The Influence of Intersectoral Ecological Competition Limitations in Russia

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19th INFORUM World Conference,
South Africa, August 2011

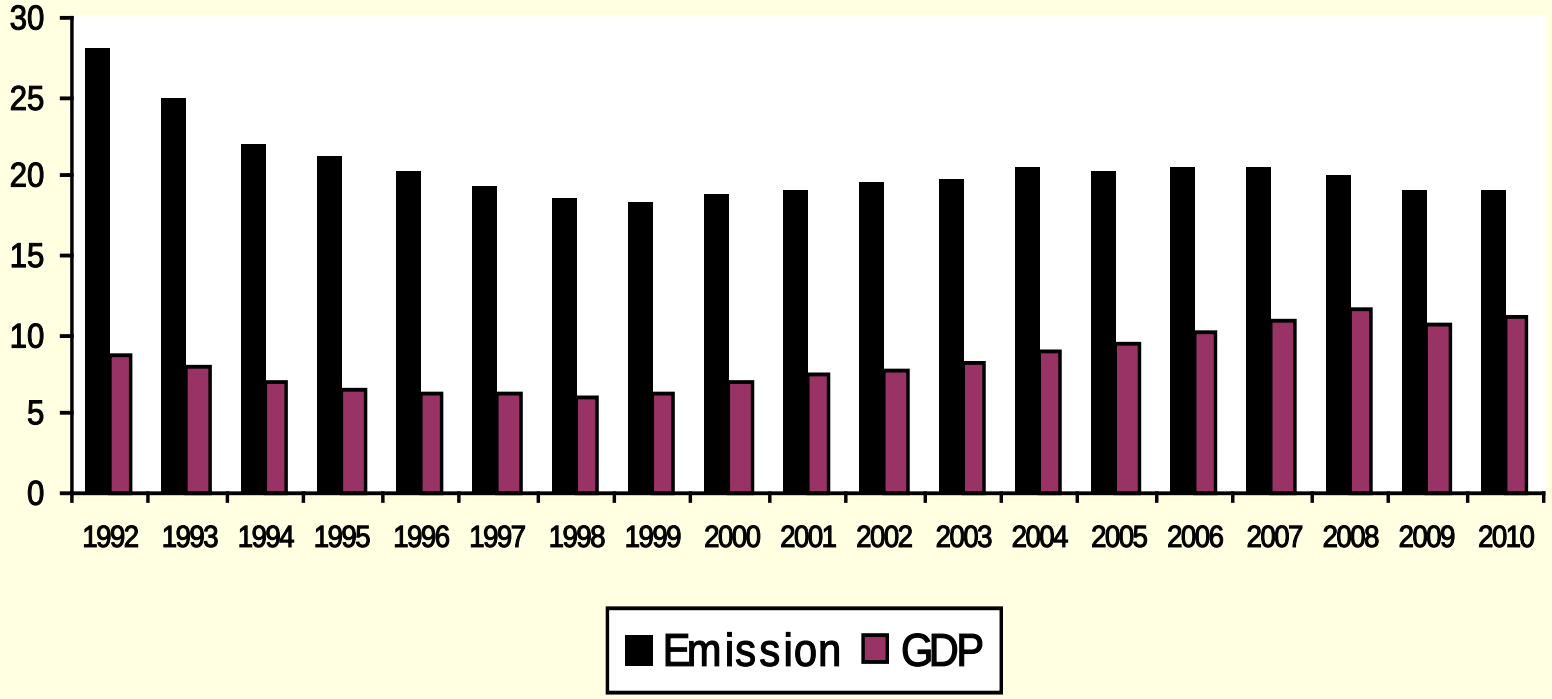
Outline

1. The motivation
2. Input-Output approach
3. The results of forecast calculations
4. Conclusions

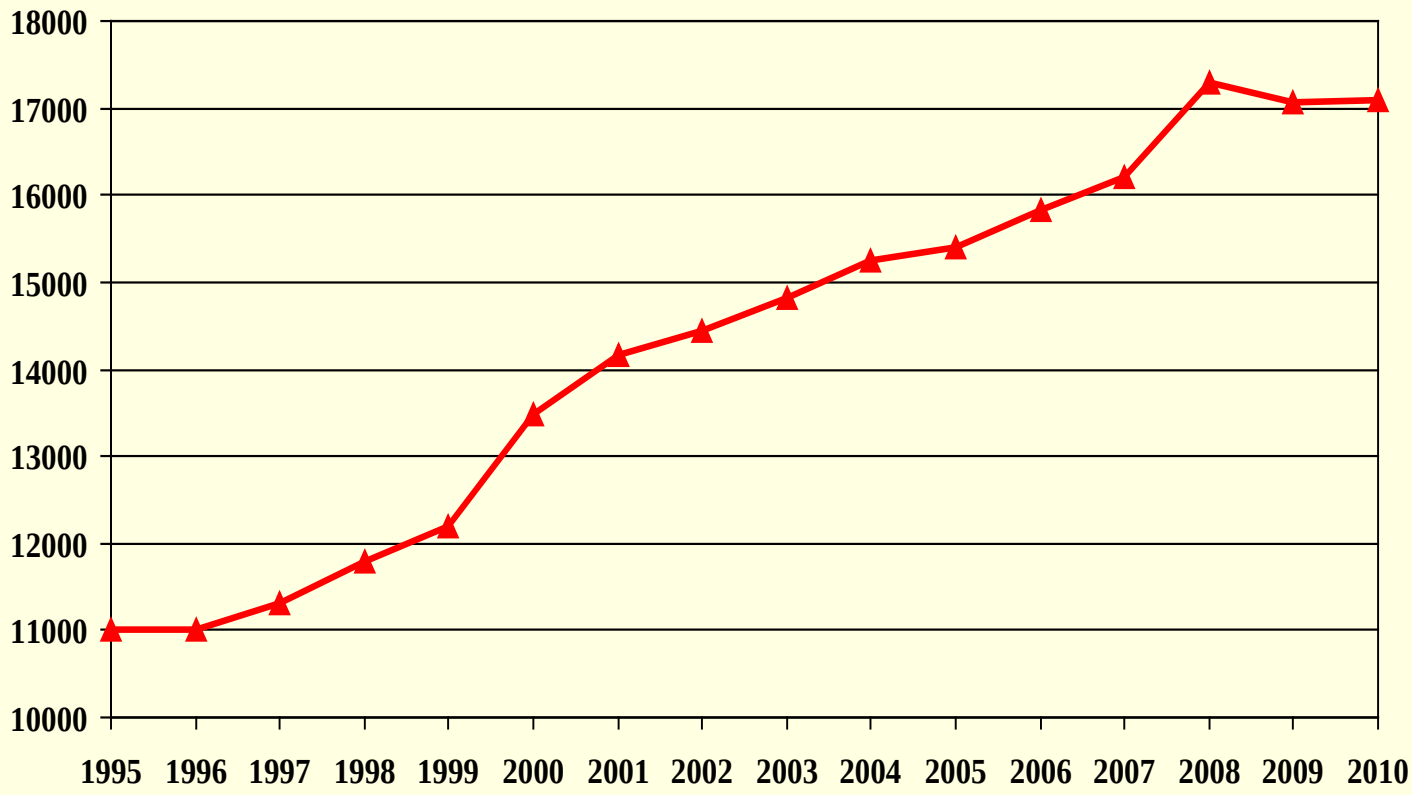
The emission of major hazardous substances, thou tons (Russia – 2007, other countries – 2005)

Countries	Sulfur dioxide	Nitrogen oxides	Carbon oxide	Carbon dioxide
Russia	4573	1733	6448	1860
Great Britain	706	1627	2408	547
Germany	560	1443	4035	847
Spain	1254	1522	2336	313
Italy	417	1114	3818	450
USA	13272	16982	80854	5707
France	465	1206	5646	384

