Environmental Economics in Russia: Valuation and Regulatory Distortions

by

Charles D. Kolstad*
Elena Gorbacheva
Julia Khaleeva
Svetlana Shcherbich

New Economic School
Moscow

November 11, 1998

Prepared for GET Project Meeting
Moscow
Nov. 20-21, 1998

Abstract

This paper summarizes the research of three masters theses. The theme of the theses is the economics of environmental problems in Russia. One thesis focuses on the damage from climate change. The work estimates the climate and weather sensitivity of Russian agriculture and estimates the output gains associated with temperature and precipitation increases associated with climate change. The second thesis involves the effect of environmental quality on housing rents in Moscow, the first step in conducting a hedonic analysis of the demand for environmental quality in Moscow. The third thesis empirically investigates the extent to which lax environmental regulations in Russia may be responsible for the relatively good performance of Russian chemicals and primary metals industries in international trade.

---

*Kolstad's permanent address and affiliation is Department of Economics, University of California, Santa Barbara, CA 93106-9210 USA. The work reported here is derived from the 1998 Masters Theses of Gorbacheva, Khaleeva and Shcherbich, conducted at the New Economic School in Moscow under the direction of Profs. Oleg Eismont and Charles Kolstad.

I. INTRODUCTION

Although there is no shortage of issues to concerns Russians today, the environment is a significant concern, not only because of the environmental problems of past years but also because of the implicit value Russians place on environmental amenities. Thus Russian concerns with environment are very much in step with environmental concerns in other parts of the world.

One of the objectives of the GET[1] program at the New Economic School in Moscow is the use modern economic analysis to better understand some of the fundamental problems facing Russia today. The work reported here concerns the environment in Russia. In particular, we consider the measurement of the demand for environmental quality and the effect of environmental regulations on international competitiveness.

II. ECONOMIC CONSEQUENCES OF GLOBAL WARMING[2]

Climate change is the most prominent environmental issue on the global agenda today. This month (November 1998), most of the world's countries are meeting in Buenos Aires to refine the protocol for control of greenhouse gases initially agreed to in Kyoto, Japan in December 1997. A major issue in the international debate is the damage that may result from climate change. A number

---

[1] GET stands for Governments and Economies in Transition. The GET program is a program of the New Economic School in Moscow and is funded by a number of international organizations.

[2] This section of the paper reports on results contained in Khaleeva (1998).

of authors, particularly Nordhaus (1991, 1994), have estimated damage from climate change from data on the US. Fankhauser et al (1997) conclude that a doubling of carbon concentrations will bring approximately 30 billion dollars a year of damage to Russia.

One of the most rigorous analyses of the damage from climate change was conducted by Mendelsohn et al (1994) for agriculture in the US. In that analysis, the effect of different climates on current land values was estimated and this variation used to project the land value decline from a 2.5°C temperature increase and an 8% precipitation increase across the US. The idea is that land value embody all of the positive and negative aspects of the climate.

Although this approach is not applicable to Russia, because of unknown agricultural land values, it is possible to measure the effect of climate on agricultural yields. As Cline (1992) has shown, the value of the lost yield from climate change is a lower bound on the damage from the climate change, since substitution is excluded and substitution serves to diminish the damage.

The approach taken in this research was to collect data for the 89 oblasts in Russia for the period 1993-95, although a few oblasts had to be excluded because the information was incomplete (e.g., Chechnja and Ingushetija).[3] The number of useable oblasts varied by year but the total ranged from 60 to 64. With annual observations for the 1993-95 period, we obtained 188 observations on annual oblast-level grains yield (tonnes per hectare). Other data used were climate variables, reflecting average temperature and precipitation in January and July (averaged over 1991-96), actual realized January and July temperature and precipitation (weather, as opposed to climate), by year, a land quality variable,and variables indicating the quantity of fertilizers applied to the land (per hectare).

We posited a linear relationship between grain yield and the exogenous variables, except that we included squares of the weather and climate variable as explanatory variables. We estimated the yield equation using ordinary least squares, correcting for heteroskedasticity in estimating the standard errors of the coefficients. Results are presented in Table I.

All four quadratic climate terms turn out to be statistically insignificant, though perhaps not jointly insignificant. Thus yield is roughly a linear function of the climate variables chosen.

