

# **Environmental and Transport Indicators in the `Old 15' and the `New 12'**

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## 1. *Background*

The InfoRegio section of the Europa website now contains the Urban Audit website, which has now been expanded to 258 cities, extending across the whole of the EU27([www.urbanaudit.org](http://www.urbanaudit.org)). Recently a set of Turkish cities has also been added, though little data is presented for these. The Urban Audit contains a wide range of indicators and in this paper we focus on the most accessible of the environmental indicators. Specifically, we will examine those included within each city's City Profile. The whole Urban Audit data set is available to educational users, with an Athens password. We will examine the indicators descriptively, present some descriptive charts, and discuss some OLS regression results, in which North/South and ex-Socialist/western comparisons are highlighted.

There is not a large research literature specifically on urban environmental indicators and relationships in European cities. Van den Berg et al (2007, pp. 44-46) clarified the place of urban policy within the EU Regional Policy Directorate, including the cost of the recent Urban Audit II (which approximated 2m. Euros for the 2000-6 funding period, though that was just for the old EU15). This volume provides welcome updates on urban policy in each of the EU15 states.

## 2. *Data*

The environmental/transport indicators included under the City Profiles are:

- ❖ Summer Smog: No. of days ozone (O<sub>3</sub>) exceeds 120µg/m<sup>3</sup> (SMOG)
- ❖ Number of days PM<sub>10</sub> concentrations exceed 50 µg/m<sup>3</sup> (PM<sub>10</sub>)
- ❖ Amount of solid waste collected (domestic and commercial) - tonnes per capita per annum (SWTPC)
- ❖ Percentage of solid waste processed by landfill (PCLF)
- ❖ Green space to which the public has access (m<sup>2</sup> per capita) (GSM2PC)
- ❖ Population density (residents per km<sup>2</sup>) (POPDEN)
- ❖ Percentage of journeys to work by car (PCJWCAR)
- ❖ Average time of journey to work (minutes) (JWMINS<sub>AV</sub>)

We will see that the number of cities that provided data for these variables varied quite widely. Some countries did not provide any, and some cities within countries otherwise well-provided were blank for some variables. In some cases (e.g. transport data for the British cities) it was known that the data was available, but had not found its way to the Urban Audit. In addition, some indicators had values that the reader had doubts about. [For example, is it really true that the amount of green space to which the public has access in Romanian cities is zero, in all cases? Or the Latvian cities had high values given for Solid Waste collected per capita which gave this reader the impression that they had in error given a figure in kg not tonnes.]

However the Urban Audit is already (and potentially even more so) an immensely valuable resource. If the missing data gaps were to be filled, and queries over specific values were to be answered reliably and promptly, the Audit could become quite central to many colleagues' research, as well as politically important.

In addition to the City data (given for the politically defined city), there was data collected where possible for the Larger Urban Zone (LUZ) except in smaller cities where it was not realistic. The LUZ were approximations to the built-up area, but also made up of local political units. But in many cases (especially for these environmental indicators), data was missing for the LUZ, and so we do not examine them here.

Likewise, data for the Sub-City Districts, which would be very valuable if it were fully available and reliable, is in the City Profiles limited mainly to the demographic/unemployment and training/education indicators.

### 3. Results

#### 3.1 Descriptive Results for all Indicators

Table 1. Descriptive Results

Full count 284 cities	SMOG	PM10	SWTPC	PCLF	GSM2PC	POPDEN	PCJWCAR	JWMINSAV	CITYPOP	LUZPOP
Mean	8.21	35.00	0.802	48.03	62.36	2257.07	59.85	24.68	444.17	1101.19
Median	3	17	0.57	49	23.5	1637	62	23	226.23	524.44
Mode	0	0	0.57	0	0	1480	59	18	364.78	5359.23
St. Dev.	12.00	43.22	1.330	39.32	115.40	2647.41	15.94	7.62	798.15	1753.71
Skewness	2.34	1.89	8.167	0.07	3.92	4.68	-0.45	2.10	6.87	4.09
Range	68	208	14.42	100	882	21015	73	57	8772.63	11612.83
Minimum	0	0	0.09	0	0	45	20	14	30.84	11.98
Maximum	68	208	14.51	100	882	21060	93	71	8803.47	11624.81
Count	175	137	160	153	154	251	181	179	284	265

The basic descriptive summary is given in Table 1, with correlations in Table 2. We see that almost all the indicators are positively skewed, and for 4 out of the 5 environmental indicators, the modal value is 0. [The exception is solid waste collected, which is hardly going to be 0 anywhere.]

