

## CHAPTER 2

# PRODUCTIVITY

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In the 15 years since the Soviet Union's collapse and the start of its economic transition, the institutions and structure of the Russian economy have greatly changed. Although much can be said about the inconsistency of the transformation and the incompleteness of many structural reforms, there is little doubt that Russia has moved from a centrally planned economy to a genuine market economy. All three main goals of economic reform initiated 15 years ago have been largely achieved. Prices are liberalized. Privatization is more or less complete. And the economy is now at least as open to international competition as many other market economies.

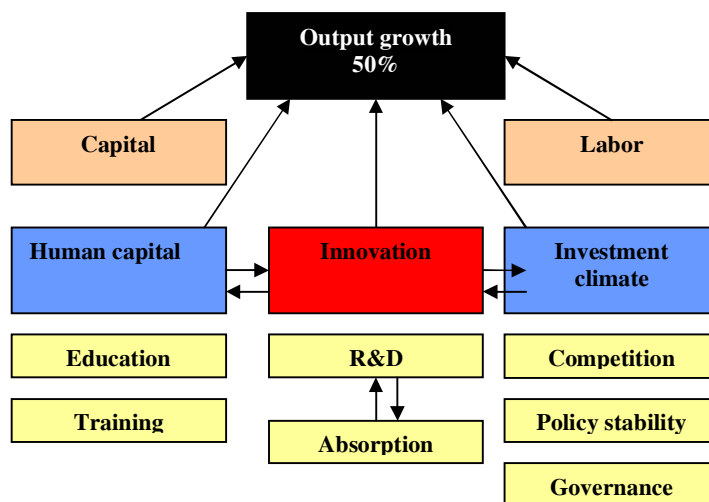
Since the prolonged economic depression of the 1990s, culminating in the major financial crisis of 1998, Russia has been one of the fastest growing (large) emerging markets. But there is a certain uneasiness about the sustainability of this growth both inside the country and abroad. Why? Because Russia's economic welfare depends on world market prices for the natural resources and primary goods that account for the bulk of its exports—and productivity in many sectors of the economy is fairly low.

Productivity is crucially important for the Russian economy for at least two reasons. First, the demographic trend of an aging work force and a declining labor supply makes labor productivity growth imperative for sustainable economic growth. Second, the increasing openness of the Russian economy, combined with the negative impact of the persistent real revaluations of the ruble, is increasing the competitive pressure on Russian producers, particularly in manufacturing, in both internal and external markets. The oil and gas sector has limited growth potential due to the continuing depletion of existing oil and gas fields and the consequent necessary move to more expensive projects in undeveloped regions and the sea shelf. In any case, the energy sector, while a locomotive of economic development, will never be large enough to provide gainful employment for a labor force of more than 70 million or prosperity for a population of 140 million. That is why having productive and internationally competitive sectors, particularly in manufacturing, is one of the most serious challenges facing the Russian economy and the Russian government.

Total factor productivity (TFP) provides a standard framework for analyzing productivity and growth. In very simple terms, economic output can be generated by growth in factor inputs (capital and labor) and by increases in the productivity of these inputs. The difference between output growth and the part of it that can be attributed to measured TFP growth is growth in inputs. The gap is sometimes referred to as the "TFP residual" or "Solow residual," after Robert Solow, the Nobel Prize winner who introduced the concept 50-odd years ago. The same framework can be used for comparing the productivity of firms, sectors, or countries. Thus, the difference in manufacturing value added across countries, after accounting for different amounts of labor and capital in manufacturing, is a difference in TFP.

Abramovitz (1956) called the TFP residual “a measure of our ignorance.” And indeed, a central focus of research in this area has been to measure the contribution to TFP of other factors such as technology, the quality of inputs, competition, the economic environment, and so on (figure 2.1). There is now a vast amount of theoretical work and empirical evidence on this from many countries and periods at the aggregate, firm, or establishment level. This assessment focuses on three contributors to TFP generally agreed to be central to growth: innovation and absorption, labor skills, and the investment climate, each the subject of a chapter.

**Figure 2.1 The sources and conditions underlying economic growth**



This chapter presents an overview of recent macro developments in the Russian economy, with a focus on productivity and exports. It next benchmarks Russian productivity and competitiveness across a range of emerging and developed market economies. It then extends the benchmarking to explore Russia’s record of R&D inputs and technology-intensive outputs, the level of training and skills of its labor force, and the quality of its investment climate. Key stylized facts, puzzles, and policy issues are identified for exploration in subsequent chapters.

## RECENT TRENDS IN THE RUSSIAN ECONOMY

During the transition of the last 15 years the Russian economy had three major sources of aggregate productivity:

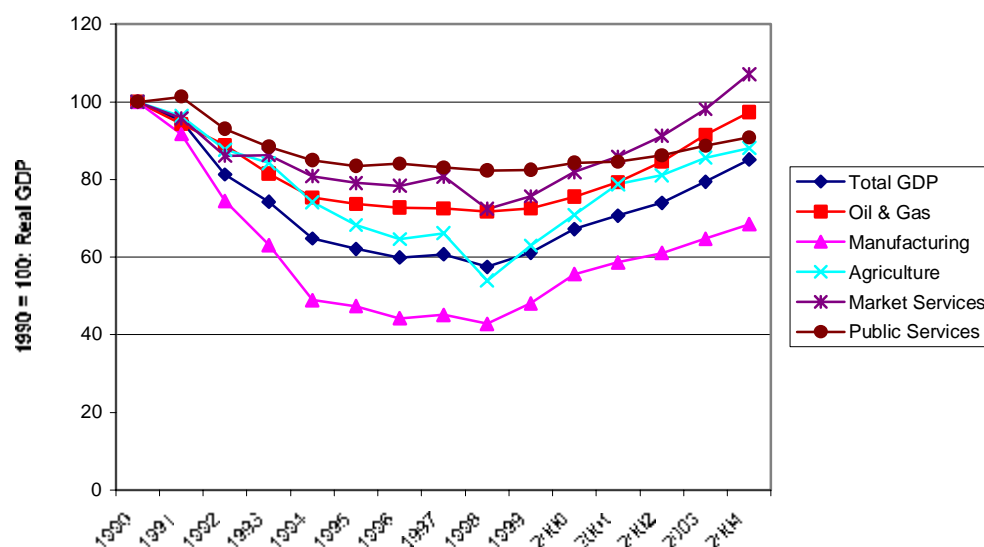
- Intersectoral structural changes—that is, the reallocation of resources among different sectors with different levels of productivity.
- The dynamic of productivity within sectors, due to reallocation of market shares among firms with different productivity levels.

- The growth of productivity inside firms due to restructuring and the absorption of knowledge and technology.

The relative importance of the three factors differed across the period, with the contribution shifting from intersectoral reallocations in the pre-1998 crisis sub-period to intrafirm productivity growth in recent years.<sup>2</sup>

By 2005 real GDP reached almost 90 percent of the pre-reform level of 1990. But this fact conceals wide variations across sectors and regions. Value added in manufacturing was less than 70 percent of the Soviet maximum (figure 2.2). The oil and gas sector reestablished its pre-reform level of output. And services—trade, transport, communications, and finance—exceeded it.

**Figure 2.2 Real GDP by sector, 1990–2004**



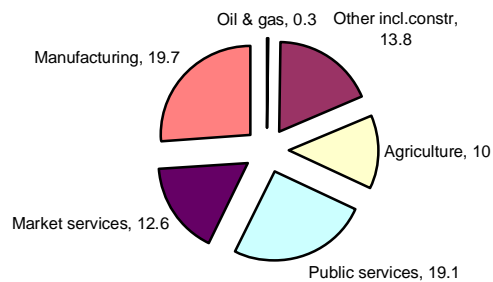
Source: Goskomstat and World Bank.

These changes in the structure of GDP were accompanied by massive reallocations of inputs across sectors, particularly from manufacturing to such newer sectors as trade and services. The reallocation of labor, though motivated mostly by necessity (massive job destruction in traditional manufacturing), transferred resources from the shrinking sectors to the growing sectors (figures 2.3–2.4).

<sup>2</sup> For a quantitative analysis, see the World Bank Country Economic Memorandum for Russia (2005d).

**Figure 2.3 Structure of employment, 1990**

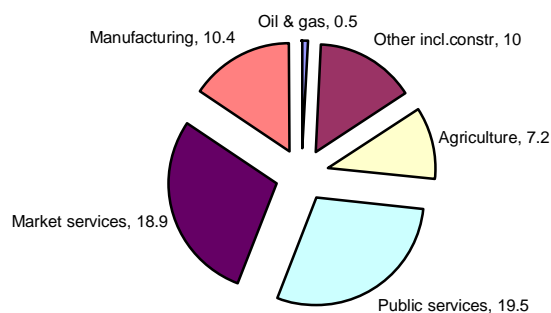
(million)



Source: Goskomstat and ILO.

