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Reforming the Russian aviation industry

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ABSTRACT

This paper discusses the question whether the Russian aviation industry has restructured sufficiently to create a position for itself as a supplier of aircraft. It describes the collapse of the market for aeroplanes in Russia which wiped away domestic demand for airplanes and discusses the policies of privatisation and restructuring of the industry. The results are of a mixed nature. On the one hand, a deep restructuring has been avoided only to become more pressing. On the other hand, firms have shown great creativity in surviving and the Putin government pursues a process of further concentration and consolidation.

KEY WORDS

Russian Aviation Industry, Restructuring, Organisation, State reforms

SHORT BIOGRAPHIES

Steven Kluiters holds degrees in both aviation engineering and Russian studies. He has written a thesis on the Russian aviation industry.

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Reforming the Russian aviation industry

Introduction

The decline of the Soviet Economy had a deep influence on the Russian aviation industry. The Soviet aviation industry had produced 25% of all aircraft and 40% of all military aircraft in the world. It held a privileged position in the Soviet Union as part of the heavy defence industry, which received subsidies. While the quality of the military products was high, the structure of the industry was burdensome and complicated. When the Soviet Union broke up in 1991, there were approximately 400 firms with 100% state-ownership that were controlled by the Ministry of Aviation. The aviation industry underwent extensive changes in structure and ownership when the Soviet Union broke up. By the end of 1995, most companies in the aviation industry had been incorporated into joint-stock companies, combining state and private ownership. A small number of aviation companies, comprising 15% of the industry remained under state control. In 1997, the Ministry of Finance initiated a process wherein it grouped enterprises into larger units, primarily holdings, in order to direct resources to the most promising sections of the industry. The concentration process, which brought together first tier design and production units, was an attempt to create more integrated units. Indeed, the post-Soviet break-up has been complicated by the lack of coherent state policy and the conflicts between competing state agencies and regional governments for control over sectors of the aviation industry.

This article examines the transformation in the corporate structure of aviation firms between 1992-2000 and discusses the prospects for survival of the industry. The paper seeks to analyse the process of corporate restructuring, from early stage privatisation in 1992 to consolidation and integration of corporate groups beginning in 1997. The paper then goes on to analyse the continuing influence of the government in the newly privatised sector and its role in the further integration and restructuring efforts that are needed to compete with foreign competitors. This study presents an analysis of the logic of restructuring of a vital sector of the Russian economy. It asks the following questions.

- Did the restructuring and privatising reforms bring about more effective rationalisation in the sector?
- Has the government's policy of consolidating units into integrated corporate groups achieved its aim of ensuring the survival of its most valued assets on a competitive footing?

This paper has four parts. Section 1 describes and analyses the Russian aviation industry. Section 2 discusses the market developments 1992-2000 and the prospects. In the third section, the privatisation and restructuring programs are analysed in terms of the government's role in transferring ownership and creating a more coherent sector. Section 4 offers an account of the state of government market relations and the prospects for future successful reforms that could augur well for the competitive success of the newly restructured firms.

The aviation industry

Soviet industry, in 1991, was in a terrible state. It consisted of huge production outlays that were part of large conglomerates, mostly organised around one of the old ministries, that were governed through an opaque structure of ministerial departments, planning agencies, sectoral bureaux, party representatives and so on. Although during the Gorbachev years, reforms were initiated to give more responsibilities to the enterprises, the old structure still persevered. After the demise of the Soviet Union, the restructuring of industry, to make it more efficient and competitive, was one of the main goals of the new government of Russia. A first step was the privatisation of enterprises to create owners with an interest in increasing efficiency of production and finding new profitable markets. Russia privatised its enterprises faster than any other country in the region. Starting in 1992, within two years fifty percent of the economy was privatised. In 1997, the share of income of the private sector had increased to 70 per cent (EBRD, 2001). However, due to the preferential treating of insiders, the privatisation has not resulted in a large change in management. In the majority of firms, management and workers together used the legally offered option to buy 51 percent of the shares in their own enterprise, which resulted in very little change in the management of firms. Since the firms had to organise the auction of another 29 percent of their shares, that could be purchased with the widely distributed vouchers, they were able to increase their insider ownership considerably (Blasi a.o., 1997; Boycko a.o., 1995). The fast privatisation, therefore, did not immediately lead to restructuring. There were many reports of asset stripping and rent seeking (Frydman a.o., 1996). The new owners apparently did not perceive restructuring as the best option to maximise their income. In many cases, they, often supported by local authorities, banks and financial groups and trade unions continued business as usual, giving rise to large payment arrears and to what

