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Russia's chemical and petrochemical industries at the eve of WTO-Accession

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**Russia's Chemical and Petrochemical Industries
at the Eve of WTO-Accession**

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Abstract

Although Russia's WTO-accession is foreseeable, there are still deficits in the literature on its concrete effects on the sectoral and regional levels. In this paper we analyse effects on Russia's chemical and petrochemical sectors (CPS), which are, unlike for example its oil and mineral gas industry, rarely in the focus of public attention. On the basis of an extensive examination of these sectors' current condition, we expect serious problems for them to emerge in the nearer future, the perhaps most serious and most puzzling problem being under-investment. Our analysis is based on data provided by GOSKOMSTAT/ROSSTAT, Russia's official statistics institute.

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Keywords: Russia, chemical and petrochemical industries, WTO

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1. Introduction

Russia's WTO accession is a widely discussed topic, especially in the country itself (*Petrov* 2002: 16). Although there are some analyses on the accession's aggregate regional or sectoral impacts (*Ustenko* 2002; *Yudayeva et al.* 2003; *Jensen, Rutherford & Tarr* 2004a, 2004b), there is so far still a deficit in the literature on its concrete impacts on the transformation of different sectors, dealing with a sector's actual economic constitution at the advent of WTO accession.

In this paper, we present such a sector-focused in-depth analysis. We examine Russia's chemical and petrochemical sector (CPS),¹ especially with respect to economic agents' investment behaviour, competition and innovative activities. As this sector is of significant importance in certain regions of Russia, we will also elaborate on some regional impacts of changes of economic performance that have to be expected for the future – not only as an effect of the WTO-accession itself, but as a result of intensifying international competition in general. While we do not completely agree with *Salichow* (2002: 5), who expects 'serious problems' for some regions in Russia after WTO-accession, we nevertheless expect challenges for many firms in Russia's CPS as a result of the country's world market integration. As the CPS is regionally clustered in Russia, regions will be affected asymmetrically by this.

We analyse the economic condition of Russia's CPS at the advent of the WTO-accession and compare it to other leading sectors of the Russian economy. In the third section we present some results of a little empirical investigation we

1 The term "chemical and petrochemical sector" (CPS) has been used by Russian classification (OKONH / Obshesojuzny Klassifikator Otrasei Narodnogo Hosjastwa) until 2005. According to Postanovlenie GOSSTANDARTA Rossii ot 06.11.2001 №454-CT, OKONH was transformed to OKWED (Obtscherossiky Klassifikator Widow Ekonomitscheskoi Dejatelnosti) after then. Therefore, all data from 2005 follows the OKWED definition of CPS, consisting of the industries chemical production, production of vulcanized rubber and plastic commodities as well as manufacturing of coke and oil commodities. Exceptions are separately explained in the respective tables.

carried out among some of Russia's leading firms in the sector. Our analysis is mostly based on data provided by GOSKOMSTAT/ROSSTAT, Russia's official statistics institute.

According to information provided by the World Bank (*World Bank* 2004; *World Bank* 2005), Russia's CPS recently experienced a remarkable reduction of growth which has almost collapsed during 2004 and the beginning of 2005 (table 1). We find that Russia's CPS suffers from severe under-investment and is rather ill-prepared for a more intense integration into the world markets. Ironically, the difficulties the industry currently faces are almost entirely 'home-made' and can only in part be attributed to intensified international competition, which of course tends to reveal and expose the weaknesses. Explaining the behaviour of Russian firms that failed to invest in times when profits and growth rates were high is, however, quite a difficult task.

Table 1. Growth of Selected Russian Industries, Compared to Period of Previous Year

	January – August 2004	September 2004	2007	6 Month 2008
Non-ferrous metals	4.1	0.5	-	-
Machinery, thereof:	13.6	5.1	12.0	-23.9
Automobiles	13.8	7.1	-	-
Chemistry	9.0	2.3	4.8	12.7
Fuels, energy; thereof:	8.0	5.9	30.0**	15.0**
Oil extraction	9.5	7.7	4.4*	19.2*
Gas	4.7	-2.0	-	-
Building materials	7.7	3.1	-	-
Electricity	0.6	-1.6	-	-

* data covers coke and oil extraction,

** data covers electricity, gas and water industries,

- no data available.

Source: World Bank: Russian Economic Report No. 8, November 2004; Russian Economic Report No 17., November 2008

http://siteresources.worldbank.org/INTRUSSIANFEDERATION/Resources/rer17_eng.pdf.

2. Russia's CPS and the World Economy

Russia's CPS is imperfectly protected against foreign competitors by import tariffs. Weighted import tariffs in the CPS are around 10 per cent and cannot be characterised as being prohibitive (table 2). Compared to changes in real exchange rates, effects of import tariffs appear to be rather insignificant.²

2 For effects of free trade between Russia and the EU see e.g. Sulamaa & Widgrén (2005); for trade effects of the EU-enlargement, Russia's WTO-accession and the Russia-EU Free Trade Agreement see e.g. Vinhas de Souza (2004).

Table 2. Import Tariffs for Selected Products of Russia's CPS

	Code	Import tariff, per cent, 1999-2001	Import tariff, per cent, 2006-2008 (in value percentages)
1. Sulphur	25	6.92	5
2. Fertilizer (Nitrogen), tons	31	10	10
3. Fertilizer (Potassium), tons	31	10	10
4. Chemical means of plant protection (insecticides, herbicides, fungicides), tons	38	5.83	5
5. Synthetic detergents, tons	34	12.4	15
6. Acyclic alcohol, tons	29	5.25	5
7. Tyres for trucks, pieces	4011 20	9.10	15
8. Car tyres, pieces	4011 20	9.10	15
9. Photo- and kinogoods	37		from 5 to 20
- Film with breadth 35 mm and more (exposed and developed, with or without sound track or only with sound track);	3706 10	9.70	20
- Photochemicals	3707	9.70	10

Source: Narodnohosjastwennye posledstwija prisoedinenja Rossii k WTO (Economic effects of Russia's WTO-Accession), Moscow 2002, Nacionalny Investicionny Soviet (National Investment Council), 96-99; O Tamoshennom Tarife RF I towarnoi nomenclature, primenjaenoi pri osut-schestwlenii wneschneekonomitschekoi dezatelnosti, Postanowlenie Prawitelstwa Rossijskoi Federacii ot 27.11.2006 №718, Moskwa.

Consequently, the Russian Academy of Sciences does not expect drastic turbulences for the domestic industries subsequent to the country's WTO accession if the country should be obliged to further cuts of its import tariffs.³ More than that, a reduction of export tariffs, even in the context of the accession, seems to be rather unlikely at present. The negotiation parties currently seem to regard it as a progress that Russia appears to refrain from its so-called *first-choice*-scenario which stipulated even transitory increases of transport tariffs for cer-

3 According to an independent expert group, no serious system turbulences are to be expected as a consequence of Russia's WTO accession. Exceptions are individual companies that are not competitive as of now, however, they do have a significant impact on overall as well as sectoral growth. In the long-run, a positive influence on economic growth is unanimously expected (*Minekonomraswitija Rossii* (Russian Ministry of Economic Development) (December 2008; <http://www.wto.ru/russia.asp?f=dela&t=11/>)).

tain sectors after the accession, with the intention to more intensely protect domestic producers against world market competition for some years to come. At the moment it is more likely that there will be a tariff binding more or less at current, non-prohibitive tariff levels. Effective import tariffs will, however, slightly increase due to reduced misclassifications after the introduction of a simplified and more transparent tariff structure in 2001 (*Chowdhury* 2003; *Afontsev* 2004; *Wojtynak & Broll* 2008). Yet, there are still several ineffective procedures and institutions in the customs and transport system, like intransparent certification procedures, unsatisfactory protection of private property and contract enforcement, corruption, administrative barriers, and an inefficient government bureaucracy that let international investors refrain from the Russian market (*Stern* 2002). Nevertheless, one must expect that Russia's WTO-accession will intensify competition – not just because of tariffs probably being cut in the long term, but especially because of the Russian government's obligation to improve contract and law enforcement and to reduce discrimination between foreign and domestic producers. In this context, dismantling barriers to market entry for providers of business services (insurance, banking, etc.) will most likely induce more remarkable effects on productivity and output of the Russian CPS than changes of import tariffs (*Jensen, Rutherford & Tarr* 2004a, 2004b). Another driving force for structural changes will probably be the increasingly sophisticated demand by Russian downstream producers and consumers which at present can only in part be met by domestic suppliers. Consequently, observers could witness an increase in imports of CPS products for the years to come and a significant increase of CPS-products' relative importance in the import structure of the Russian economy.