Weather, on the other hand, clearly has a nonlinear influence on yield, although the square of January precipitation is insignificant. A positive coefficient on the squared term implies a concave upwards relationship between weather and yield; a negative coefficient the opposite. For July temperature, the yield curve in concave downwards, with an optimal temperature of 22°C, an intuitively plausible result. For winter temperature, the yield curve is concave upwards but with a minimum yield point at –29°C, which is quite chilly. Effectively the relationship between winter temperature and yield is monotonically increasing for most realistic winter temperatures. Summer precipitation results in a concave downwards yield curve with maximum yield at 8.7 cm per month of precipitation. These points of minimum and maximum yield are independent of other variables because of the quasi-linear functional form assumed for yield. The model appears to generate reasonable results for the relationship among climate, weather and grain yield.

---

[3] For the most part, data come from annual bulletins of Goscomstat. Some weather data from

One of the important counterfactual experiments in Mendelsohn et al (1994) was to use the land value equation they obtained for the US and estimate the value loss from a 2.5°C warming with an 8% precipitiation increase[4]. We can perform a similar analysis using our yield equation for grains output. Over our data set, such a climate change (assuming weather stays the same), results in an expected increase in grains output of 88 kilograms per hectare, for the average oblast. Simply applying this yield increase to all of the productive land in our sample increases grains output by 4.5 million tonnes, which is approximately 7% of the 1996 grains output over our sample set of oblasts.

This is a very significant result. It suggests that for Russian agriculture, global warming is a good thing, at least as far as average temperature and precipitation is concerned. Of course, climate change could come in a different form (such as increased frequency of storms) which could have negative effects on output.

III. HOUSING PRICES AND ENVIRONMENTAL QUALITY IN MOSCOW[5]

One of the most active areas of environmental economics around the world is in the measuring of the demand for environmental goods and services (see Braden and Kolstad, 1991). Individuals clearly have preferences involving environmental quality but because of a lack of markets, it is difficult to measure demand functions for environmental quality. One of the oldest approaches to this problem is the revealed preference method whereby we observe the price of goods closely associated with environmental quality and calculate how those prices change as enviornmental

---

Gidrometrcentr was also used (through 1994).

[4] Mendelsohn et al (1994) actually examine the effects of a 5°F temperature increase (2.78°C). We examine the effects of a 2.5°C increase in temperature, as well as an 8% increase in precipitation.

quality changes. Ridker and Henning (1967) examined the price of houses in the US and measured the extent to which they changed with air pollution. Although their work was flawed, this general approach to measuring demand using hedonic prices has received a great deal of theoretical and empirical attention over the past quarter century.

The basic approach of the hedonic literature is to estimate a relationship between price and characteristics of the market good, including enviornmental quality. This is the hedonic price equation. The second step is to estimate the willingness to pay for changes in environmental quality. Estimating this second curve, which is equivalent to a demand curve has proved difficult.

Until recently, it has been difficult to apply such revealed preference methods in Russia because of a lack of markets for goods correlated with pollution, such as housing. However, in recent years the housing market in cities such as Moscow has developed to the stage where such analyses can be performed. Surprisingly, the data on rental rates for apartments is quite good for Moscow; what is less available is good measures of environmental quality. Quantitative measures of levels of five pollutants are available for 1995 but more recent data is confidential. More recent qualitative measures are available. Figure 1 shows a map with qualitative estimates of levels of environmental quality, from April, 1998. Superimposed on the map are indices of atmospheric pollution at 11 stations in 1995. Estimated 6.0 isopleths are also plotted. Although the data from the 11 stations does not correspond closely to the qualitative data presented on the map, it is important to

---

[5] This section of the paper is based on Shcherbich (1998).

realize that the qualitative data takes more factors into account, such as accessibility to parks.

Information on the rental price of apartments, and their characteristics, was obtained from the magazine *Only Real Estate* (*Prosto Nedveshemost*) from various issues in 1998. Information was available on 1143 one-room apartments and 1521 two-room apartments. After the data was "cleaned," 978 one-room and 1356 two-room apartments remained. Ata are available on the characteristics of the apartment, location of the apartment, and monthly rent. Rental rates for one bedroom apartments ranged from US$150 to US$800 per month and for two-bedroom apartments, from US$200 to US$4000 per month. Table II summarizes the data for two-bedroom apartments.