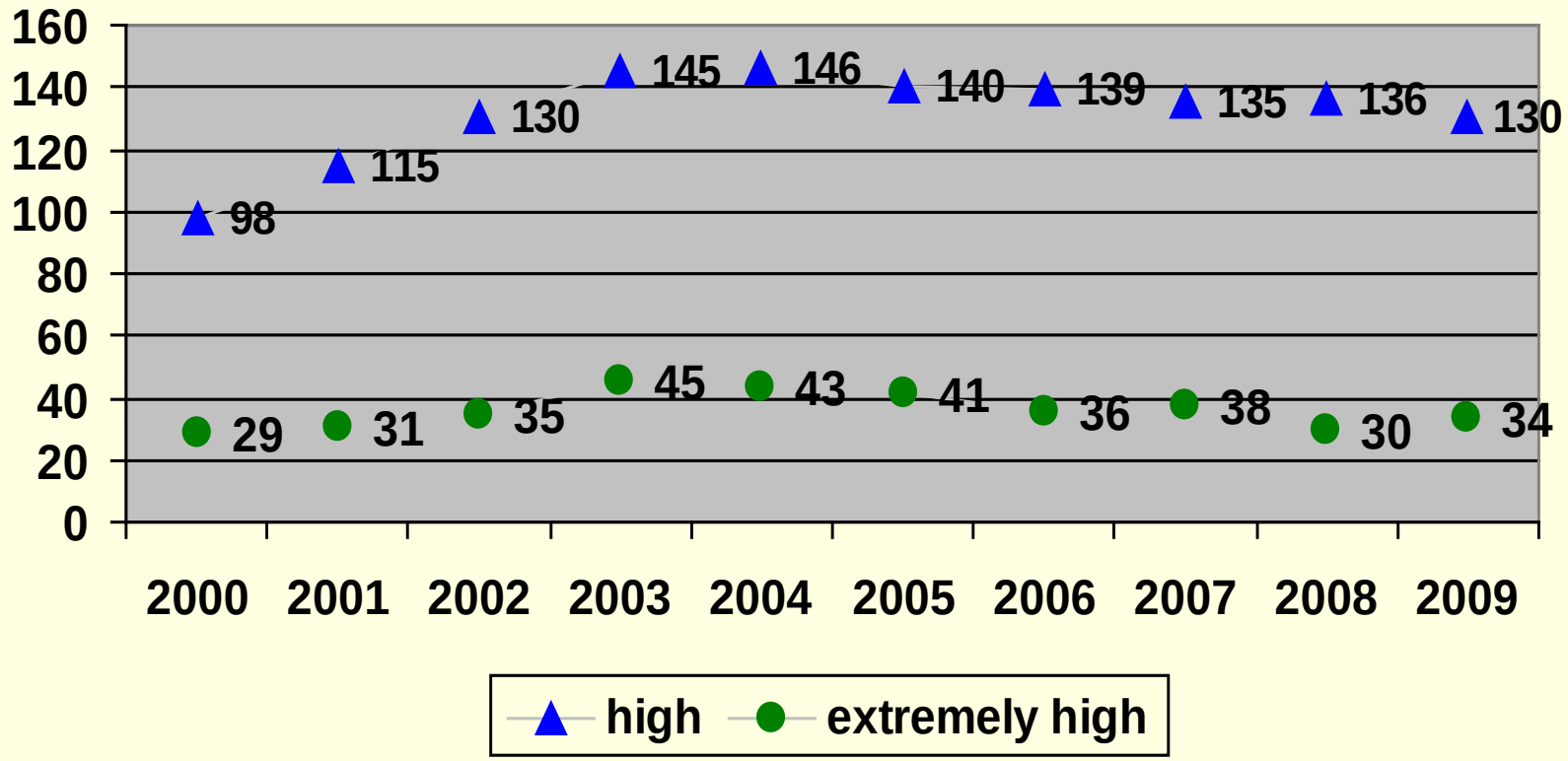
Stationary emission (mln. tons) and GDP (bln. Rbl, before 1998 - trln. Rbl, prices of 2000)



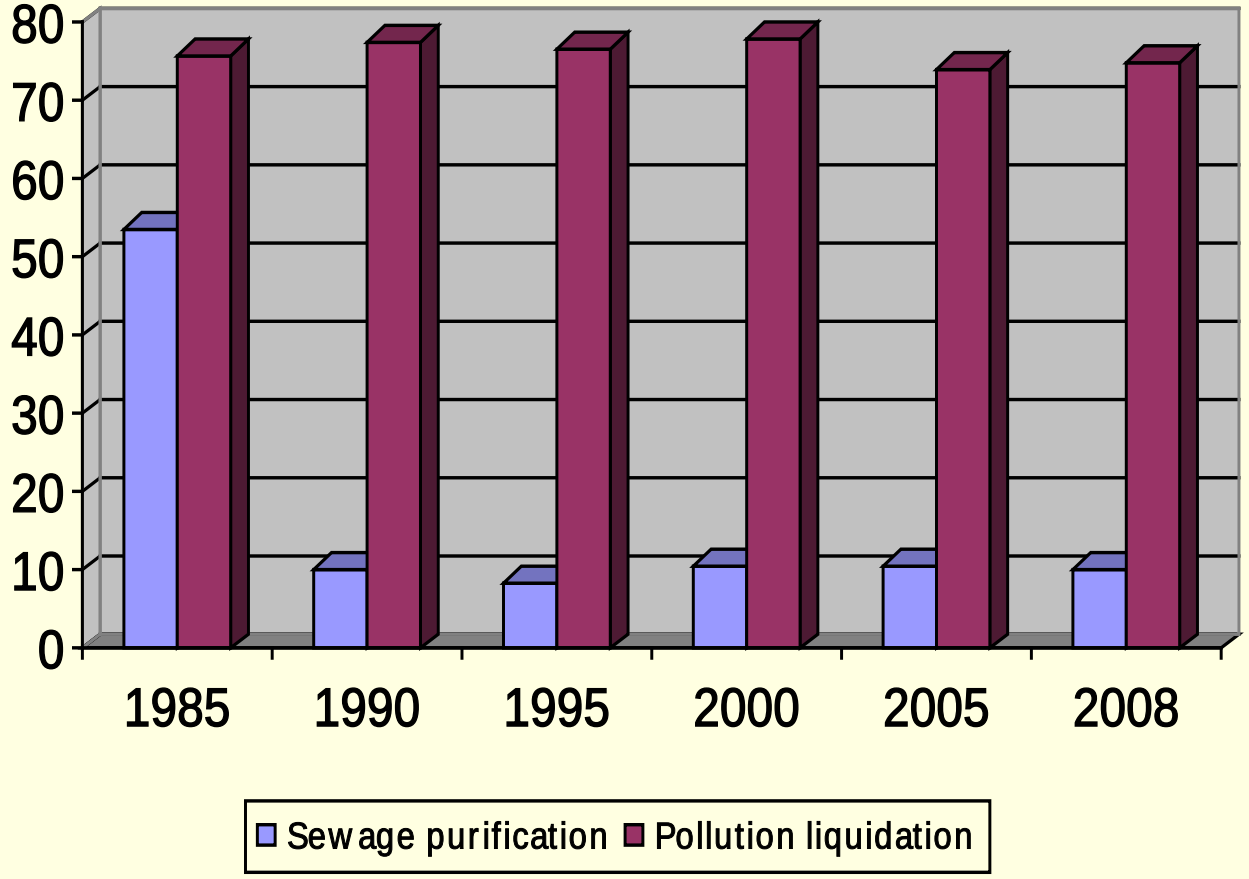
Motor transport emission of polluting substances into atmosphere (thousand tons)