Exporting roughly one third of its production, the CPS is one of the sectors of the Russian economy that will be most strongly exposed to international competition after WTO-accession. Among the documents being most widely discussed in the context of Russia's WTO-accession is *Narodnohosjastwennye posledstwija prisoedinenija Rossii k WTO* (Economic consequences of Russia's WTO-accession) which was published by the National Investment Council

(*Nacionalny Investicionny Soviet* 2002). The document describes two different paths of the accession, called the realistic and the optimal one. In both scenarios, the council concludes that the WTO-accession will not cause serious damages to the Russian economy (*Nacionalny Investicionny Soviet* 2002: 17). Yet, not surprisingly, there are many different opinions to be found in the literature which can be summarized as follows:

1. Some authors maintain that the sector of raw materials and fuels, accounting for almost two thirds of Russia's exports, will not suffer seriously from its more extensive integration in the world economy (*Nacionalny Investicionny Soviet* 2002: 8; *Wojtynak & Broll* 2008).
2. Regarding the CPS, some authors expect serious problems, especially because of the 'lasting under-utilisation of production capacities' (*Nacionalny Investicionny Soviet* 2002: 9) as well as a better accessibility of the Russian market for oil- and engeneering-related commodities and services which will put competitive pressure on the (comparable inefficient?) domestic companies in this segment (*Galiev & Havkin* 2008).
3. The Investment Council identifies regions that are characterised by agglomerations of specific industrial sectors and are consequently closely tied to these sectors' destiny. Regarding CPS, these regions are Nishegorodskaja Oblast/Region, Republic of Tatarstan and Permskaja Oblast/Region.
4. *Kucobin and Glasjev* (2002: 34) conclude that "[i]n sum, for the crisis-shaken Russian economy the consequences of the accession will be negative in the short and mid-term". In the long run, given a stable and sustained growth, the authors expect positive global effects of an opening of the country's internal markets and a growing FDI inflow (*Lissowolik & Lissowolik* 2004).
5. While some Russian scholars emphasise that the effects of the WTO-accession will remain moderate due to many sectors' limited integration in the world economy, they do not fail to recognise the fact that the Russian economy is bound to follow the general tendency of open economies

to gain in sectors which are comparatively efficient and to lose in those being comparatively inefficient (*Kucobin & Glasjev* 2002: 31, 35). As a consequence, they predict a ‘sharp, dramatic character’ of structural changes that will be induced by the accession (*Kucobin & Glasjev* 2002: 31).

6. Recent model-based investigations expect mostly positive effects in the mid term. While *Yudayeva et al.* (2003) predict rather insignificant effects of tariff reductions, they expect productivity increases in Russia’s CPS and small output reductions in some Russian regions. *Rutherford, Jensen and Tarr* (2004a, 2004b) as well as *Tarr* (2007) emphasize strong positive effects of a liberalisation of business services amounting to roughly two thirds of total positive effects of WTO-accession which, in their model, will sum up to some 7.7 per cent increases of Russian consumption compared to the non-accession scenario in the mid-term.

Negotiations on Russia’s WTO-accession have lasted for more than fifteen years now, the relevant documents having been submitted by the Russian government as early as in 1993. In 1995, there was a first meeting of the working party which was in charge of Russia’s accession. This meeting was followed by another 18 sessions. Between 2001 and 2008 more than 380 meetings and conferences took place in all Russian regions in order to discuss and prepare the WTO-accession problems, in particular export promotion and the access of foreign markets for Russian commodities. However, from today’s point of view it cannot be predicted when Russia’s accession to the WTO will be completed – with the upcoming tariff union among Russia, Belarus and Kazakhstan (scheduled to start on the 1st of July in 2010 with a common tariff codex) being another influential factor.

Opponents of the accession are mainly to be found within sectors that are not export-oriented and focused on the interior market. The main arguments against accession are not particularly inventive and well known from other discussions concerning the opening of an economy. First of all, it is argued that after the ac-

cession Russia will lose its leading position as a supplier of raw materials and fuels. The reason is that Russian firms are expected to be not sufficiently competitive anymore in international markets once the country has entered the WTO. Very often the argument is stressed that, once having joined the WTO, Russia will be unable to carry out an independent industrial policy. Instead, for the sake of national security it is held to be advisable to strive for protection of domestic industries against foreign influence and to fuel growth of key sectors with resources of the domestic government (*Department of Science and Industrial Policy of the City of Moscow* 2007).

Other authors indirectly assert that the threat of international competition in the current situation is rather insignificant because domestic CPS can rely on low production costs, especially for energy and transport and that these industries are consequently rather threatened by rising energy and transport prices. Thus, according to these authors, the Russian CPS is competitive on international markets mainly because of its low input and transport prices – and not because of its protection against international competitors (inter alia *Beljanin* 2002: 24). However, this does not seem to constitute a very convincing argument in the face of (i) low productivity levels in the domestic CPS, (ii) the importance of product innovations in these industries and (iii) provided that in many CPS-segments transport costs amount to only an insignificant share of total production costs. Furthermore, an investigation by *Gaidar* (2002: 223) has shown that while for the Russian industry as a whole international competition is becoming increasingly prevalent, domestic competition is of even greater importance for Russia's CPS than international competition.

3. The Condition of Russia's CPS since 1995

A. General Economic Situation

The CPS is one of Russia's traditional sectors. In the late Soviet period the sector stagnated when there were hardly any new companies founded. However, during the following period the number of company establishments began to rise again. Other key sectors of the Russian economy, namely fuel industry and machinery construction, developed accordingly (*Achmetov* 2002: 9). Nowadays, the CPS is far from being Russia's most important sector. Russia's economy is dominated by machinery construction and metal processing (21.1 per cent of the entire industrial production in 2003, in prices of 1999), fuel industry (16.9 per cent), food industry (15.6 per cent), non-ferrous metallurgy (10.5 per cent), electricity (8.1 per cent), and black metallurgy (8.3 per cent). The CPS held a stable 7th position among Russia's leading industries between 1992 and 2003 (7.1 per cent in current prices; *GOSKOMSTAT* 2004a: 184). Since then, CPS' position has only slightly improved with 2007 showing the following picture:⁴ energy & resources industries ca. 45 per cent of shipped goods from domestic production including related services, metallurgy ca. 11 per cent, food industry 9 per cent, CPS about 9 per cent.⁵

The limited importance (and the technological behindness) of Russia's CPS surprises if one keeps in mind Russia's enormous natural petroleum resources. Attempts have been made to strengthen the sector. For instance, 2005 the Russian Government adopted the *Conception for the Development of the Chemical and Petrochemical Industry until 2010* (<http://rcc1.ru/Rus/LegalServices> 2004), which was drawn up by the Russian Ministry for Science and Technology, as well as a related implementation plan. Currently, the experts from Minpromenergo (the Ministry for Energy Production) develop a concept for the de-

4 Own calculations following ROSSTAT (2008a: 198-199).

5 The comparison is aggravated by changes in Russian statistics, cf. GOSKOMSTAT (2004a: 184) with ROSSTAT (2008a: 198-199).

velopment of Russia's CPS until 2015.⁶ Russia's CPS is regionally agglomerated in Privolzhsky Federalny Okrug/District (11.8 per cent of the sector's total production), Jushny Federalny Okrug/District (7.7 per cent), and Centralny Federalny Okrug/District (6.9 per cent) (*GOSKOMSTAT* 2003b: 344). According to the *Expert-200*-ranking, the biggest companies on the territory of the Russian Federation are located in the following regions: Republic of Tatarstan, Samarskaja Oblast/Province, and Republic of Bashkortostan. All these regions belong to the Privolzhsky Federalny Okrug/District. In 2007 35.3 per cent of Privolzhsky Federalny Okrug's/District total production belonged to CPS, the figures for Centralny Federalny Okrug/District and Jushny Federalny Okrug/District are 27.3 per cent and 24 per cent respectively.⁷

In the following we compare Russia's CPS and its preparedness for WTO-accession with that of two other leading sectors, namely fuel industry and machine construction/metal processing. The regions Republic of Tatarstan, Republic of Bashkortostan, and Samarskaja Oblast/Region will be scrutinised with specific attention.

6 See <http://www.minprom.gov.ru/expertise/meeting/archive/29>.

7 *Rossiskiy Statisticheskiy Eshegodnik* (Russian official statistical yearbook), Rosstat, Moscow, 2009, 372-375.

Table 3. Industrial Production of Leading Sectors

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2007
Industry total	96.7	95.5	102.0	94.8	111.0	111.9	104.9	103.7	107.0	106.3*
Fuel industry	99.2	96.9	99.6	97.4	102.5	104.9	106.1	107.0	109.3	101.9
Machine construction and metal processing	90.9	95.4	103.6	91.4	117.4	119.9	107.1	101.9	109.2	119.1**
Chemistry and petrochemistry	107.6	92.9	103.7	94.3	123.5	114.9	104.9	100.7	104.6	106.0***

* index including extraction of natural resources, manufacturing industries, energy, gas and water production and distribution (Rossija w cifrach. 2008, Rosstat, 200);

**only machines and constructions;

*** only chemistry.

Source: Rossisky Statisticheskyy Eshegodnik (Russian official statistical yearbook), GOSKOMSTAT, Moscow, 2004, 359; Rossija w cifrach. 2008, Rosstat, 2008, 200-202.

Table 3 shows that, except for the years 1996, 1998 and 2002, Russia's CPS performed better than the industry as a whole. In relative terms, the CPS even outperformed the fuel industry (in 1995, 1997, 1999, 2000 and 2007). After having experienced a period of severe downturn after the collapse of the Soviet Union, Russia's CPS has entered a phase of moderate recovery in the aftermath of the economic crisis of 1998, albeit in many segments starting from a low level. This is indicated in the following table which shows growth rates of production quantities for several products of Russia's CPI in the periods 1990-1998 and 1998-2001.

