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Growth and Diversification of the Russian Economy in Light of Input-Output Tables

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Abstract

This paper addresses the issues of measurement of Russia's dependence on oil and gas as well its attempts for diversification with shift toward a technology-centered economy. It further develops the Russia's input-output system to provide a better understanding of these issues. First, it clarifies the extent of the GDP of the mining (oil and gas) sector in Russia by modifying the original supply and use tables. Second, it provides an analysis of the diversification attempts through development of light automobiles by extending the supply and use tables. Third, it presents an attempt of multi-sectoral growth accounting based on our estimations of capital stock, focusing on the capital and TFP (Total Factor Productivity) contributions to growth.

Key Words: Russia, oil dependence, diversification, input-output, growth accounting

1. Introduction

The importance of the Russian oil and gas industry to the Russian economy as well as to the global energy markets is rather obvious when we look at statistics of proved reserves and foreign trade of oil and gas. Russia accounted for 13 percent of global crude oil exports and 27 percent of global pipeline gas exports in 2007. And internally, the shares of oil and gas in the country's export and GDP in 2007 were 62.0 and 16.9 percent respectively (the corresponding shares in 2005 were 61.6 and 19.5 percent, respectively). Excluding refined oil or oil processing products, the shares of crude oil and gas in the country's export and GDP were 47.2 and 12.9 percent respectively (the corresponding shares in 2005 were 47.6 and 15.0 percent respectively). [2]

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[2] All figures are derived from BP (2009), External (2007, 2008), the Rosstat data (www.gks.ru) and the Bank of Russia data (www.cbr.ru).

However, when we look at GDP statistics compiled by Rosstat (Russian Statistical Office) based on the System of National Accounts (1993) and data supplied by enterprise units, the country's dependence on oil and gas is less clear. The problem with the official Russian figure is that it is very low. The share of the oil and gas sector in the Russian GDP under the traditional industrial classification (*OKONKH*) is 7.8 percent in 2000 and 6.8 percent in 2003.[3] The share of the mining sector in the country's GDP under the new industrial classification (NACE v.1; *OKVED*) is still low, namely 10.2 percent in 2005 and 8.1 percent in 2008 as seen below. In this paper, we offer alternative figures for the better understanding of the specific characteristics of the Russian economy. Although our estimation following Kuboniwa *et al.* (2005) is preliminary, it is sufficient to pose an important problem that should be resolved with Rosstat's cooperation. Our attempt also provides the manufacturing sector's GDP not only at basic prices but also at producers' prices or market prices that may be useful for an international comparison of industrial structure.

As Gaddy (2004, p. 346) points out, Russia's oil and gas sector will continue, for the predictable future, to be the key to the country's economic growth. Nevertheless, the recent policy direction for reforming Russia's industrial structure should also be noted and studied. As is well known, the Russian government adopted a policy to target diversification away from heavy dependence on oil and gas. A hopeful factor for this diversification and modernization of the Russian economy would be further development of the auto-industry, including domestic production (assembly) of light automobiles (passenger cars) by foreign companies. This paper provides a preliminary observation on the Russian auto-industry using unpublished versions of input-output tables.

A variety of desirable applications of input-output tables is possible. Due to the lack of appropriate data, we confine ourselves here to an application of multi-sector data to growth accounting for the further development of our analyses of Russian optimal growth configurations for diversification.

2. How large is the Mining Sector of Russia?

The official figure for the share of the oil and gas sector in the Russian GDP

[3] ***OKONKH*** **(*obshesoiuzhyi krassifikator otraslei narodnogo khoziastva*; all-union classification of sectors of the national economy). *OKVED* (*obsherossiiskii krassifikator vidov ekonomisheskoi deiatel'nosti*; all-Russian classification of economic activities). See *Otdel'hye*, 2004..**

for 1991-2003 can be derived only from the input-output tables for corresponding years compiled by Rosstat. As stated, the problem with the official Russian figure is that it is very low. When we add a part of the value added attributed to the trade and transportation sectors (as trade and transportation margins and net taxes on oil and gas) to the official figure, we obtain substantially different figures: 24.1 percent in 2000 and 19.8 in 2003. These figures are shown in Table 1, the updated version of Kuboniwa *et al*. (2005). If this is the case, the share of industry should be increased by some 10 percent, and the share of the trade sector should be reduced accordingly (here, we neglect net taxes on products). This outcome completely changes the structure of the Russian GDP and determines that the contribution of the oil and gas sector to Russian economic growth must be reconsidered.

Table 1. Value Added at Basic Prices
(percent of total GDP at market prices; old sector classification)

Component	2000	2001	2002	2003
Industry	28.2	25.2	24.4	23.9
Oil and gas sector	7.8	6.7	6.6	6.8
Transportation and communications	8.0	8.5	8.4	8.1
Transportation margins of oil and gas	1.0	1.1	0.9	0.8
Trading & intermediary services	21.2	26.6	26.7	26.9
Trade margins of oil and gas	10.7	7.7	7.4	7.7
Net taxes on products	11.4	12.3	11.5	12.1
On oil and gas	4.6	5.0	4.1	4.5
Total contribution of oil and gas sector	24.1	20.5	19.0	19.8
Contribution excluding refined oil	18.7	15.9	14.5	15.1

Sources: Kuboniwa *et al*., 2005, p.7; *Sistema*, 2005, 2006; and unpublished Rosstat data.