The approach taken in this study is to estimate how apartment rentals depend on characteristics of the apartment, including environmental quality. This is the hedonic price equation. Unfortunately, we have no information on the incomes of apartment renters so there is no hope of estimating a marginal willingness to pay for environmental improvements equation.

We have examined the rent determination equation for both one-bedroom and two-bedroom apartments. The one-bedroom equation gives a low level of significance to the environmental variables so we concentrate on the two-bedroom market, which in any case is a larger data set.

There are a number of different ways of estimating the hedonic price function. With respect to the environmental variables, we can focus on the dummy variable representation of environmental quality or use the continuously varying from 1 to 4 variable, ECOLOGY. We define two models, one with dummy variables for the levels of environmental quality. Model 2 uses the variable ECOLOGY to represent environmental quality as well as dummy variables for regions of Moscow. Results are presented in Table III.

Note the high degree of significance of all the variables in this regression. All of the variables have the expected signs. For Model 2, note that the ECOLOGY variable also has the expected sign and is significant. Recalling that the worst environmental quality is associated with ECOLOGY = 1 and the best with ECOLOGY = 4, higher levels of environmental quality increase the rent. Model 1 is the same equation but using the dummy variables for environmental quality; in this case, we find that an environmental quality of 2 increases the rent by 8% relative to the lowest level of environmental quality, level 1. Quality level 3 generates a 16% premium over the lowest level and the highest level of environmental quality results in a 41% rent increase relative to the lowest level of quality. These percentages are statistically significant and very meaningful. The rents of lower priced apartments tend to be less sensitive to increases in environmental quality. Higher priced apartments are much more sensitive to environmental quality levels. To the extent that income is correlated with the price of apartments, these results suggest that there may be very significant willingness to pay for increased levels of environmental quality.

IV ENVIRONMENTAL REGULATIONS AND COMPETIVENESS OF RUSSIAN INDUSTRY[6]

---

[6] The material reported here is drawn from Gorbacheva (1998).

One of the controversies in the environmental economics and international trade literature in recent years is the extent to which lax or tight environmental regulations influence the competitiveness of industry (e.g., see Jaffe et al, 1995; Xing and Kolstad, 1998). Russian industry has not done well during the 1990's. Figure 3 shows the decline in output over the decade. Note that the industries which have declined the least are fuels production, non-ferrous metals and chemicals. Because of the relatively lax level of environmental regulation in Russia, the question arises as to whether these industries have done relatively well because of weak Russian environmental laws, or at least weak enforcement of existing laws. This research sets out to answer that question.

The approach will be to examine four particularly polluting sectors (fertilizers, pig iron, primary steel and aluminum) and examine a cross section of countries. The hypothesis we seek to test is whether lax environmental regulations tend to confer comparative advantage in the international market. To implement such a model we must have knowledge of comparative advantage as well as the level of stringency of environmental regulations.

The measure of comparative advantage is straightforward. We adopt the measure introduced by Belassa (1965). Define the revealed comparative advantage in industry j, time period t, RCA_{jt}, for a country as

$$RCA_{jt} = \frac{x_{jt}}{X_{jt}} \Big/ \frac{x_i}{X_t} \tag{1}$$

where x_{jt} is the country's exports of industry j, X_{jt} is total world trade for industry j, x_t

is total exports for country I and X_t is total world trade (exports for all countries). This measure has been used in the context of environmental regulations by Low and Yeats, 1992). Table IV shows the revealed comparative advantage indices for three years and four polluting industries for a number of countries.

The next task is to determine the extent to which RCA differences can be explained on the basis of lax environmental regulations. Let E* be the level of environmental regulations. We wish to estimate the equation

$$RCA = f(Z,E^*) \tag{2}$$

Where Z is a vector of explanatory variables. Unfortunately, we do not have observations on E* so we adopt the approach of Xing and Kolstad (1998), noting that sulfur emissions are also generated by E*:

$$S = e(X,E^*) \tag{3}$$

Where X is another vector of explanatory variables. In principle this equation can be solved for E* and used to estimate the RCA equation. In particular, we assume that the sulfur emissions equation can be inverted to obtain E*:

$$E^* = S_i/G_i + \alpha_I I_I + \alpha_P P_I + \alpha_{ENSTR} ENSTR_I + \epsilon_I \tag{4}$$

Where i indicates the country, G industrial GDP, I is the share of industrial output in GDP, P the domestic price of energy, ENSTR the structure of energy consumption (the energy obtained from solid fuel divided by total energy consumption), and ϵ is an error term with zero mean. G, I, P and ϵ are expected to be uncorrelated but S and ϵ may be correlated.