is termed a virtual economy (Gaddy and Ickes, 1998, 2001; Polonsky and Zaven, 2000). There were very few bankruptcies that would indicate the closure of inefficient firms. On the other hand, several empirical studies on firm level find that managers actively try to restructure their firms; they engage in changing management structure and processes and they adapt the product assortment and try to develop new markets (Linz and Krueger, 1998, Linz, 2001).

One of the industries that was especially vulnerable during the years of reforms was aviation industry. It had inherited a complicated structure that was characterised by:

- a high degree of integration between the military and civil sectors, with a high degree of cross financing;
- a separation of design and construction of aircraft;
- a large number of organisations that are involved in controlling and financing the industry;
- a small number of elite design bureaux and producers that dominated the industry (Vorobyev, 1996).

In contrast, the aviation industry in western countries is dominated by the producers of aircrafts. The market for aeroplanes is highly segmented, but individual segments are dominated by a few producers only. Some producers are dominant in more than one segment (Bluestone a.o., 1981; Bonaccorsi and Giuri, 2001). Producers take the lead in design and production of a new type of aeroplane, but work in close cooperation with suppliers of engines, landing gears, avionics (the wiring systems) to develop an aircraft. The development of new planes is financed by the concerned firms, and subsequently paid for by the airlines, that buy the aircraft. With respect to military aircraft, the situation is somewhat different as the state also finances the

development of fighter jets, transporter planes and helicopters. This may also lead to cross financing.

The restructuring of the Russian aviation industry thus not only involved increasing the efficiency of individual firms, but also the reorganisation of the sectoral structure as a whole.

Market developments

Spread over 11 time zones as it is, and with many places unreachable by road for large parts of the year, there will always be a market for air travel in Russia. Whether it will be a mass market, however, is uncertain. In the Soviet days, travel was highly subsidised and plane tickets were very cheap. Russians from remote places could easily board a plane to Moscow, or other large cities, to sell their home produce of vegetables on the street markets and return home with a profit.

With the economic crisis in the 1990s, air travel collapsed. Table 1 summarises the developments in passenger transport in the 1990s. Overall, travel diminished about 40 per cent, in line with the reduction in national income, that declined by 40-50 per cent. However, air travel diminished much more. In 1990, 90 million passengers flew 160 billion passenger kilometres, whereas, in 1999, a mere 22 million passengers travelled 53 billion passenger kilometres.

Take in Table 1

Interestingly, the decline was in domestic travel only, with a decrease of almost 80 per cent and domestic passenger air travel now is back at the level of 1970.

International travel actually increased with 22 per cent. Also, shorter flights suffered more than longer ones as the average length of a air trip increased from 1778 kilometres to 2477 kilometres. Freight transport by air, initially decreased in the 1990s, but has almost been restored to its 1990 level of 2.6 billion tonkilometers. More than half of the airports, 245 out of 575 were closed between 1993 and 1998 (Zaitsev, 2000). The decline in air transport makes it hard to operate an airline company successfully. The reorganisation of the airline industry created many financially weak carriers. In 1991, Aeroflot, which had a fleet of 3200, was broken up into 484 separate carriers, some with no more than 2 to 5 planes. In 1998, there, supposedly, was a total of 315 airlines in Russia, of which only 27 were financially stable (O'Rourke, 1998). The largest Russian airline company continued to be Aeroflot, with 120 aeroplanes. Aeroflot predominantly operated in the international market, where it enjoyed a large market share. In 1998, it only had 3 % of the domestic market. Of the other successor airlines, Nikoulichev (1997) estimates that due to fierce competition, about 100 of them have been put out of business by 1996. The Federal Aviation Service aimed to further reduce the number to 53 carriers in 2000 (O'Rourke, 1998). This goal has not been achieved. Products. Inc, an airline database, lists 175 air carriers for Russia in 2002. The large reduction in air traffic and the break up of Aeroflot in many small, financially weak airlines has had severe consequences for the aviation industry.