**Figure 2.4 Structure of employment, 2004**

(million)



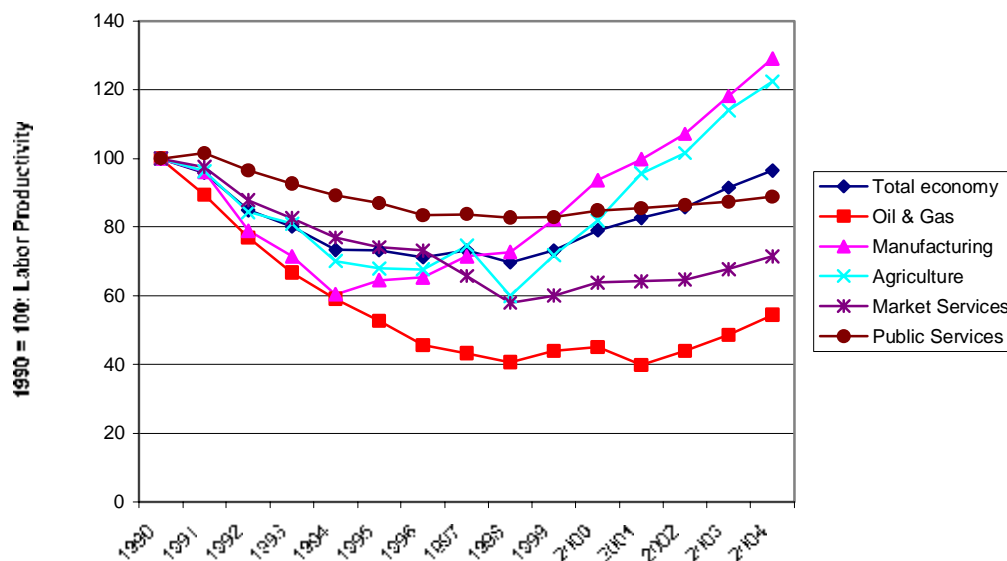
Source: Goskomstat and ILO.

After the bottoming-out of the “transformational recession” in the mid-1990s, productivity dynamics went in the opposite direction. The fastest growing sectors (oil and gas, market services) had the slowest increases in labor productivity, and the sectors with the deepest initial declines in output (manufacturing) saw the biggest subsequent increases in productivity (figure 2.5). The explanation for this apparent paradox is that the downsizing that redistributed labor resources from declining to growing sectors also increased the productivity of the former.<sup>3</sup> In the

<sup>3</sup> The structural changes between aggregate sectors of the Russian economy were to some extent distorted by the large-scale practice of transfer prices, which diminished industrial output and exaggerated the share of trade.

first half of the transition, productivity growth in the Russian economy depended mostly on the competitive pressure on manufacturing, which had high productivity growth because of significant restructuring through downsizing and exits. Oil and gas and market services, facing less competitive pressure and more market opportunities, expanded employment along with output.

**Figure 2.5 Labor productivity by sector, 1990–2004**



Source: Goskomstat and ILO.

So, despite structural changes and resource reallocations in the 1990s, the Russian economy started to grow after eight years of economic decline, with overall labor productivity at about 70 percent of the 1990 level. The trigger for the growth that started in 1999 was the 1998 financial crisis and deep devaluation of the ruble. Imports became relatively expensive. Labor, energy, and some other material inputs became relatively cheap. And the competitiveness of Russian products, particularly in domestic markets, sharply increased as a result. In manufacturing, the growth of output led to higher capacity utilization for fixed capital and labor, and this contributed to growing productivity.

Subsequent growth has been supported by increases in world market prices for Russia's key exports of oil, natural gas, and metals. The growth of export revenues—together with a conservative budget policy and higher contract and tax discipline—provided for macroeconomic stability and improvements in state finances, the banking system, and corporate finances. Additional revenues from higher production, higher efficiency, and export activities were distributed through the economy. This resulted in the steady growth in incomes and eventually consumer demand—and to less extent in the demand for investment goods. Growth of internal demand became the major driver of the Russian economy, fed by energy and metal exports. The

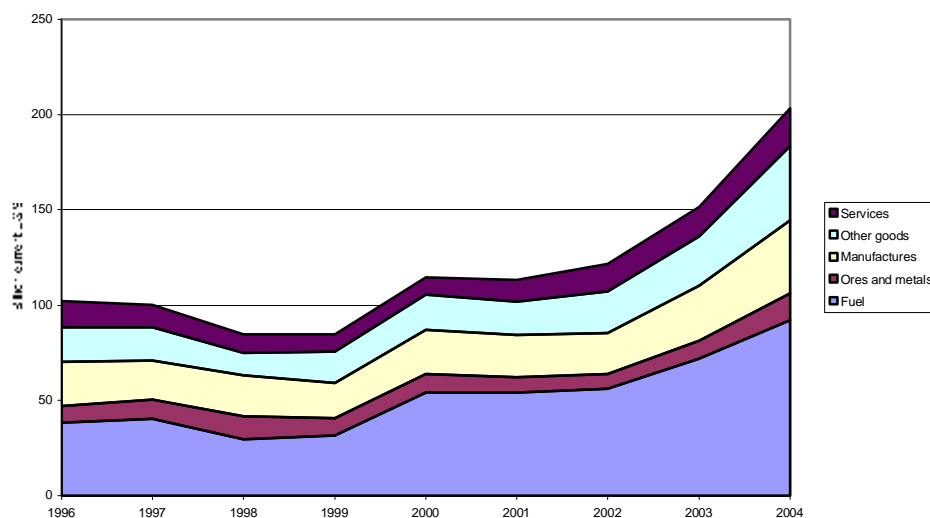
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Nevertheless, the main trends in sectoral productivity stand even after correcting output for transfer pricing. More detailed analysis is in the CEM.

fastest growing sectors became retail trade, construction, real estate, and market services. Manufacturing also gained from this expansion in demand, though the effect was not as great or prolonged as for non-tradables.

This internally oriented growth indicates the limited competitiveness of Russian manufacturing in world markets, despite annual growth of manufacturing productivity of 10 percent since 1998. While overall exports more than doubled between 1999 and 2004, it was mostly a result of the increases in oil and gas prices on the world market. The share of manufacturing in total exports remained very low (figure 2.6). Even in the internal market, Russian producers of manufacturing goods are beginning to lose market share. Since 2002 the volume of imports has grown much faster than that of exports despite the increases in export prices for Russian oil and gas. The appreciation of the real exchange rate explains this to some extent. But it is also a result of the Russian industry's inability to provide enough competitive consumer and investment goods to meet growing internal demand. The situation is aggravated by the fact that, on both consumer and investment goods markets, increasing revenues, incomes, and imported goods lead not only to higher demand but also to higher standards of quality.

**Figure 2.6 Russian exports, 1996–2004**



Source: World Bank (2006e).

So though the current Russian trade balance looks extremely healthy, the trends are not favorable: export revenues depend exclusively on world market prices for natural resources, while import growth is a result of the relatively low competitiveness of manufacturing and will probably continue independent of exports. The competitiveness of the Russian economy, and of manufacturing in particular, cannot be achieved through a protectionist trade policy closing the domestic market to international competition. Already a part of the global economy, Russia will be even more integrated after its accession to the WTO. For more balanced growth, Russia needs more diversified international trade, which can come from a more competitive and more productive manufacturing sector.

## THE RUSSIAN ECONOMY AND MANUFACTURING PRODUCTIVITY IN THE INTERNATIONAL CONTEXT

This section benchmarks Russia—its economic structure, competitiveness, and productivity—against other countries and groups of countries competing directly with Russian producers in the markets (or for FDI) and against leading developed market economies at the world technological frontier.

### Box 2.1 Countries selected for benchmarking

*BRICS group*—large emerging economies. Brazil (B), India (I), China (C), and South Africa (S) together with Russia (R) are considered by world financial markets to be a group of large emerging economies expected to grow rapidly in the medium to long term. They will compete for international investors.

*Poland (P)*—the largest former transition country of Eastern Europe, now an EU member. A typical competitor for Russia on European markets and an example of a successful transition.

*South Korea (SK)*—a successful Asian Tiger. An advanced economy that can be considered a “former emerging economy.”

*Spain (SP)*—a developed European country. A latecomer to the EU, which has made major progress in “catching up” with European leaders.

*Germany (G)*—the largest and most advanced of the major EU economies.

GDP per capita at purchasing power parity (PPP) is a standard indicator of aggregate productivity and of the standard of living and level of development. Russia is one of the richer BRICS countries, comparable to Poland, but its per capita GDP is less than half that of the developed countries, even a “new developed country” such as South Korea (table 2.1). Even with relatively high rates of growth, it will take decades for Russia to catch up with the leaders.

