

MISSILE CITIES

10. MIGRATION AS A FACTOR IN THE EVOLUTION OF MISSILE CITIES

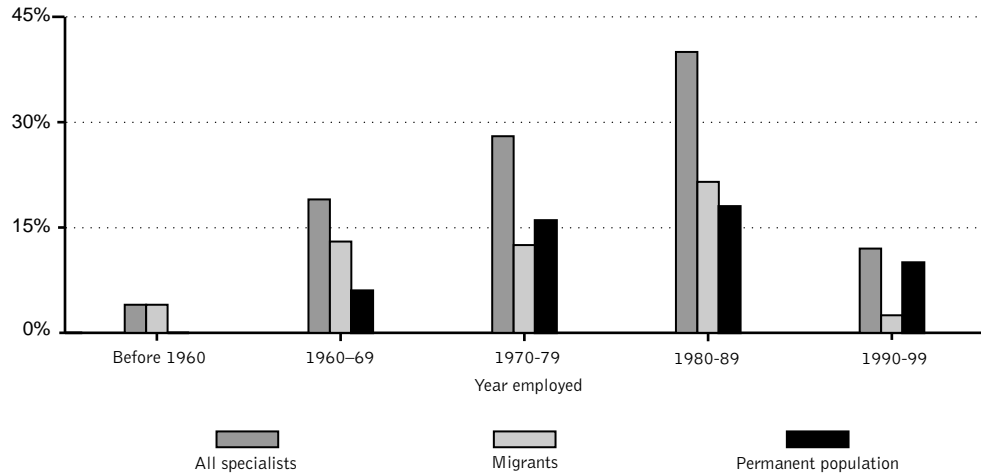
10.1. Migrant¹ Specialists in Missile Cities: Changing Numbers

The evolution of the Russian missile industry has been anything but uniform. Its development included a period of gestation and rapid growth from the late 1940s to the early 1970s. As international tensions eased in the 1970s and arms control agreements influenced the rates of missile production, growth in the missile industries slowed. The industry entered an unprecedented period in the 1990s, however, with the collapse of the USSR and the related economic depression, the effects of which persist to this day. In the 1990s, the industry's employment fell drastically, owing to both insufficient government funding and retrenchments and to the creation of new opportunities in private enterprises in which specialists could earn much more than in government projects.

1. As in our analysis of migratory processes in closed cities, we divide all specialists into migrants and permanent residents of missile cities. Migrants moving into missile cities are those specialists who graduated from colleges and universities outside the missile city and made a deliberate, independent decision to work in missile cities. Migrants include local residents who studied outside the missile cities and outsiders. Local residents include those born in missile cities plus those born outside who moved to missile cities as children with their parents, that is, never selected their present residence in a deliberate, independent manner. By outsiders, we mean those born outside missile cities who moved in after graduation. Permanent residents of missile cities are local residents who graduated from colleges and universities in the missile cities themselves. Such categorization presumes that migration is treated not merely as a change of residence, but rather as an independent, deliberate choice to relocate.

This developmental history of the missile industry is manifest in its hiring profile (figure 10-1).

Figure 10-1. Migrants vs. permanent residents taking jobs in missile cities, % of the survey sample



Thus migration of specialists into missile cities peaked in the 1980s and then started to decline. As the number of migrants working in the missile cities began to decline, the number of permanent resident specialists being hired there increased. Growth in resident hiring slowed noticeably in the 1990s, which witnessed a dramatic overall drop in the number of specialists employed at the surveyed enterprises, reversing the trend of the 1980s. Thus, the 1990s represented a profound crisis in the civilian and military rocket industries alike.

10.2. Migrants vs. Permanent Residents of Missile Cities

The impact of migration on the profile of specialists hired is most obvious in the changing ratio of permanent residents to migrants throughout the development of the missile cities (table 10-1).