We assume the RCA index is a linear function of the laxity of environmental regulations (E*), share of a specific industry's output in GDP (R), energy intensity (EN), the price of energy (P), industrial wages (W), and an error term η with zero mean and independent of ϵ. If we combine this with the previous equation determining E*, we obtain

$$RCA_i = \qquad (5)$$

$$C + \beta_R R_i + \beta_{EN} EN_i + (\beta_P + \beta_E \alpha_P) P_i + \beta_W W_i + \beta_E S_i/G_i + \beta_E \alpha_I I_i + \beta_E \alpha_{ENSTR} ENSTR_i + \xi_i$$

Where ξ_i is the error term with mean zero and uncorrelated with any of the exogenous variables except S. Also because this equation involves cross-country effects, the variance of the error term may not be homogenous. We use instrumental variables to estimate this model. As instruments we use all exogenous variables plus the share of household income spent on food, a human development index and nurses per unit population.

In estimating Eqn. (5), we are interested in the parameter β_E. If this parameter is significant, it suggests that the laxity of environmental regulations have an effect on comparative advantage. If the coefficient is significant, we would expect it to be significantly positive, suggesting that laxer environmental regulations lead to higher values of RCA. Tables V shows the results of estimating Eqn. (5) for the four sectors. Note that the coefficient of S/G is not significant except for Aluminum where it is significantly positive at the 90% level. This suggests that lax environmental regulations do tend to help the aluminum industry. Unfortunately, the data set is too small to be able to conclude much else.

V. CONCLUSIONS

We have seen that modern methods of economic analysis can be used in effectively used to address Russian problems. To be sure, there are significant data problems in doing such analysis in Russia. It is hoped this paper may motivate further research on environmental and resource problems in Russia.

REFERENCES

Bellasa, Bela, "Trade Liberalization and 'Revealed' Comparative Advantage," Manchester School of Economics and Social Studies, **33**:99-124 (1965).

Braden, John and Charles Kolstad (Eds), *Measuring the Demand for Environmental Quality* (North-Holland, Amsterdam, 1991).

Cline, William R., *The Economics of Global Warming* (Institute for International Economics, Washington, DC, 1992).

Fankhauser, Samuel, Richard Tol, David Pearce, "The Agrregation of Climate Change Damages: A Welfare Theoretic Approach," *Environmental and Resource Economics*, **10**:249-66 (1997).

Gorbacheva, Elena, *Do Lax Environmental Regulations Explain International Competitiveness of Russian Chemical and Primary Metals Industries?,* Master's Thesis, New Economic School, Moscow (June 1998).

Jaffe, Adam B, Steven R. Peterson, Paul R. Portney and Robert Stavins, "Environmental Regulation and the Competitiveness of U.S. Manufacturing," J. Economic Literature, 33:132-63 (1995).

Khaleeva, Julia, *Global Warming and Agricultural Sector in Russia*, Master's Thesis, New Economic School, Moscow (June 1998).

Mendelsohn, Robert, William Nordhaus and Daigee Shaw, "The Impact of Global Warming on Agriculture: A Ricardian Analysis," *Amer. Econ. Rev.,* **84**:753-71 (1994).

Nordhaus, William D., "The Cost of Slowing Climate Change: A Survey," *The Energy Journal*, **12**:37-65 (1991).

Nordhaus, William D., *Managing the Global Commons: The Economics of Climate Change* (MIT Press, Cambridge, Mass., 1994).

Ridker, Ronald and John Henning, "The Determinants of Residential Property Values with Special Reference to Air Pollution," *Rev. Econ. Stat.*, **49**:246-57 (1967).

Shcherbich, Svetlana I., *Environmental Amenities and the Rent Gradient in Moscow*, Master's Thesis, New Economic School, Moscow (June 1998).