Table 4. Output Quantities of Russia's CPS, Selected Products, periods 1990-1998 and 2000-2007, changes in per cent

Production of basic kinds of products of CPS								
		1990	1998	1990-1998	2000	2007	2000-2007	1990-2007
1. Sulfuric acid, monohydrate	Mio. tones	12.8	5.8	-7	8.3	9.7	1.4	-3.1
	%	100	45.3	-54.7%	64.8	75.8	11	-24.2%
2. Soda ash 100% (without potash)	Thsd. tones	3240	1538	-1702	2201	2939	738	-301
	%	100	47.5	-52.5%	68	91	23	-9%
3. Caustic soda 100%	Thsd. tones	2258	847	-1411	1241	1297	56	-961
	%	100	37.5	-62.5%	55	57.4	2.4	-42.6%
4. Chemical means of plant protection (in 100% calculation to the operated substance)	Thsd. tones	111	5.8	-105.2	10.6	15.5	4.9	-106.1
	%	100	5.2	-94.8%	9.5	14	-4.5	-86%
5. Syntethic resins and plastic materials	Thsd. tones	3258	1618	-1640	2576	4464	-1888	+1206
	%	100	50	-50%	79	137	+58	+37%
6. Chemical detergent agent	Thsd. tones	876	253	-623	436	807	-371	-69
	%	100	29	-71%	50	92	+42	-8%
7. Tyres for trucks, buses, trolley buses	Mio. Pieces.	19.7	7.4	-12.3	10.1	11.8	-1.7	-7.9
	%	100	37.6	-62.4%	51.3	60	8.6	-40%
8. Tyres for cars	Mio. Pieces.	15,9	14.6	1.3	17.7	29.4	-11.7	+13.5
	%	100	91.8	8.2%	111.3	184,9	73.6	+84.9%
Production of fertilizer								
9. Fertilizer (Nitrogen), tons	Thsd. tones	7186	4100	-2307	5818	7203	1385	+17
	%	100	57	-43%	81	100,2	+19,2	+0,2%
10. Fertilizer (Potassium), tons	Thsd. tones	3848	3600	-248	4016	7277	+3261	+3429
	%	100	93.5	-6.4%	104.4	189.1	+84.7	+89.1%

Production of sulphur								
11. Sulphur	Thsd. tones	2499	3986	+1487	4966	6460	+1494	+3961
	%	100	159.5	+59.5%	199	259	+59.5	+159%
Production of photogoods								
12. Kino-photofilm, 35 mm	Mio. m	816	-	-	14,1	8,7	-5.4	-807.3
	%	100	-	-	1.7	1.1	-0.6	-98.9%

Source: on Basis of: *Promyshlennost Rossii (Russian Industry)*, GOSKOMSTAT, 2002, 186-196; *Promyshlennost Rossiio 2008*, Rosstat, 2008, 220, 221, 227; *Rossisky Statistichesky Eshegodnik (Russian official statistical yearbook)*. 2002, GOSKOMSTAT, 2002, 186; *Rossisky Statistichesky Eshegodnik*. 2008, Rosstat, 2008, 413, 414, 415.

As is demonstrated by the table, there are also several product segments in Russia's chemical and petrochemical industries that are far from recovery. More than that, if production has declined by more than 50 to 60 per cent during the period of 1990 to 2007, there is almost no sign of recovery whatsoever. As a consequence, the production in segments like photographic films or chemical pesticides has expired or is about to expire. During the period between 1990 and 2007, the production within the segments caustic soda, chemical means of plant protection, tyres for trucks and buses as well as photographic films dropped by more than a quarter.

This is not necessarily in every case due to insufficient competitiveness of Russian producers but may also be attributed to technical change in general causing certain products (like video tapes) to disappear because of emerging new technical standards. However, there is indication that Russian producers are far from recovering pre-crisis production levels especially in segments of more elaborated products. If we consider that the increasing share of imports of chemical products is largely due to sophisticated products like chemical detergents, input materials for the construction industry and car-production it becomes evident that Russian producers appear to have difficulties in meeting the sophisticated domestic demand which is increasing especially because of rising real household incomes. At present, the country's agrochemical production capacities are far from being able to meet domestic demand.

Like chemical and petrochemical production in general, Russia's CPS is very capital-intensive. As a consequence, increasing market shares of imported products reduced capacity utilisation rates in Russia's CPS and induced a tendency towards progressively rising unit costs. According to Ageev and Salichov (2002: 132), reductions in capacity utilisation rates of 50 per cent have induced cost increases of 20 to 30 per cent. Thus, the question arises whether firms in Russia's CPS still operate profitably?

B. Financial Conditions of Firms in Russia's CPS

Like other major industries, the Russian CPS so far operates profitably *on average*, although a decline in average profits can be observed between 1999 and 2003 which may be both due to increased competition or decreasing competitiveness. Right before the financial crisis, the industry seems to have recovered to some extent in terms of profitability.

Table 5. Profitability (profit-turnover-ratio) of Production, in per cent, years 1995-2007⁸

	1995	1997	1998	1999	2000	2001	2002	2003	2007
Total industry	17	8	11	20	19	16	13	12	15.7*
Fuel industry	17	12	14	31	34	26	17	16 (17)	23**
CPS	6 (17)	4	9	18	15	10	8	8.6 (6)	16
Machine construction and metal processing	9 (17)	7	9	15	12	12	10	8 (3)	8

* including extraction of natural resources, manufacturing industries, energy, gas and water production and distribution;

** fuel production.

Source: *Rossisky statistichesky eshegodnik 2004*, Moscow, GOSKOMSTAT, 2004, 359, 376, 385, 387; in brackets:⁹ *Rossija w cifrach (Russia in Figures)*, GOSKOMSTAT, 2004, 184, 191, 194, 195; authors' calculations, *Rossisky statistichesky eshegodnik. 2008*, Rosstat, 2008, 366, 387, 413, 424.

Is is remarkable, however, that among the major sectors Russia's CPS exhibits a comparatively low profitability. If we look at the sector more precisely, we find that average figures are not very informative here as the number of unprofitable firms has risen dramatically since 1992 (*GOSKOMSTAT 2003b*: 365). Roughly 30 to 35 per cent of all firms in these sectors must be considered par-

8 The table shows profit-turnover ratios (in per cent) which is not identical with the original data published by GOSKOMSTAT (Tab. A – see appendix) . As we were told on our request, GOSKOMSTAT defines profitability as profit divided by original costs. Thus, compared to more common measures, like profits divided by turnover, GOSKOMSTAT's profitability figures will be higher if firms make profit, because in this case turnover exceeds costs, making the denominator in the GOSKOMSTAT-definition smaller than in turnover-based indicators. If, on the other hand, firms incur losses, this will, in the GOSKOMSTAT-definition lead to smaller figures in negative profitability as in this case costs in the denominator will be greater than turnover. As a consequence, the data could not be directly compared to usual profitability data, so we had to calculate the more commonly used profit-turnover-ratios.

9 It is puzzling, however, that data from different sources, namely *Rossisky Statistichesky eshegodnik* and *Rossija w cifrach* occasionally diverges, so we decided to show divergent data provided by the latter source in brackets. Similarly, there is puzzling divergence in the statistical data of “coefficient of equipment renewal” for the period 2003-2007 – despite an identical definition of the term. See *Rossisky Statistichesky Eshegodnik 2006* and *Promyschlennost Rossii 2008*, Rosstat, 375.

ticularly vulnerable in situations of economic crisis. The share of unprofitable firms is particularly high in some regions. In 2002, 41.8 per cent of all companies were defined as unprofitable in Centralny Federalny Okrug/District, in Privolzhsky Federalny Okrug/District there were 45.7, in the Republic of Tatarstan, Bashkortostan, and Samarskaya Oblast/Region the respective figures were 41.8, 38.3 and 43.9 per cent respectively (*GOSKOMSTAT* 2003d: 814-815). However, the figures for 2007 picture a considerable drop in the ratio of unprofitable firms (table 6). Unfortunately, one has to be cautious to interpret this as a sign of improvement. Once again, a change in statistical coverage might at least partly drive the effect. After 2003, statistics were amended in order to include all firms of the industry, whereas the older statistics included only manufacturing firms. This corresponds to the increase of the number of covered firms (see table 11 below).¹⁰

Table 6. Ratio of Unprofitable Firms in Major Sectors of the Russian Industry 1992-2007, in per cent, from total number of firms

	1992	1995	1998	2002	2003	2007
Whole economy	15.3	34.2	53.2	43.5	43 (41.3)	25.5 (23.4)
Industry; thereof:	7.2	26.4	48.8	45.1	44.5 (42.0)	-
Fuel industry	14.1	32.1	53.9	48.2	48.9 (46.6)	31.9 (29.2)*
CPS	2.0	14.7	41.5	42.4	40.5 (38.7)	29.1 (29.2)**
Machine construction and metal processing	4.9	24.5	47.2	40.4	40.5 (37.7)	21.4(17.9)

* *fuel production;*

** *chemistry only;*

Source: Rossisky statistitschesky eshegodnik 2004, Moscow, GOSKOMSTAT, 2004, 589; in brackets: Rossiya w cifrach (Russia in Figures), GOSKOMSTAT, 2004, 333; Rossisky statistitschesky eshegodnik 2008, Rosstat, 2008, 682; in brackets: Rossiya w cifrach. 2008, Rosstat, 2008, 380-381.

10 A cautious conclusion could be that the firms working around the core ('old') industry structure in Russia's CPS tend to be smaller, younger, more competitive and less unprofitable. At the same time, this would imply that profits in these areas should not be supracompetitively high.