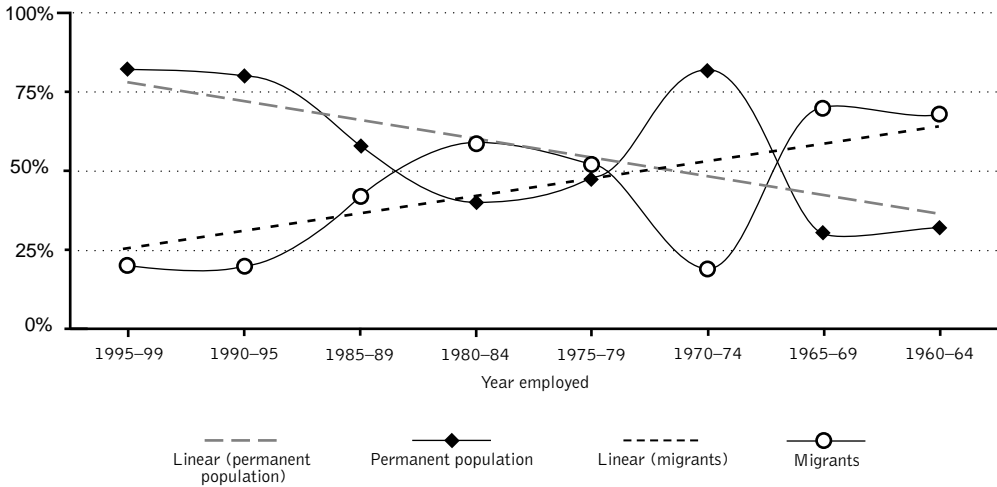
Table 10-1. Migrants vs. permanent residents of missile cities, time profile, %

YEAR EMPLOYED IN MISSILE CITY JOB	SPECIALIST GROUPS		ALL SPECIALISTS
	Permanent residents	Migrants	
1990-99	81	19	100
1980-89	47	53	100
1970-79	57	43	100
1960-69	30	70	100
Total sampling	49	51	100

Currently, there is virtual parity in the number of migrants and permanent resident specialists employed by missile city enterprises, although one can see a trend toward a growing share of permanent residents among new employees.

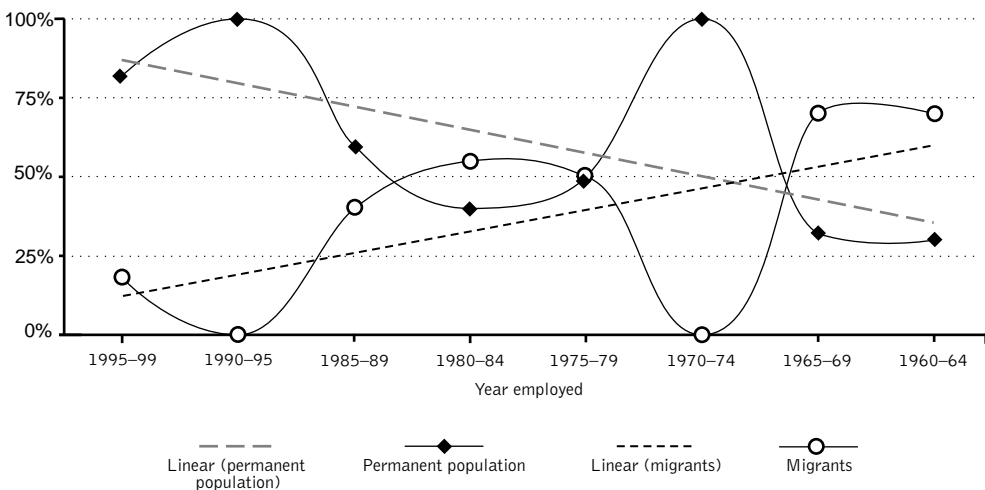
Figure 10-2 depicts this process in greater detail, illustrating the generally downward trend in the number of migrants employed.