Xing, Yuqing and Charles D. Kolstad, "Do Lax Environmental Regulations Attract Foreign Investment?," Working Paper, Department of Economics, University of California, Santa Barbara (1997).

Table I: Estimation Results for Grain Yield.

Note: Dependent variable is grains output per hectare per year by oblast.

Description	Variable	Estimated coefficient	t-statistic	t-statistic corrected for heteroscedasticity
Constant	C	-17.195	-0.9	-0.93
Land Quality Index	I	0.7564	8.67	9.07
Avg Jan Temp	AJAN	-0.5374	-1.92	-1.85
AJAN * AJAN	SQAJAN	-0.0088	-1.06	-0.85
Actual Jan Temp	JAN	0.9191	4.63	4.91
JAN*JAN	SQJAN	0.0161	3.39	3.54
Avg July Temp	AJUL	-3.181	-1.38	-1.19
AJUL*AJUL	SQAJUL	0.0941	1.54	1.26
Actual July Temp	JUL	8.1370	3.39	2.96
JUL*JUL	SQJUL	-0.1852	-3.76	-3.14
Avg Jan Precip	ARJAN	0.0459	0.41	0.40
ARJAN*ARJAN	SQARJAN	0.0007	0.51	0.53
Actual Jan Precip	RJAN	-0.1359	-2.53	-3.01
RJAN*RJAN	SQRJAN	0.0004	0.73	1.01
Avg July Precip	ARJUL	-0.0966	-1.07	-1.09
ARJUL*AARJUL	SQARJUL	0.0005	0.75	0.74
Actual July Precip	RJUL	0.0868	3.14	3.07
RJUL*RJUL	SQRJUL	-0.0005	-2.99	-2.94
Mineral Fertilizer Applied Per Hectare	MIN	0.0778	6.23	5.61
Organic Fertilizer Applied Per Hectare	ORG	-0.4435	-2.36	-2.14
	Adjusted R^2 0.77	Number of Obs: 188		

▨

Indicates significance at 95% level.

Figure 2: Qualitative estimate of environmental quality in Moscow.

Source: Shcherbich (1998), adapted from Izvestya, 17 April 1998; numbers on map correspond to the "Index of Atmospheric Pollution" (IAP) at different points in Moscow for 1995. The Index is the sum of subindices for five air pollutants where each subindex is defined as the average concentration divided by the maximum permissible concentration. An IAP ≥ 14 is "extremely polluted"; 14 > IAP ≥ 7 is polluted; 7 > IAP ≥ 5, moderately polluted; and IAP < 5 is low pollution. Scale: 1 cm = 3 km.