The number of cities with high and extremely high level of pollution

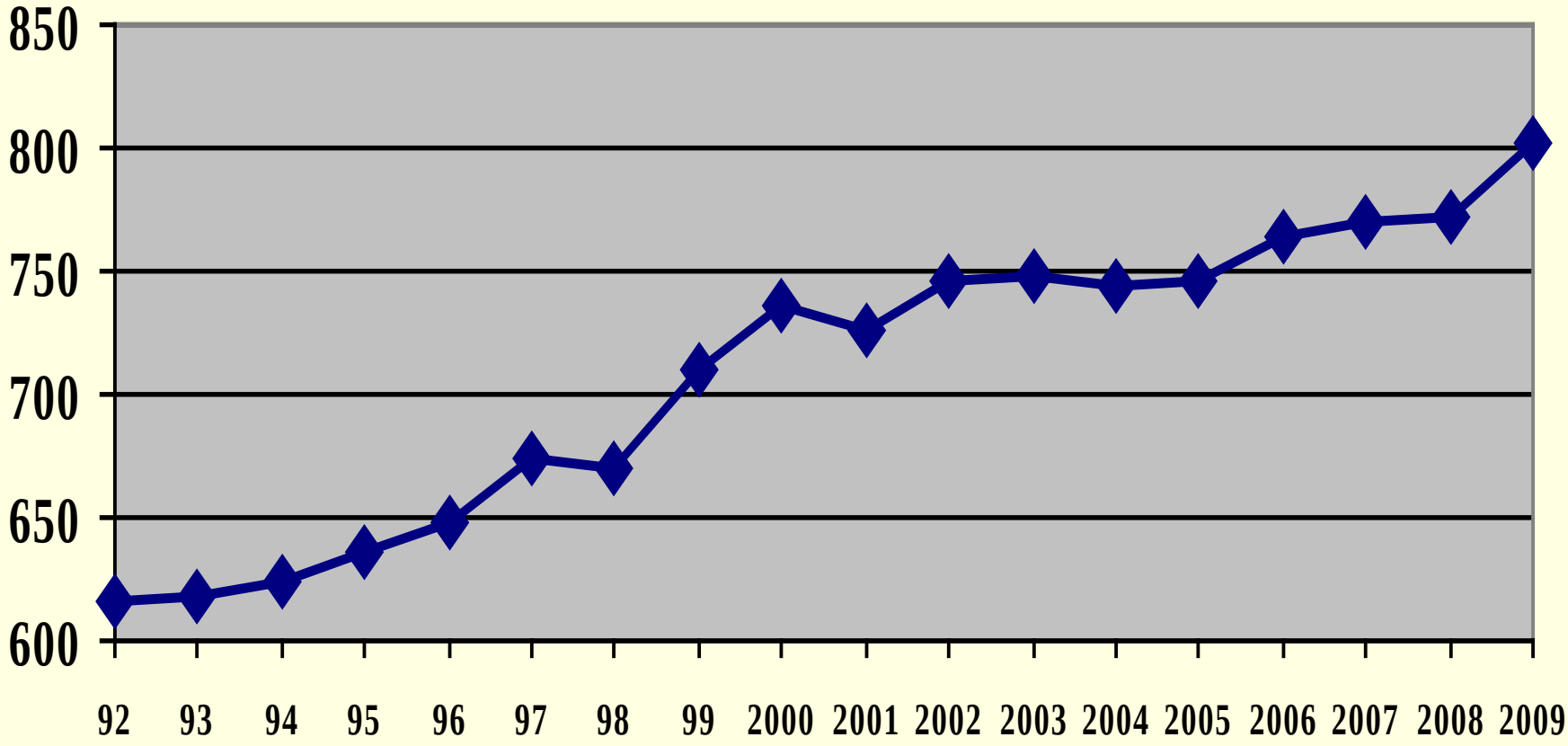


The proportion of sewage purification and pollution liquidation in total volume of their formation (%) in Russia



Morbidity in Russia

(registered patients with the first diagnosed disease for every thousand people)



Health risk factors:

- **1) economic**
- **2) psychological**
- **3) the general level of culture**
- **4) the level of medical care and preventive health care**
- **5) genetic**

- **5) the environmental situation in the country**

Full Costs I-O Approach in Estimation of Environment Pressure

Let's take:
n as amount of branches,
V^p_i as total annual pollution of branch ***i***, and
x_i as total annual output of branch ***i***.
Then a direct pollution coefficient of branch ***i*** is calculated as follows:

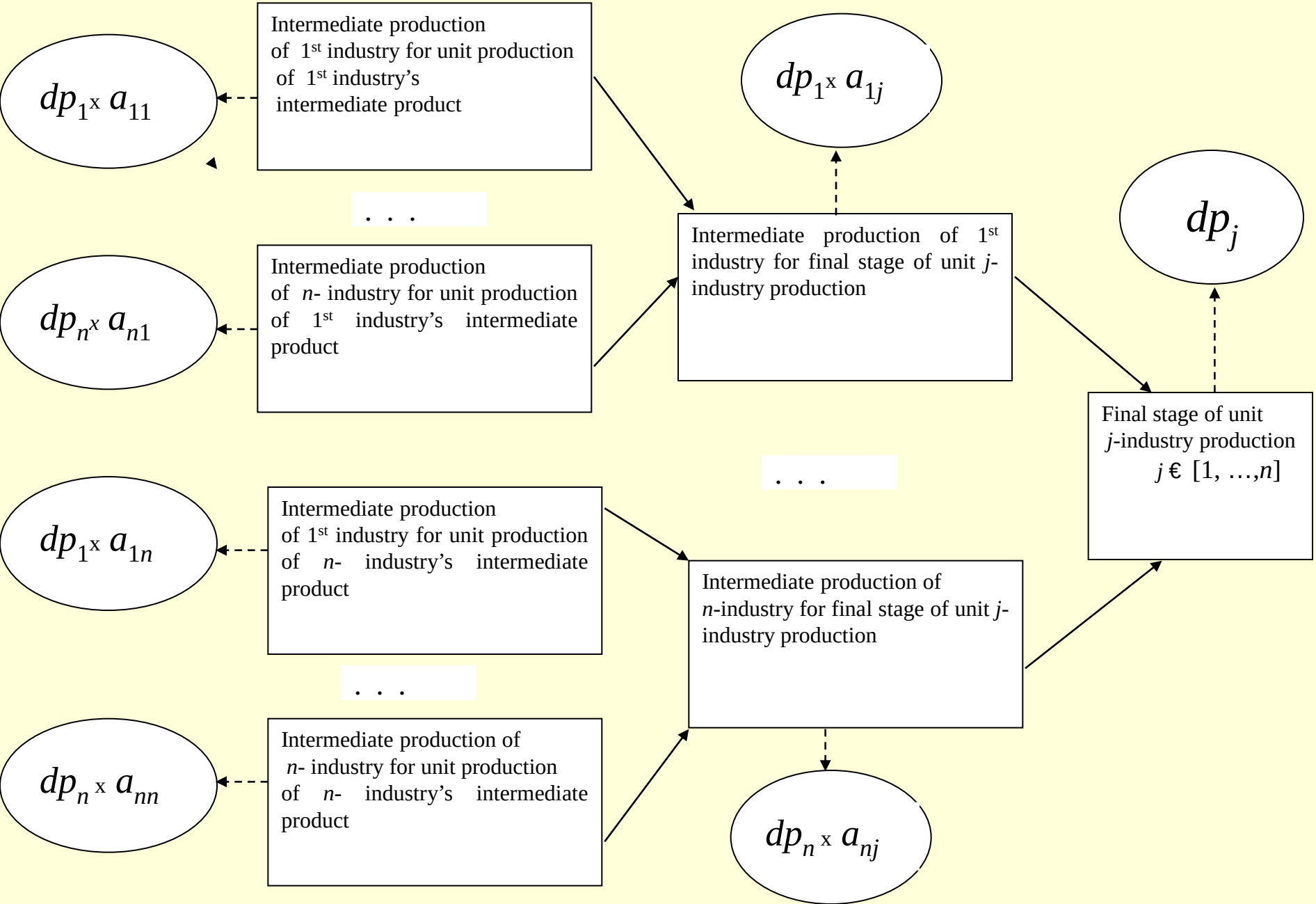
$$dp_i = V^p_i / x_i \ , \ i = 1,\ldots, n.$$

Full pollutant coefficient of branch ***j*** (fp_j) shows an amount of pollution produced per unit of branch ***j*** final output. Calculation of full pollution coefficient of branch ***i*** is defined by the following equation:

$$fp_j = \sum_{(i=1,..n)} dp_i \cdot b_{ij},$$

where b_{ij} – specific coefficient of full costs I-O matrix (inverse matrix to the difference between unit matrix and input-output matrix).

The scheme of full pollution formation (three production stages). Continuous lines illustrate the production processes. Dotted lines show pollution formation. The summary pollutions (in ovals) make the full pollution.



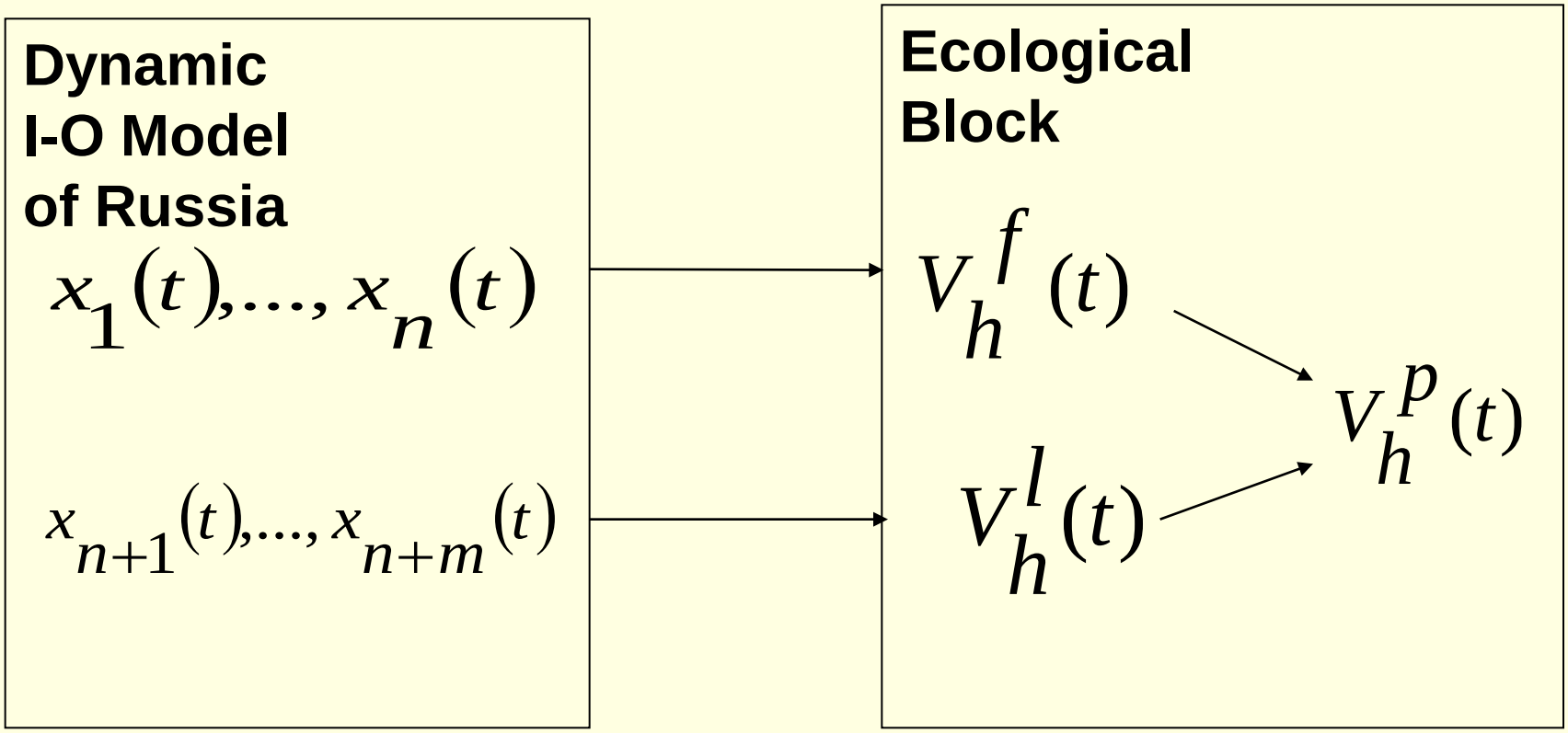
Estimations of Russian Branches Environment Pressure