Notes: Total contribution of oil and gas implies value added of oil and gas at market prices.

The method employed is based on a modification of the input-output tables (i.e., supply and use tables), involving a change of the units of statistical observation from enterprises to enterprise groups. Large holdings in the oil and gas sector include the following types of enterprises: (1) producing enterprises that extract and process oil and gas; and (2) trading enterprises that sell the oil and gas in domestic and international markets. Both are independent legal entities that generate their own statistical reports. As the main activities of the first type comprise extraction, the value that they add is not large. The value added by the second type (sales) is considerably larger than that of the producing enterprises, because the gross revenue of foreign trading enterprises is the difference between international and domestic price levels. Thus, for example, in 2002 the average export price of gas was more than 11 times higher than the gas producers' price.

Such considerable price differentials accounted for the main income of the country's largest and exclusive gas exporter (trading enterprise), Gazprom. These two types of enterprises are independent legal entities but both are completely controlled by Gazprom. The same situation is observed in Russian oil majors, including Lukoil. Lukoil is registered as a trading and intermediary enterprise, while crude oil extraction enterprises, affiliations controlled by Lukoil are registered as crude oil extraction enterprises. We integrated two types of enterprises into enterprise groups. It should be noted that the resulting discrepancy can be traced to the sector's specific characteristics rather than to faulty methodological treatment by Rosstat. In Table 1 a part of the pipeline transportation margins is added to value added of oil and gas because gas pipeline transportation is monopolized by Gazprom and oil pipeline transportation is monopolized by Transneft which can be regarded as a portion of the oil industry group.

Rosstat reorganized all statistics by sector based on the new industrial classification corresponding to the International and European standard, NACE v.1. The official input-output systems (supply and use tables; SUTs) for 2004 and 2005 were made public in SNA Russia (2007, 2008) as a highly aggregated format with only 15 sectors, sectors A to O in NACE. Extraction of crude oil and gas is integrated into the mining sector. Although the mining sector excludes oil processing and includes extraction of coal, ore and so on, the major part of the mining sector consists of crude oil and gas, key products of Russia. And the specific Russian characteristics have remained unchanged. In 2005 the average export price of gas (151 dollars per 1,000 m^3) was approximately 13 times higher than the gas producers' price (11.7 dollars per 1,000 m^3). In 2005 the average export price of crude oil (330 dollars per ton; 45.2 dollars per barrel) was also approximately 2 times higher than the crude oil producers' price (170 dollars per ton; 23.3 dollars per barrel).(*Tseny*, 2008, pp.138-139.) These price differentials generate trade margins of the mining sector for 2005. Therefore, we made modifications to the SUTs for 2004 and 2005 with a method similar to Kuboniwa *et al.* (2005). We did not introduce any modification to transportation margins because data on oil and gas pipeline transportation margins are not available and coal transportation (railroad etc.) margins, which cannot be attributed to the coal enterprise group, may occupy a large share of transportation margins of mining.

By adding a part of the value added attributed to the trade sector (as trade margins and net taxes on mining products) to the official figure, we obtain the

following figures: 17.9 percent in 2004 and 20.4 percent in 2005 which are twice as large as the official figures. Most of the net taxes on mining products are generated by export taxes on crude oil and gas products, which constitute the main sources of the stabilization fund of the Russian federal government. Official GDP statistics, s, usually provides the value added at basic prices. However, trade margins and net taxes on products by sector can be derived only from supply tables compiled by Rosstat.

Table 2. Value Added at Basic Prices
(percent of total GDP at market prices; new sector classification)

Component	2004	2005	2006	2007	2008
Industry	27.8	29.3	28.1	27.4	26.0
Mining sector	8.7	10.2	9.4	8.7	8.1
Trading & intermediary services	17.8	16.8	17.6	17.7	18.1
Trade margins of mining products	5.6	4.8			
Transportation and communications	9.5	8.9	8.5	8.3	8.2
Transportation margins of mining products	…	…			
Net taxes on products	12.7	14.2	14.6	14.0	15.1
On mining products	3.5	5.4			
Total contribution of mining sector	17.9	20.4			

Sources: Author's estimation based on SUT for 2004-2005 (SNA Russia, 2007, 2008) and www.gks.ru.

The aforementioned method allows us to modify the matrix of outputs of the supply table so that sales, which support the marketing of the sector's products, are treated as secondary activities in the mining industry. Table 3 presents a fragment of the modified supply table for the year 2005.

Table 3. Fragment of the Modified Supply Table for 2005

	Official table		Modified table	
	Mining sector (industry)		Mining sector (industry)	
Products and services	Mil. rubles	Pct. of total	Mil. rubles	Pct. of total
Mining extraction products	2,885,715.2	90.2	2,885,715.2	60.1
Other industrial products	272,992.9	8.5	272,992.9	5.7
Trading & intermediary services	10,295.8	0.3	1,611,814.6	33.6
Foreign trade services			805,813	16.8
Transportation services	15,180.3	0.5	15,180.3	0.3
Export transport services				
Real estate services	15,901.2	0.5	15,901.2	0.3
Total	3,200,085.4	100.0	4,801,604.2	100.0

Sources: Author's estimation based on supply table for 2005 (SNA Russia, 2008) and unpublished Rossat data.