If such a high share of firms makes no profits (table 6) while the average profitability of an industry as a whole is quite satisfactory (table 5), this might imply that the remaining firms make rather high profits, perhaps pointing towards deficiencies in the competitive structure of these markets. Thus, Russia's industrial landscape appears to be divided in unprofitable and highly profitable firms. On the one hand, among the former there might be some share of entrants which have not yet passed the break-even point. On the other hand, smaller and younger firms seems to perform better than (some of) the big old industrial ones since the inclusion of (in tendency) smaller firms from the related non-manufacturing parts of the industry considerably reduced the share of of unprofitable units. Thus, there could also be a three way structure: (i) big manufacturers enjoying high profits (due to anticompetitive gains?), (ii) unprofitable and uncompetitive (big?) manufacturers and (iii) competitive (and smaller and younger?) firms in the neighbouring areas within the industry with small competitive profits. Unfortunately, it is difficult to obtain data that allows to discriminate between the hypotheses. However, some of the following considerations on technological development and innovative competitiveness might in tendency support the latter reasoning.

C. State of Technical Development and Technical Competitiveness of Russia's CPS

The degree of attrition of equipment in the Russian CPS has deteriorated significantly between 1970 and 1990, as is also indicated by the equipment renewal coefficient (table 7).

Table 7. Degree of Attrition and Equipment Renewal Coefficients in Major Industrial Sectors (End of Year)

	1970		1990		1998		2002		2003		2007	
	1	2	1	2	1	2	1	2	1	2	1	2
Industry total	25.7	10.6	46.4	6.9	52.9	1.2	52.9	1.8	51.4	1.8	45.7**	2.2**** (14.6 ^A)
Fuel industry	34.7	10.0	46.7	8.1	54.7	1.7	52.6	3.2	50.7	3.5	50.3***	2.3**** (14.3 ^B)
CPS	22.1	12.1	56.3	4.1	62.6	0.5	57.0	0.7	53.5	0.9	40.5*	2.6**** (für verarbeitende Industrie) (14.8)
Machine construction and metal processing	25.3	12.7	47.5	6.6	53.2	0.4	54.8	0.8	52.8	0.9	41.8	

* - data calculated as average values for the industries coke & oil, chemistry and rubber & synthetics; - data on file with authors,

** data calculated as average values for resource extraction and manufacturing,

*** - data for Brennstoff-Energie-Bodenschätze-Förderung,

**** data of 2005 on Basis of (2007 data on file with authors),

in brackets: ^A average value for resource extraction and manufacturing (Promyshlennost Rossii, 2008, Rosstat, 110), ^B value for energy industry (Promyshlennost Rossii, 2008, Rosstat, 110);

1 – Degree of attrition of equipment, end of year, large and medium-sized facilities.

2 – Coefficient of equipment renewal (share of capital stock having been put into operation in the year compared to value of capital stock by the end of the year), in constant prices, large and medium-sized production facilities.

Source: Rossisky Statisticheskyy Eshegodnik (Russian Official Statistical Yearbook), GOSKOMSTAT, Moscow, 2003, 354; Rossisky Statisticheskyy Eshegodnik (Russian Official Statistical Yearbook), GOSKOMSTAT, Moscow, 2004, 374; Rossisky Statisticheskyy Eshegodnik. 2008, Rosstat, 2008, 386; Promyshlennost Rossii. 2008, Rosstat, 2008, 110-112, www.gks.ru/bgd/regl/b06_13/IssWWW.exe/Stg/d01/11-28.htm.

11 The data on the equipment renewal coefficient considerably varies among the available Russian statistical sources in the period 2003-2007 despite an (apparently) consistent definition of the term 'equipment renewal coefficient'. Compare, for instance, Promyshlennost Rossii. 2008 (11.9 – 14.5 per cent; case A) with Rossisky Statisticheskyy Eshegodnik (Russian Official Statistical Yearbook) 2006 and Rossija w cifrach. 2004 (2.8 – 1.7 per cent; case B). In a response to our query, ROSSTAT explains the differences with the use of different norming price standards, namely reference prices (year 2000) in case B and non-corrected contemporary prices in case A.

Obviously, there is a lack of renewal investments that turned out to be particularly dramatic after the economic crisis of 1998/1999. Only the fuel industry has hesitantly begun to recover. It is puzzling, however, that firms in the Russian CPS – at least those firms that made substantial profits – hardly made any investments. Rather, the very small equipment renewal coefficients indicate that firms largely relied on a capital stock which had been installed years before the transition crisis. After capacity utilisation had reached a minimum during the crisis of 1998, several firms just had to increase utilisation rates to meet increasing demand during economic recovery after 2000. Consequently, profits were mainly due to rising utilisation rates – at least in some segments (table 9) and by saving investment costs instead of expanding capacities. The question arises, however, why firms did not anticipate the current situation of capacity limits, of intensified competition with world market competitors producing more sophisticated products with more efficient capital stocks, increasing prices for input materials and rising wages. While this question cannot be answered extensively here, the hypothesis might be worth discussing that after having experienced economic instability for several years after economic transition, a large share of managers developed a preference for short-term optimizing behaviour. Another reason, however, might be some confidence into protective measures from the side of political authorities. Again, verification of this hypothesis is beyond the scope of this paper.

Table 8. Capacity Utilisation Ratios for Selected Products of the CPS

	1990	1998	2001	2003	2007
mineral fertilisers	75	47	67	73	87
plant protectants	46	7	21	14	23
synthetic resins and plastic materials	84	45	62	74	78
laquers and varnishes	74	15	22	24	39
tyres for passenger and agricultural vehicles, motorcycles	91	59	76	83	87

Source: Rossisky Statisticheskyy Eshegodnik (Russian Official Statistical Yearbook), GOSKOMSTAT, Moscow, 2004, 370; Rossisky Statisticheskyy Eshegodnik. 2008, Rosstat, 2008, 383-384.

The constitution of the capital stock of Russia's CPS is quite representative for many sectors of the Russian economy. The average age of industrial equipment was about 20.7 years by the end of 2003. The age structure is as follows. Only 7.8 per cent of all production facilities are less than five years old; 4.9 per cent were installed six to ten years ago; 16.4 per cent 11 to 15 years ago; 22.7 per cent are older than 16 years and 48.2 per cent were installed more than 20 years ago (*GOSKOMSTAT* 2004b: 372).

According to the data, in 2002 81 per cent of the equipment that was suspended from the production process had to be turned off because of attrition, while only 11 per cent were decommissioned because of inefficiency (*GOSKOMSTAT* 2003a: 197). The procurement of equipment is dominated by machinery from domestic production (89 per cent); 27 per cent of the equipment procured is used material, predominantly from domestic production (*GOSKOMSTAT* 2003a: 197). The share of completely attrited material is 29.1 per cent, almost any fifth building is fully worn out and 16.9 per cent of transport capacities must be considered entirely worn out (*GOSKOMSTAT* 2003b: 106). The average utilisation ratio of production capacities in the CPS differs widely between products. While it is at some 80 per cent in the fields of polyvinyl chloride resins and vinylchloride-copolymers it does not exceed 22 per cent in the production of lacquers and varnishes (*GOSKOMSTAT* 2003b: 183).

To sum up, the capital stock of Russia's CPS is in a critical state and, as a consequence, its productivity levels are rather low compared to western or Asian producers. This is particularly true for production facilities that are completely in Russian ownership. Obviously, investors' inclination to install more recent technology, entailing higher productivity and competitiveness, is greater if equity is at least partially owned by foreign investors (table 10). One might expect that the situation for medium-sized and large firms in Russian ownership is unlikely to improve significantly after WTO-accession as long as input costs and real exchange rates will continue to rise and protection against foreign competitors will be reduced. Note that attrition and equipment renewal data in

table 8 is only given for large and medium-sized firms, i.e. the incumbent firms in Russia's CPS. The situation for entrant firms is not that clear. The mere fact that their average labour productivity is lower than that of firms being partially owned by foreigners does not necessarily mean that they all rely on outdated material, perhaps purchased on markets for used machinery in Russia due to notorious capital scarcity. Rather, as already mentioned before, these productivity levels might also be a consequence of above-average R&D activities, particularly small scale effects or other phenomena typically occurring at early stages of product and firm life cycles.

Table 9. Ownership Structures in Leading Sectors of the Russian Industry, 2003 (2002 z.)/2007, end of year, per cent

	Number of firms	Output	Number of industrial personnel employed
industry total, thereof,	100 (100)/100	100 (100)/100	100/100
state-owned	3.0 (3.1)/ 3.3	7.9 (8.2)/ 4.8**	12.8 (12.8)/-
communal	2.1 (2.1)/ 5.9	1.4 (1.3)/ 0.1	2.2 (2.2)/-
private ¹⁾	87.9 (87.8)/ 80.7	45.2 (43.8)/ 52.2	49.0 (49.0)/-
property of social or religious organisations	0.5 (0.6)/ 5.3	0.3 (0.2)/0.5	0.7 (0.7)/-
mixed Russian ²⁾	4.8 (4.9)/ 4.8*	22.4 (24.3)/10.3	25.0 (25.0)/-
joint Russian and foreign property ³⁾	1.7 (1.5)/-	22.8 (22.2)/18.6	10.3 (10.3)/-
Chemistry and petro-chemistry, thereof,	100 (100)/100	100 (100)/100	100 (100)/100
state-owned	1.6 (1.8)/7.7***	3.9 (4.3)/2.0	5.8 (6.4)/-
communal	0.1 (0.1)/3.1	0.0 (0.0)/0.0	0.1(0.1)/-
private ¹⁾	91.9 (92.1)/78.0	44.7 (42.9)/46.9	50.5 (48.7)/-
property of social or religious organisations	0.3 (0.3)/0.1	0.2 (0.2)/0.0	0.4 (0.4)/-
mixed Russian ²⁾	3.3 (3.3)/4.7	31.9 (33.0)/20.2	28.6 (32.1)/-
joint Russian and foreign property ³⁾	2.8 (2.4)/4.0	19.3 (19.6)/23.1	14.7 (12.3)/-

¹⁾ – including property of Russian citizens with permanent residence abroad.