№	The industries	Waste water discharge coefficients, cubic m per 1 thou Rbl of output in 2003		Atmospheric pollutant emissions coefficient, kilo per 1 thou Rbl of output in 2003		Average annual growth rates of output in 2003-2007, %
		direct	full	direct	full	
1	Power engineering	0,837	1,332	3,597	4,942	1,5
2	Fuel industry	0,127	0,579	1,302	2,413	3,3
3	Ferrous metallurgy	0,689	1,434	2,414	4,668	4,7
4	Non- ferrous metallurgy	0,453	1,140	3,562	6,514	4,4
5	Chemical and petrochemical industry	1,636	2,855	0,525	2,343	7,4
6	Machine-building and metal-working industry	0,244	1,118	0,214	2,107	8,7
7	Logging, wood-working, pulp and paper industry	2,518	3,868	0,556	1,853	5,1
8	Building materials industry	0,312	0,958	0,990	2,633	9,0
9	Light industry	0,277	1,114	0,195	1,258	1,6
10	Food industry	0,037	0,852	0,107	0,855	5,4
11	Other industries	0,603	1,650	0,356	2,377	6,8
12	Construction	0,008	0,553	0,185	1,314	14,2
13	Agriculture	0,988	1,553	0,095	0,644	3,0
14	Transport and communication services	0,104	0,538	1,452	2,279	2,9
15	Trade	0,001	0,260	0,019	0,475	13,9
16	Other branches of material production	0,014	0,535	0,082	0,704	7,2
17	Non-material service	2,754	3,361	0,262	0,935	7,3
	Average in Russian Economy	0,813	1,32	0,850	1,379	5,1

The coefficients of correlation between the average annual growth rates of gross output in 2003-2007 and the pollutant coefficients in 2003

	Spirmen correlation coefficient	Linear coefficient of pair correlation	Significant level
Direct waste water discharge coefficient, cubic m per 1 thou Rbl of total output	-0.28	-0.15	0.573
Full waste water discharge coefficient, cubic m per 1 thou Rbl of final output	-0.16	-0.16	0.542
Direct atmospheric pollutant emissions coefficient, kg per 1 thou Rbl of total output	-0.46	-0.46	0.065
Full atmospheric pollutant emissions coefficient, kg per 1 thou Rbl of final output	-0.27	-0.36	0.152

Model Apparatus of Forecast Calculations *)



*) ***Baranov A.O., Pavlov V.N., Tagaeva T.O.*** *Analysis and Forecast of the State of Environmant and Environmental Protection in Russia with Use of a Dynamic Input-Output Model // Environmental and Resource Economics. - 1997. - Vol. 9, No. 1. - P. 21-42.*
http://www.ingentaconnect.com/content/klu/eare/1997/00000009/00000001/00112534

$$x(t) = (x_1(t), \ldots, x_n(t), x_{n+1}(t), \ldots, x_{n+m}(t))$$

$x_i(t), i = 1, \ldots, n$ - gross output of industry *i* in year *t*

$x_{n+h}(t)$ *h=1,…,m* - current environmental protection cost for natural resource h

$$V_h^f(t) = \sum_{i=1}^{n} w_{ih}(t) x_i(t) + D_h(t)$$

w_{ih} – coefficient of pollutant *h* formation (volume of polluted natural resource *h,* referred to manufacturing of a unit of production of industry *i*)

$D_h(t)$ - output of pollutant *h* (volume of pollution or destruction of a natural resource) in household.

$$x_{n+h}(t) = \sum_{i=1}^{n} g_{ih}(t) V_{ih}^l(t)$$

$$V_h^l(t) = \sum_{i=1}^{n} V_{ih}^l(t)$$

$g_{ih}(t)$ – current cost to recover unit of natural resource *h* (to destroy or to trap unit of pollutant *h*) in industry *i*

$V_h^l(t)$ – volume of a recovered natural resource (destroyed or trapped pollutant) of type *h*

$$V_h^p(t) = V_h^f(t) - V_h^l(t)$$

- volume of pollutant *h* (a polluted natural resource) that gets into the natural environment without purification (or by volume of destroyed but not reproduced natural resource)

The Basic scenario of the forecast was constructed on the basis on the following assumptions:

A. In 2010 the economy was starting to emerge gradually from the crisis. In these conditions, demand for Russian exported good grew, that stimulated economic growth in Russia.

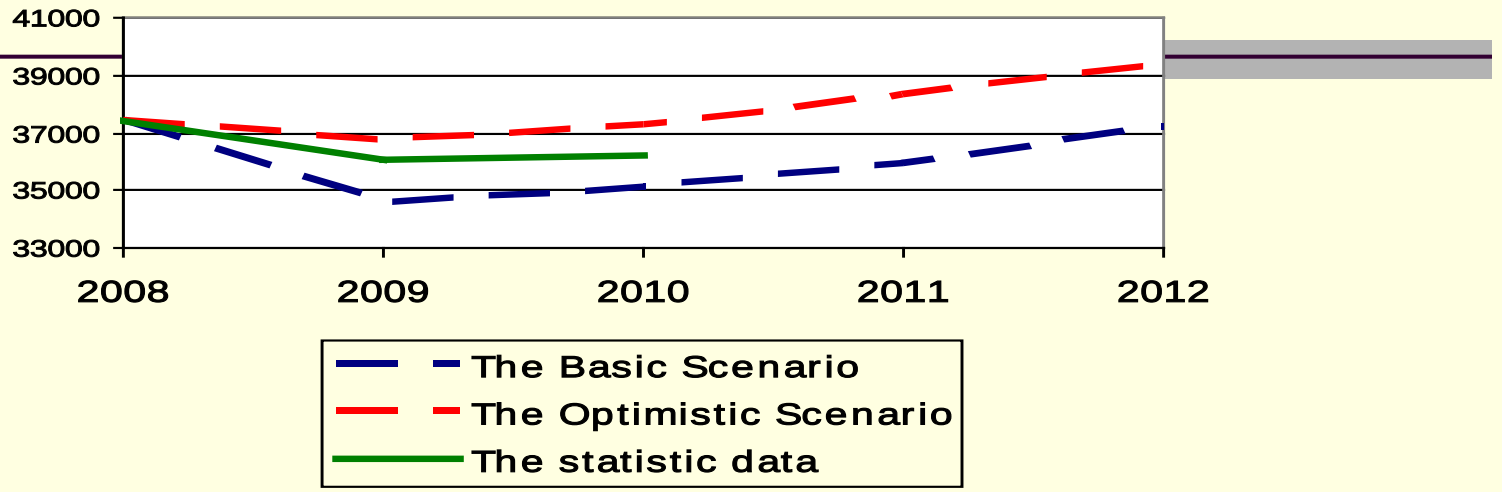
B. Measures taken to stabilize the Russian financial system gave noticeable results in 2010 that resulted in increased crediting of business and population. The increase of GDP will be 8,7% in 2012 to 2008.