The airlines depreciated aircraft at a very high rate. Table 2 summarises the depreciation of 9 types of aircraft. Another figure, based on depreciation rates of 28 types of aircraft, comes to 2713 aircraft being written down between 1990 and 1996¹.

Take in Table 2

More than half of the stock of the 9 aircraft that make up table 2 was written down between 1990 and 1999 and the rest will most likely follow in the coming five years. Harter (1998) argues that most planes need to be depreciated at a much faster rate and some should even be taken out of service entirely. Despite this very high depreciation rate, demand for new aircrafts has been negligible during the 1990s. The fleet in 2000 is smaller than in 1990, but consists almost exclusively of aircraft that were already in operation in 1990.

In 1990, Soviet enterprises produced approximately 500 aircraft and 215 helicopters. Of these, 100 aircraft and 90 helicopters were for civil purposes. In 2000, enterprises in Russia, which inherited about 85 per cent of the Soviet aviation industry, produced a mere 10 aeroplanes and 40 helicopters for civil purposes. Military production, for 1997, was estimated to be 35 fighter jets and 70 helicopters (Harter, 1998). For the three year period 1998-2000, we calculated orders for 373 civil aircraft and 265 military aircraft, however, orders were subject to financing and some large orders stand out. For example, the Saratovsky company sold 48 Yak-54 sports aircraft to American training centres and the Tyumen aviation company, in 1999, ordered 25 passenger aircraft from Aviakor, that it would start paying in 2000 (Vremja, 1999). In general, demand is dispersed over many suppliers and many types of aircraft and both domestic as well as export orders, in general, are very small.

Another problem for the aircraft producers is the competition from western producers like Boeing and Airbus. Since Russia and the other Central and Eastern European countries allowed foreign companies to sell aircraft in their countries, the

Russian producers have lost market shares rapidly. In 1998, Russian carriers purchased 26 western aircraft, compared to 23 Russian ones. Aeroflot, for instance, nowadays flies with Airbus and Boeing as well as with Russian aircraft. The markets of the former communist allies are lost almost completely to Russian producers. Russian aircraft have in most cases been designed in the 1960s and 1970s. Their fuel consumption is between 1.5 and 2 times that of comparable western aircraft. The Tupolev 154M jet aircraft, for example, uses 30-32 grams of fuel per pp/km, and an Ilyusin 62M jet aircraft uses 45 gram of fuel per pp/km, whereas a comparable western jet would use 18-22 gr. of fuel per pp/km. The producers did improve the performance of the new generation of Russian aircraft to 20-25 grams per pp/km, but this is still somewhat below the western standards. Furthermore, Russian engines need more maintenance and have a shorter lifespan than those of western origin. A Russian engine goes 5,000 hours before needing its first repairs whereas a western engine can run between 8,000 and 10,000 hours before needing a first repair. Furthermore, they often do not comply to the strict noise and pollution restrictions that apply in western and Asian countries and, therefore, Russian aeroplanes are losing their landing rights at western airports. This puts the Russian producers in a difficult position. They are meeting western competitors in their own markets, whereas they are unable to enter new foreign markets.

Nevertheless, the government expects demand to be about 100 aircraft per year until 2015. Given that most aircraft in Russia are of an old design and old themselves, most of this demand will be replacement of older aircraft. The production capacity stands at about 650 aircraft (Nikoulechev, 1997).