²⁾ – including property of retail cooperatives,

³⁾ – including foreign property,

* “other forms of property, incl. mixed Russian foreign, joint Russian and foreign”,

** manufacturing industries,

*** chemistry.

Source: *Rossisky Statisticheskyy Eshegodnik* (Russian official statistical yearbook), GOSKOMSTAT, Moscow, 2003, 346; 2004, 365; *Rossisky Statisticheskyy Eshegodnik*. 2008, Rosstat, 339-341, 378-379.

According to table 9, privatisation has made the most significant progress in the CPS. More than nine out of ten of all firms are in private hands in periode 2002-2003. However, from 2003 to 2007 this figure has significantly dropped again to 78 per cent. Only a very small share of the firms operating in the CPS is owned by the state in Periode 2002-2003. Again, a certain drawback can be identified thereafter. The figures for 2007 can be interpreted as the starting point for a (limited?) de-privatization process with the state and the communes regaining control over a larger share of the number of CPS companies. Yet, the

size of private firms owned completely by Russians tends to be small as they contribute only roughly 45-47 per cent to total output in the sector in Period 2002-2007. If the equity is in part owned by the state (mixed Russian property) or foreign investors, firms' size is usually far above the average. Obviously, firms which are at least partially owned by foreign investors tend to have highest labour productivity. We obtain similar results if we look at other leading sectors, like fuel and machinery construction. Surprisingly, private firms owned by Russians seem to have the lowest labour productivity, while firms in public-private ownership range in-between. One reasonable assumption might be that the smaller firms owned by Russian citizens so far have operated with a capital stock which is smaller than the average, so that they produce with a lower capital intensity and only moderate scale effects. Another, perhaps complementary, hypothesis is that they are particularly R&D intensive and operate at initial stages of product life cycles. Thus there appear to have been some entries of research intensive firms, presumably in niche segments. Obviously, small firms are beginning to play a role in the CPS. Especially after the economic downturn in 1998, small firms apparently entered the markets to some degree (table 10).

Table 10. Number of Firms and Employment, Small and Medium-sized Firms 1998-2007

	Number of firms (end of year),		Production Volume		Employment	
	total	in per centage	total, Mio. Rbl.	in per centage	total, thousand persons	in per centage
Whole industry						
1998	136117	100	56081.1	100	1357.6	100
1999	136187	100	116917.2	100	1439.3	100
2000	134155	100	150896.9	100	1432.5	100
2001	125050	100	195854.9	100	1351.6	100
2003	118700	100	391000.0	100	1594.0	100
2007	123600	100	1460500.0*	100	1645.5	100
CPS						
1998	5325	3.9	5032.1	9.0	48.5	3.6
2000	5254	3.9	8094.7	6.9	59.8	4.2
2001	6120	4.6	13290.2	8.8	70.5	4.9
2002	5898	4.7	17518.6	8.9	76.4	5.7
2007**	12000	9.3	204600.0	14.6	185800	10.3

* The 2007 figure refers to 'turnover of small enterprises' as opposed to 'production volume' in the other years. According to *Promyshlennost Rossii. 2008//Rosstat, 2008, 375*, 'turnover of small enterprises' is defined as „... the value of self-produced and shipped commodities, ... as well as the revenue from sales of on the side acquired commodities (without value-added taxes, excises and other obligatory payments) ...”, whereas 'production volume' is defined as “...the volume of shipped commodities – the output value that factually was shipped to the costumers during the reporting period” (*Promyshlennost Rossii. 2002//GOSKOMSTAT, 2002*

http://www.gks.ru/bgd/regl/B02_48/IssWWW.exe/Stg/d020/i021700r.htm). Unfortunately, this difference in definition can not fully convincingly explain the difference in the figures.

** average of “coke and oil production, chemical production as well as rubber and plastic commodity production”,

Source: *Promyshlennost Rossii (Russian Industry), GOSKOMSTAT, 2002, 95, Rossiya w cifrach (Russia in figures), 2004, GOSKOMSTAT, 164, Promyshlennost Rossii. 2008, Rosstat, 2008, 94-95.*

Table 10 indicates that small and medium-sized firms in the CPS appear to have entered a phase of consolidation. While the recent decline in the number of operating firms indicates some shake-out, employment continues to increase.

A look at profitability figures displays a typical picture. Not surprisingly, sectors characterized by lower concentration ratios (machine construction and metal processing; CPS) also exhibit lower profit ratios, compared to other sectors like fuel industry or non-ferrous metallurgy. However, lower profits ratios due to a more competitive market structure should in sum exert a positive influence on technological development, technological competitiveness and industry dynamics in the future.¹² So far, SMEs mostly contributed to job creation rather than to profits, but this might be typical for growing firms which predominantly produce niche products. Most of the small firms are located in Moscow, the surrounding regions, and in St. Petersburg, where firms find a surplus supply of skilled labour force and a substantial demand for products or services of SMEs.

D. International Competitiveness of Russia's CPS

a. Technological Competitiveness

According to the GOSKOMSTAT-terminology, innovative activity is defined by the elaboration and introduction of new or improved products, technological processes and other kinds of innovative activities. Despite this broad definition, however, only a small minority of the firms in Russia's CPS can be classified as innovation active at all. Only roughly a half (53 per cent) of Russia's industrial firms entertains product or process innovations. Most product innovations are created in machinery construction. Although slightly above the industry average, the share of innovative firms in Russia's CPS remained extremely low and

12 There is a well-discussed trade-off between *incentives to innovate* (originating from and sustained by competitive pressure) and the *financial means to innovate* (which can next to capital markets originate from supra-competitive profits and scale effects of highly concentrated markets). Therefore, *Aghion et al.* (2005) argue for a inverted U-shaped relationship between market concentration and innovation (technological progress). In theory, there can be too much competition for technological progress. However, against the background of the industry history of Russia, it is very doubtful whether this is the case here. Instead, it is very likely that there was not enough competition intensity (too much concentration) in the past and more competitive pressure drives technological progress. This corresponds to modern insights in economics that view competition as the major and indispensable driving-force of technological competitiveness (*Kerber* 2006, 2010; *Baker* 2007, 2008). See also *Budzinski* (2008) and *Cantner* (2010).

was almost constant during recent years. In general, innovative activity appears to be located mostly in larger firms disposing of resources to finance R&D expenditures. However, this might be due to a measurement bias, focusing on larger firms and neglecting (less visible) innovation activities in smaller firms.

Table 11. Numbers of Firms in Russian Industry and CPS Undertaking Innovative Activities, Years 1998-2003 (in brackets. shares of innovative firms in per cent)

	Number of industrial firms	Number of SMEs (end of year) in industry (share in prozent)	Number of innovative firms ¹³	thereof organisations with product innovations:		
				Number of significant Innovations, product innovations	Number of incremental innovations	Other
Industry total						
1998	160000	136117 (85%)	1225 (0.8)	790	413	203
1999	158000	136187	1680 (1.1)	893	412	182
2000	161412	86.25%)	2282 (1.4)	1264	739	263
2001	155000	134155 (83.1%)	2164 (1.4)	1127	655	261
2002	151000	125050 (80.7%)	2168 (1.4)	1204	636	247
2003	145328	121000 (80.1%)	2191 (1.5)	1201	608	240
2007*	456409 ¹⁴	118700 (81.7%) [124500 (27.3%)] ¹⁴	2485 (0.56)	-	-	-

13 “Innovation-active firms” in Promyschlennost Rossii. 2005 and “organizations that conduct technological innovation” in Promyschlennost Rossii. 2008. The numbers are the result of a regular survey conducted by the Russian official statistical observation.

14 The significant increase in 2007 firm numbers is a result of a change of statistical coverage (Promyschlennost Rossii. 2005, Rosstat, 68-69; Promyschlennost Rossii. 2008, Rosstat, 60-61). Until 2003, the number of firms reflects the number of so-called ‘working industrial organisations’, whereas the data from 2007 covers all firms. For instance, in 2003 the number of ‘working industrial organizations’ accounted for 32.3 per cent of the firms in the industry. Note, however, that the 2007 number of SME’s does not correspond to the extended coverage of firms. Actually, the share of SME’s somewhat increased from about 15.7 per cent (1998) if the modified statistical coverage is taken into account.

<i>Thereof:</i>						
<i>CPS</i>						
1998	5831	5325	111 (1.9)	74	48	21
1999	5776	5254	124 (2.2)	73	45	15
2000	6836	6120	153 (2.2)	101	63	22
2001	6710	5898	152 (2.3)	96	60	21
2003**	30297**	-	237	-	-	-
2007**	35370**	-	230 (0.68)	-	-	-

* data covers resource extraction, manufacturing industries and energy and gas industries (*Promyshlennost Rossii. 2008//Rosstat, 2008, 333*),

** data covers coke and oil production, chemistry and rubber and synthetics (*Promyshlennost Rossii. 2008, Rosstat, 2008, 60*),

- no data available.

