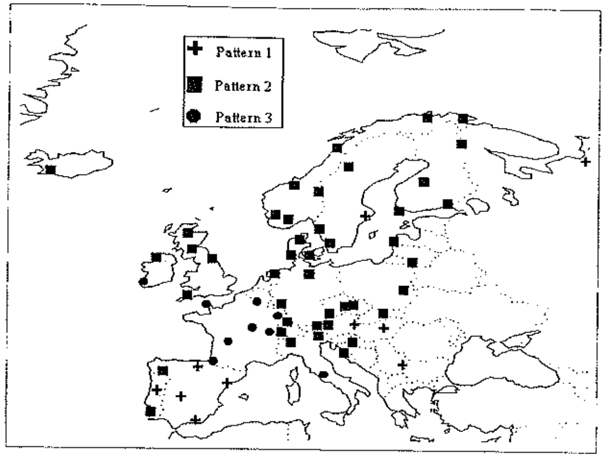

Figure 3 Difference 1997-1993 of $SO_2$ emission inventories (1000 Tonnes)

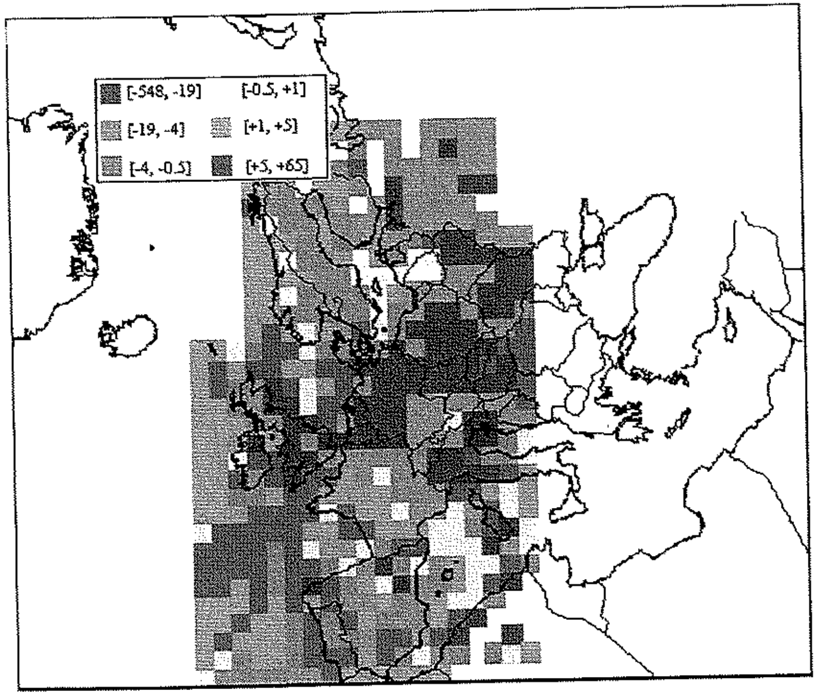

Figure 4 Difference 1997-1993 of $NO_2$ emission inventories (1000 Tonnes)

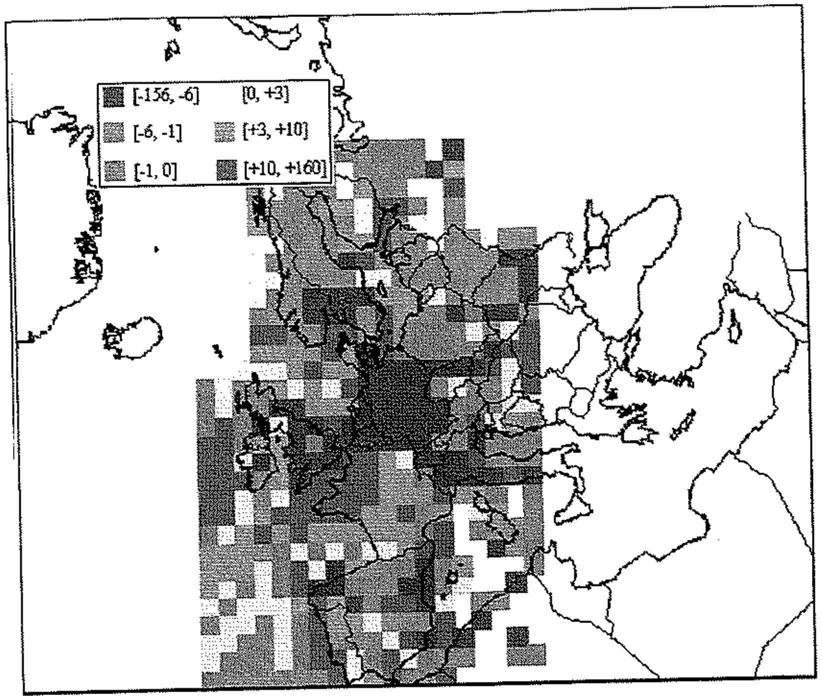

Table 1 Statistics for the three patterns. Fixed effects approach

| Pattern | Number of stations (N) | Number of data points | $H_{o1}$ | $H_{o2}$ | $H_{o3}$ | $\hat{\beta}$ (std. error) | Slope sig. level | t statistic of slope | $R^2$ |
|---|---|---|---|---|---|---|---|---|---|
| Peripheral | 11 | 120 | 0.00001 | 0.62 | 0.00001 | +0.057<br>(0.0089) | 0.00001 | 6.48 | 0.83 |
| Central | 42 | 455 | 0.00001 | 0.96 | 0.00001 | +0.022<br>(0.0018) | 0.00001 | 11.89 | 0.88 |
| French | 9 | 90 | 0.00001 | 0.89 | 0.00001 | -0.022<br>(0.0073) | 0.004 | -3.02 | 0.50 |

Table 2 Statistics for the three patterns. Classical pooling

| Pattern | Number of stations (N) | Number of data points | $\hat{\alpha}$ (std. error) | $\hat{\beta}$ (std. error) | Slope Sig. level | t statistic of slope | $R^2$ |
|---|---|---|---|---|---|---|---|
| Peripheral | 11 | 120 | 4.83<br>(0.14) | +0.059<br>(0.019) | 0.002 | 3.1 | 0.10 |
| Central | 42 | 455 | 4.59<br>(0.03) | +0.021<br>(0.0048) | 0.00001 | 4.47 | 0.10 |
| French | 9 | 90 | 5.16<br>(0.07) | -0.015<br>(0.0098) | 0.1 | -1.65 | 0.10 |

Table 3 Statistics for the three patterns. Aggregate time series regression model

| Pattern | Number of stations (N) | Number of data points | $\hat{\alpha}$ (std. error) | $\hat{\beta}$ (std. error) | Slope sig. level | t statistic of slope | $R^2$ |
|---|---|---|---|---|---|---|---|
| Peripheral | 11 | 12 | 4.80<br>(0.10) | +0.064<br>(0.014) | 0.001 | 4.68 | 0.68 |
| Central | 42 | 12 | 4.60<br>(0.02) | +0.020<br>(0.0030) | 0.00001 | 8.07 | 0.84 |
| French | 9 | 12 | 5.11<br>(0.06) | -0.001<br>(0.009) | 0.31 | -1.06 | 0.10 |