Privatisation and restructuring

As indicated, when the Soviet Union broke up, there were about 400 companies that all specialised in narrow fields of the aviation industry. An extensive websearch of the archives of the Research Institute for Economics of the Russian Aviation Industry resulted in a list of 233 firms that are active in the aviation industry². In table 3, we distinguish between three types of products that are important and four types of activities in the industry.

Take in Table 3

Together, they cover the entire range of activities and products in the industry. As could be expected, given the importance of the design bureaus in the past, a large number of firms engage in the design of aircraft, engines or instruments. There still is a large number of firms that deal with aircraft. This reflects the wide range of airplane types that used to be produced in the Soviet Union. The Russian aviation industry still offers a large portfolio of types. The most common combination for an enterprise is that of productive activities for instruments (53), followed by the design of instruments (27) and the production of aircraft (24). Engines were produced in 12 enterprises and designed in 7 enterprises. Remarkably, Research and Development almost always was a separate activity, unrelated to any product. This may have been the consequence of the unique place that R&D had in the Soviet structure. It was concentrated in large science complexes. This may be a worrying feature, however, in a commercial sector where it should be closely related to the design and production of new products. The high number of unknowns is due to the incompleteness of the datasets.

As indicated, during the Soviet days the separate stages for aircraft production, from design to production, were organised in separate companies. Furthermore, the location of enterprises was determined politically rather than for economic reasons, which very often resulted in high transport costs because suppliers were located at large distances of producers further down the production chain. Furthermore, the dominant position of the, Moscow based, design bureaux resulted in a low degree of integration between separate stages of the production chain. Finally, it is worth noting that the links between the aviation industry and the defence industry created a rather opaque business structure with the main design bureaux as the pinnacles. These design bureaux were a kind of ministries within the ministries and the government had lost control over the industry in the 1970s to them and they acted as co-ordinators and lobby's within and for the industry (Vorobyev, 1996).

The developments in the restructuring of the aviation industry reflect the complexity of the sector as well as the political sensitivity with regard to the aviation industry. In 1990, the Ministry of Aviation was dissolved and its responsibilities were transferred to the Ministry of Industries. A limited number of enterprises was already privatised in 1990 and 1991. By 1992, the Russian committee on Defence Industry took over from the Ministry of Industries. Later, in 1996, responsibilities were transferred to the Ministry of Defence, which, in 1997, was incorporated in the Ministry of Economy. By 1999, the responsibilities were dispersed to specific directorates within the Russian aerospace agency. Top managers of design bureaux and production enterprises tried to destroy central control and to transform themselves into legitimate (co)owners of one of the most dynamic and internationally competitive sectors of the Russian economy (Vorobyev, 1996). At the same time, the privatisation gained momentum.

In June 1992, a Russian privatisation program was enacted and many firms were corporatised. In our list of 233 companies, 101 companies were turned into Open Joint Stock companies (OAOs), and 10 became Closed Joint Stock Companies (ZAOs). These companies could subsequently be privatised by selling off the shares. Despite these privatisation efforts, the state remained a dominant factor in the industry. Given the importance of large parts of the aviation industry in the defence industry, the state maintained ownership of 37 companies, while on average the state maintained an average of 28.7 percent of the shares in the 75 OAOs that we know the state share of. Other sources mention 40.9 percent of all aviation companies having the state holding a package of shares that guarantees its influence over the companies. More importantly, after 1995, the government considerably slowed down the privatisation. It drew up a list of 125 companies with strategic significance for Russian national safety, of which it would not sell its packages of shares for the next time to come (Government of Russia, 1995). In other decrees, the government presented additional lists of companies, whose packages of shares or golden shares were extended or that were excluded from privatisation altogether. These lists added as well as deleted companies from the original list of 125 companies (Government of Russia, 1996a,b, 1998). The privatisation was aimed at individual firms.