Table 2. Correlation Coefficients (r) between Indicators and City Size variables.

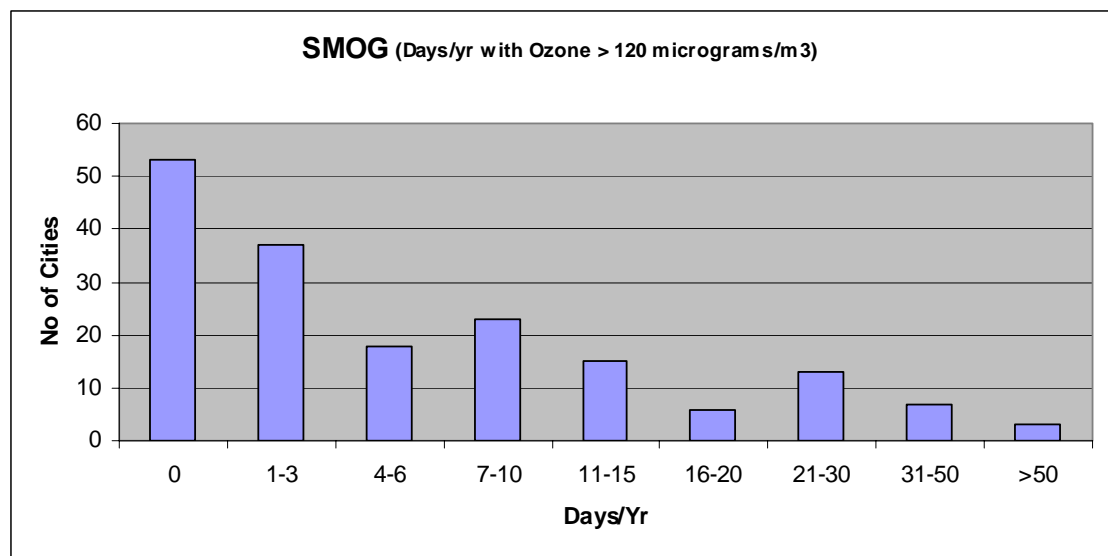
	SMOG	PM10	SWTPC	PCLF	GSM2PC	POPDEN	PCJWCAR	JWMINSAV	CITYPOP	LUZPOP
SMOG	1									
PM10	-0.003	1								
SWTPC	0.034	0.024	1							
PCLF	-0.118	0.269	-0.141	1						
GSM2PC	0.188	-0.112	0.200	0.036	1					
POPDEN	0.077	0.355	0.022	-0.053	-0.193	1				
PCJWCAR	-0.244	-0.491	-0.228	0.010	-0.204	-0.246	1			
JWMINSAV	-0.009	0.698	0.126	-0.215	0.153	0.230	-0.568	1		
CITYPOP	0.105	0.043	-0.065	-0.217	-0.139	0.346	-0.256	0.344	1	
LUZPOP	0.057	0.009	-0.080	-0.171	-0.115	0.407	0.046	0.192	0.642	1

We do not provide significance detail for the values of r. [Since the `matching set' of cities used varies in number for each pair of indicators, so would the critical level of r.] We can see that most of the r-values are rather low. The naïve idea that cities with lots of smog also have lots of particulates (PM10) is simply not true. Some are even a bit counter-intuitive: the r = - 0.49 for

the (% journey to work by car) against PM10. We find below that the `southern' dummy (not the Eastern bloc) turns out to be the strongest explainer of PM10. Likewise high length in minutes of the journey to work is highly correlated with PM10, in former socialist countries with high public transport use.