**Table 2.1 Basic indicators for the selected countries**

	<i>B</i>	<i>R</i>	<i>I</i>	<i>C</i>	<i>S</i>	<i>P</i>	<i>SK</i>	<i>SP</i>	<i>G</i>
Population (millions)	184	144	1,080	1,296	46	38	48	43	83
GDP (US\$ billions)	604.0	581.4	691.2	1,931.7	212.8	242.3	679.7	1,039.9	2,740.6
2004 GDP per capita in PPP (2000 \$)	7,531	9,101	2,885	5,419	10,286	11,924	18,840	23,019	26,013
GDP growth p.a. 2000–04	2.2	6.1	6.2	9.4	3.2	2.9	4.6	3.1	0.7
Share of employment in agriculture (%)	19.8 (2002)	10.0 (2003)	56.7 (2000)	44.1 (2002)	10.3 (2003)	18.4 (2003)	8.8 (2003)	5.7 (2003)	2.5 (2003)
Exports of goods and services (% of GDP)	18.0	35.0	19.1	34.0	26.6	39.0	44.1	25.7	38.0
Imports of goods and services (% of GDP)	13.4	22.3	22.5	31.4	27.1	41.0	39.7	29.3	33.1
Merchandise exports (% of GDP)	16.0	31.6	10.9	30.7	21.6	30.9	37.3	17.2	33.3
of which:									
Agricultural raw materials	0.6	1.0	0.1	0.2	0.5	0.4	0.3	0.2	0.3
Food	4.5	0.4	1.1	1.1	1.9	2.6	0.4	2.5	1.4
Fuel	0.7	15.8	0.9	0.7	2.0	1.7	1.5	0.6	0.6
Ores and metals	1.4	2.4	0.7	0.6	4.8	1.3	0.6	0.3	0.8
Manufactures	8.6	6.6	8.0	28.1	12.5	25.0	34.4	13.3	28.0
Unclassified	nil	5.3	0.1	0.1	nil	nil	nil	0.3	2.3

Source: Population, GDP per capita, GDP growth, exports: World Development Indicators (World Bank 2006e). Share of employment in agriculture: World Development Indicators, except for India, Indian National Statistical Survey.

Russia is more industrialized than most of the BRICS countries, with the share of employment in agriculture near South Korea's and declining quickly: since 1990, employment in agriculture has fallen by more than 20 percent. China and India, the last in the group to start the catching-up process, have the biggest employment shares in agriculture. Even China, with all its achievements in manufacturing and exports, is still a relatively poor and largely rural agricultural economy. A large, low-productivity agricultural sector is the main reason behind the relatively low per capita GDP of these countries. Russia, with a high share of services and industry, could be expected to have higher level of GDP per capita.

The share of exports in GDP shows Russia to be an open economy, little different from the other more open countries in the group (35 percent against 34 percent in China, 39 percent in Poland, 37 percent in South Korea, 38 percent in Germany). Where Russia is different is in the structure of exports: more than half of exports are fuels, ores, and metals. Russia has a lower ratio of manufacturing exports to GDP (7 percent) than all the other countries, comparable only to the relatively closed economies of Brazil and India and far behind China (28 percent), South Korea (34 percent), and even Poland (25 percent). And it has by far the lowest share of manufacturing in overall merchandise exports (about 20 percent against more than 50 percent in any other comparator).

The low share of manufacturing in Russian exports is due to the low productivity and poor competitiveness of Russian manufacturing goods (table 2.2). International comparisons of aggregate productivity usually rely on comparisons of output per worker, partly for reasons of data—those on fixed capital are often unavailable or unreliable—and partly because studies that compare TFP and labor productivity show the two to be closely correlated.<sup>4</sup>

Labor productivity in manufacturing in Russia is low even compared to most of the BRICS countries. Productivity in Brazil is 50 percent higher than in Russia, that in Poland twice as high, and that in South Africa three times as high. Value added per worker in Germany is 10 times that in Russia. Manufacturing value added per worker in Russia is about the same as that in China. Note that the relatively strong ruble in 2004 raises measured manufacturing output per worker using current exchange rates, and that the adjustment for transfer pricing does the same. So in this sense, estimates of manufacturing productivity in Russia reported in the table are generous.

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<sup>4</sup>This correlation reflects the fact that capital/output ratios vary much less across countries than do TFP levels.

**Table 2.2 Productivity indicators**

	<i>B</i>	<i>R</i>		<i>I</i>	<i>C</i>	<i>S</i>	<i>P</i>	<i>SK</i>	<i>SP</i>	<i>G</i>
	2004	2004		2000	2004	2004	2004	2004	2004	2004
		<i>Unadjusted</i>	<i>Adjusted</i>							
Manufacturing value added per employee (2004 US\$)	11,094	6,723	7,226	1,908	6,894	21,116	15,532	40,473	50,180	68,640
Manufacturing value added per employee (Russia adjusted = 100)	153.5	93.0	100.0	26.4	95.4	292.2	214.9	560.1	694.4	949.9
BEEPS-PICS Survey-based TFP estimates for manufacturing firms (Russia = 100)	209	100		139	102	350	208	493	369	452
Median employment	44	50		23	172	95	15	28	20	38
Number of firms	1,575	185		2,631	2,447	563	562	208	114	218
Annual manufacturing productivity growth, 2000–04				n.a.						
Output	5.0	5.9			10.6*	1.9	5.6	6.6	1.1	0.6
Employment	7.5	-4.3			2.4*	3.5	-1.4	0.0	1.1	-1.2
Productivity	-2.3	10.6			7.9*	-1.5	7.1	6.6	0.0	1.8
Monthly wages in manufacturing in US\$ (2002)	\$309	\$142		\$24	\$111	\$493	\$469	\$1,484	\$2,834	\$3,972
Memo items:										
Industry value added per employee (2004 US\$)	11,855	9,254	12,667	2,209	6,225	19,867	17,034	39,781	50,063	64,723
Industry value added per employee (Russia adjusted = 100)	93.6	73.1	100.0	17.4	49.1	156.8	134.5	314.1	395.2	511.0

*Note:* The table shows industry and manufacturing value added per employee in 2004 at current exchange rates. The exception is India, with productivity for 2000 in 2004 rupees and at the 2004 dollar-rupee exchange rate. The first column for Russia uses official Goskomstat data, and the other adjusts Goskomstat data for transfer pricing effects using the CEM methodology (World Bank 2003). Transfer pricing moves profits from industry to trade. Most profits moved are for fuel and energy, only some for manufacturing. Industry is defined as manufacturing, electricity, gas, water, and construction.

*Source:* Industry and manufacturing value added: UN national accounts data in local currency units converted at current exchange rates, with estimations for China, India, and Russia, where manufacturing is estimated from MMEGW in 2004 and manufacturing share of MMEGW is taken from a national source for an earlier year. India nominal value added data converted from 2000 to 2004 rupees using domestic inflation rate. Employment: mostly ILO (widest possible coverage). Monthly wages in US\$: mostly ILO. Russian value added adjusted for transfer pricing effects (World Bank 2000a).

## **BENCHMARKING OF TOTAL FACTOR PRODUCTIVITY (TFP) IN BEEPS AND ENTERPRISE SURVEYS**

A similar picture emerges when TFP is estimated directly using a very different data source, the Business Environment and Economic Performance Surveys (BEEPS). Three waves of surveys were conducted in 1999, 2002, and 2005, covering both manufacturing and non-manufacturing firms. In 2004–05 the BEEPS was expanded to cover six developed OECD countries. The World Bank has for a number of years also been conducting surveys of manufacturing firms in various developing countries in the Productivity and Investment Climate Surveys (PICS), now called Enterprise Surveys. The survey data can be used to estimate TFP levels in manufacturing firms in Russia<sup>5</sup> and all the comparator countries considered here.

The results should be treated with some caution for a variety of reasons, however. Only data on gross sales rather than value added are available for all the countries of interest. The surveys cover predominantly small and medium enterprises and may not be representative of aggregate manufacturing. And the sample sizes are small for most countries, including Russia. The results in table 2.2 are from a simple two-input (labor and fixed capital) Cobb-Douglas production function estimation with the TFP level of the firms in the Russia BEEPS of 2002 and 2005 as the benchmark. Despite all the caveats, the results are very similar to those from the comparisons of aggregate manufacturing value added: TFP in Brazilian and Polish small and medium enterprises is about twice that in Russia, and small and medium enterprises in the advanced market economies of South Korea, Spain, and Germany have TFP levels 4 to 5 times greater than those of Russian firms. Once again, China has the productivity level closest to Russia.<sup>6</sup>

Russia is an evident leader in productivity growth only in 2000–04, but this is not a cause for optimism. The period after the financial crisis of 1998 was one of abnormally high productivity growth due to increases in capacity use. A reported decline in the share of the shadow economy may have added to measured output growth. These factors were mostly spent by 2004, and future productivity growth cannot be based on continuation of these trends. Also to be stressed is that Russia is the only country among those considered here where labor shedding has made such a large contribution to productivity growth. Manufacturing output growth in 2000–04 was not exceptional.