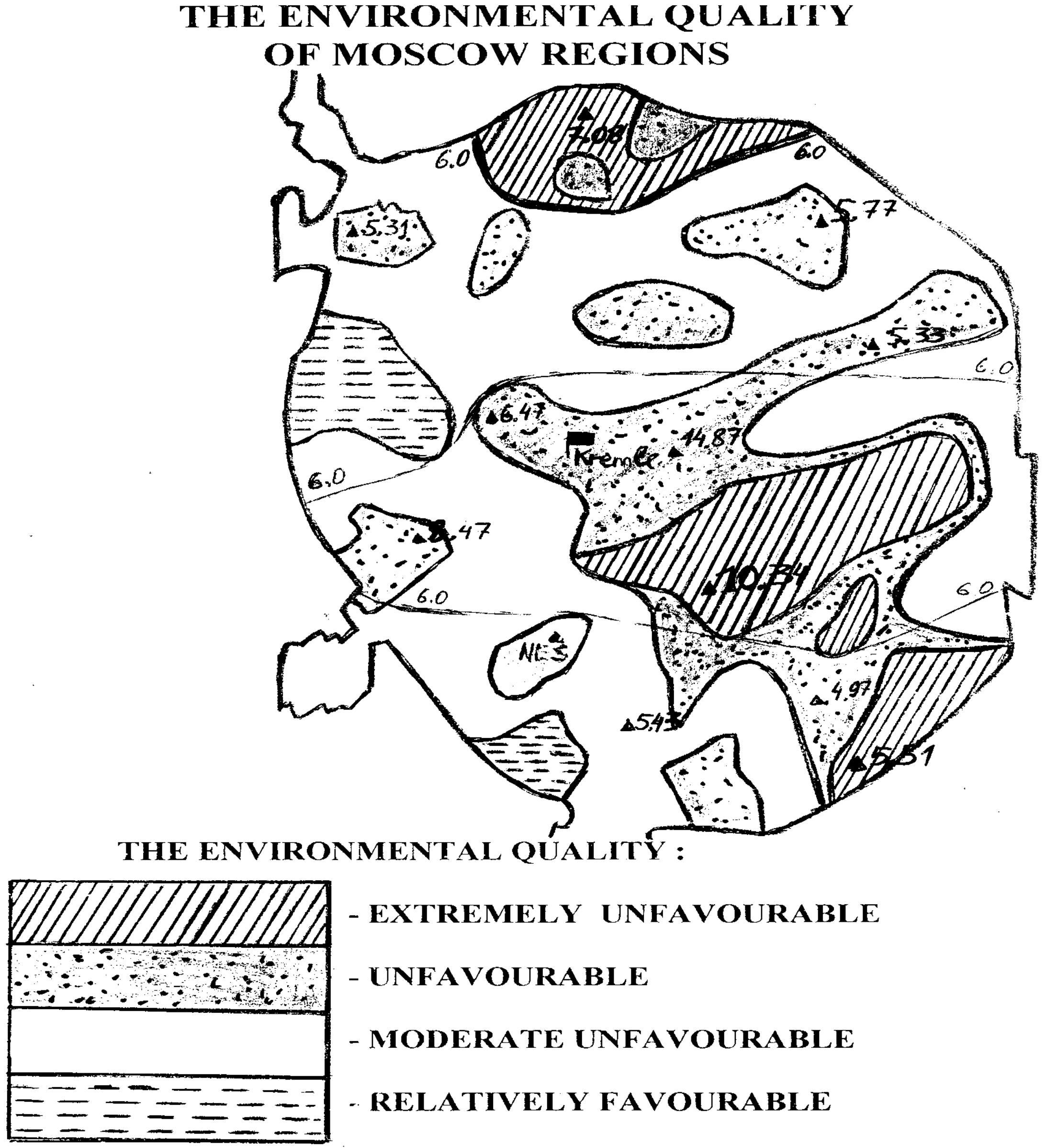

Table II: Characteristics of data set for two-bedroom apartments (N=1356).

Variable	Description	Mean	Std. Dev.	Min	Max
NORD	Dummy for North part of Moscow	0.263	0.44	0	1
WEST	Dummy for West part of Moscow	0.151	0.36	0	1
EAST	Dummy for East part of Moscow	0.215	0.41	0	1
SOUTH	Dummy for South part of Moscow	0.264	0.44	0	1
CENTRE	Dummy for Center of Moscow	0.130	0.34	0	1
E=1	Dummy for Env. Quality Level (Figure 1)	0.139	0.35	0	1
E=1.5	“	0.083	0.28	0	1
E=2	“	0.262	0.44	0	1
E=2.5	“	0.055	0.23	0	1
E=3	“	0.435	0.50	0	1
E=3.5	“	0.006	0.08	0	1
E=4	Env. Qual Dummy (1=lowest; 4=highest)	0.021	0.14	0	1
ECOLOGY	Value of Env. Qual. Level (Figure 1)	2.333	0.77	1	4
DISTANCE	Distance to Red Square (km)	27.42	10.1	1.8	46
TIME	Time to metro station (minutes)	8.634	4.30	2	30
TRANSPORT	0 if metro in walking distance; 1 otherwise	0.515	0.50	0	1
LIVING SPACE	Living space, square meters	30.15	4.16	21	52
KITCHEN SPACE	Kitchen space, square meters	7.639	1.86	5	20
PHONE	1 if telephone; 0 otherwise	0.968	0.14	0	1
PRICE	Monthly rental rate, Rubles	524.4	268	200	4000
MONTHS	Number of months advanced payment req.	1.900	1.06	1	12
EMPTY	1 if apartment empty; 0 otherwise	0.058	0.23	0	1
SET	1 if basic furniture included; 0 otherwise	0.613	0.49	0	1
SUITE	1 if furniture suite included; 0 otherwise	0.297	0.46	0	1
EVROREP	1 if luxury furniture included; 0 otherwise	0.035	0.18	0	1
FIRST FLR	1 if on the first floor; 0 otherwise	0.144	0.35	0	1
LAST FLR	1 if on the top floor; 0 otherwise	0.111	0.31	0	1

Table III: Hedonic Price Functions for Moscow, 1998

NB: Dependent variable is log(PRICE); sample size is 1356.