### 3.2 Summer Smog (Ozone)

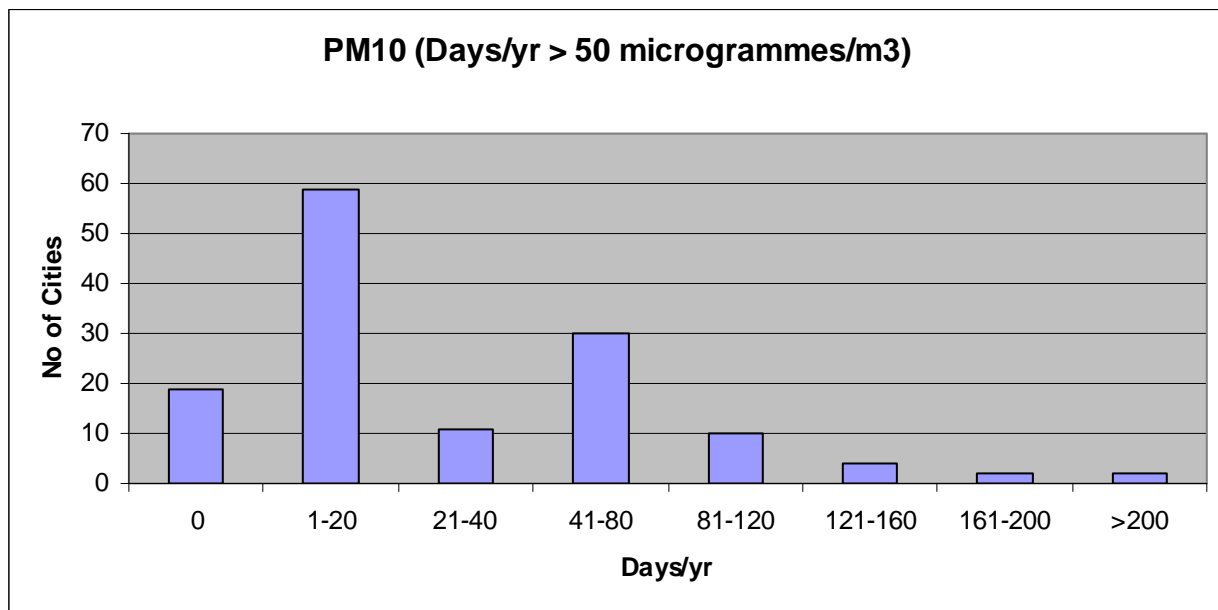
<i>SMOG</i>	<i>Frequency</i>
0	53
1-3	37
4-6	18
7-10	23
11-15	15
16-20	6
21-30	13
31-50	7
>50	3
N	175



Extreme values: >30 days/year for Düsseldorf, Freiburg, Karlsruhe, Mainz, Bologna, Milano, Venezia, Luxembourg, Graz, Wien.