The analysis of the structure of the sector's output presented in Table 3 indicates that the share of trading and intermediation services (which are essentially secondary types of activity or product) in the mining industry amounts to more than 30 percent of the industry's output. One half of this share is occupied by foreign trade activities. Although not shown here, the share of such services in the gas sector can be estimated to be several times higher than the output of the sector's main activity (i.e., extraction). From the perspective of SNA framework, such a modified output matrix may appear peculiar. One should remember, however, that it does reflect the realities of the Russian economy.

After appropriate modifications of the supply table, we also made changes in the use table. Due to the lack of data on the structure of input consumed by trade activities of the mining sector, we simply applied the overall value added ratio (value added to output) given in the original use table to calculations of the value added of trade activities related to the mining sector. Details of our estimation for 2004 and 2005 are shown by Table 4.

Table 4. Estimation Method for 2004 and 2005

			2004	2005
	All components at basic prices			
1	Trade margin of mining	Mil. rubles	1,472,953	1,611,815
2	Value added ratio of total trade sector		0.65056	0.65060
3	Value added ratio of trade of mining	Line 3=Line 2	0.65056	0.65060
4	Value added of trade of mining	Mil. rubles	958,244	1,048,647
5	Value added of trade of mining	Pct. of GDP	5.6	4.8

Sources: Author's estimation based on SUT for 2004 and 2005 (SNA Russia, 2007, 2008).

Notes:
Line 1 is from the official supply table and Table 3 for 2004-2005.
Line 2 is calculated from the official use table for 2004-2005.
Line 3 makes a crucial assumption that Line 3 equals Line 2.
Line 4 is derived from (Line 1)*(Line 3).
Line 5 is derived from (Line 4)/(total GDP at market prices).

To examine plausibility of our estimation, we applied the method to estimate the corresponding value added of trade services of the oil and gas sector for 2000-2003. As indicated by Table 5, the differences between estimates by Rosstat and the author are rather marginal.

Table 5. Application of the Method Employed Here to Oil and Gas for 2000-2003.

(Percent of total GDP at market prices)

	Value added generated by trade of oil and gas at basic prices		Difference
	Table 1 (Rosstat)	Estimation method employed here	
2000	10.7	10.2	0.5
2001	7.7	7.7	0.0
2002	7.4	8.9	-1.5
2003	7.7	8.0	-0.3

Sources: Table 1 and author's calculations.

All of sectoral value added data compiled by Rosstat, irrespective of SNA (GDP) statistics or input-output tables, are evaluated at basic prices, which exclude net taxes on products. To obtain the sectoral value added at market prices or sectoral GDP, net taxes on products should be allocated to each sector or industry in an appropriate manner. Taxes on exports of crude oil and gas are paid by the trading companies of crude oil and gas. Although we can allocate net taxes on mining products to the trade sector, we lose the information of source products of the taxes. Employing our methodology, these problems are avoided. It should also be noted that most fixed capital investments for oil and gas extraction have been financed from profits and revenues from foreign trade of crude oil and gas. A rational method to prevent losing the relationship among profits, investments (fixed capitals) and production is also proposed here. Except for the mining and trade sectors, sectoral value added at market prices or sectoral GDP can be obtained by adding the transpose of a column vector of net taxes on products in a supply table to a row vector of sectoral value added at basic prices in a use table.

Table 6 displays the change in the structure of value added (in basic prices) across all industries of the Russian economy caused by modification of input-output tables. The table also shows the result of the Russian GDP structure across all industries for 2005.

As is evident, re-allocation of trade margins reduces the share of trade and intermediation activities in value added at basic prices from 19.6 percent to 13.9 percent. Sectoral allocation of net taxes on products further reduces the share of trade and intermediation activities in GDP to 12 percent which is much less than corresponding shares of mining and manufacturing sectors. Sectoral allocation of

net taxes on products brings about increases in the GDP shares of mining as well as manufacturing, which amounts to the largest share, 23.3 percent.

Table 6. Value added and GDP by Sector for 2005

		Official use table	Modified use tables	
	Sector (Industry)	Pct. of value added at basic prices	Pct. of value added at basic prices	Pct. of GDP at market prices
A	Agriculture, hunting, and forestry	5.2	5.2	4.6
B	Fishing	0.4	0.4	0.3
C	Mining and quarrying	11.9	17.5	20.4
D	Manufacturing	18.8	18.8	23.3
E	Electricity, gas, and water supply	3.4	3.4	3.0
F	Construction	5.4	5.4	5.1
G	Wholesale and retail trade; repair of motor vehicles and household goods	19.6	13.9	12.0
H	Hotels and restaurants	0.9	0.9	1.0
I	Transport and communications	10.3	10.3	9.3
J	Financial intermediation	4.1	4.1	3.5
K	Real estate, leasing, and business activities	9.9	9.9	8.6
L	Public administration and defense; compulsory social security	5.1	5.1	4.4
M	Education	2.6	2.6	2.3
N	Health and social work	3.0	3.0	2.6
O	Other community, social, and personal services	1.7	1.7	1.6
	FISIM	-2.4	-2.4	-2.0
	Total value added (at basic prices)	100.0	100.0	
	GDP (at market prices)	-	-	100.0

Sources: SUT for 2005 (SNA Russia, 2008) and author's calculations.