The state influence with the sector as a whole clearly showed in its attempts to form integrated structures around the aircraft design companies. Already in 1992, a government decree ordered the creation of a aviation corporation Tupolev from the design bureau of the Tupolev aircraft and series producer Aviakor in Samara. However, we did not find any further reference to this enterprise, and, therefore, we assume that this company never was formed. A second attempt, in 1994 and 1995, to create a holding company around the Ilyushin family of aircraft also failed, despite

presidential approval and several attempts. A successful merger was the one that joined 14 enterprises that design, produce parts and assemble MiG fighters and Kamov helicopters into a VPK MAPO group. This one was created in January 1996. In 1997, this group was ordered to merge with an aircraft design bureau, but is unclear whether this merger actually materialised, since in 1999 the design bureau does not appear in the merged structure. From press reports and government decrees we were able to distinguish twelve separate groups of firms, that are being brought together to create holdings. We list them in table 4. Some firms belong to more than one group. The groups are very diverse. Most groups seem to concentrate on horizontal integration and bring together enterprises with similar activities, possibly to enjoy economies of scale or economies of scope. There seems to be a concentration of enterprises that are involved in the production of aircrafts, with four groups exclusively focusing on aircraft and two more that combine aircrafts with engines. Three more groups emphasise on instruments. This could indicate a tendency of concentration and rationalisation in the industry that is similar to what has been observed in western markets. VPK MAPO is the only example with a conglomerate structure, bringing together all the separate activities in aircraft production and deal with all type of products. Here again, Research and Development stand out to form a separate group.

Take in table 4

Surviving

In many respects, the Russian government continued to support the aviation industry. Several programs were adopted. In 1992, the government formulated the Program for development of civil aviation in Russia until the year 2000. This program received federal status in 1993. It aimed to provide government support of 1.06 trillion rubles (266 bn. US\$ at that time) between 1993 and 2000 from budgetary as well as non-budgetary funds (Vorobyev, 1996). High inflation ate away large parts of this support, which in itself was only paid out fractionally. Only in 1992 the intended support was paid, but the fraction of the plan paid decreased rapidly afterwards to a mere 8.3 percent in 1998. The support could take form in tax exemptions, credits or grants. The money was used to develop new aeroplanes, to restructure existing ones, to modernise the production facility or to finance the purchase of Russian aircraft. Given the high rates of inflation in the decade, the direct financial government support to the aviation industry remains fairly small. Furthermore, it is dispersed among many enterprises. The additional support from regional authorities does not make any significant differences.

A budgetwise cheaper, but nonetheless important support has been the creation of a legal framework that should facilitate leasing of aircraft. Also, in 1994, the government created a 50 percent import tariff for aircraft and all their constituent parts, engines fell under a 20 percent tariff (Government of Russia, 1994). These measures, however, did not have a great impact due to the large number of temporary customs exemptions that were made. Furthermore, tariffs for aircraft were lowered to 30 percent in 1997 and to 20 percent in 1999 (Segodya, 1999).

In 1999, the government adopted a new program for the development of the aviation industry until 2015. With respect to civil aviation, the program focuses on larger

aircraft, leaving the rest to be developed commercially. It aims to make Russian aircraft more attractive to airlines than foreign aircraft. In the first period the aim is to complete the upgrading of existing designs. Later, the attention will shift to designing new aircraft. The estimated cost of the program is 185 billion rubles (6.5 bn. US\$), of which 30 percent is needed in the first period, which runs from 2000 until 2005, and 70 percent covers the second one, running from 2005 onwards. The federal budget will finance about a quarter of the program, leaving the rest to commercial financing (Interfaks, 2000).

In 2001, the government yet again adopted a new plan to consolidate hundreds of firms into 6 or 7 holding companies, of which only one or two will produce aircraft (Pronina, 2001). It is also setting a credit system that would allow carriers to purchase new aircraft, by means of leasing (Moscow Tribune, 2001).