### 3.3 Particulates (PM10)

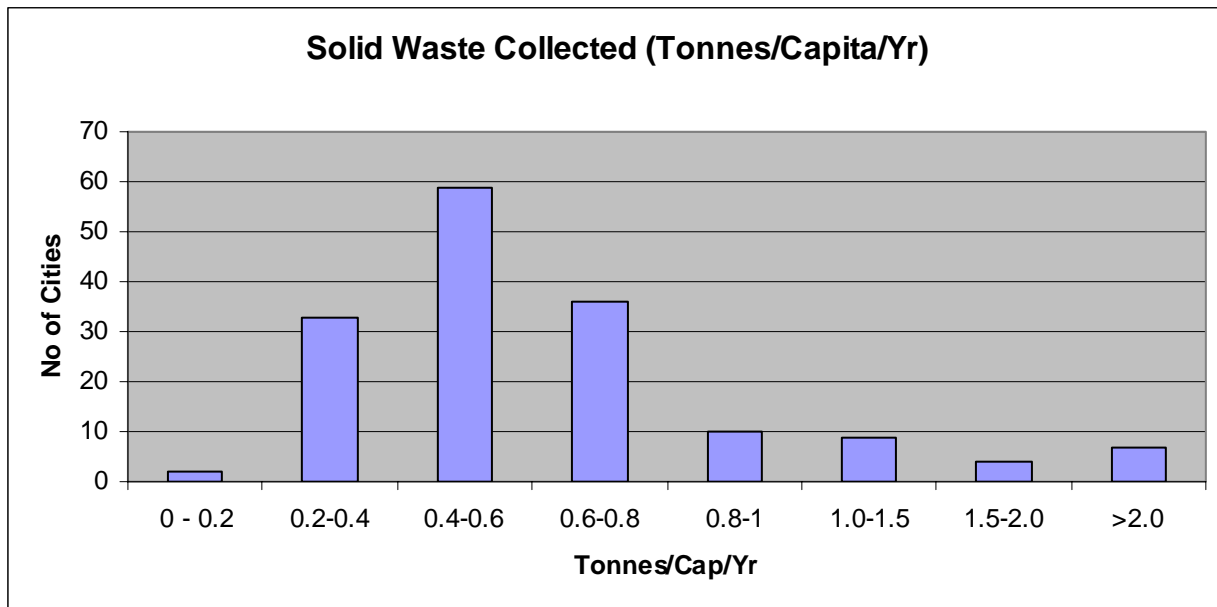
	PM10
0	19
1-20	59
21-40	11
41-80	30
81-120	10
121-160	4
161-200	2
>200	2
N	137



Extreme values: >120 days/year for Liege, Athens, Larissa, Patras, Thessaloniki, Nikosia, Budapest, Miskolc

### 3.4 Solid Waste Collected (Tonnes/Pop/Year)

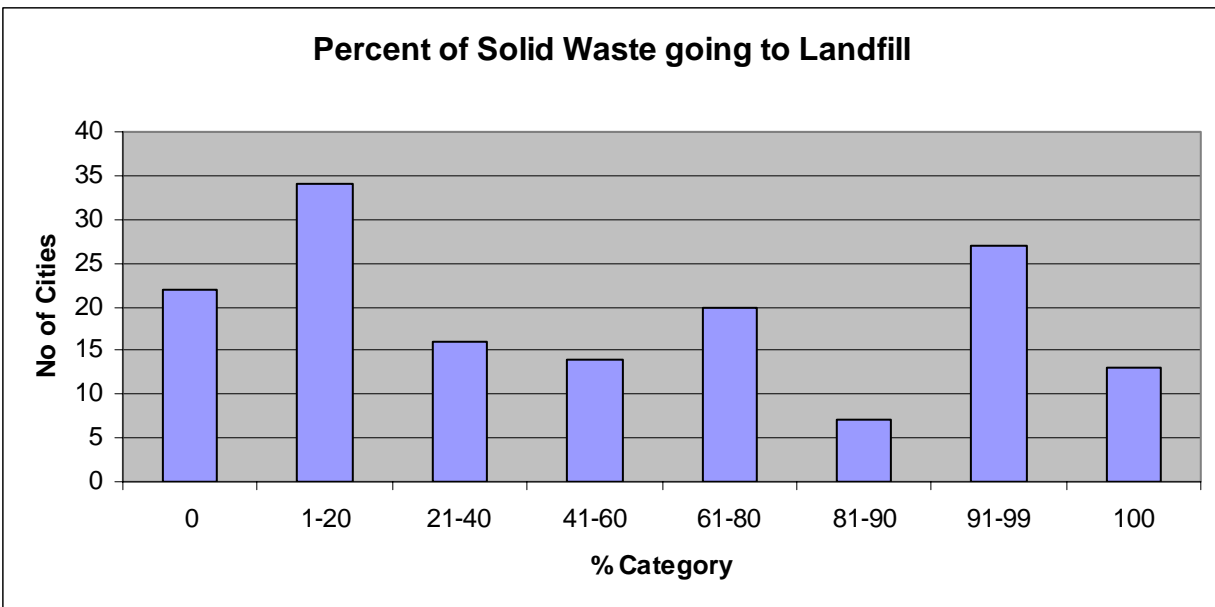
	SWTPC
0 - 0.2	2
0.2-0.4	33
0.4-0.6	59
0.6-0.8	36
0.8-1	10
1.0-1.5	9
1.5-2.0	4
>2.0	7
N	160



Extreme values: >2.0 Tonnes/Cap/Yr for Pleven (Bulg.), Aalborg, Tallinn (Est.), Athens, Kosice, Nitra (Slovakia), Panevezys (Lith.)