The Optimistic scenario of the forecast was constructed on the basis on the following assumptions:

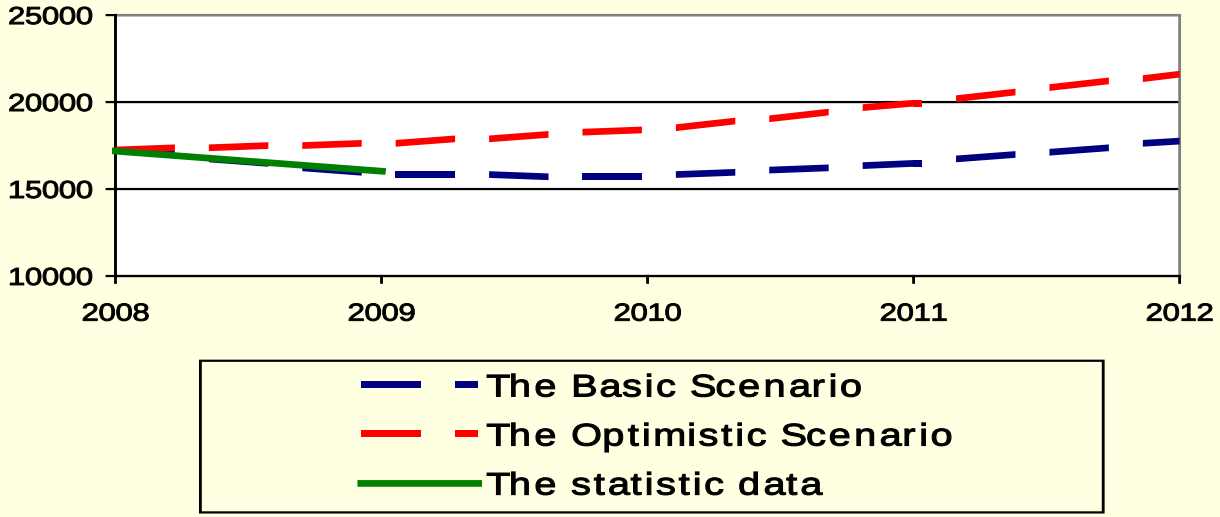
A. Measures taken to stabilize world economy was starting to bring positive results by the end of 2009 and early 2010 already. And the slump of production isn't so great as the basic variant.

B. Beginning with 2010, there was economic recovery in the USA, European Union and Japan; there was greater economic growth in China and other key countries of the world economy. That led to an increase of demand for traditionally exported Russian goods and stimulated a noticeable production recovery in Russia by 2010 already. World economic growth also encouraged the stabilization of the Russian banking system, which got an opportunity to attract financial resources from abroad. The increase of GDP will be 16,6% in 2012 to 2008.

Amount of Emission Polluting the Atmosphere (thousand tons) according to Results of Forecasting Estimates



Amount of Waste Water Discharge (mln. cubic meters) according to Results of Forecasting Estimates



The transformation of pollution industry structure in 2008-2012 in Russia according the optimistic scenario, %

№	The industries	The atmospheric emission	The dumping of the polluted sewage
1	Power engineering	+0.2	-0.8
2	Fuel industry	+0.5	-0.4
3	Ferrous metallurgy	-0.8	-1.0
4	Non- ferrous metallurgy	-0.6	-0.7
5	Chemical and petrochemical industry	-0.2	-1.1
6	Machine-building and metal-working industry	+0.1	+0.1
7	Logging, wood-working, pulp and paper industry	0	-1.1
8	Building materials industry	-0.1	-0.3
9	Light industry	0	-0.1
10	Food industry	+0.1	0
11	Other industries	0	-0.3
12	Construction	+0.1	0
13	Agriculture	+0.1	-0.5
14	Transport and communication services	-0.4	-0.1
15	Other branches of material production	+0.1	0
16	Non-material service	+0.9	+6.3
	Russian Economy	0	0

- The analysis of results demonstrates that the share of industries with high direct and full pollution coefficients will be statistically slightly dropping in the total amount of emission (the coefficients of linear pair correlation between direct and full pollution coefficients and forecast industry's shares in total pollution are - 0.45 and – 0.57 respectively).
- In the case of discharge of polluted water such correlation is not observed. One of the possible explanations is that Russia has an inefficient system of monitoring polluted waste water.

Conclusions

- **The Russian ecological situation is getting worse. In 2009 the number of cities with negative ecological situation was 130 (in 2000 it was 98). The unfavorable ecological situation influence badly health of Russian people. The common morbidity increased by 30% in 1990-2009.**

Conclusions

- **Proposed approach based on direct and full pollution coefficients allows to take into consideration an environmental competition restrictions between branches for analysis of a national economy structural transformation. The results show a possible impact of environment restrictions on development of Russian branches, but this possible impact is very negligible, especially to waste water discharging.**

Conclusions

- **The results of forecasting with using Dynamic Input-Output Model show us the growth of environmental pressure in 2010-2012 in Russia. The most optimistic from economic point of view scenario is the most pessimistic from ecological point of view because of the considerable environmental pressure.**

Conclusions

- **The analysis of results of conducted forecast estimations demonstrate that a share of gross output of industries having high ratios of direct and full emission would be statistically slightly dropping in the total amount of emissions. So the forecast calculations also confirm conclusion about “soft” ecological competitive limitations in Russia.**

- **Thus, the results of this study suggest a need for tightening of the Russian environmental legislation.**

Thanks for your attention !

Dynamics of Branch Outputs of Russian Economy in 2008-2012 according to the Basic Scenario (%, 2008 year = 100%)

	2009	2010	2011	2012
GDP	93,3	95,2	100,3	108,7
Extractive industry	91,2	92,9	95,7	98,8
Manufacturing industry	80,6	82,2	85,3	91,0
including Machine-building industry	85,2	88,1	101,4	120,1
Power engineering	94,2	90,1	91,5	94,9
Agriculture	101,5	104,2	103,8	105,9
Construction	83,1	82,1	88,2	99,9
Transport	84,7	87,3	88,1	91,5
Trade	99,9	102,9	111,9	126,9
Other branches of material production	98,6	85,5	87,9	93,6
Non-material service	91,2	89,2	94,6	103,6

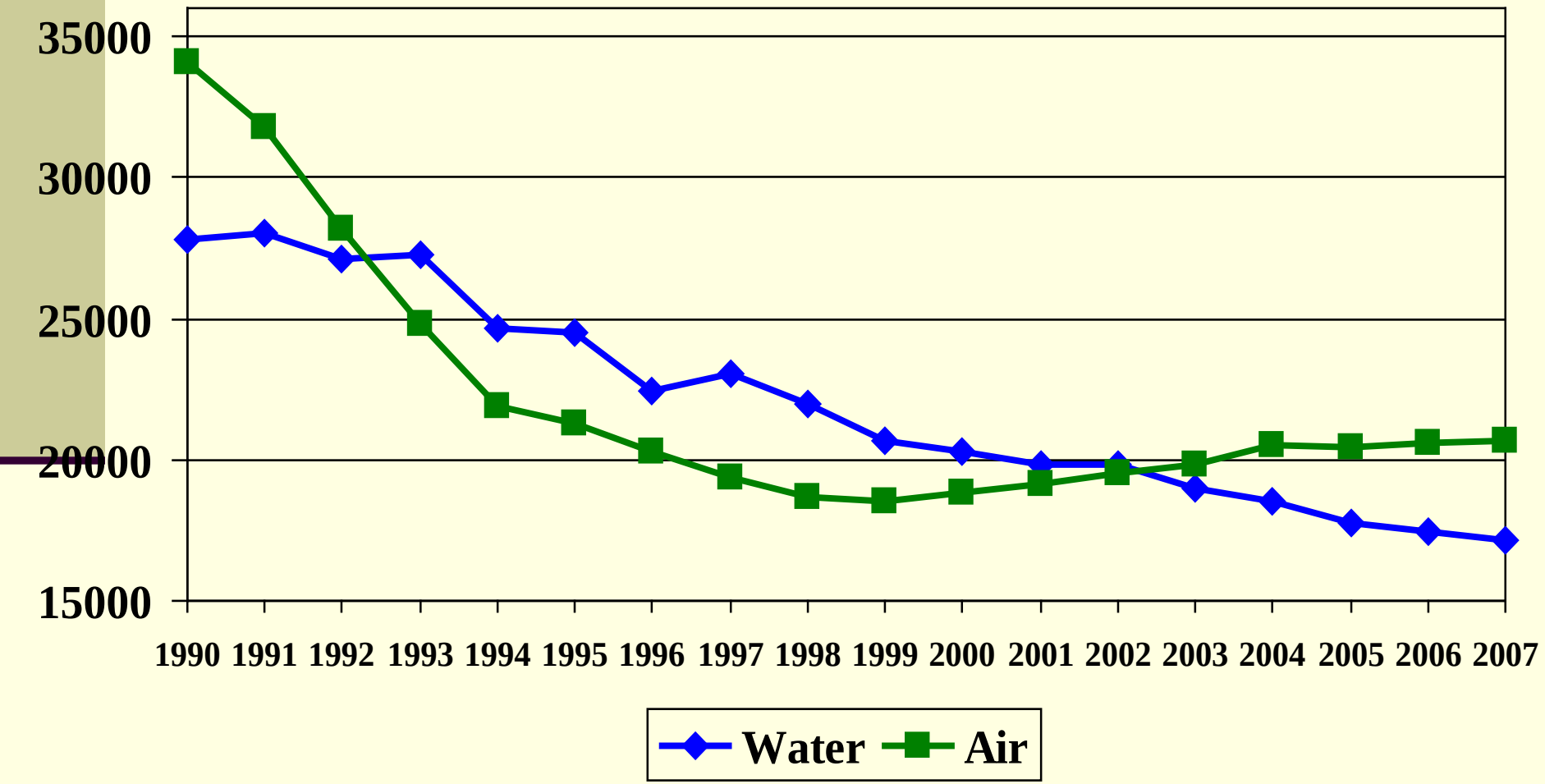
Dynamics of Branch Outputs of Russian Economy in 2008-2012 according to the Optimistic Scenario (%, 2008 year = 100%)