	Model 1		Model 2	
Variable	Estimate	t-statistic	Estimate	t-statistic
Constant	5.70	33.21	5.871	35.23
E2 + E2.5	0.0757	4.38		
E3	0.162	9.74		
E3.5	0.246	2.75		
E4	0.412	8.98		
Log(ECOLOGY)			0.078	4.52
NORD + SOUTH			0.154	8.22
WEST			0.241	10.91
Log(DISTANCE)	-0.269	-19.53	-0.297	
Log(TIME)	-0.116	-8.73	-0.127	-9.94
Log(TRANSPORT)	-0.076	-5.92	-0.090	-7.21
Log(LIVING SPACE)	0.330	6.40	0.284	5.68
Log(KITCHEN SPACE)	0.159	5.30	0.178	6.09
Log (MONTH)	-0.048	-3.43	0.041	-3.06
Log (SUITE)	0.220	15.47	0.203	14.70
Log(FIRST FLR)	-0.089	-5.02	-0.088	-5.16
Log (EVROREP)	0.921	24.36	0.908	24.67
Adjusted R^2	0.658		0.680	

Figure 2: Output of Russian Industry, 1990-96, relative to 1990.

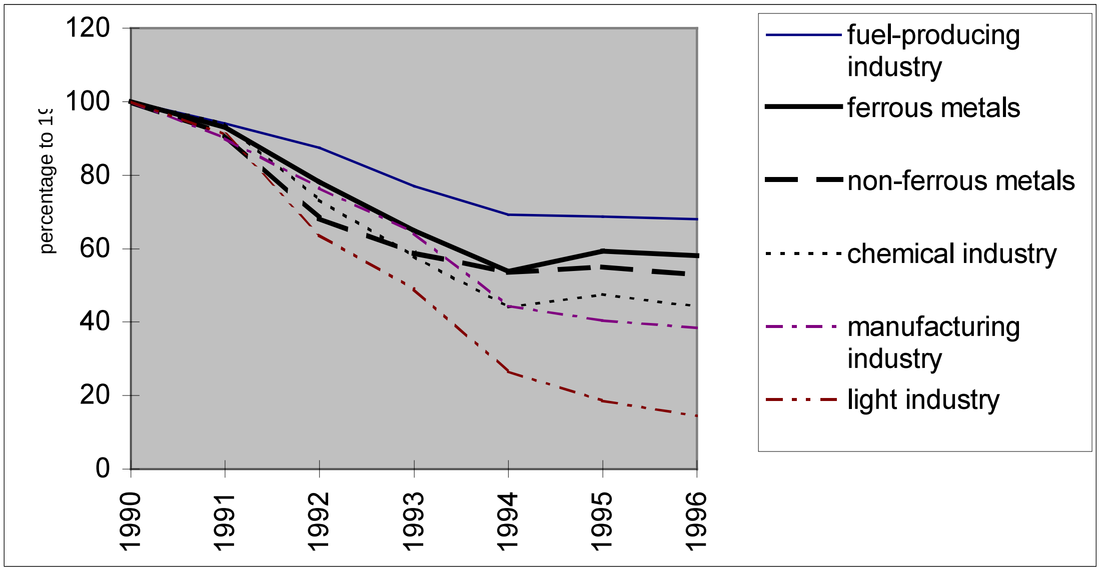

Table IV: Revealed Comparative Advantage Indices

	fertilizers			***pig iron***			***primary steel***			***aluminum***		
	1992	**1993**	**1994**	**1992**	**1993**	**1994**	**1992**	**1993**	**1994**	**1992**	**1993**	**1994**
BELGIUM	1.66	1.60	1.63	0.53	0.58	0.67	3.33	2.94	3.44	1.22	1.17	1.15
CANADA	3.01	3.36	3.33	0.47	0.49	0.41	0.79	0.68	0.52	2.68	2.87	2.95
CHINA	0.10	0.19	0.19	3.76	4.12	3.92	0.52	0.14	0.35	0.21	0.20	0.28
FRANCE	0.45	0.53	0.42	1.22	1.08	0.94	1.23	1.38	1.39	1.01	1.05	1.00
GERMANY	0.73	0.79	0.85	0.57	0.51	0.35	1.12	1.24	1.22	1.08	1.10	1.06
GREECE	1.41	1.48	0.66				2.16	1.48	1.74	4.34	4.48	4.81
INDIA				3.91	6.03	4.69	0.68	1.20	0.70	1.29	0.78	0.80
ITALY	0.27	0.23	0.08	0.34	0.26	0.18	0.61	1.05	0.76	0.62	0.69	0.67
JAPAN	0.10	0.11	0.09	0.19	0.20	0.40	0.65	0.84	0.85	0.28	0.30	0.32
KOREA	0.76	0.91	0.82				3.34	3.13	2.54	0.25	0.27	0.41
NETHERLANDS	2.08	2.03	2.05	0.02	0.49	0.44	0.82	1.05	1.28	1.24	1.24	1.32
NORWAY	2.90	3.69	3.32	8.13	8.81	7.74	0.08	0.10	0.07	6.01	6.42	6.95