### 3.5 Percent solid waste processed by Landfill

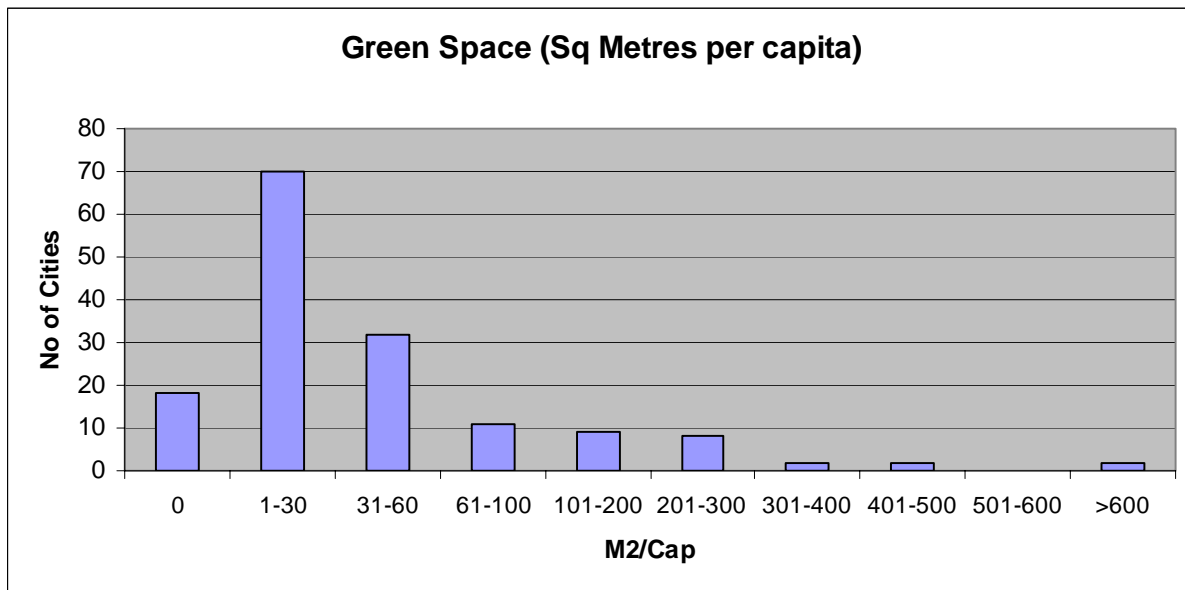
	<i>PCLF</i>
0	22
1-20	34
21-40	16
41-60	14
61-80	20
81-90	7
91-99	27
100	13
N	153



Extreme values: Percent = 100% for Erfurt, Weimar, Thessaloniki, Ajaccio (Corsica), Marseille, Gozo, Valletta (Malta), Bialystock, Gorzow, Jelenia, Kielce, Lublin, Nowy Sacz (Poland)