3. Contribution of the Mining Sector to Russian Economic Growth

This outcome shown by Table 6 completely changes the structure of the Russian GDP and suggests that the contribution of the mining sector to Russian economic growth should be reconsidered.

In the Russian growth calculations employing chain index with an annual change of the base year, the growth contribution rate of a sector at the year *t* is defined as [the value added share of the sector at year (*t*-1)]*[the growth rate of the sector at year *t*]. Therefore, an increase in the value added share of a sector at the previous year results in an increase in the growth contribution rate of the sector at the current year.

First, we consider modifications of nominal growth by sector for 2005 caused by changes in the minimal industrial structure. Using the official data, the nominal growth rates of mining, manufacturing and trade sectors in 2005 were 48.9 percent, 30.8 percent and 20 percent respectively (see Table 7). The nominal growth rate of the trade sector was much less than the total nominal growth rate, 27.6 percent. The nominal growth rate of value added related to mining trade showed a markedly low value, 9.4 percent. The nominal growth rate of net taxes on products was rather high at 42.6 percent. In particular, the nominal growth rate of net taxes on mining products showed a remarkably high value, 97 percent.

Table 7. Modifications of Nominal Growth by Sector for 2005

	Official data at basic prices			Modified data at market prices		
	2004	2005		2004	2005	
	Pct. GDP share a	Pct. Growth rate b	Pct. Growth contributio a*b	Pct. GDP share c	Pct. Growth rate d	Pct. Growth contribution rate c*d
Mining	8.7	48.9	4.3	17.9	45.9	8.2
Manufacturing	15.8	30.8	4.9	23.0	29.5	6.8
Trading & intermediary services	17.8	20.0	3.6	12.3	24.4	3.0
Trade of mining	5.6	9.4	0.5	-	-	-
Other sectors	44.9	21.1	9.5	46.8	20.5	9.6
Net taxes on products	12.7	42.6	5.4	-	-	-
On mining	3.5	97.0	3.4	-	-	-
On manufacturing	7.2	26.6	1.9	-	-	-
On trade	0.1	-47.4	-0.0	-	-	-
GDP at market prices	100.0	27.6	27.6	100.0	27.6	27.6

Sources: SUT for 2004 and 2005 (SNA Russia, 2007, 2008) and author's calculations.

Employing the modified data, the nominal growth rates of mining and

manufacturing sectors became slightly less than those based on the official data, while the nominal growth rate of the trade sector became greater than that based on the official data. The contribution rate of the mining sector was 8.2 percent which was approximately two times higher than that based on the official data, 4.3 percent. The contribution rate of the manufacturing sector was 6.8 percent, which was much higher than that based on the official data, 4.9 percent. The contribution rate of the trade sector was 3 percent, which was slightly higher than that based on the official data, 3.6 percent. Thus, the major sources of nominal GDP growth were the mining and manufacturing sectors.

Next we consider modifications of real growth by sector for 2005 caused by changes in the minimal industrial structure at the base year and in the coverage of mining and trade sectors.

The growth rate of value added of trade of mining products is not known. The growth rates of value added of trade sub-sectors should be based on their trade turnovers. Foreign trade turnovers or exports of crude oil and gas showed negative growth in real terms for 2005 and 2006 as shown below. There is no reason to apply high growth rates of the trade sector in the official data to the growth of trade of mining products. Therefore, we assumed that the growth rate of value added of trade of mining products is equal to that of the value added of the mining sector in the official data.

Table 8. Modifications of Real Growth by Sector for 2005 and 2006

Sector	2005	2006	2005	2006
	Growth rate (Pct.)		Contribution rate (Pct.)	
	Official data at basic prices			
Mining	0.5	-3.3	0.04	-0.3
Manufacturing	6.0	7.3	0.9	1.2
Trading & intermediary services	9.4	14.1	1.7	2.4
Other sectors			2.5	3.1
Net taxes on products	9.4	9.1	1.2	1.3
GDP at market prices	6.4	7.7	6.4	7.7
	Modified data at market (producers') prices			
Mining	2.3	-0.004	0.4	-0.001
Manufacturing	7.1	7.9	1.6	1.8
Trading & intermediary services	13.5	21.1	1.7	2.5
Other sectors			2.7	3.3
GDP	6.4	7.7	6.4	7.7

Sources: Author's calculations based on www.gks.ru and SUT for 2004-2005.

This resulted in marked increases in the growth rates of the trade sector based on the modified data from 9.4 percent to 13.5 percent in 2005 and from 14.1 percent to 21.1 percent in 2006 because a large part (the value added of trade of mining) with lower growth was removed from the original value added of the trade sector. The high growth rates of the trade sector may be largely due to the boost of trade turnover of imported goods.