	2009	2010	2011	2012
GDP	95,3	99,4	107,5	116,6
Extractive industry	95,6	97,0	99,2	102,0
Manufacturing industry	92,4	93,8	99,6	105,5
including Machine-building industry	85,7	93,6	112,7	134,0
Power engineering	96,0	97,2	99,2	99,7
Agriculture	101,5	102,6	106,8	110,8
Construction	82,7	85,6	96,2	108,7
Transport	87,5	88,1	91,5	95,1
Trade	94,6	102,4	116,7	135,4
Other branches of material production	88,4	89,9	95,2	101,0
Non-material service	101,5	109,0	120,5	132,8

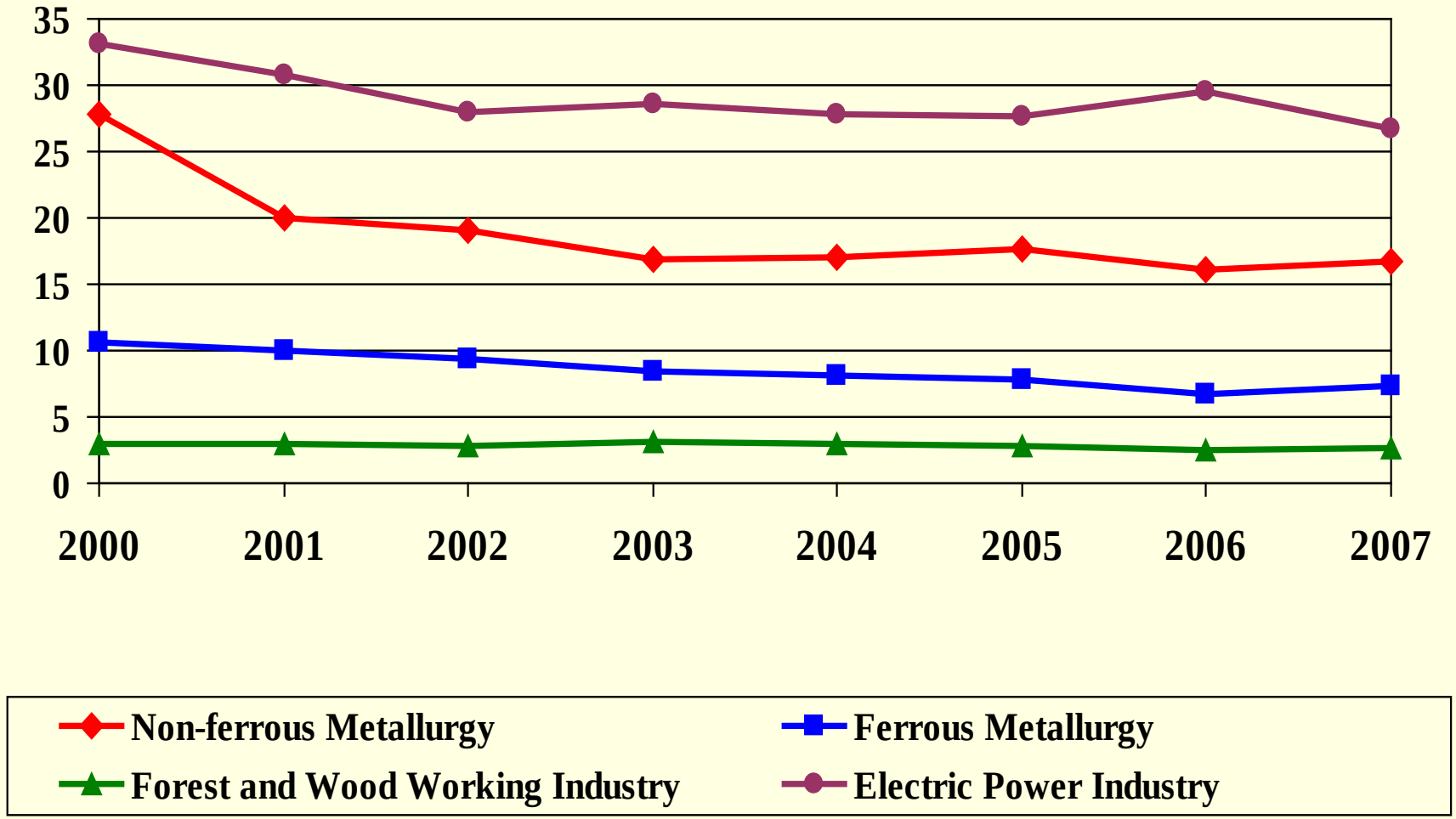
Coefficients of Water Pollution
(cubic m per 1 thou Rbl, before 1998 - per 1 million Rbl)
and Air Pollution
(tons per 1 million Rbl, before 1998 - per 1 billion Rbl), price of 2003.

	1990	1997	2000	2003	2008
Coefficients of sewage formation per unit of Gross Product	0.78	1.49	1.13	0.90	0.63
Coefficients of waste water disposals per unit of GDP	1.63	2.23	1.81	1.43	0.98
Coefficients of air-pollutant formation per unit of Gross Product	3.51	4.48	4.23	3.27	2.70
Coefficients of emissions per unit of GDP	1.78	1.70	1.68	1.50	1.18

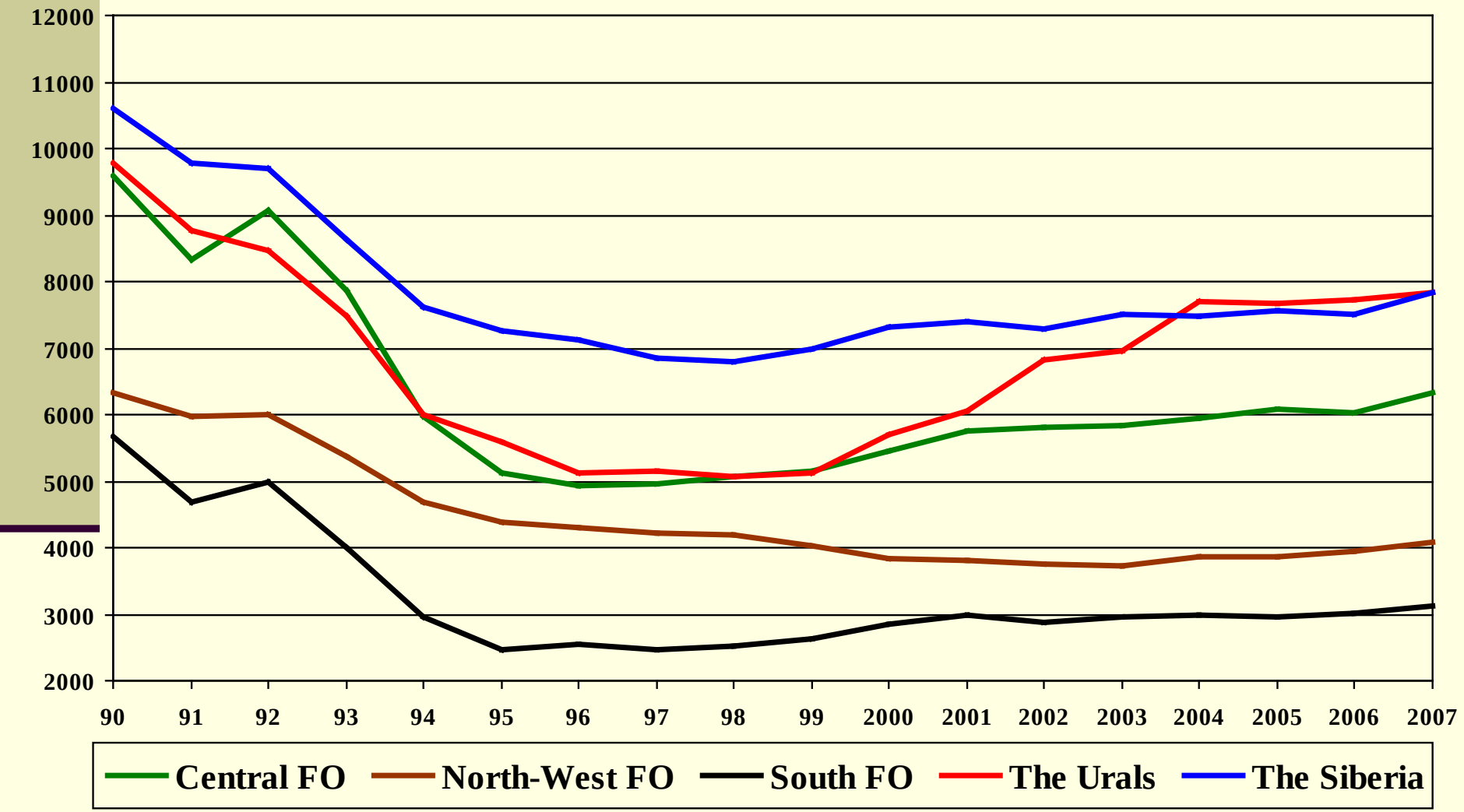
Volumes of Waste Water Disposals (million cubic m) and Emissions (thou tons) in Russia