The low productivity in manufacturing would be less of a concern if it were matched with competitive (low) wages. Comparable cross-country data for wages in manufacturing are available only for 2002. They show that, while Russian manufacturing is about as productive as China's, it loses the competitive battle in labor costs: Chinese wages in manufacturing are 30 percent lower than in Russia. Per dollar of wages, one employee in manufacturing produced about \$4.00 of value added in Russia, \$5.20 in India, and \$6.60 in China. But compared with other countries, Russian wages in 2002 were still competitive: in Brazil, one dollar of wages added about \$3.00 in value, in Poland about \$3.50, and in other countries even less. But this

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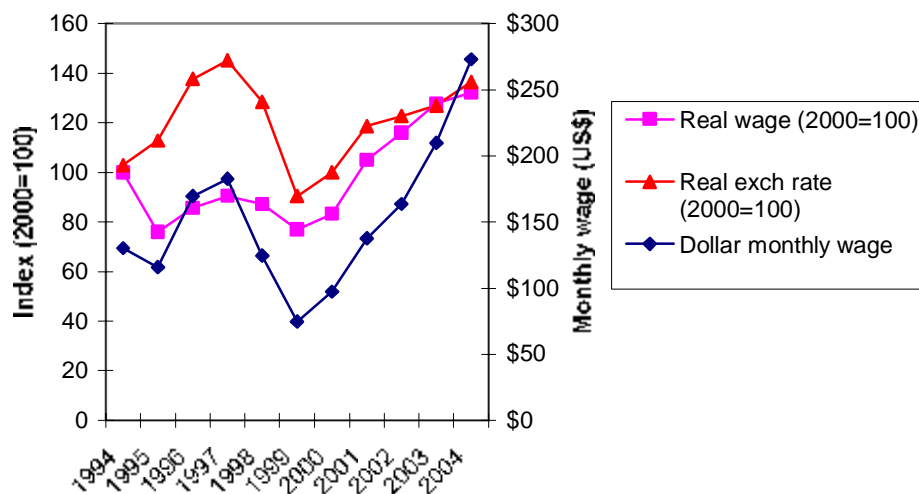
<sup>5</sup> Details of TFP calculations are given in annex table A2.1.

<sup>6</sup> The outlier country in the TFP results is India: firms in the enterprise survey have much higher levels of productivity than would be expected given the aggregate manufacturing output per worker. The likely explanation is that India has a large informal sector in manufacturing, which has very low levels of productivity and is difficult to capture in a survey exercise.

competitive advantage no longer exists. Since 1999 Russia has experienced rapid wage inflation, with wages growing far faster than labor productivity.

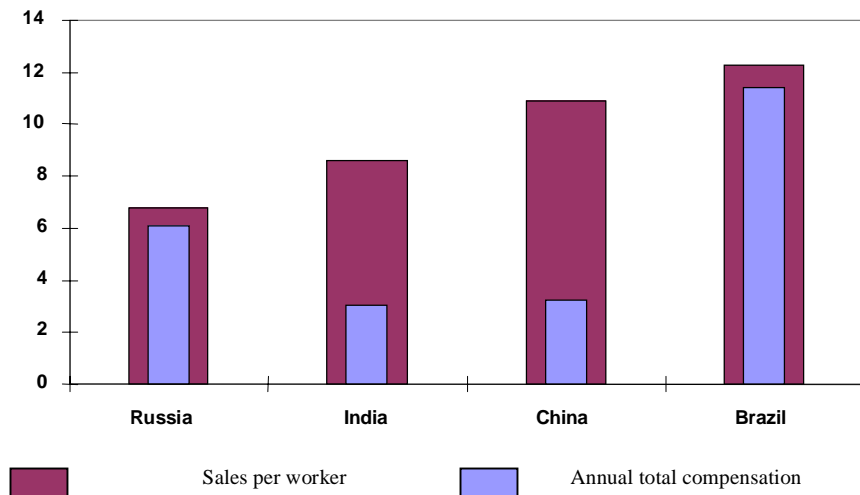
The real wage in total industry in Russia (deflated by the producer price index) has increased by 72 percent since 1999. The current dollar monthly wage in industry in 2004 was over \$250, an increase of 67 percent in just two years, and a remarkable 266 percent increase over the \$75 per month in 1999 (figure 2.7). Trying to compete internationally with cheap labor (not only with China and India but with Brazil and South Africa) is not an option for the Russian manufacturing sector. In Russia, sales per worker are \$6,800, below India (\$8,600), China (\$10,900), and Brazil (\$12,300). But labor costs are fairly high at \$2,600, compared with India (\$1,300), China (\$1,400), and Brazil (\$4,900). The gap between sales and labor is fairly small in Russia and Brazil, but large in China and India (figure 2.8).

**Figure 2.7 Real exchange rates and wages in Russian industry**



Source: Goskomstat and ILO.

**Figure 2.8 Productivity in manufacturing, in Russia, Brazil, India, and China**  
(thousands of U.S. dollars)



Source: Authors' calculations from World Bank Enterprise Surveys.

### **DYNAMICS OF EMPLOYMENT AND PRODUCTIVITY IN THE TRANSITION (1992–2004)**

As is well-known, Russian manufacturing shrank significantly during the transition, both relatively and absolutely: its share in total production fell from about 30 percent to 20 percent and it lost about 40 percent of jobs. Did job destruction and creation lead to higher productivity? Did the most efficient enterprises create new jobs? Although it would be interesting to see whether the strongest survive and the weakest leave the market, we do not have data to analyze enterprises that ceased to exist during the period. The analysis is limited to firms still operating at the time of our survey and with information from the beginning of the transition. Within this subset some variables have comparability problems, so the focus is on a few comparable indicators for the whole period.

The subsample of firms that can be traced throughout the transition period is 409, about 40 percent of the total sample.<sup>7</sup> The very fact that these firms survived could be expected to bias the subsample toward better performing enterprises. But the data do not support this. In 2004 firms traced to the pre-reform period do not differ significantly from the rest of the sample in productivity. So, the results for this subsample are valid for at least 80 percent of the firms in the full sample (those created before 1992). The only caveat is that exiting firms not represented in

<sup>7</sup> That does not mean that the rest of the sample consists of newly established firms. Actually, another 40 percent of firms in the sample started before 1992, but they may have changed names or registration codes or were not included in the available databases, and so cannot be traced back to the Soviet period. This is classic problem in constructing this type of panel data.

the sample or the subsample could be different (but testing or controlling for this censored data issue would require additional data collection outside the scope of this analysis).<sup>8</sup>

Total employment trended downward through the transformation period: the subsample had 40 percent fewer employees in 2004 than in 1991. Almost three-quarters of the firms (72 percent) lost jobs, and about a quarter (28 percent) increased employment or kept it at the same level. In a market economy, a firm’s ability to keep or increase employment over a long period of time may be looked on as an indicator of competitiveness, and the factors underlying such competitiveness are worth investigating. Following the terminology in some of the literature (Blanchflower and Burgess 1996), firms with lower employment are “job-destroyers,” and those with higher employment, “job-creators.”

Job-creators as a group generated additional employment even in the first half of the 1990s, when the economy was in recession, and faster in the 2000–04 period of fast growth (table 2.3). Job destruction was more common for larger enterprises, job creation, for smaller ones. At the beginning of the transition in 1991 the average employment was 1,417 in the job-destroying firms, 441 in the job-creating group. By 2004, average employment was 722 and 658, respectively. The declines and increases in employment depended strongly on the sector and industry. In the food industry 58 percent of firms were job-creators, compared with only 8 percent in textiles. In the rest of industry the share of job-creators varied less: from 14 percent in machinery to 23 percent in the wood industry.