Unlike trade margins, sectoral growth rates of net taxes on products are uniform. The official total growth of net taxes on products was higher than the macro growth. Accordingly, allocation of net taxes on product to mining and manufacturing sectors makes the growth rates of these sectors higher than the values prior to modifications.

In Table 8 we present the results. Based on modified data, the contribution rates of the mining, manufacturing and trade sectors for 2005 were 0.4 percent, 1.6 percent and 1.7 percent respectively. The corresponding rates for 2006 were zero (-0.001) percent, 1.8 percent and 2.5 percent respectively. The contribution of the trade sector to Russian economic growth was the largest for 2005 and 2006, followed by the manufacturing sector's contribution. The contribution of the mining sector, including crude oil and gas, to Russian economic growth was almost non-existent.

Generally, according to the Russian GDP statistics in real terms the net exports have not contributed to the GDP growth. The real income growth in Russia prior to the Lehman shock , however, seemed to have been much greater than the real GDP growth owing to the marked increase in the terms-of-trade effects (TT) arising from high oil prices. This gap in perception can be solved by employing the so called "command GDP," which is defined as real GDP plus terms-of-trade effects (see Kuboniwa, 2007).

The terms-of-trade effect expressed in base-year prices can be defined as follows:

$$TT_r = (E_n - M_n)/P - (E_r - M_r) = M_r(1 - P_m/P) + E_r(P_e/P - 1)$$

$$E_r = E_n/P_e,\ M_r = M_n/P_m\ ,$$

where subscripts *r* and *n* denote the real and nominal terms respectively. *TT* is the terms-of-trade effects, and *E* and *M* are the exports and imports respectively. P_e and P_m are the export and import deflators respectively, and *P* is a common deflator of exports and imports.

If we set $P = P_m$, then $TT_r = E_r(P_e/P_m - 1)$.

We employ this result in our calculations with an assumption that the above macro relations are applicable to sectoral relations using a uniform macro deflator, namely the import price index. We consider only the crude oil and gas sector's terms-of-trade effects. Table 9 is obtained by adding these effects to the GDP of the mining sector.

Table 9. Terms-of-Trade Effects and Growth of "Command GDP"

	2005	2006
	"Command GDP" growth (annual percentage change at previous year prices)	
Mining sector	38.0	15.6
Total economy	12.9	10.7
Memo:	Data for calculations	
Exports of crude oil and gas (mil. $)	114,812	146,089
Real growth rate of exports of crude oil and gas at previous year prices (pct.)	-0.5	-1.8
Real exports of crude oil and gas at previous year prices (mil. $)	79,784	112,772
Export price index of crude oil and gas	1.439	1.295
Import price index of the country	0.970	1.056
Terms-of-trade effect of crude oil and gas (mil. $)	38,522	25,525
Terms-of-trade effect of crude oil and gas (mil. rubles)	1,090,172	693,985

Sources: Author's calculations based on Table 8; use tables for 2004-2005; External Trade 2007, 2008; and www.gks.ru

The growth rate of command GDP of mining sector accounted for 38 percent in 2005 and 15.6 percent in 2006. In this context, we can state that the contribution of the mining sector to Russian economic growth in real terms was extremely large for 2005 and 2006.

4. Diversification of the Russian Economy

The Russian economy is heavily reliant upon the mining sector including crude oil and natural gas. This situation will not change for the foreseeable future. Even so, recent policy direction for reforming Russia's industrial structure should also be noted and studied. As is well known, the Russian government has adopted a policy targeting diversification and thus, moving away from heavy dependence on oil and gas.

Table 10 shows the government's target for long-term changes in the Russian

industrial structure. The government expects the GDP share of the oil and gas sector will show decreases from 19.7 percent in 2006 to 15.6 percent in 2015 and 12.1 percent in 2020. In contrast, the GDP share of the "high-tech" industry is expected to show increases from 10.5 percent in 2006 to 13.8 percent in 2015 and 18.9 percent in 2020. The government's figure of the GDP share of oil and gas in 2006 proves that the government employs our methodology, shown in Table 1. The government relied upon the increasing trend of manufacturing, including the machinery industry, in contrast to the decreasing trend of mining, including crude oil and gas for 2000-2007. Although the Russian government, in its long run plan, did not provide feasible policy measures to realize its target, we can state that the auto-industry is expected to become a key factor for the diversification and modernization of the Russian economy.

Table 10. Long Term Prospect for Changes in Russian Industrial Str
(Pct. of total GDP at 2006 market prices)

Sector	2006 actual	2010	2015	2020
		forecast		
"High-tech"	10.5	11.2	13.8	18.9
Oil and gas	19.7	16.3	15.6	12.1
Resource materials	8.4	7.9	7.4	6.8
Transport	6.6	6.2	5.5	4.9
Trade	17.7	14.5	13.6	12.2
Others	37.1	44.0	43.9	45.1
GDP	100.0	100.0	100.0	100.0

Source: MER, 2007, p.35.

Notes: ThetTable shows the optimistic case (innovative case).

The " high-tech" sector or the "innovative" sector should consist of the machinery industry, science, information-communication technology, education, and healthcare. This is quite different from the Western terminology.