### 3.6 Green Space accessible to the public (m2 per capita)

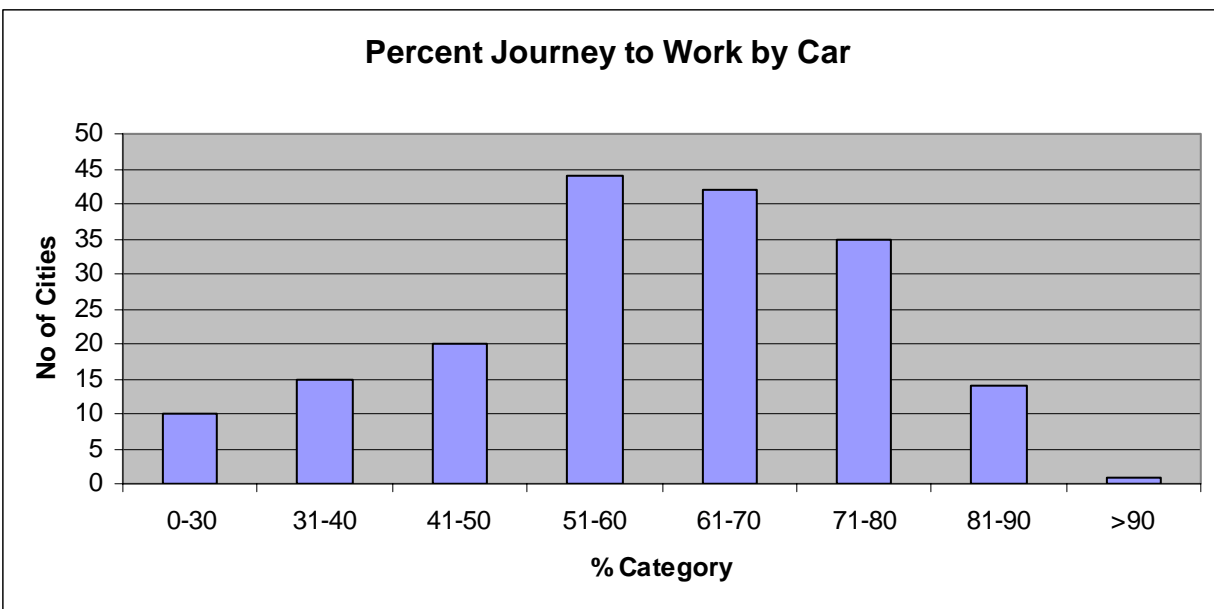
	GSM2PC
0	18
1-30	70
31-60	32
61-100	11
101-200	9
201-300	8
301-400	2
401-500	2
501-600	0
>600	2
N	154



Extreme values: over 300 m<sup>2</sup> per capita for Usta nad Labem (Czech Rep.), Darmstadt, Frankfurt/Oder, Freiburg, Banska Bystrica, Kosice (Slovakia).

### 3.7 Percent Journey to Work by Car

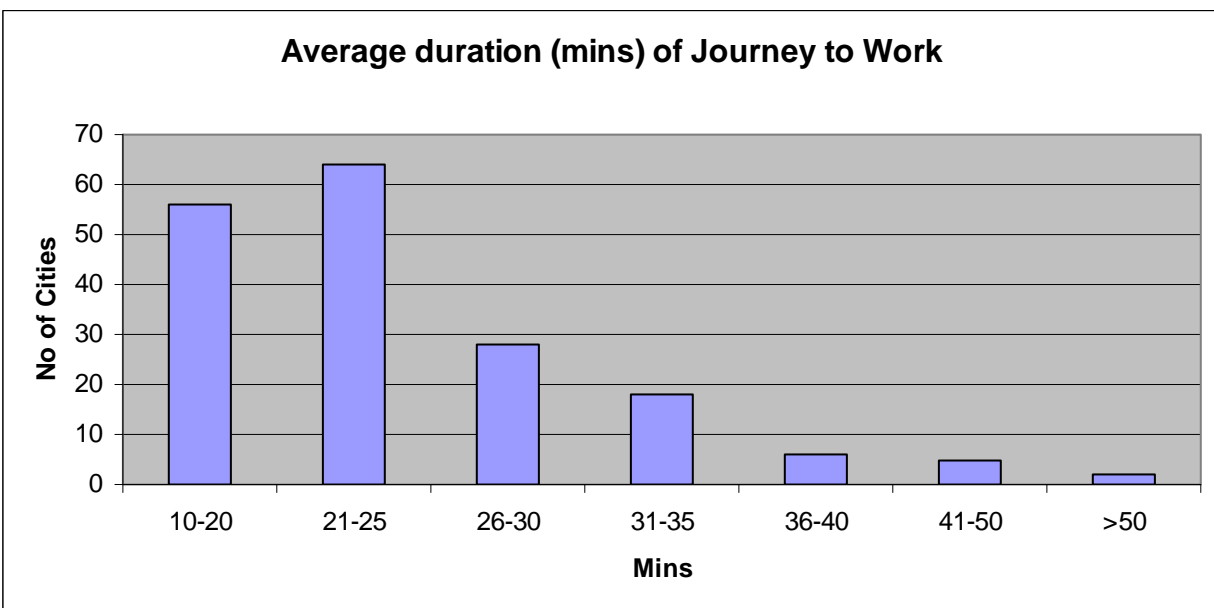
	PCJWCAR
0-30	10
31-40	15
41-50	20
51-60	44
61-70	42
71-80	35
81-90	14
>90	1
N	181