Source: data compiled from *Promyshlennost Rossii (Russian Industry)*, GOSKOMSTAT, 2002, 95, 414, *Rossija w cifrach (Russia in Figures)*, GOSKOMSTAT, 2004, 164, 184, 309, *Rossisky Statistichesky Eshegodnik (Russian Official Statistical Yearbook)*, GOSKOMSTAT, Moscow, 2004, 554; *Rossisky Statistichesky Eshegodnik (Russian Official Statistical Yearbook)*. 2008, Rosstat, 339-340, 625-626; *Promyshlennost Rossii. 2005, Rosstat, 2005, 69-70, 420*; *Promyshlennost Rossii. 2008, Rosstat, 2008, 333-335*.

Among the most important factors restricting Russian firms' R&D-engagement are a lack of own financial resources, unacceptable conditions on financial markets to obtain loans for R&D investments (for instance, high interest rates, reluctance of lending institutions to secure the long-term financing of enterprises and shortages in general credit volumes) and the duration of the time period for R&D projects (*GOSKOMSTAT 2003c*, 541). 43 per cent of the firms mention a lack of own resources and too high costs of R&D (18 per cent) as major impediments to carry out R&D. Many firms also attribute this to limitations of innovative potentials of organisation (42 per cent) and to a lack of qualified staff. Among the most important obstacles to R&D, firms identify deficits in the legal and regulatory framework (see also in more detail *Gorodnikova & Gosteva 2009*) and a lack of public (financial) support of innovative activity (26 per cent) as well as an insufficient demand for innovative products by costumers (24 per cent) (*GOSKOMSTAT 2003c*: 541). In addition, among the other reasons for the moderate innovative activity are inefficient utilisation of scientific

and technological information due to scarcity of skilled personnel and of services for patenting and licensing within the firms (*GOSKOMSTAT* 2003c: 541).

Table 12. Technology Trade in Major Industrial Sectors, 2003 (in brackets: 2002)/2007

	Number of agreements	Export Share, per cent	Transaction volume, Mln. Rbl.	Number of agreements	Import Share, per cent	Transaction volume, Mln. Rbl.
Total in economics, thereof Thereof: Industry, *	1480 (1320)/ 1825	100 (100)/100	23631.7 (26431.0)/5374 9.0	954 (800)/152 4	100 (100)/100	40207.5 (56759.9)/6511 6.5
Fuel industry	2 (2)/ -	1 (1)/-	20.8 (20.8)/ -	65 (71)/ -	12 (15)/-	33426 (4392.8)/ -
CPS	13 (7)/ -	6 (5)/-	261.3 (250.9)/ -	47(36)/-	8 (8)/-	1688.7 (1313.6)/-
Machinery construction and metal processing (without medicine technology)	158 (129)/ -	76 (94)/-	1138,0 (933.1)/ -	110 (90)/-	20 (19)/-	638.8 (2184.7)/-
Others	35 (26)/-	17 (16)/88.6	20678.2 (25166)/-	177 (136)/-	60 (58)/-	26389.5 (42744)/-

* data covers resource extraction, manufacturing industries and energy and gas industries,
- data not available.

Source: *Rossisky Statisticheskyy Eshegodnik (Russian Official Statistical Yearbook)*, *GOSKOMSTAT*, Moscow, 2003, 535; *Rossija w cifrach (Russia in figures)*, *GOSKOMSTAT*, Moscow, 2004, 307; *Rossisky Statisticheskyy Eshegodnik* 2008, Rosstat, 2008. 624.

An indicator for Russia's present international competitiveness may be its technology trade balance. A glance at it immediately reveals that Russia is a net importer of technology, both as far as the number of contracts is concerned and

(even more clearly) as far as their transaction volume is concerned. The value of technologies transferred to countries abroad by the Russian industry is about ten times smaller than the respective transaction value of technology imports. While technology exports of Russia's industry amount to only a small share of the country's entire technology exports (12.6 per cent), industrial firms are the most important technology importers (58.4 per cent). While industrial technology export is dominated by the machinery construction and metal processing sector, CPS is absolutely insignificant in this field. Like other industrial sectors, Russia's CPS relies on technology imports as characterised by a transaction volume of imports being more than five times greater than the transaction volume of technology exports. Most important technology exporters to Russia are Germany (24 per cent), United Kingdom (14 per cent) and the US (13 per cent), while Russian technology is mainly exported to the US (29 per cent) and to Germany (14 per cent).

These figures are quite difficult to interpret and have to be looked at in the context of other findings already made here. First of all, one must consider that the dominance of technology imports over technology exports is nothing unusual for transition countries. More than that, it must be regarded as an essential requirement for technological catch-up. There are several examples of countries with successful technology assimilation, such as the 'Asian Tigers'. To come to grips with the situation in Russia's CPS we have to consider the technology trade figures in the context of other indicators. One important question in this respect is whether technology imports are complements or substitutes of domestic R&D. So far, one cannot conclude that technology import and domestic R&D are complements, because domestic R&D continues to remain on a very low level in spite of increasing technology imports. Technology transfer induced modernisation of Russian industrial firms must be considered as limited given the fact that firms still operate with outdated material and have gone to a period of losing profitability. Thus, there is so far hardly any evidence that technology import produces sustained country-endogenous technological progress across industrial firms. This does not exclude, however, that the absorp-

tion of technologies from abroad might be asymmetric. As already mentioned above, profitability levels differ strongly between firms. It seems plausible to assume that technology import is confined to a limited number of innovative firms. Thus, an alternative explanation for different profit levels would be at hand. However, such a conclusion must remain speculative as disaggregated data in this field is not available. Nevertheless, we have to expect a significant shake-out in the nearer future which will be additionally intensified by Russia's WTO accession.

One might be more optimistic about the future of Russia's CPS if it were in a process of technological catching-up. Again, the overall picture is not very encouraging. One explanation of this insufficient innovative activity might be that Russian firms obviously find themselves in a situation with restrictive conditions for the funding of R&D investments which is in part due to the fact that private funding of risky R&D activities is virtually nonexistent in Russia.

Table 13. Structure of Funding of Innovative Activities of Industrial Corporations in Russia, years 1995-2007, per cent

	1995	1998	1999	2000	2001	2005	2007
Own resources	87	75	85	82	87	78.7	79.6
Federal budget	2	4	3	3	2	4.4	3.8
Budgets of RF-subjects and local budgets	2	0	0	1	1	0.1	0.4
Extra-budgetary funds	4	3	3	3	2	0.1	0.1
Foreign investments	5	10	7	5	2	1.5	0.3
Others	0	8	2	6	6	14.6	15.8

Source: Promyshlennost Rossii (Russian Industry), GOSKOMSTAT, 2002, 418; Promyshlennost Rossii. 2008, Rosstat.

Unfortunately, there are no figures available about the share of financing of R&D provided by banks or other private organisations. But again the mere fact that only a stagnant fraction of roughly two per cent of the firms in Russia's CPS are innovation active indicates that private loans do not play a major role in the R&D-environment. It is puzzling that the engagement of foreign inves-

tors constantly declined since 1998. Apparently, it takes time to restore confidence after the crisis of 1998.

Industrial firms in Russia mainly rely on their own resources in their R&D funding. More than that, as the magnitude of resources dedicated to R&D remains limited, most of industrial firms' innovativeness is not based on their own R&D activities but stems mainly from the procurement of machinery with innovations embodied in them (table 14).

Table 14. Structure of Industrial Spending on Technological Innovations (shares in per cent)

	1995	1998	1999	2000	2001	2005*	2007*
1 R&D for product and process innovations	26	22	15	14	18	16	17
2 Procurement of machinery with embodied innovations	44	43	49	58	60	60	58
3 Purchase of new technologies	19	3	8	4	1	1	2
4 Software procurement	0	1	3	2	2	2	3
5 Production planning, other ways of production preparation; introduction of new services and production methods	2	17	10	10	10	11	12
6 Education, enhancement of human capital	1	1	0	1	0	0	1
7 Marketing research	0	1	1	2	1	1	0
8 Other	8	12	14	9	8	9	7

* data covers resource extraction, manufacturing industries and energy and gas industries.

Source: *Promyshlennost Rossii (Russian Industry)*, GOSKOMSTAT, 2002, 418; *Rossiyskiy statisticheskiy eshegodnik. 2008*, Rosstat, 626.

Russian industrial firms obviously seldom pioneer industrial R&D but rely merely on technology adoption. If industrial competition is performance based, as will mostly be the case in this field, it is not surprising that Russian firms find themselves in a situation of their international competitiveness being constantly reduced. In addition to that there is a danger of being further left behind because of reduced capacities to absorb recent technologies due to the firms' insufficient human capital investments.

To sum up this part, we cannot falsify the hypothesis that high profitability of at least some firms in Russia's CPS stems from the creation and/or adoption of technological innovations. Nevertheless, Russia's CPS in general cannot be characterised as innovation active as only a small fraction of firms is involved in innovative activities. As world market competition in the chemical and petrochemical industry is not only price-, but also performance-based, increased exposure to the world market after WTO-accession will encounter Russia's CPS in a critical condition, especially as adoption of innovations created elsewhere, while perhaps sufficient to gain a leading position in domestic competition, will only have a limited competitive impact for Russian firms having to operate on the world markets. If we scrutinise the world market position of Russia's CPS, the impression of insufficient competitiveness on domestic and world markets is confirmed.

b. World Market Position of Russia's CPS

As it is well known, Russia is one of the world's leading exporters of mineral oil and gas. Thus, it is not astonishing that mineral oil products hold the leading position in the country's export structure. While exports of commodities from the CPS traditionally do not play a leading role in Russia's foreign trade, the sector is strongly export-oriented as more than 30 per cent of its production is sold abroad. The picture is becoming particularly interesting if we look at the import structure. Here, imports of commodities from the chemical sector rank third behind imports of machinery, vehicles and production facilities as well as manufactured goods and agricultural raw materials. The growing importance of imported CPS products was one of the most obvious changes in the country's trade structure between 1995 and 2003.