**Table 2.3 Net employment growth in job-creating firms and job-destroying firms, 1991–2004**  
(percent)

<i>Group</i>	<i>1991–95</i>	<i>1995–2000</i>	<i>2000–04</i>
Job-destroying firms	70.1	83.4	80.4
Job-creating firms	104.7	112.0	138.8

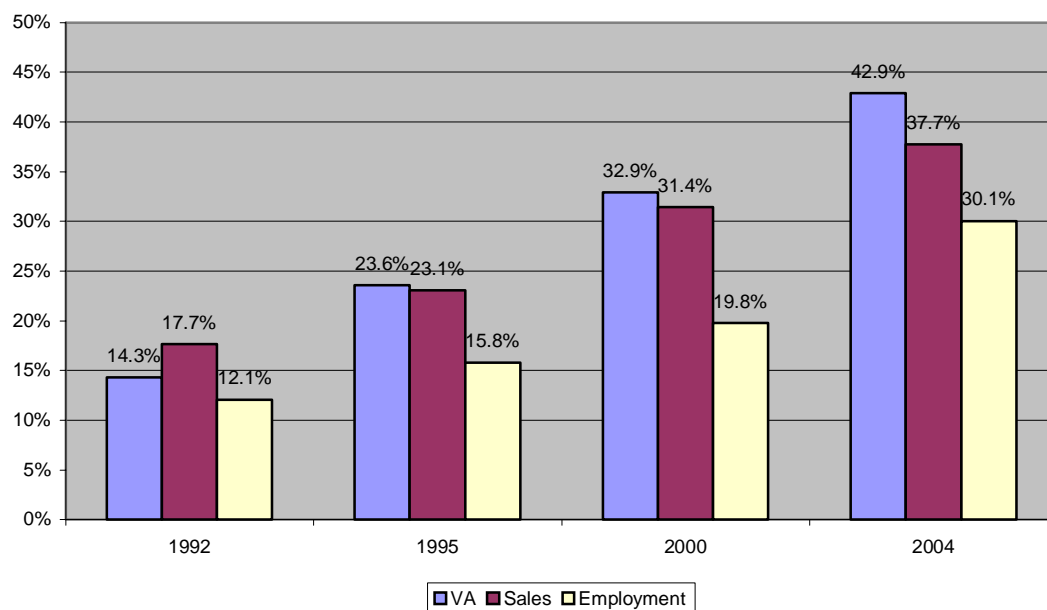
Initially, the smaller job-creating firms were nevertheless more “capitalized,” with a ratio of fixed assets to labor on average 1.4 times higher in 1991. This may be an indication not only of more fixed capital but also newer and better capital. The difference became smaller during the transition but was still 1.2 in 2004. Since employment in the job-creators’ group grew significantly, the difference would indicate that job-creating firms were more active in making new investments as well. The capital-labor ratio for job-creators in 2004 was slightly higher than that for new firms (those that report having begun production after 1992).

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<sup>8</sup> One way to collect this data would be to construct a sample representative of large and medium manufacturing firms in the base year, large enough to include a sizable proportion or all 409 firms in the LME survey used in the present analysis. Then, by tracing the evolution of these firms forward, it would be possible to identify the characteristics of exiting firms and to use this information to control for censored data. For a discussion of different approaches to collecting and constructing datasets for firm dynamics studies, which compares the LME dataset with other types of firm-level data, see Haltiwanger and Schweiger (2004). A recent example of this kind of study is Scarpetta, Hemmings, Tressel, and Woo (2002).

The data on productivity for both groups suggests that Russian manufacturing went through “creative destruction,” in the sense that net job creation occurred in more productive enterprises. It is worth noting that the productivity of job-creating firms increased during the transition. Labor productivity (measured by value added per employee) was 20 percent higher in job-creating firms in 1992 than in job-destroying ones. By 2000 it was 56 percent higher, and in 2004 it remained 57 percent higher. Redistribution of employment in favor of more productive enterprises resulted in significant growth of their share in total sales: in 1992, when job-creators produced 17 percent of total output. In 2004 their share more than doubled to 37 percent, while their share in employment grew from 12 percent to 30 percent (figure 2.9). The employment share of job-creating firms grew less rapidly than their share of value added produced but more than their share in total output.

**Figure 2.9 Contribution of job-creating firms to total sales, employment, and value added, 1992–2004**



Source: Rosstat. Statistical Annual.

The “creative destruction” story has another side, however. Did the destruction of jobs in job-destroyers lead them to become more productive? On the whole, no. Despite job cuts, they did not manage to increase their productivity up to the average. In 2004, labor productivity in job-destroying firms (value added per employee) was still 25 percent lower than the sample average and almost 60 percent lower than that in job-creating firms. This does not mean that cutting labor cannot help in increasing productivity. About 27 percent of job-destroying firms increased their productivity over the sample average, and more than 40 percent of them had labor productivity above the industrial average. But for 60 percent of firms in this group, downsizing did not help much. There is also a group of evident outliers with productivity almost three times lower than average. This group is not small—16 percent of the sample, accounting for 11 percent of employment.

As we saw, the likelihood that a firm will create jobs in the long run depends in large part on its sector and on its endowment of capital inherited from the Soviet era. The trends for the capital-labor ratio indicate that job-creating firms are also more active in making investments, allowing them to keep their leadership in capital-labor ratios, despite increases in employment. Overall, labor resources were redistributed in the right directions during the transition—from less to more productive enterprises, a reallocation that contributed to productivity growth in manufacturing. But downsizing, a passive adjustment strategy, did not lead to productivity improvements in 60 percent of firms. As a result, about 16 percent of the surveyed enterprises and 40 percent of firms traced to the pre-reform period are still falling behind, and the gap between this group and the rest of the industry is widening.

## **INDUSTRIAL HETEROGENEITY**

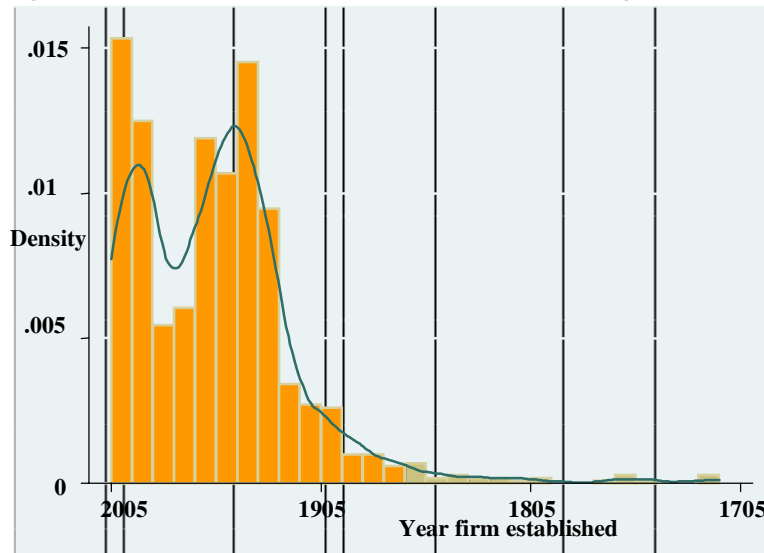
The 2008 CEM for Russia argues that reallocations of resources between incumbent firms and newer, more productive firms in leading sectors of the economy would be the major source of future productivity improvements. Restructuring and the entry of competitive firms would drive this intrasectoral reallocation forward.<sup>9</sup> In this section we use the LME survey to investigate the heterogeneity of newer and older firms in productivity and in other characteristics. The objective is to characterize the nature and strength of the links between firm age and productivity.

The LME sample of medium and large manufacturing firms (see the annex) consists of two main groups of firms, new entrants during the transition and incumbent firms established in the Soviet era (figure 2.10). There is also a third, smaller group, of firms that date to before the 20th century. A statistical description of this age profile would note bimodal distribution that peaks in early 1990s and the mid-20th century, with a fat tail. The origins of each of these waves of industrial entry reflect marked shifts in the economic system and the industrial policy. Some caution is needed on the year of establishment, as some factories may have been constructed in the 19th century but managers reported a more recent (but still Soviet) date.

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<sup>9</sup> The CEM (World Bank 2005b, p. 77) advances the following idea about the heterogeneity of productivity across Russian firms: “Given that the productivity improvements in Russia are likely to continue to be located within sectors, further restructuring within the largest sectors is crucial to unlocking growth. Russia’s development, like that of other transition economies, will probably be dominated by competition between new, initially small and medium-size, but highly productive, enterprises and old enterprises inherited from the previous system, with lower value added per worker and often in need of downsizing.”

**Figure 2.10 Waves of firm creation in Russian manufacturing, 1705–2005**

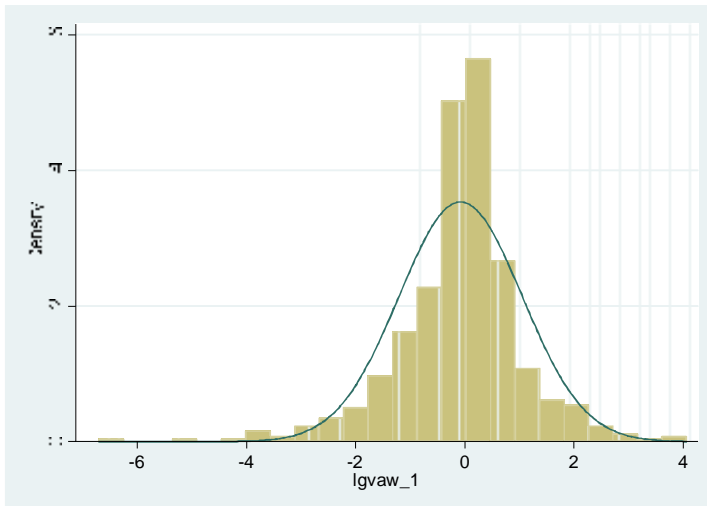


Source: LME survey.