The state support may have helped firms to withstand the crisis, but it certainly was insufficient to create a competitive industry, especially since support was mainly linked to specific projects. The formation of groups may have reduced the vulnerability of the partners. From press reports one can retrieve many examples where it shows that the industry itself engages in a large variety of activities, some within the aviation industry, and some in other lines of business. Of course, repairs, upgrading and extending the technical life of existing aircraft continued to generate business. A few firms started subcontracting for western producers of aircraft or engines or formed joint ventures to produce western products. Aviakor, for example, start started to build high quality parts for Boeing equipment, while Russian competitor Aviastar started to produce caissons for Boeings large western rival, Airbus. Airbus also subcontracted production of parts for its aircraft to Gidroavtomatika. Others went one step further and created partnerships. Premskiye

Motory, for instance created a partnership with Pratt&Whitney for the production of aircraft engines and the Krunichev aerospace research and production centre entered a joint marketing agreement with Lockheed Martin and is commercially launching peddling rockets it developed for the military.

Two major activities outside aviation that firms engage in lie in medical appliances, agricultural and energy sector applications. These may be extensions of the existing product line, as aircraft have a high tech contents and jet engines are creating thrust for propulsion. Fighters producer MAPO-MiG, tried to produce crop dusters, but could not get the money to finish the project. The Saratovski group, which produces aircraft and instruments tried its hand at agricultural combines. The list of activities, however, is long. Aviastar produced only 3 aeroplanes in 1997, but it achieved a profit in that year by selling refrigerators on the consumer market.

The results of all these activities are mixed. Out of 28 occasions in a three year time span (1997-1999), concerning 17 firms, we have 17 reports of a profit and 11 reports of a loss. Of 27 firms, at least 10 report a wage arrears in the period November 1998 April 2000. One of the largest companies in the industry, Aviastar, even faced two strikes as a result of these arrears. Many companies laid off workers or sent workers home on special leave, but since production decreased even more, labour productivity still dropped. Financially, many firms are in a weak position facing creditors, without sales or debtors to honour their obligations. It is, however, very difficult to get complete figures for a large number of firms.

Perspectives

The Russian aviation industry was hit hard by the economic crisis that followed the start of the reforms in Russia in early 1992. It is not clear by what percentage the industry production contracted, but a production of 10 aeroplanes and 40 helicopters for civil purposes in 2000 versus 100 and 90 in 1990 indicates a serious drop of production for the industry and it seems save to say that the aviation industry is among the hardest hit sectors if the economy. The reduction in passengerkilometers in air traffic was bigger than that of passenger transport in general. The income reduction in the Russian economy makes it unlikely that airline traffic will pick up soon. An increase in income will most likely benefit other hard hit industries, like the light industry and the food industry, more than the airlines and as a consequence the aviation industry.

The aviation industry heavily depended on state support, both by its ties with the defence industry and by the heavy subsidies that went into air transport. The withdrawal of the state from direct production processes, 70 percent of production now is in private industry, leaves the civil aviation industry in particular in a difficult situation of finding new customers by itself. The budgetary problems have cut subsidies to airline tickets and this added to the reduction in air traffic makes life for airlines very difficult. They are unable to order new aircraft. The airline industry is going through a process of restructuring and many have gone out of business. The remaining companies, however, very often still are in a bad financial shape and continue to operate with old aeroplanes. A major problem in the renewal of fleets is the financing.

Therefore, it seems unlikely that Russia can sustain the current size of the aviation industry. Its markets have simply shrunk too much. Furthermore, Russian producers

face serious competition from western firms. Although more expensive to purchase, western aircraft are cheaper to operate and their producers are often able to offer financing to its customers. Companies and the state alike have to take restructuring serious if companies are to survive in the global market. Like other sectors, the aviation industry, in the 1990s, was able to avoid thorough restructuring.