Table 15. Structure of Commodity Export/Import in Russia, in years 1995, 2003 and 2007, per cent

	Export			Import		
	1995	2003	2007	1995	2003	2007
1. Manufactured goods and agricultural raw materials (except textile)	1.5	1.5	1.8	29.4	21.4	13.7
2. Mineral products	40.4	60.0	68.4	2.9	1.2	0.9
3. Commodities from the chemical sector, caoutchouc	9.9	6.2	5.4	11.4	18.4	14.4
4. Tanning raw materials, furs and articles of them	0.5	0.2	0.1	0.4	0.4	0.4
5. Products of timber and pulp and paper industry	6.1	4.3	3.4	3.0	4.5	2.6
6. Textile, textile articles and shoes	1.3	0.5	0.1	4.7	4.1	4.3
7. Metals, precious stones and articles of them	19.5	21.4	16.4	5.0	5.0	5.9
8. Machinery, vehicles and production facilities	8.3	7.1	3.4	38.7	40.8	54.3
9. Others	1.3	1.3	1.0	4.5	4.2	3.5

Source: Rossiysky statistichesky eshegodnik. 2008, Rosstat, 768-770.

This does not necessarily imply that Russia's CPS *in general* is not competitive on the world market. Rather, one has to further disaggregate the data to obtain a clearer picture. For example, Russia is one of the world's leading exporters of mineral fertilisers and used to be a major producer of chemical fibres before 1990. Currently Russia's CPS appears to be left behind especially in segments of more sophisticated products like detergents, chemicals for the construction sector and specific lacquers and varnishes for the automobile industry. Thus, the limited technological competitiveness, especially in segments of more refined products, puts large parts of Russia's CPS at risk. Limited foreign investment figures do not indicate substantial changes of this situation:

If one takes a look at the historical development of foreign investment volumes in major Russian industries, it is somewhat surprising that in the machine construction and metal processing sector the economic downturn of 1998 and 1999 hardly caused any lasting damages. As foreign investment is not only driven by risk perceptions but also by long term profit expectations, many investors obvi-

ously did not feel deterred from entering the Russian market in the aforementioned sector. Nevertheless foreign investments almost collapsed in the fuel industry and in the CPS. Notwithstanding the lower level of foreign investment in this field, the sector reacted very sensitively to economic crisis – yet not as dramatically as the fuel sector – but recovered quickly after 1999.

Table 16. Foreign Investments in Important Industrial Sectors, years 1995-2007

	1995		1998		2000		2003		2007	
	Mio. US-\$	share, per cent	Mio. US-\$	share, per cent	Mio. US-\$	share, per cent	Mio. US-\$	share, per cent	Mio. US-\$	share, per cent
Investments total	2983	100	11773	100	10958	100	29699	100	120941	100
Thereof: Industry; thereof:	1291	43.3	4698	39.9	4721	43.1	12330	41.5	50163*	41.4
Fuel industry	262	8.8	1880	16.0	621	5.7	5305	17.9	15860**	31.6
CPS	174	5.8	52	0.4	243	2.2	503	1.7	1637**	3.3
Machine construction and metal processing	197	6.6	305	2.6	470	4.3	769	2.6	927**	1.85

* data covers resource extraction, manufacturing industries and energy and gas industries,

** data covers energy resource extraction,

*** data covers chemical industrie,

**** data covers the production of machines and equipment.

Source: *Rossisky Statisticheskyy Eshegodnik (Russian Official Statistical Yearbook)*, GOSKOMSTAT, Moscow, 2003, 604; *Rossisky Statisticheskyy Eshegodnik. 2008*, Rosstat, 733.

In general, FDI in Russia has increased between 1995 and 2007 but nevertheless remains at a comparative low level. Only the fuel industry has been able to attract substantial FDI during recent years. Obviously, foreign investors are attracted by high profitability levels in the fuel industry and hesitate to invest in the CPS and machinery construction where investments appeared less profit-

able. Unlike the fuel industry where substitution of domestic production through imports is impossible, production in Russia's CPS is in part substituted by imports. In spite of existing import tariffs for refined products, firms apparently found it more favourable to produce these commodities elsewhere. There appear to be several reasons for this kind of behaviour. The most important reason, however, seems to be ongoing deficits in contract enforceability, especially for investors holding minority interests of a company's equity in Russia.¹⁵ Another reason, however, seems to be connected with the fact that firms in Russia's CPS are typically vertically integrated. If investors try to build up on-site upstream fabrication, then they become competitors of upstream producers of vertically integrated Russian firms and might face difficulties to enter the market (entry barriers through vertical integration). In addition, due to the limited capacity of firms in Russia's CPS to optimally refine high-quality input goods from Western producers, the use of high-quality inputs is not the preferable option in many instances.

E. Regional Impacts

The production of chemical products and of products containing a large portion of input goods from the chemical industry is geographically concentrated in three Russian regions, namely Centralny, Privolzhsky and Sibirsky Federalny Okrug/district.

15 See on the shortcomings of joint ventures and other cooperation patterns between Russian and foreign business partners and the consequences of these deficiencies *Jasper, Gumerova & Schaimijeva* (2003) and *Mescherjakova* (2008).

Table 17. Production of Chemical Goods and Goods Containing High Portions of Chemical Inputs: Shares of Leading Russian Regions, in per cent, end of 2003 (in brackets: 2002)/2007

	Syntethic ammoniac	Synthetic resins and plastic materials	Tyres for passenger and agricultural cars, motorcycles, and scooters	Freight vehicles	Televisors	Refrigerators
Centralny Federalny Okrug	25.8 (24.9)/-	13.8 (13.8)/15.4	27.3 (28.4)/23.8	2.1 (2.0)/4.42	40.3 (50.2)/16.7 *	65.0 (60.3)/51.2*
Pri-volshsky Federalny Okrug	41.6 (40.9)/-	39.4 (38.6)/44.5	37.6 (35.9)/44.3	94.9 (96.9)/89.2	0.8 (0.8)/0.06	23.3 (21)/20.1
Sibirsky Federalny Okrug	7.7 (7.8)/-	27.1 (28.2)/21.2	21.9 (22)/16.7	0/(0.002)/0	1.5 (1.5)/0.03	19.9 (16)/18.7

- data not availabled,

* 2006.

Source: *Rossisky Statisticheskyy Eshegodnik (Russian Official Statistical Yearbook)*, GOSKOMSTAT, Moscow, 2003, 349-353; *Rossisky Statisticheskyy Eshegodnik (Russian Official Statistical Yearbook)*, GOSKOMSTAT, Moscow, 2004, 366, 369; *Promyshlennost Rossii. 2008*, Rosstat, 223, 229, 261; *Regiony Rossii. 2007*, Rosstat, 513, 515.

There is a tendency towards further clustering in some sectors. For example, in 1990 sulphur acid production was localised in Moskovskaja oblast (13 per cent), Wologodskaja oblast (9 per cent), Saratovskaja oblast (10 per cent), Leningradskaja oblast (12 per cent), and Swerdlowskaja oblast (9 per cent), and 47 per cent of the entire output was produced in other regions. In 2001, sulphur acid production was centered in three regions, namely Wologodskaja oblast (25 per cent), Saratovskaja oblast (15 per cent), and Moskovskaja oblast (13 per cent). Another example is caustic soda. Its production is centered in the Republic of Bashkortostan (output share increased from 16 to 21 per cent between 1990 and 2001) and Irkustskaya oblast (with a constant share of 22 per cent), while production almost disappeared from Permskaya oblast and Nishegorodskaya oblast. Mineral fertiliser production is increasingly centered in the

Republic of Bashkortostan, the Republic of Tatarstan, and Irkustskaya oblast/Province. As a consequence, intensified exposure of Russia's CPS towards the world market will affect Russia's regions asymmetrically. However, according to *Yudayeva et al.* (2003), regional effects of the WTO-accession will remain rather insignificant.

It is not surprising that the local agglomeration of major sectors of the Russian industry corresponds with a local concentration of foreign investments. Again, it is the Centralny Federalny Okrug which leads the ranking of foreign investment locations with having attracted 48.1 per cent of all foreign investments in 2002 (*GOSKOMSTAT* 2003c: 343). It is followed by Sibirsky Federalny Okrug (*GOSKOMSTAT* 2003c: 344), having attracted 14.9 per cent of foreign investments, mostly in the fuel sector and in non-ferrous metallurgy. Privolzhsky Federalny Okrug, which is leading in the CPS, has attracted 7.3 per cent. This area deserves some more careful consideration as it is one of Russia's most important industrialised regions.