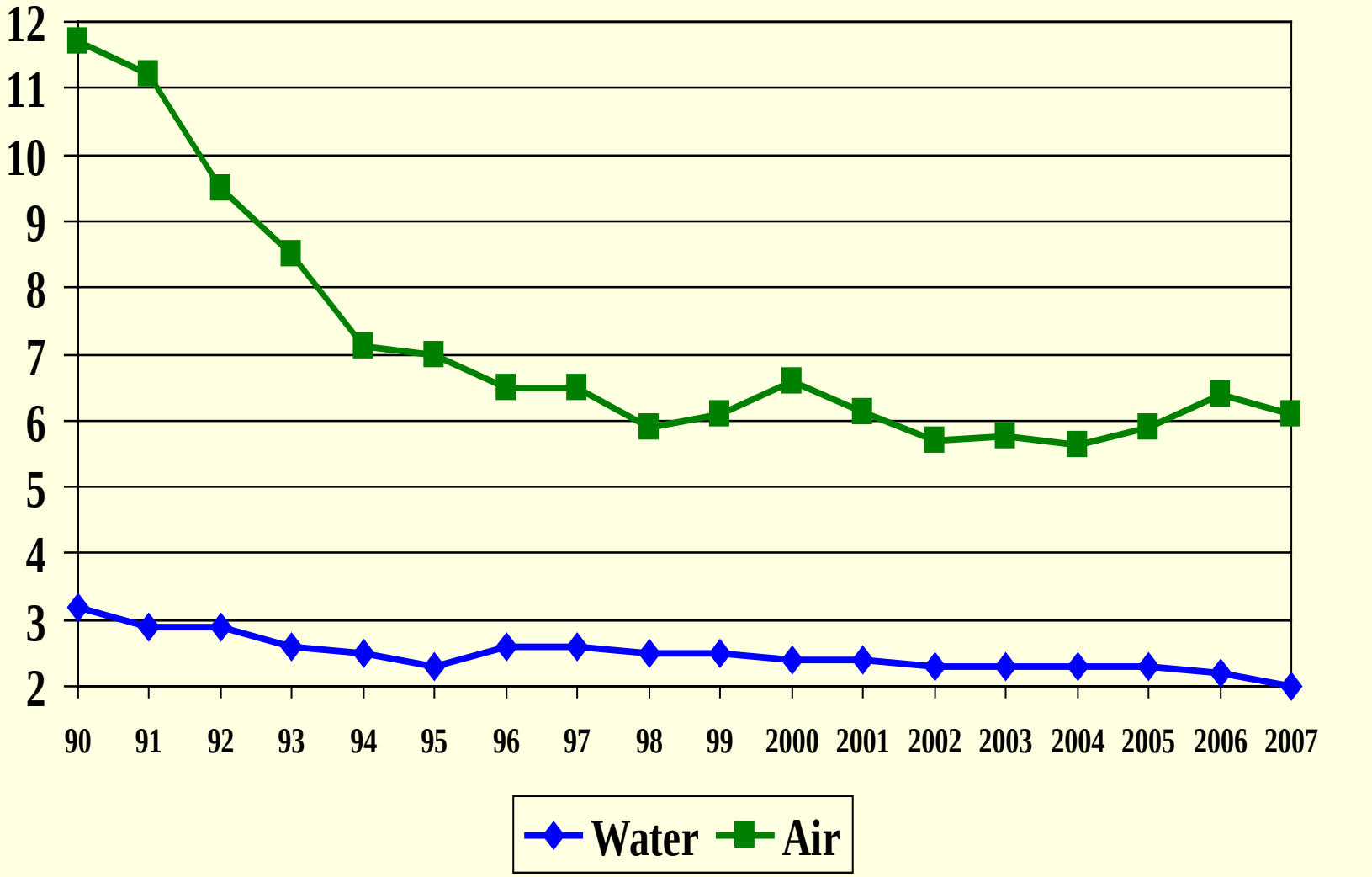
Coefficients of Air-pollutant Formation per Unit of Product (tons per 1 million Rbl, price of 2003)



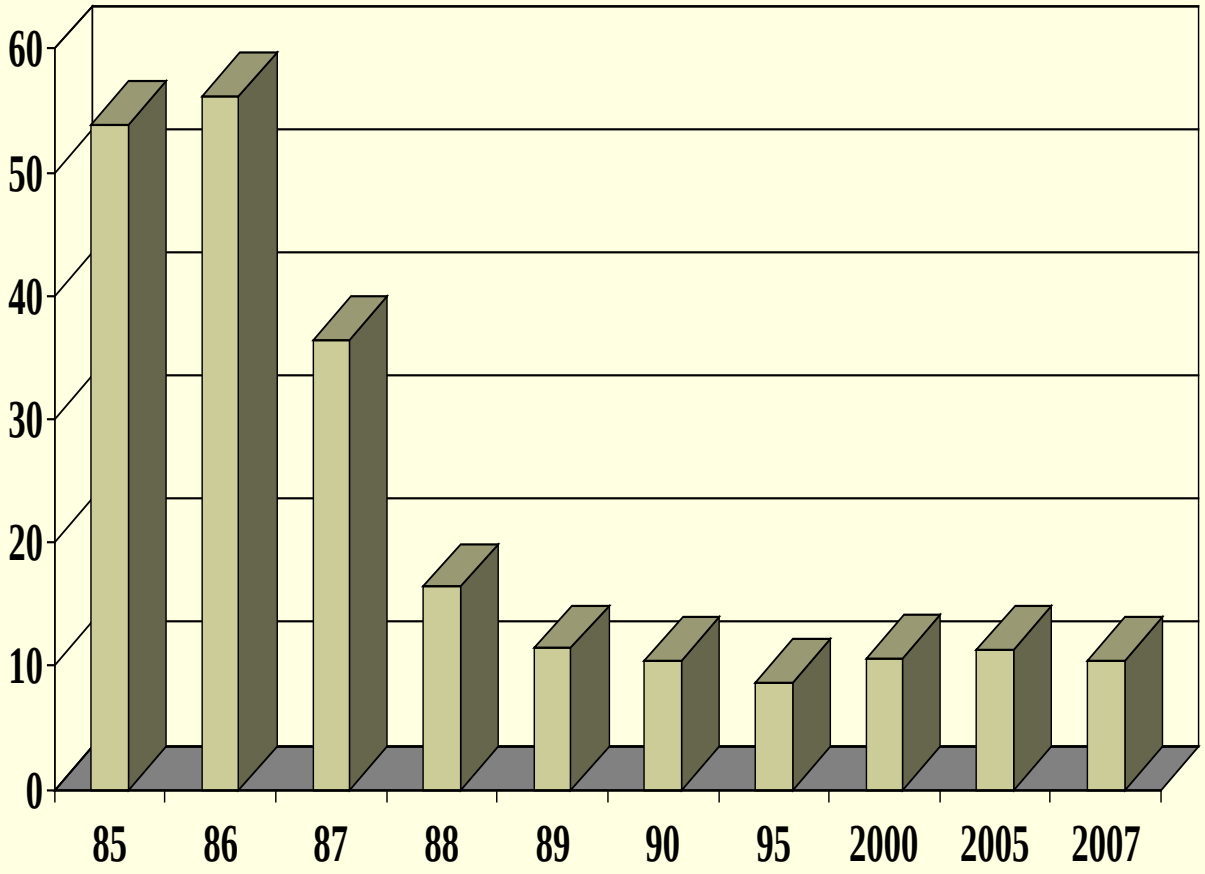
Volumes of Emissions in Federal Okrugs (FO), thou tons