The productivity of enterprises in the sample (measured by value added per worker) has a much more regular profile, approximately log normal (figure 2.11).<sup>10</sup> This implies that, while there is a great deal of heterogeneity in the productivity of Russian manufacturing firms, there are no distinct industrial clusters with different average productivities. Indeed, many other firm characteristics are also distributed as a log normal, including the size of the firm's workforce, the size of the investments in fixed capital assets (or also in machinery and equipment), the proportion of employees having attained a higher educational degree, and the amounts spent on R&D (see the annex).

<sup>10</sup>That is, it is a continuous distribution in which the logarithm of productivity has a normal distribution.

**Figure 2.11 Labor productivity in Russian manufacturing**



Source: LME survey.

Having found that labor productivity is approximately log normal, we now check whether younger firms entering during the transition are more productive than the incumbents from the Soviet and Tsarist era. To test this hypothesis, we compare the labor productivity distributions for the firms established before and after 1990.<sup>11</sup> They are not significantly different. But one has to interpret this result with care because the sample does not include small manufacturing firms, arguably the new entrants into sectors with higher productivity. In addition, most or nearly all firms in the sample are privatized firms, and very few are new private firms.

Because of the relationship between firm age, size, and productivity, it is not clear that newer firms will be more productive than older firms. The reason is that labor productivity is closely connected to firm size—larger firms are more capital intensive and thus would have higher labor productivity. And as older firms tend to be large, a new firm may have higher labor productivity than an older firm of the same size, but the average new firm is likely to have lower labor productivity than the average old firm.<sup>12</sup>

The analysis here does not support the hypothesis that the productivity profile is different for older and newer firms. In other words, the waves of Russian manufacturing firms entering at different periods are characterized by labor productivity distributions that are statistically indistinguishable. Because of this, we believe that it is a reasonable approximation to frame the policy discussion in terms of measures that can support an “average” manufacturing firm as

<sup>11</sup> This is corroborated by the *Kolmogorov–Smirnov* statistic that tests for the equality between two distribution functions.

<sup>12</sup> In annex table A3.7, we find that the dummy variable designating firms established after 1992 and with no share of common stock owned by the government is not significantly correlated with the likelihood to engage in R&D. Similarly, tables A3.2 and A3.3 indicate no significant correlation with the probability of introducing a new product or technology.

opposed to a target group with precise characteristics, though some selection problems and biases are mentioned.<sup>13</sup>

## **THE DETERMINANTS OF PRODUCTIVITY GROWTH**

After 15 years of transformation, the Russian productivity gap today cannot be explained simply by reference to transition shocks or the inefficiencies inherited from the Soviet period. The relatively low productivity in Russia is even more puzzling in light of rich natural resources and rich human capital, with an educated labor force and a history of major scientific and technological advances.

### **ABSORPTION AND R&D EXPENDITURE**

Much micro and macro evidence now exists on the links between innovative activity, R&D expenditure, and productivity growth. Another link that is relevant for this study concerns the relationship between trade and absorption: openness to trade is particularly important in facilitating the transfer of technology between developed, middle income, and developing countries (chapter 3).

Not surprisingly, micro data for Russia indicate a clear correlation between innovative activity by firms and their productivity levels and growth. The Russia LME Survey of approximately 1,000 medium and large manufacturing firms collected information on a variety of measures of innovative activity: introduction of products and technology, acquisition of new technology, R&D expenditures, and so on. Simple log-linear estimations show that innovative activity, however measured, tends to be associated with firms that have high or growing levels of TFP—indeed with firms that are employing growing numbers of workers or that are investing and expanding their levels of fixed capital (see the appendix for details).

The puzzle in Russia is not absence of a connection between technology adoption and growth at the micro level, but in the low productivity of the Russian R&D sector. Simply put, although Russia has a large R&D sector, its output is unimpressive. Despite devoting significant resources at the aggregate level to R&D and innovative activity, Russia's current record of knowledge absorption is weak. And as shown above it has not translated into higher levels of TFP.

The Soviet R&D inheritance should have been a blessing. Russia started the transition with a large R&D sector by international standards and with a history of major technological achievements in the space program and military technology. UNESCO figures for the USSR in 1990 show the vast inputs devoted to R&D: spending of more than 5 percent of GDP and close to 6,000 researchers per million population. Both measures of inputs are double what is found today in the advanced and technology-intensive economies of Germany and South Korea (figure 2.12).

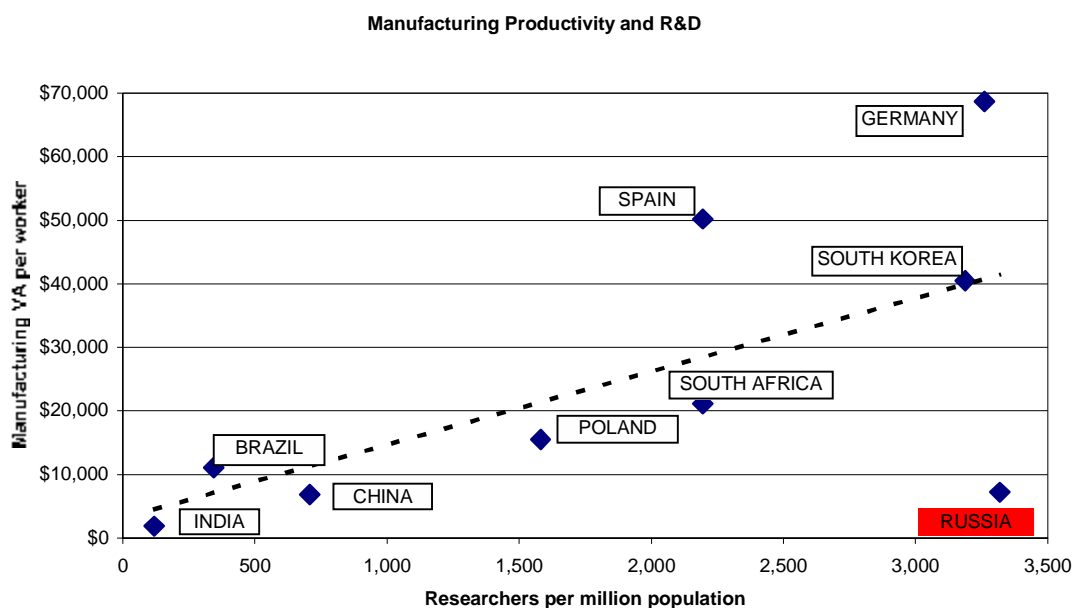
Despite a significant decline of the R&D sector during the transition, the scale of inputs into R&D activity in Russia is still substantial. The number of researchers per million population has halved, but this takes Russia down only to the internationally high levels of Germany and South

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<sup>13</sup> For example, the discussion of matching grants outlines general principles for program design that do not explicitly target specific groups of firms, but it also pays attention to selection problems that could lead to wastage and crowding-out of R&D and how they could be resolved.

Korea. Spending on R&D has fallen substantially, to about 1 percent of GDP, but this is still above the levels observed in most of the other BRICS countries or the EU8. The definition of R&D inputs in these international comparisons tends to understate the scale of R&D activity because it cannot fully capture the inputs devoted to imitating and adopting new technologies (Keller 2004).

**Figure 2.12: Manufacturing value added per worker and researchers per million population**



Source: World Bank (2006e) and OECD (2005b)

The coexistence of a large R&D sphere and low productivity in manufacturing indicates either low productivity in R&D institutions or weak links between R&D and the economy. Some evidence supports the first hypothesis (see table A2.1 in the annex). The number of scientific publications per thousand researchers in Russia is about the same as in China—around 30—but significantly lower than in the other comparator countries. Researchers in Poland, India, Brazil, and South Korea are generating 2–3 times more scientific publications per person, and German and Spanish researchers about 6 times more.

A very similar picture emerges with another indicator of the productivity of R&D spending—the number of U.S. patents per thousand of researchers (Jaffe and Trajtenberg 2002). Russia is at the same level as China and Poland, but Spanish researchers generate almost 10 times more patents per person, Korean researchers 60 times more, and German researchers 100 times more. The second hypothesis—poor links between R&D expenditure and industry—is also supported by the evidence, in this case by the high share of state financed R&D expenditure and very low R&D activity at the firm level (OECD 2005b).