Table 18. Foreign Investment in Privolzhsky Federalny Okrug, years 1995-2007

	1995		1998		2001		2003		2007	
	Mio. US-\$	share, per cent	Mio. US-\$	share, per cent	Mio. US-\$	share, per cent	Mio. US-\$	share, per cent	Mio. US-\$	share, per cent
Russian Federation	2983	100	11773	100	14258	100	29699	100	120941	100
Privolzhsky Federalny Okrug; thereof:	359	12.0	1332	11.3	1220	8.6	945	3.2	5973	4.9
Republic of Baschkortostan	4	0.1	67	0.6	29	0.2	40	0.1	320	0.2
Republic of Tatarstan	161	5.4	684	5.8	651	5.6	176	0.6	1679	1.4
Samarskaja Oblast	77	2.6	193	1.6	260	1.8	414	1.4	2367	2.0

Source: *Rossisky Statisticheskyy Eshegodnik (Russian Official Statistical Yearbook)*, GOSKOMSTAT, Moscow, 2003, 606; *Rossisky Statisticheskyy Eshegodnik (Russian Official Statistical Yearbook)*, GOSKOMSTAT, Moscow, 2004, 621, 622; *Rossisky Statisticheskyy Eshegodnik (Russian Official Statistical Yearbook)*, Rosstat, 2008, 734-735.

Among the regions of Privolzhsky Federalny Okrug the Republic of Tatarstan is clearly in the focus of foreign investors in the CPS although it was not left untroubled by the economic crisis after 1998 as foreign investments almost disappeared in 1999. Since 2000, foreign investment volumes are recovering, albeit on a rather low level (*Jasper, Gumerova & Schaimijeva* 2003: 168).

The largest shares of foreign property or mixed Russian-foreign property are to be found in the regions Centralny Federalny Okrug (44 per cent of total joint ventures), Sewero-Zapadny Federalny Okrug (16 per cent) and Sibirsky Federalny Okrug (11 per cent). These are followed by Privolzhsky Federalny Okrug with 9 per cent (*GOSKOMSTAT* 2003, b, 77). In Privolzhsky Federalny Okrug JVs are concentrated in Permskaja Oblast, Saratovskaja Oblast, and Samarskaja Oblast (*Oreshkin* 2002: 58).

4. Results of a Non-representative Survey

In order to gain some empirical insights about the current situation of Russia's CPS we carried out a non-representative survey among leading firms of Russia's chemical and petrochemical industry. We asked executives about their assessments of Russia's WTO-accession and its consequences for their companies. Extensive questionnaires were sent to 17 companies that had been selected out of a list of Russia's 33 leading CPS-firms. Six firms responded. Following is a list of the responding firms and their main characteristics.

Table 19. Main Characteristics of Interviewed Leading Firms of Russia's CPS

Company name	1	2	Region	Legal form ¹⁶	Year of foundation	Organisational structure	Turnover in 2002, thousand €	Capitalisation (million Rbl.) ³
1. Nishnekam skneftechim	34	1	Republic of Tatarstan	joint stock company	1967	vertically integrated	621.061	9451.4
2. Salavatnefteorgsyntez	37	3	Republic of Baschkortostan	open joint stock company	1948	./.	./.	5177.7
3. Nishnekamskchina	61	5	Republic of Tatarstan	open joint stock company	1971	Holding company	222.129	449.1
4. Kazanorgsyntez	67	8	Republic of Tatarstan	joint stock company	1958	vertically integrated	216.000	1796.9
5. Kaustik	110	13	Republic of Baschkortostan	closed joint stock company	1964	vertically integrated	151.350	./.
6. Kirovo-Tschepeckiy Kombinat	121	17	Kirovskaja Oblast/Region	joint stock company	1946	vertically integrated	180.000	./.

Source: authors' investigations.

¹ – rank among Russia's top-200 companies according to turnover,

² – rank among Russia's leading CPS-companies according to turnover,

³ – according to data from 'Expert-200', 'Expert' 36/2003,

./. - information not revealed by the company.

16 Open joint stock companies (OJSCs) and closed joint stock companies (CJSCs) differ in the following ways: 1) CJSCs are not allowed to issue equity to the public; 2) in CJSCs stock owners have the prerogative when new equity is issued; 3) the number of stockholders in CJSCs must not exceed 50; 4) OJSC's minimum equity share capital is determined with 1000 minimum wages, while in an CJSC only 100 minimum wages are required; see Kurakow (2004: 42).

While, at the time, none of the interviewed companies were undertaking direct investments abroad, only one firm intends to engage in foreign direct investments as a consequence of Russia's WTO-accession.

With respect to the WTO-entry two different groups of firms become distinguishable. While a minority apparently expects an output increase, the majority of firms do not expect any changes in their business activities. All companies emphasize the necessity of FDI and expect that FDI will increase production capacities and efficiency levels by the introduction of recent technologies, the replacement of outdated production facilities, energy savings, environmental protection, and the development of new fields of activity.

All companies in our sample sell their products in the Commonwealth of Independent States (CIS), Europe, and Asia, but opportunities to enlarge their sales markets are regarded as problematic by the firms' executives. It is remarkable that for the companies in the sample internationalisation is confined to the sales side while almost 100 per cent of input materials are purchased from domestic suppliers.

The WTO-accession will increasingly expose Russian firms to international performance and quality competition. Here, the actual condition of Russia's CPI-firms appears to be unsatisfactory and may cause concern. Only one of the companies in our sample meets international quality standards - besides for only a half of its products. Other firms only meet Russian quality standards.

The firms in our sample confirm a high degree of physical attrition of their production facilities – more than 70 per cent on average. Roughly 50 per cent of the sample firms' production facilities were produced abroad, which is a result of the Soviet Union's strategy to equip domestic firms with up-to-date technology from other countries of the former socialist economic bloc (COMECON). It becomes clear that the current capital stock of Russia's CPS is still on a big scale shaped by decisions taken during the pre-transformation era.

None of the companies in the sample was at the time of the interviews planning the setup of additional production capacities in order to deliver other customers but their key accounts. Instead, they predominantly strive for bringing their actual products to the market a better way while cost-reduction apparently is not a first-rank objective.

The firms in our sample rely on technologies they are already familiar with, while their dedication to research and technology appears to be moderate (although we again must emphasize that these answers are not necessarily representative): Three companies confirmed that they were carrying out R&D-activities, one answer was negative. According to the information we obtained from one firm, only 0.6 per cent of the company's turnover were invested for R&D. None of the firms intended an expansion of its R&D activities after Russia's WTO-accession. The introduction of new key technologies was planned by four companies for the time after the expected accession, but the point in time was not linked with it.

5. Conclusions

We can summarize our observations as follows.

1. Russia's CPS in general is in a critical state. Its capital stock is in an insufficient condition and there are a large number of unprofitable firms.
2. Russia's CPS cannot be characterised as innovative. Even if new firms are beginning to invest in R&D this is hardly reflected in the data so far. Due to insufficient finance and business services sectors, carrying out R&D remains particularly difficult for Russia's SMEs.
3. Given a situation of insufficient capital renewal and low utilisation ratios in the late 1990s, Russia's CPS apparently met increasing demand mostly by increasing capacity utilisation. This strategy is currently about to fail because of

increasing substitution of domestic products by exports, especially in segments of more sophisticated products.

4. (Slowly) rising renewal coefficients, market entries by small and medium sized firms and increasing occupation are signs of hope, but recovery and renewal unfold rather slowly.

5. Foreign investors still hesitate to invest in Russia's CPS.

6. Increasing exposure towards the world markets will affect Russia's regions asymmetrically.

7. Russia's CPS seems to be an example for the limited information that can be derived from aggregated data. While average figures show satisfactory profitability, Russia's CPS seems to be divided into unprofitable and highly profitable but less competitive manufacturers as well as competitively profitable firms in the neighbouring areas within the industry. The question is whether existing high profits are supracompetitive and predominantly stem from anticompetitive behaviour or emerge from a situation of otherwise restricted competition. We cannot verify this with the data at hand but there is some evidence that there is still a lack of competitive pressure on many Russian firms and in many markets within CPS (*Hare 2002; Broadman 2004: 85-87*).

With the exact date of the WTO accession still unknown, it remains an important recommendation for Russia to make markets more competitive and improve legal certainty (in particular contract enforceability) for foreign investors. More competitive Russian markets seem to be the best recipe for creating and fuelling improved international competitiveness of Russian CPS companies. Unfortunately, the recently declining ratio of private companies (the so-called de-privatization process; see table 9) cast considerable shadows on the actual development in this regard. Furthermore, it must be suspected that the existing problems for Russian CPS firms with obtaining sufficient investment financial

facilities from the lending institutions have been further aggravated by the consequences of the current financial crisis.

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7. Appendix

Table A. Profitability (profit-cost-price-ratio) of Production, in per cent, years 1995-2007

	1995	1997	1998	1999	2000	2001	2002	2003	2007*
Total industry	20.1	9.0	12.7	25.5	24.7	18.5	14.4	13.5	18.6
Fuel industry	20.8	13.1	15.7	44.5	51.1	35.9	21.2	18.8	30.1
CPS	6.1	4.3	9.7	22.3	17.0	11.5	8.8	9.0	19.0
Machine construction and metal processing	10.9	8.0	10.3	17.4	14.1	13.6	11.3	8.7	8.7

* index including extraction of natural resources, manufacturing industries, energy, gas and water production and distribution;

Source: *Rossija w cifrach (Russia in Figures)*, GOSKOMSTAT, 2004, 180, 191, 194, 195; *Rossisky Statisticheskyy eshegodnik*. 2008, Rosstat, 2009, 387, 413, 424.

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