Table 11 shows an international comparison of the auto-industry including all motor vehicles and auto-components. The GDP share of the auto-industry in Japan (2000), USA (2000), and Germany (2002) with the most advanced foreign-make cars was 1.6, 1.2, and 3.1 percent respectively.

The table also shows the auto-industry's GDP share in BRICs. The GDP share of the auto-industry in Brazil (2005), Russia (2005), India (2003/2004), and China (2002) was 2, 1, 1, and 1.5 percent, respectively. Brazil showed the largest share of BRICs. The domestic production level of passenger cars in 2005 was 2 million

(Brazil), 1.1 million (Russia), 1.3 million (India), and 3.1 million (China) in physical number (*Automotive Yearbook*, 2009). In 2002, China's passenger car production was 1.1 million. This suggests that Russia's position in the auto-industry was the lowest of all BRICs in 2005. All BRICs showed rapid development in the auto-industry in the 2000s before the world crisis. The auto-industry in China and India, with small and cheap cars, has continued its rapid growth after the Lehman shock, while only Russia has shown a rapid fall.

Table 11. An International Comparison of Auto-industry

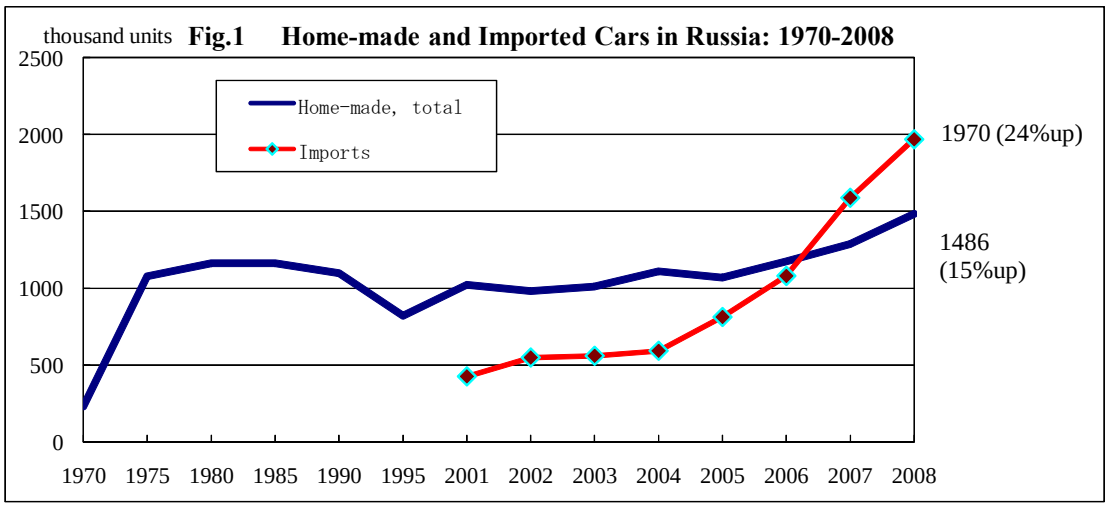
Country	Year	Pct. of GDP at market prices
Japan	2000	1.6
USA	2000	1.2
Germany	2002	3.1
Brazil	2005	2.0
China	2002	1.5
India	2003/2004	1.0
Russia	1987	2.4
	1995	0.9
	2004	1.2
	2005	1.0

Sources: Author's estimation using input-output tables.
Notes:

The GDPs of auto-industry of all countries are evaluated at market prices.

The Russian GDP for 1987 is and estimate by Kuboniwa and Ponomarenko.

In 1987 of the Soviet era, the auto-industry's GDP share of Russia was 2.4 percent with a passenger car production of 1.2 million. This was achieved in a non-competitive environment. The Russian auto-industry's challenge in a competitive environment started just before the global economic crisis. Now it is facing serious difficulties. However, Russia must develop the auto-industry if it really would like to achieve diversification of the economy. Russia has no other alternative for diversification and modernization in the medium run.



Sources:Rosstat, Federal Service of Customs.

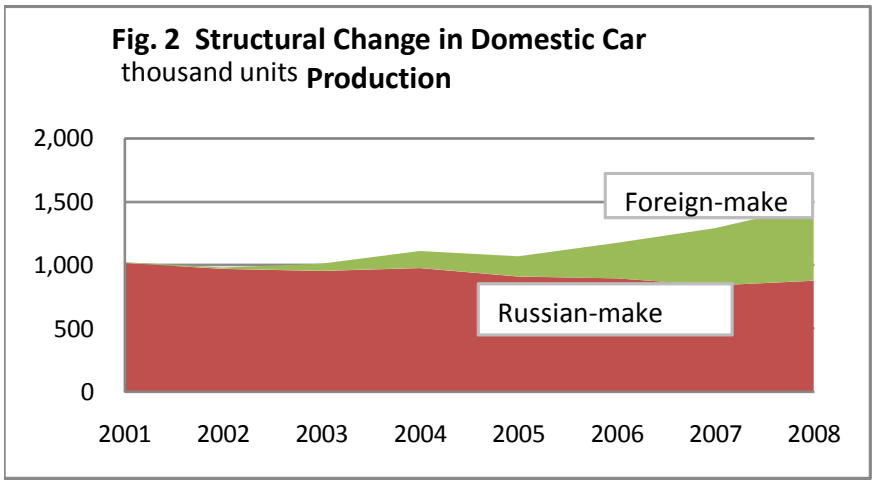
Fig.1 shows the Russian dynamics of passenger or light cars produced and imported in physical unit numbers. From this, we can report the following:

First, the boost of passenger or light car imports began in 2005 and continued until 2008. The number of car imports reached about 2 million in 2008, which was 3.3 times higher than the number imported in 2004. In particular, it showed a remarkably high growth at 47 percent in 2007. Although it slowed down in the second half of 2008, it showed high year-on-year growth at 24 percent in 2008 thanks to a boost in the first half of the year.