POLAND	4.13	2.91	3.54	1.51	1.40	0.91	5.80	3.48	3.85	0.43	0.64	0.58
RUSSIA	***14.04***	***11.43***	***7.22***	***9.78***	***12.67***	***9.79***	***4.94***	***9.32***	***7.38***	***3.47***	***7.07***	***7.47***
SPAIN	0.94	0.68	0.67	0.39	0.29	0.42	0.84	0.91	0.95	0.87	1.04	1.13
SWEDEN	0.46	0.57	0.48	2.79	2.62	2.27	1.32	1.22	1.33	0.86	0.92	0.91
TURKEY	0.81	0.42	0.62	2.66	2.48	2.11	6.63	6.61	7.21	0.55	0.51	0.60
UNITED KINGDOM	0.32	0.25	0.23	0.61	0.45	0.37	1.00	0.95	0.96	0.77	0.73	0.79
UNITED STATES	1.68	1.50	1.86	0.31	0.27	0.22	0.21	0.14	0.17	0.82	0.73	0.76

Table V: Estimation Results, Eqn. (5).

Sector	**Variable**	**Coefficient**	**t-Statistic**	**Prob.**
ALUMINUM	C	1.339376	0.893455	0.3907
	S/G	0.011424	0.478703	0.6415
N = 19	RA	0.785485	3.980101	0.0022
Adj R^2 = 0.761	I	0.002705	0.064212	0.9500
	P	4.011679	0.409757	0.6899
	EN	0.011439	2.410093	0.0346
	ENSTR	-5.152048	-2.059668	0.0639
	W	-0.018848	-0.430871	0.6749
PIG IRON	C	-4.365781	-1.010413	0.3387
	S/G	-0.061868	-1.241720	0.2457
N = 17	RP	-0.043087	-1.209577	0.2573
Adj R^2 = 0.546	I	0.266536	1.914529	0.0878
	P	-40.18345	-2.328811	0.0448
	EN	0.030761	2.787956	0.0211
	ENSTR	1.731965	0.361793	0.7259
	W	-0.034020	-0.355517	0.7304
STEEL	C	5.272258	2.749266	0.0189
	S/G	-0.009998	-0.331487	0.7465
N = 19	RS	0.079959	3.619787	0.0040
Adj R^2 = 0.616	I	-0.196074	-2.934629	0.0136
	P	26.19936	2.402862	0.0351
	EN	-0.007474	-0.900495	0.3871
	ENSTR	-3.609663	-1.174163	0.2651
	W	0.008654	0.136472	0.8939
FERTILIZERS	C	-0.323256	-0.138854	0.8921
	S/G	0.122791	1.834054	0.0938
N = 19	RF	-0.042198	-0.470089	0.6475
Adj R^2 = 0.380	I	0.069816	0.806995	0.4368
	P	-4.891334	-0.378648	0.7122
	EN	0.010578	1.216845	0.2491
	ENSTR	-11.44424	-2.088664	0.0608