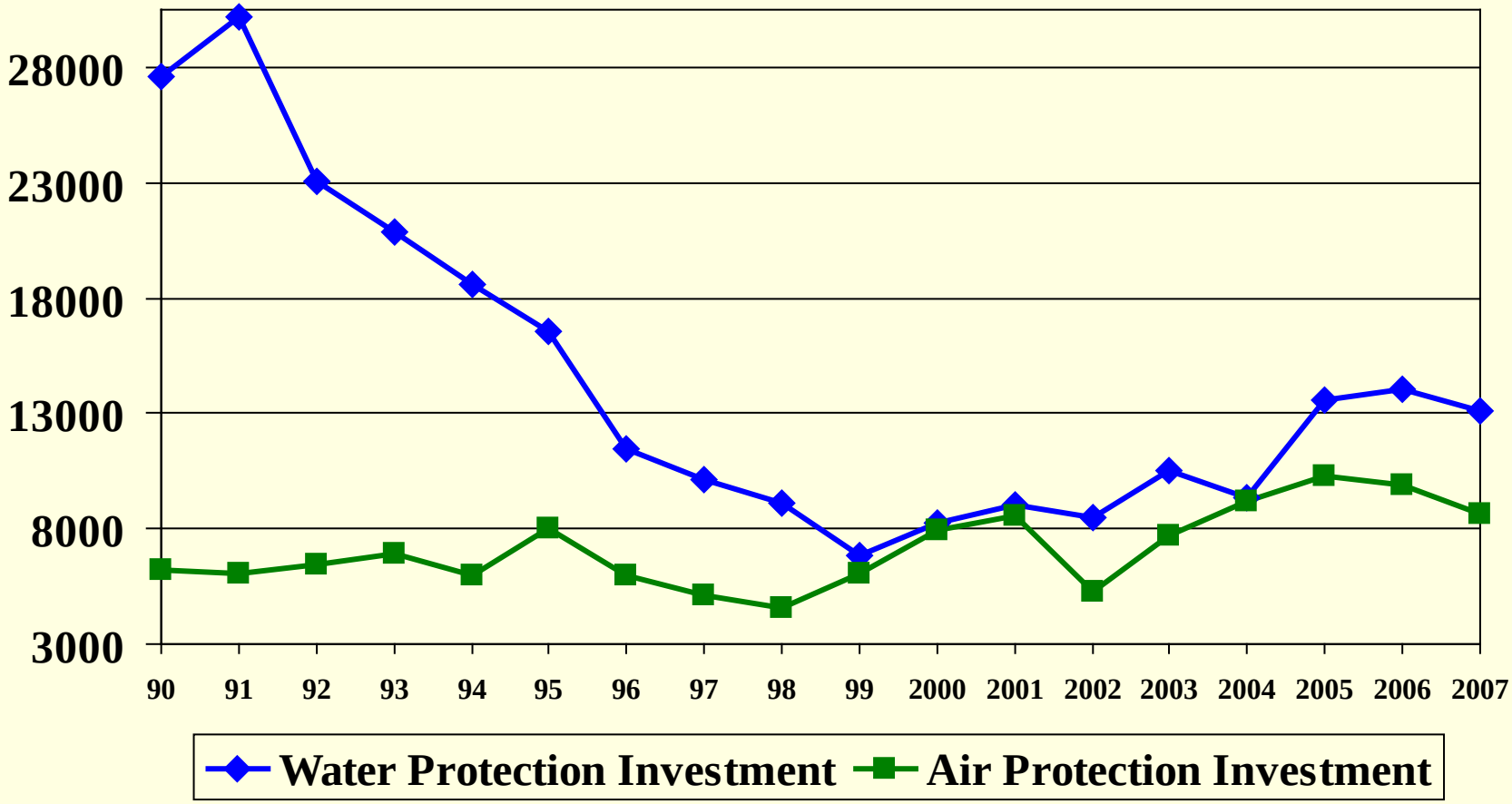
Volumes of Sewage Purification (billion cubic m) and Pollution Trapping (10^7 tons)



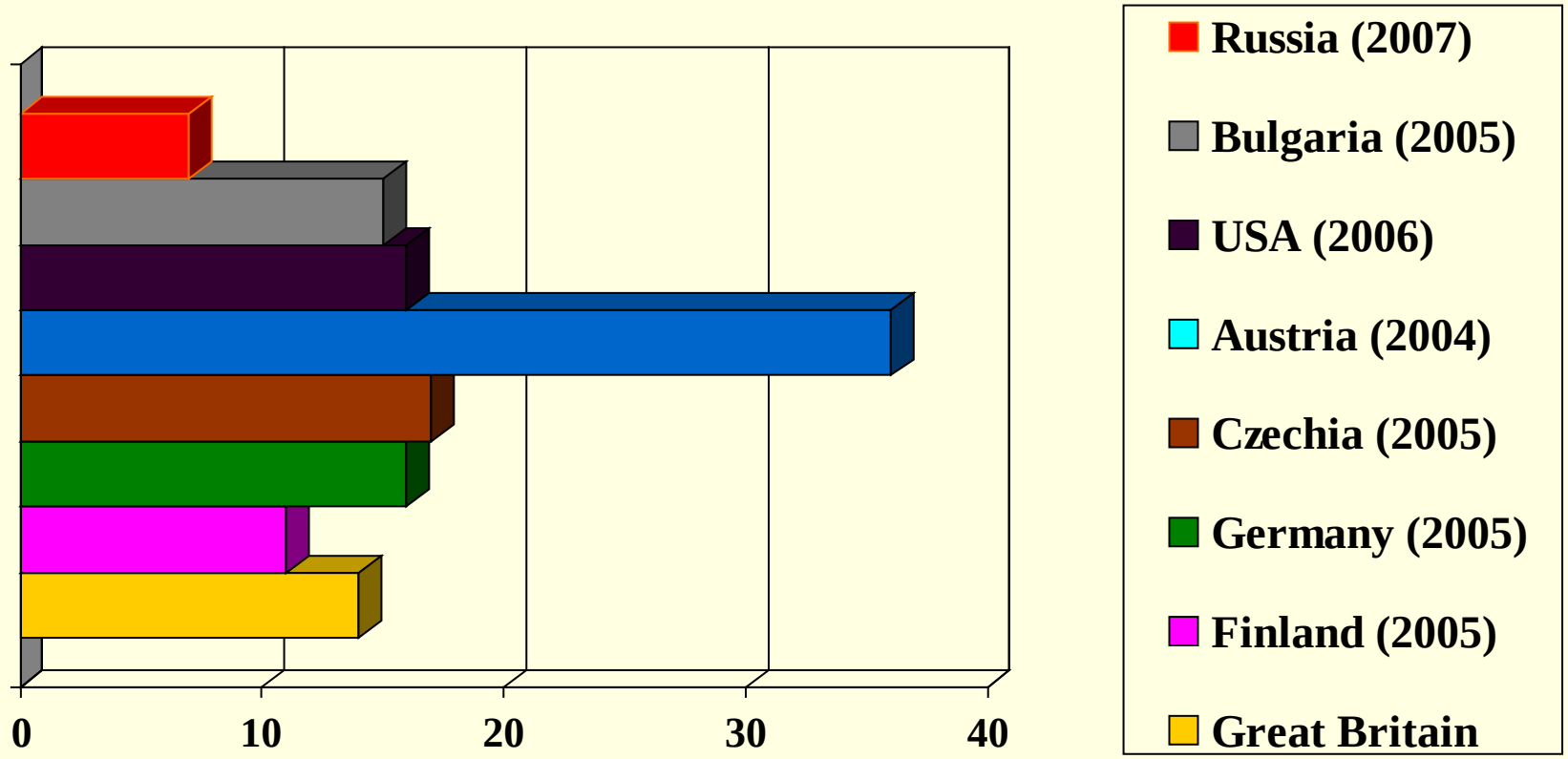
The Proportion of Sewage Treatment Providing Their Standard Quality (%)



Ecological Investment (million Rbl, before 1998 - billion Rbl, price of 2000)



Environmental Protection Cost ($ per 1000 $ of GDP, 2004-2007)



Putting into Operation of Environvental Fixed Assets

	1990	1992	1997	2003	2005	2007
Putting into service the production facilities for sewage treatment (thou cubic m per day)	2000	751	1004	522	1300	1500
Putting into service the production facilities for pollution trapping (thou cubic m hour)	16400	5642	3101	4378	4200	4100