### **Box 2.2 Productivity, absorption, skills, and the investment climate—findings and methodological Issues**

The estimation methodology uses simple log-linear equations to test for the correlation between measures of innovative activity and measures of productivity and growth. The correlations reported include several key characteristics of firms known to be related to productivity and growth from other studies. These include size, ownership (new firm established after 1991—the dataset includes virtually no state-owned enterprises), export activity, and regional characteristics. The regression results are shown in table A2.1 in the annex.

The findings can be summarized as follows. First, absorptive activity, however measured, is basically uncorrelated with TFP (column 1, when TFP is estimated using the log of VA, and column 3, when TFP is estimated using the log of sales), where TFP is productivity after accounting for capital and labor inputs. The exception is R&D spending, positively though not robustly correlated with higher TFP. This result is supported by work done on other countries. Wiesner (2005) shows that R&D activities are an important factor in explaining productivity growth for OECD countries. He further suggests that the elasticities of total factor productivity to R&D are lower in Europe and Japan than in the United States, suggesting a more efficient use of R&D capital in the United States, the existence of greater enabling institutions, or both. The failure to find a correlation between innovative activity and TFP is essentially a multicollinearity problem. Innovative activity is strongly and positively correlated both with the capital-labor ratio (column 5), and with labor productivity (columns 2 and 4). In essence, firms that are absorbing and creating products and technology are also firms with lots of fixed capital, and after accounting for the endowment of fixed capital, there is little for absorption to explain. This may be either a measurement problem (measuring the flow of capital services is notoriously difficult, measuring R&D activity even harder) or a kind of double-counting problem (many of the R&D activity measures in the LME Survey imply fixed investment, which is also captured in the fixed capital measure).

The findings for training measures are similar but stronger; the difference is that the multicollinearity problem is lower or absent. Training measures are positively correlated with both TFP and labor productivity—and positively correlated with the capital-labor ratio. The explanation may lie in how labor and capital inputs are measured. Labor is measured in numbers of people, so there is no correction for “labor quality.” Fixed capital, by contrast, is measured by value, so high quality capital gets a larger value than low quality capital. Since quality is not captured by our labor input measure, there is an observed relationship between labor quality (skills) and TFP.

The picture is similar for growth of TFP, inputs, and output (columns 6–9). Most knowledge absorption measures are uncorrelated with TFP growth. Only a few are positively correlated, and even then the statistical significance is not great. But absorption is positively correlated with the growth of both inputs and output: employment growth, growth of fixed capital (investment), and growth of sales. This can again be interpreted as a kind of multicollinearity problem, as absorption activities are correlated with measures of growth of inputs and output, but not with the residual (TFP). The results for training measures are complementary: they are correlated with growth in sales and especially employment.

The findings for size (SME dummy) and new private ownership complement this picture. Smaller firms have lower labor productivity levels, but this is driven by their lower capital intensity. Thus when a TFP equation includes a measure of fixed capital, the TFP levels of SMEs are not significantly lower than those for larger firms. New private firms are also less capital intensive than privatized firms, but they do not have lower labor productivity, and their TFP, after accounting for labor inputs, is higher.

SMEs are shrinking rapidly in both inputs and output, so their TFP growth is only modestly lower than that of larger firms. New private firms are growing somewhat faster than privatized firms in terms of outputs but not inputs, but the difference is not great, so their TFP growth is no faster. Export activity is not associated with higher TFP; exporting firms are capital intensive, and this explains their higher labor productivity. Interestingly, firms growing in both TFP and sales are the ones exporting to developing countries rather than to the developed West or the Commonwealth of Independent States.

Finally, there is a very strong relationship between city type (national or oblast capital, or city size) and productivity: firms in the large cities have much higher levels of productivity. This is true of TFP, labor productivity, and capital intensity. Moving to growth, however, the city type/population relationships disappear. Roughly speaking, the duality gap between big-advanced and small-backward cities isn't changing: low productivity firms in the smaller cities and rural areas are not falling farther behind firms in the major cities and capitals, but they aren't catching up either.

The regional investment climate (IC) risk measure, from an external source ([www.raexpert.ru](http://www.raexpert.ru)), captures a single classification (low, medium, high). The IC risk measure is strongly negatively correlated with productivity (a move up one category is associated with 20 percent lower productivity). The IC risk measure is not (as may have been supposed) correlated with other characteristics of firms, such as industry and size, that also influence productivity. The industrial structure of the sample as well as the average size of firms are very similar in groups of regions with different risks.

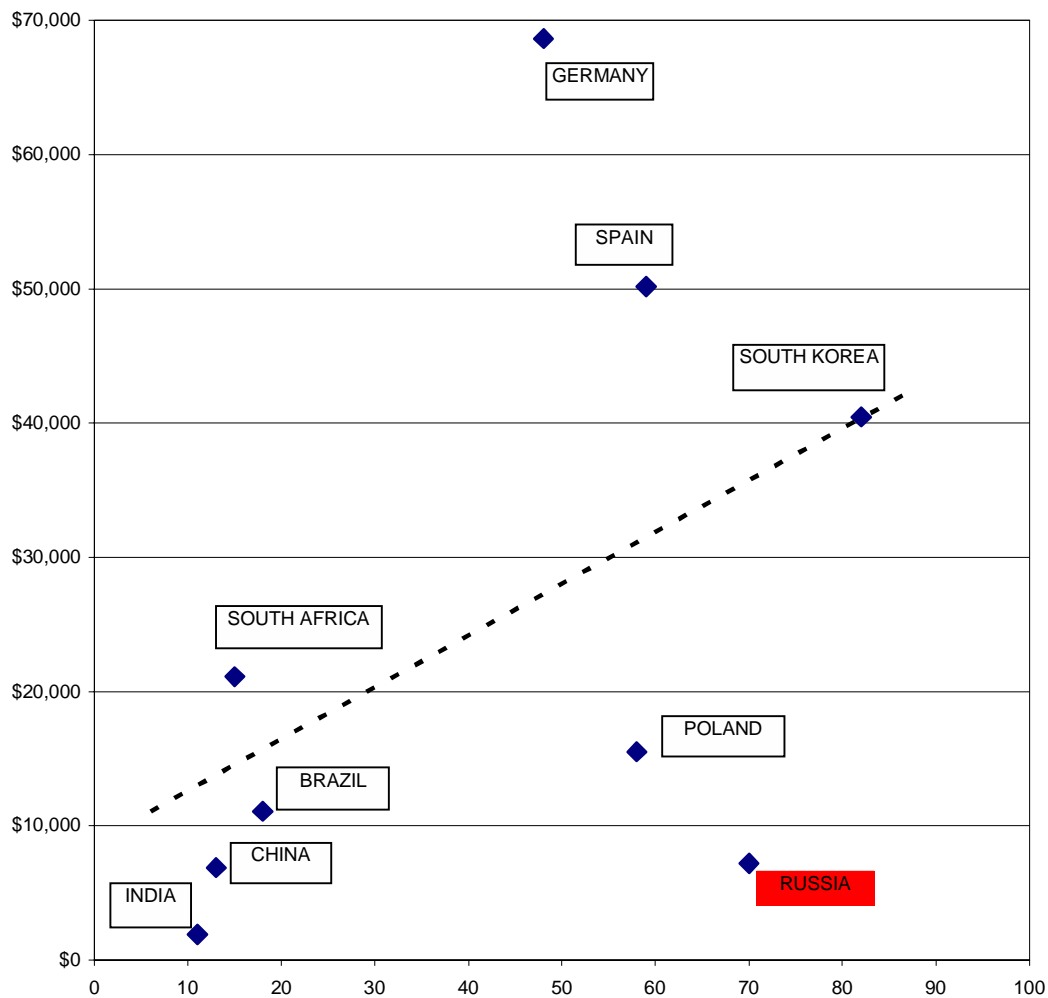
## **SKILLS AND HUMAN CAPITAL**

There is now a wide consensus on the role and importance of human capital in the generation of economic and productivity growth. A considerable amount of research since the late 1980s has explored this connection (see Krueger and Lindahl (2001) for a recent review). The connection is evident in the Russia LME Survey as well. Using the same methodology as above for R&D activity, the data show that firms with formal training programs—and a greater percentage of the workforce with higher education—have higher productivity. The differences are large and significant. Either a 20 percentage point difference in the share of employees with higher education or the existence of a formal training program is associated with 25 percent higher TFP (see the annex table A.2.1 for further details).