Second, the number of passenger or light cars produced in Russia or homemade cars exceeded the Soviet peak level in 2006 and showed marked increases at 10 percent in 2007 and 15 percent in 2008. It reached about 1.5 million, which was 1.34 times higher than the number produced in 2004.

Fig.2 shows the structural change in Russia's domestic light car production.

The boost of foreign-make cars made in Russia has been the major source for an increase in domestic light car production for 2001-2008. The number of foreign-make light cars made in Russia increased from 5,000 in 2001 to 591,000 in 2008, i.e., by more than 100 times. Its share in the total domestic production increased from 0.5 percent in 2001 to 40 percent in 2008.



Sources: Rosstat, Autostat.

The Russian government, as well as most Russian traditional carmakers, clearly reached the perception that Russian-make cars cannot be competitive in quality. Russian large carmakers, except for AvtoVAZ producing LADA, shifted to the assembly of foreign-make (foreign-brand) cars. Major foreign carmakers began to expand their assembly in Russia, making full use of preferential import duties on car components, based on "the Industrial Assembly" regime introduced in 2005. Thus, the boost in the assembly of foreign-make cars in the territory of Russia was brought about.

The Industrial Assembly regime assumes preferential duties on car component imports for (foreign or Russian) car assembly plants under the local content that they should meet the requirement of a higher than 30 percent self-sufficiency rate of components within 4.5 years of their production start. Namely, makers enjoying the Industrial Assembly regime are required to switch from CKD (complete knockdown method) to SKD (semi-knockdown method) in several years. A marked increase in the self-sufficiency rate is in the common interest of both the Russian government and the foreign makers. The foreign makers need to raise the self-sufficiency rate to at least 70 percent to reduce their production costs. The governments expect that this increase will bring about a radical development of the Russian industrial base, which has been the major bottleneck for Russian manufacturing.

The government expects foreign assembly makers to organize the production of auto-components in Russia by themselves. Unlike the cases of China, India and Brazil, the Russian government had no industrial policy for the further

development of the domestic production of components and parts except for the extension of the Industrial Assembly regime to foreign and Russian auto-part makers. The government should provide a more favorable investment environment for auto-part makers, including Russian SMEs and foreign giants.

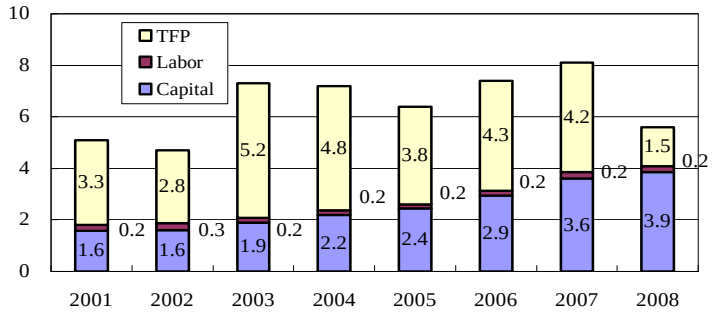
According to our rough simulation using the unpublished 2004 input-output tables (SUT) with an explicitly separate auto-industry sector compiled by Rosstat, the Russian total GDP will show a 4 to 5 percent increase when the net final demand for automobiles becomes twice the level of 2004 by the reduction of car imports (import substitution) and/or some other reasons. In our simulation the self-sufficiency rate of auto-component is fixed at 30 percent. If the self-sufficiency rate of auto-components shows an increase to more than 70 percent, the expansion effect of the auto-industry on the GDP would be much greater through the reduction of imports for the auto-industry. It should be noted here that both an assembled car and its components belong to the auto-industry sector. Thus, the expansion of domestic car production would provide a basis for the further development of the diversification of the Russian economy away from its dependence on the oil and gas sector.

5. Russian Growth Accounting

Fig. 3 presents the author's calculations of macro growth accounting of the Russian economy for 2001-2008 based on our estimates of the capital stock and capital distribution ratio (70 percent) and the official data on GDP and employment (see Kuboniwa, 2008, 2009a). As is evident, the major source of Russian growth was TFP (Total factor Productivity) for 2001-2007, followed by the capital increment which showed steady growth. The TFP showed a marked decline in 2008 and further decline is expected in 2009.