The prospects for the future of the aviation industry are mixed. Although the government did not actively use its share in companies, it continued its involvement in the industry by ordering companies into groups. It started doing so in 1992 and most recently in 2001 told producers to team up. It is unclear, however, if these decisions have been or will be followed up by the creation of new holdings. Nor is it clear that the creation of holdings have lead to a restructuring in the sector of individual firms for that matter. Although many airlines went out of business, there have not been many bankruptcies in the aviation industry. The privatisation did of course limit the decision making power of the government with respect to firm behaviour. Overall, the challenges that the aviation industry faces are huge, even with the new accepted plan to restructure the industry.

During the past decade, however, the industry itself has shown great resilience and creativity to stay afloat. They have used their production capacity to produce a wide range of other goods, they have tried to develop new markets, they continued to design new aeroplanes and they have started to integrate in the global market for the aviation industry by creating alliances with western producers. The government programs did result in a concentration of the industry and the newest program from 2001 reinforces this tendency. The incumbent government seems to be stable and determined enough to actually get the desired results. A continuation of the economic growth of the past two years will recover some of the travel and, more

importantly, will strengthen the state budget. This enables the state to honour its promises and to increase its actual defense expenditures. There is no question that further restructuring of the industry and of individual firms still is necessary and that many firms will go into bankruptcy, but after ten years of trouble, the prospects are improving.

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Table 1: Development of passenger transport in Russia

	1990	1995	1999	99/90 (%)
Total (bn pass/km)	791.0	552.2	468.7	59.2
Of which: air	159.5	71.7	53.4	33.5
Of which: international	18.5	23.2	22.6	122
Domestic	141.0	48.5	30.8	21.8
Passengers (mn.)	90		22	24.4
avg. trip length (km)	1778		2477	

Source: Goskomstat, 2000

Table 2: depreciation of selected aeroplanes³

Type	< 97	97	98	99	00	01	01-05	In use 2001
Tupolev 154 (jet)	55	71	53	47	49	50	126	165
Tupolev 134 (jet)	26	59	17	15	17	20	85	139
Ilyusin 86 (jet)	3	11	9	13	5	4	4	35
Ilyusin 76 (jet)	14	55	3	12	7	9	106	124
Ilyusin 62 (jet)	11	22	7	7	6	3	27	63
Yak 42 (jet)	2	17	17	3	6	4	13	39
Yak 40 (prop)	50	53	59	49	46	60	223	114
Antonov 24 (prop)	60	102	58	45	38	35	196	157
Antonov 12 (prop)	27	17	30	16	12	10	70	79
Total	248	407	253	207	186	195	850	915

Table 3: Products and Activities in aviation industry⁴

Product		Activities	
Instruments	91	Design	56
Engines	29	Production	92
Aircraft	45	Repair or Modernisation	6
		R&D	17
Unknown	69	Unknown	74
Total	234	Total	235

Table 4: Strategic Groups

Name	# firms	Product	Activity
Sukhoi	9	Aircraft	Design and production
Tupolev	4	Aircraft	3 in production
MVZ	4	Aircraft	3 in production
Kamov	5	4 in aircraft	4 in production
Russian Aviation consortium	3	Aircraft and engine	2 in production
state group	5	Aircraft and engine	Design and production
Unnamed	5	Engines	Everything
Oborudovaniy	4	Instruments	3 unknown
Unnamed	3	Instruments	Unknown
Vinty	3	2 in instruments	Unclear
VPK MAPO	11	Everything	Design and production
Unnamed	5		R&D

¹ (www.avia.ru/stat/air-a3.shtml)

² Unfortunately, we were able to collect the same information on all firms. On many of our topics, such as ownership structure, the fields of activity, the financial situation of firms, the employment situation, government support, there are large voids in our information.

³ Source: www.avia.ru/stat/ * These figures are likely to contain errors. For example, the number of two types of aeroplanes, Antonov 24 and Antonov 12 to be depreciated between 2001 and 2005 exceeds the number in use in 2001

⁴ Because some firms are in two categories, the totals are a little higher than 233