As with R&D expenditure, the puzzle is not the connection between human capital, skills, and productivity at the micro level—it is how Russia compares at the macro level. Enrollment rates in formal education in Russia are at least as high as in the developed countries, not only in coverage by secondary school education but also in higher education enrollment. A very large portion of Russian students complete some form of university education—in the set of comparator countries considered here, only South Korea sends more students to universities. The same picture emerges when considering workforce education and skills: across the comparator countries the micro-level BEEPS-Enterprise surveys show that Russian manufacturing firms have the most employees with higher education, the most managers with a university or higher degree, and skilled labor forces comparable to those in the leading countries used for benchmarking.

But this higher level of skills and education in Russia is not being transformed into higher productivity. Russia is a clear outlier: other countries have either high productivity and a highly educated population, or low productivity and a less educated population (figure 2.13). Russia (and to less extent Poland, which is emerging from a similar economic system) combines high levels of skills and education with low levels of productivity.

**Figure 2.13 Enrollment in higher education and value added per employee in manufacturing**



Source: Enrollment: UNESCO, Eurostat, European Commission. Value added per employee: table 2.2.

The lack of a correlation between education and productivity in Russia is due to several factors. First, formal education indicators do not reflect actual qualifications and skill levels. Second, the Russian labor force is in some sense overqualified for the jobs that educated persons occupy—too many resources are going into producing skills and education that are not suitable for a low-productivity emerging economy. Third, the labor force training institutions are relatively ineffective—more suitable for generating workers for the centrally planned economy than for imparting skills for a dynamic market economy (chapter 4).

## INVESTMENT CLIMATE

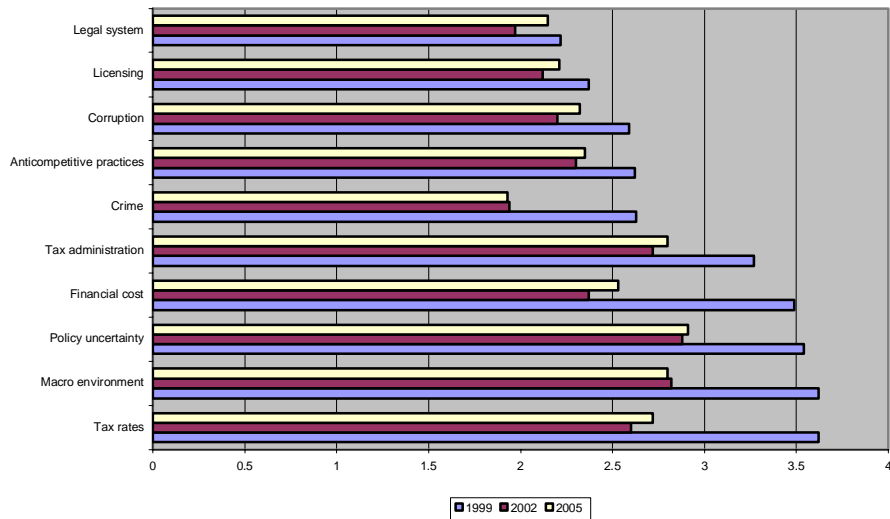
If Russia is pursuing innovative activity on a large scale and has a highly educated work force, why isn't productivity higher? One answer is obvious: the R&D and human capital capacities are ineffective because they are deployed in a weak investment climate with ineffective economic institutions.

The investment climate has many aspects, and measuring the quality of this climate is challenging, particularly across countries. The analysis here exploits the large-scale data collection for the BEEPS-Enterprise surveys and uses a standard section in the questionnaires. Managers were asked about the constraints facing their businesses in access to infrastructure, state regulations, macroeconomic stability, legal system, corruption, and so on. The results reported here refer to manufacturing firms only. A full set of comparisons is reported in the annex and includes regression analysis of the relative importance of different investment climate constraints in the selected countries (chapter 5).

A very useful feature of the data is that they include results for three separate surveys conducted in Russia in 1999, 2002, and 2005. This allows an assessment of changes in the investment climate from the aftermath of the financial crisis of 1998 to the current period. Since 1999 the business environment in Russia has, in the perceptions of managers, improved significantly (figure 2.14). Some of the changes are natural consequences of the economic growth in the recovery period (access to finance, macroeconomic environment). And some are due to economic reform (tax burden, licensing) and better state regulation. But most successes were achieved between 1999 and 2002. From 2002 to 2005 the situation changed little or even deteriorated. The danger here is that favorable improvements in the macroeconomic situation and in government finances may have led the government to reduce the priority given to improving the business climate further.

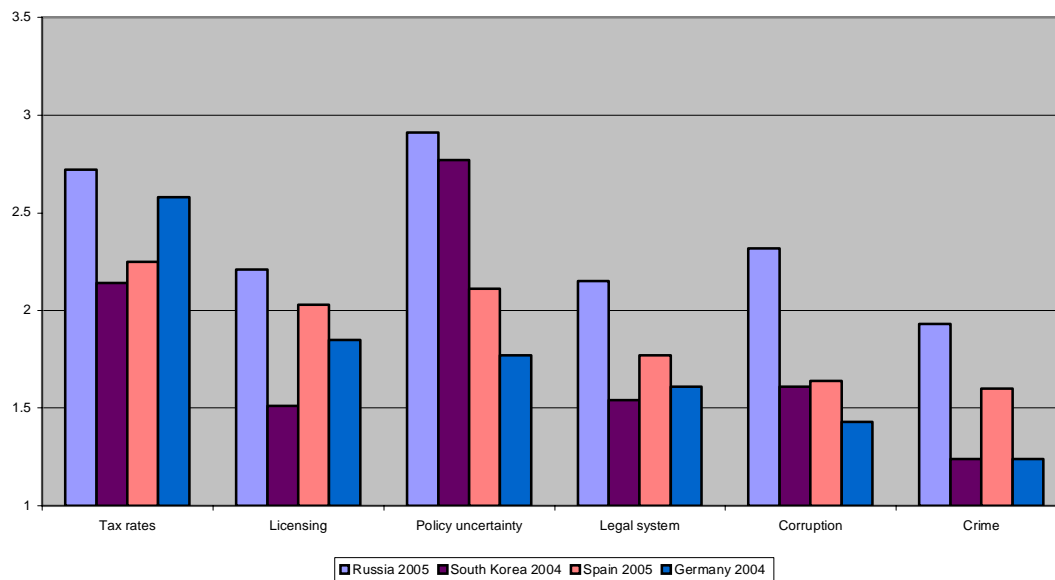
This is a serious problem. Comparisons with other countries show that Russia still has a long way to go: the Russian business environment in many aspects is significantly worse than in the most developed benchmark countries (South Korea, Spain, Germany). The most serious gaps between Russia and these countries concern the effectiveness of the legal system, corruption, crime, and political stability (figure 2.15).

**Figure 2.14 Changes in the severity of investment climate constraints in Russia since 1999**  
*(1=not an obstacle 4=major obstacle)*



Source: Annex table A2.4.

**Figure 2.15 Indicators for selected investment climate constraints: Russia and developed economies**



Source: BEEPS.

Compared with the poorer but rapidly growing BRICS countries, the Russian investment climate presents a mixed picture. Access to infrastructure—electricity, telecoms, transport—is less of an obstacle in Russia than in India and China (see annex table A2.3). This is expected, given that these two countries are still largely agricultural, whereas Russia has been largely industrial for many years. But Russian firms cite policy uncertainty and tax administration as bigger problems than their Indian and Chinese counterparts (chapter 5).

## CONCLUSIONS

Russian productivity has been growing steadily since 1999—but from a very low level, especially in manufacturing. The sources of productivity and output growth lay in the sharp devaluation of the ruble in 1998, in the decline of non-payments and barter, in the growth of capacity utilization, and in the contraction of the informal shadow economy. These factors were transient, so the growth they supported may not be sustainable. Productivity in Russian manufacturing is lower than in most BRICS countries and uncompetitive because of rising real and dollar wages. This lack of competitiveness is very visible in the structure of Russian exports. While very much a part of the global economy, as evidenced by its high ratio of trade to GDP, manufacturing produces mostly for the internal Russian market. Exports consist largely of fuel (oil and gas) and raw materials, and manufacturing exports as a share of GDP are very low by the standards of either other major emerging economies or developed market economies.

The paradox is that productivity in Russia is very low despite the significant resources devoted to R&D and to education and training of the workforce. The scale of inputs devoted to these activities is as high as that observed in the leading industrial countries. But the result is productivity below that of most BRICS countries and far from that in the leaders.

The investment climate, measured directly by surveys of managers, points to major improvements since the surveys started in 1999. Most of these improvements were, however, experienced in the immediate post-crisis period, and the rate of improvement between 2002 and the most recent survey in 2005 ranges from small to negligible or even negative. The overall quality of the investment climate is much worse than in the developed countries—and overall no better than in the poorer developing countries.