For 2001-2007 the average growth rate for Russia was 6.6 percent. Average contributions of capital, labor and TFP to this growth were 2.3, 0.2 and 4.1 percent, respectively. Namely, more than 60 percent of the growth was due to the TFP contribution. When we employ the official data of the growth rates of capital stock (www.gks.ru), the average contributions of capital, labor and TFP to the growth amounted to 1.2, 0.2, and 5.2 percent, respectively. Approximately 80 percent of the growth was due to the TFP contribution. Smaller capital contributions induced greater TFP contributions. TFP incorporates all components of technical progress due to capital replacement, management reforms and so on.

Fig. 3 Growth Accounting (contribution rate; percent)



Sources: www.gks.ru and author's estimations.

Here we present the preliminary results of sectoral growth accounting. It should be noted that in the beginning of 2009 Rosstat made an upward revision of the manufacturing growth and a downward revision of the mining growth for 2005-2007.

Table 12. Sectoral Growth Accounting of the Russian Industry for 2005-2007

(Percent)

	Growth			Contribution			Growth	
	GDP	Capital	Labor	Capital	Labor	TFP	Labor productivity	Capital productivity
Mining								
2005	0.5	7.0	-3.4	4.9	-1.0	-3.4	3.9	-6.5
2006	-3.3	8.4	-0.8	5.8	-0.2	-8.9	-2.5	-11.7
2007	-2.7	9.8	-0.5	6.9	-0.1	-9.4	-2.2	-12.5
Manufacturing								
2005	6.0	4.1	-2.4	2.9	-0.7	3.8	8.4	1.9
2006	7.3	4.6	-1.3	3.2	-0.4	4.5	8.6	2.7
2007	8.1	6.1	0.2	4.2	0.1	3.8	7.9	2.0
Electricity, gas, and water supply								
2005	1.2	3.1	0.6	2.2	0.2	-1.2	0.6	-1.9
2006	5.7	3.1	0.6	2.2	0.2	3.4	5.1	2.6
2007	0.4	4.5	-1.1	3.1	-0.3	-2.4	1.5	-4.1

Sources: Author's calculations.

Table 12 shows the results using the official growth rates of value added by sector. High increases in capital stock of the mining sector did not induce its economic growth because they were not accompanied by any technical progress,

which is shown by negative TFP contributions. Due to terms-of-trade effects the mining sector was able to increase capital stock but this has not yet brought about the corresponding economic growth of domestic production. .

In contrast, the high growth rates of the value added of the manufacturing sector were caused by capital increments as well as TFP contributions. Labor productivity also showed rapid growth. Regarding the electricity, gas and water supply sector, the better growth of the sector in 2006 was due to the TFP contribution as well as capital increment. In both 2005 and 2007, no contribution of the TFP was observed.

Table 13 shows the results using estimates of the sectoral GDP growth rates. The higher economic growth rates of the mining and manufacturing sectors resulted in improvements in the TFP contributions.

Table 13 Sectoral Growth Accounting based on Estimated GDP for 2005-2006

(Percent)

	Growth			Contribution			Growth	
	GDP	Capital	labor	Capital	labor	TFP	Labor productivity	Capital productivity
Mining								
2005	2.3	7.0	-3.4	4.9	-1.0	-1.7	5.7	-4.8
2006	-0.004	8.4	-0.8	5.8	-0.2	-5.6	0.8	-8.4
Manufacturing								
2005	7.1	4.1	-2.4	2.9	-0.7	4.9	9.5	3.0
2006	7.9	4.6	-1.3	3.2	-0.4	5.0	9.1	3.3

Sources: Author's calculations.

Table 14 displays the author's preliminary calculations of growth accounting of the machinery sector for 2005-2007. The table shows that rather high growth rates of the machinery sector were caused by high TFP contributions and improvements in labor productivity.

Table 14　Growth Accounting of the Machinery Industry

(Percent)

	Growth	Contribution			Growth
	GDP	Capital	labor	TFP	Labor productivity
2005	10.4	0.4	-1.8	11.8	16.3
2006	8.6	1.3	-1.2	8.5	12.4
2007	15.4	2.1	0.7	12.6	13.1

Sources: Author's calculations.

6. Concluding Remarks

The Russian economy depends on the mining sector including crude oil and gas. The dependence on oil and gas has been much heavier than the situation shown by the official data. Terms-of-trade effects caused by increases in oil prices had induced much higher growth than that shown by the official figure. Nevertheless, some developments of diversification in the Russian economy were also found. They included an increase in the domestic production of foreign-make cars and better growth of manufacturing due to TFP contributions and capital increments.

After steady growth for 1999-2008, Russia entered a recession together with the rest of the world due to the global financial crisis. Now, we cannot expect positive terms-of-trade effects, such as oil windfalls, and improvements in the TFP of manufacturing sectors. The terms-of-trade effects disappeared in 2008. In spite of rather high oil prices, around 60 US dollars per barrel, the effects will not appear in 2009. The Russian economy will need more time to recover from the present deteriorations.

Regarding the input-output data base of Russia, the following points are noteworthy. First, more disaggregated SUTs, with 50 to 100 sectors, should be made public. Second, a time-series of SUTs in real terms should be prepared. Third, a compilation of capital stock vectors or matrices corresponding to SUTs would provide an appropriate database for the policy making of diversification of the Russian economy.

Whether "dreaming with Russia" will come true is still debatable. This paper provides only preliminary observations on this issue from lens of input-output tables and growth accounting.

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