Extreme values:  $\leq 30\%$  for Brno, Ostrava, Praha, Usta nad Labem (Czech Rep.), Barcelona, Budapest, Miskolc (Hungary), Banska Bystrica, Bratislava, Kosice (Slovakia).

### 3.8 Average Duration (minutes) of Journey to Work

	<i>JWMINSAV</i>
10-20	56
21-25	64
26-30	28
31-35	18
36-40	6
41-50	5
>50	2
N	179



Extreme values:  $\geq 41$  minutes for Budapest, Miskolc, Nyiregyhaza, Pecs (Hungary), Lisboa, Bratislava, G. London.

#### 4 *Some OLS Regression Results*

Table 3. Econometric Estimates with 5 environmental indicators as dependent variables.

(t-statistics in parentheses; \* signif at 10%, \*\* signif 5%, \*\*\* signif 1%)

	SMOG	PM10	SWTPC	PCLF	GSM2PC
Const	29.3	84.0	0.924	26.1	101.5
<b>Dummy E bloc</b>	-8.07* (1.7)	0.134 (0.01)	12.5 (1.65)	47.7*** (8.2)	4.2 (0.2)
<b>Dummy South</b>	-1.38 (0.5)	43.7*** (4.7)	-2.79 (0.4)	40.1*** (6.0)	-75.5*** (4.2)
PCJWCAR	-0.301*** (3.2)	-1.02*** (3.9)			
City Pop	-0.0005 (0.2)	0.001 (0.1)			-0.029* (1.69)
Pop Density			0.0004 (0.3)	-0.0007 (0.7)	
%Adj R <sup>2</sup>	5.6	37.7	0.3	34.8	10.5
n	123	97	160	151	154

Some preliminary simple OLS regressions suggest some quite surprising results.

The former Eastern bloc has lower summer smog, as do cities with high car use in the journey to work. So the highest incidence of summer smog (ozone) is in western cities with middling to low car use.

High levels of PM10 particulates are strongly associated with the South of Europe, and with cities with low car use.

Solid waste collection in tonnes/capita is difficult to explain.

A high percentage of solid waste going to landfill is very much associated with the Eastern bloc and the South.

Accessible Green Space per capita is significantly lower in the South of Europe, and weakly lower in bigger cities.

All the measures of goodness of fit are poor, with Adjusted R<sup>2</sup> under 40%, or much lower.

## 5. *Other Environmental and Transport Indicators*

In addition to the indicators discussed above, there are a substantial number of other environmental and transport-related indicators, listed below. They are available as part of the New Cronos data base within Eurostat:

### **Environmental and Transport Indicators in Urban Audit**

Winter Smog: Number of days SO<sub>2</sub> exceeds 125Ág/m<sup>3</sup>  
Summer Smog: Number of days Ozone O<sub>3</sub> exceeds 120Ág/m<sup>3</sup>  
Number of days per year that NO<sub>2</sub> concentrations exceed 200mg/m<sup>3</sup>  
Number of days per year particulate matter PM<sub>10</sub> concentrations exceed 50 Ág/m<sup>3</sup>  
Concentration of lead Pb in ambient air in Ág/m<sup>3</sup>  
Total carbon dioxide CO<sub>2</sub> emissions  
Total carbon monoxide CO emissions  
Total methane CH<sub>4</sub> emissions  
Total non-methane volatile organic compounds NVOC emissions  
Total sulphur dioxide SO<sub>2</sub> emissions  
Total nitrogen dioxide NO<sub>2</sub> emissions  
Proportion of residents exposed to outdoor day noise levels above 55 dB(A)  
Proportion of residents exposed to sleep disturbing outdoor night noise levels above 45 dB(A)  
CO<sub>2</sub> emissions per capita  
Consumption of water (cubic metres per annum) per inhabitant  
Percentage of dwellings connected to potable drinking water supply infrastructure  
% dwellings connected to sewerage treatment system  
Number of water rationing cases days per year  
Number of scheduled water stoppages days per year  
Amount of collected solid waste per capita per annum  
Proportion of solid waste arising within the boundary processed by landfill  
Proportion of solid waste arising within the boundary processed by incinerator  
Proportion of solid waste arising within the boundary processed by recycling  
Proportion of solid waste arising within the boundary processed by other method  
Annual amount of toxic waste per inhabitant  
Total land area (km<sup>2</sup>) according to cadastral register  
Green space to which the public has access per capita  
Proportion of the population within 15 minutes walking distance of urban green areas  
Proportion of the area in green space  
Proportion of the area used for agricultural purposes  
Proportion of the area in mineral extraction  
Proportion of the area industrial and manufactory use  
Proportion of the area in road network use  
Proportion of the area in rail network  
Proportion of the area in ports use  
Proportion of the area in airports use

Proportion of the area in water treatment use  
Proportion of the area in waste disposal use  
Proportion of the area in commerce finance and business use  
Proportion of the area in recreational sports and leisure use  
Proportion of the area in housing/residential use  
Proportion of the area unused including contaminated or derelict land areas  
Proportion of the urban area subject to special conservation measures  
Population density - total resident population per square km  
Net residential density - pop. per land area in housing  
Electricity consumption per capita (kWh)  
Gas consumption per capita (toe)  
Share of electricity use in transport sector  
Share of electricity use in industry sector  
Share of electricity use in domestic sector  
Share of electricity use in commercial sector  
Proportion of journeys to work by rail or metro  
Proportion of journeys to work by car  
Proportion of journeys to work by bus  
Proportion of journeys to work by tram  
Proportion of journeys to work by motor cycle  
Proportion of journeys to work by bicycle  
Proportion of journeys to work by foot  
Proportion of journeys to work by other modes  
Average number of occupants of motor cars  
Number of registered cars per 1000 population  
Road accidents resulting in death or serious injury per 1000 population  
Proportion of incommuters of persons employed in the city  
Proportion of out-commuters of employed persons living in city  
Average time of journey to work  
Av. speed of inner-city car traffic during the rush hour  
Average waiting time for a bus in the rush hour  
Length of public transport network / land area  
Length of public transport network per inhabitant  
Ratio of day-time to night time population  
Total km driven in public transport per capita

We do not have space to discuss this data base any further, except to note that the availability of these indicators is a bit patchy. A final histogram is of the count of values given out of the 258 cities in the EU27 data base. [Turkey has cities listed, but no data at all given yet.]

Table. Availability of data for the 71 environmental and transport indicators in Urban Audit (from 258 cities in EU27).

<i>Data given</i>	<i>Frequency</i>
up to 40	4
41-60	2
61-80	14
81-100	15
101-120	11
121-140	13
141-160	2
161-180	5
181-200	2
201-220	1
More than 220	2

We see that the modal band of the count (out of 258 cities) is 81-100, followed by 61-80. Clearly, where only roughly one in three of the cities has a value given, this rather devalues the Urban Audit data, and we hope that a high priority will be to consistently fill the gaps.

## 6. *Conclusions*

We have presented some descriptive and basic statistical analysis of 7 indicators from the Urban Audit data base, using its data on city size and population density in addition, with a focus on environmental and transport elements of the urban quality of life. We examined briefly the relationships between these indicators, using basic correlation and OLS regression. The full data base has 71 environmental and transport indicators, but availability of the data is patchy, and for some of these indicators rather poor, as yet. Improvements in data availability would be very useful for research on EU cities.

## *References*

Van den Berg L., E. Braun and J. van der Meer (2007) National Policy Responses to Urban Challenges in Europe (Aldershot, Ashgate).