Figure 10-2. Migrants vs. permanent residents of missile cities, %



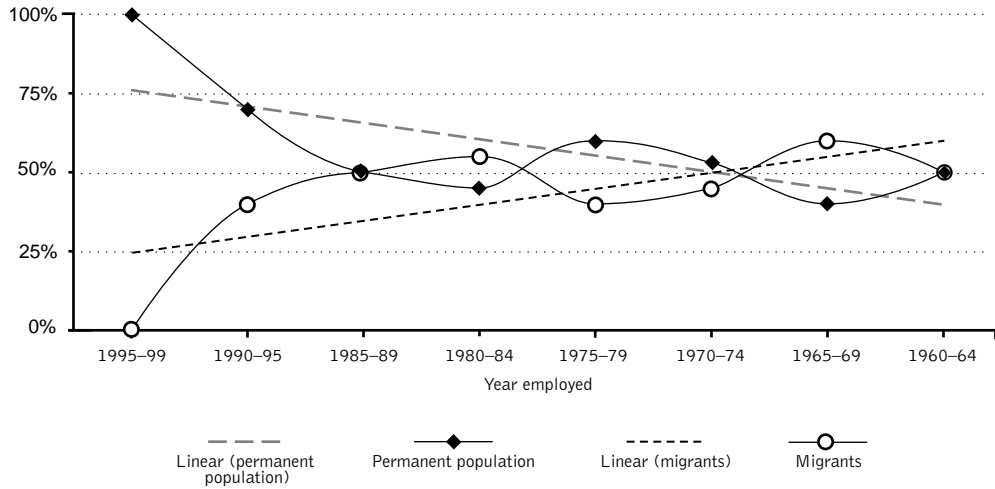
In addition to fluctuations in hiring patterns throughout the missile industry, research has uncovered divergent hiring patterns in different cities (figures 10-3 and 10-4).

Figure 10-3. Korolev: permanent residents vs. migrants, %



In Korolev (fig. 10-3) and Votkinsk, there was a persistent upward trend in the percentage of permanent residents hired over time. In Miass (pronounced 'me-U's'), by contrast, the overwhelming majority of specialists are migrants (fig. 10-4).

Figure 10-4. Miass: Permanent residents vs. migrants, %



10.3. Structure of Migratory Inflows to Missile Cities

According to our definition, specialist migration into missile cities is composed of two groups: local residents and outsiders (table 10-2).

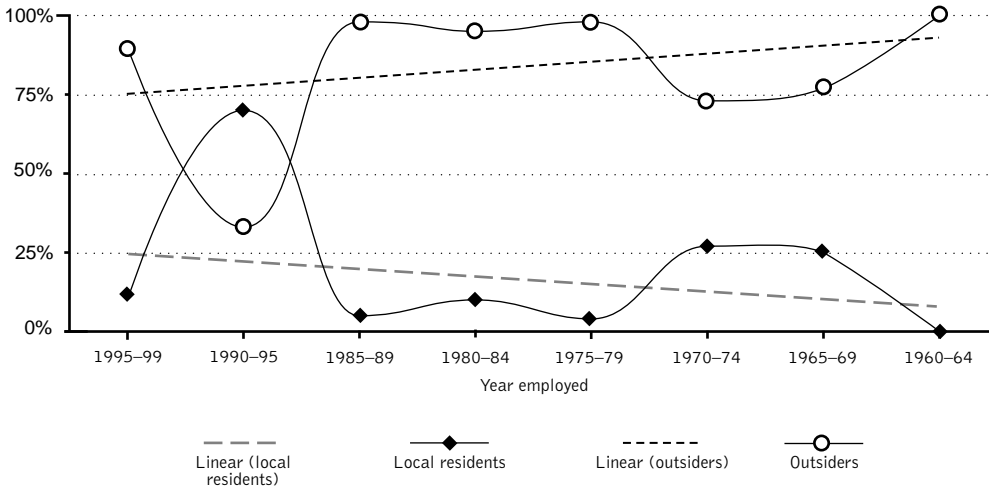
Table 10-2. Specialists' migration flow for surveyed cities, time profile, %

YEAR EMPLOYED IN MISSILE CITY JOB	LOCAL RESIDENTS	OUTSIDERS
1990-99	29	71
1980-89	6	94
1970-79	6	94
1960-69	14	86
Total sampling	8	92

In addition to the dramatically lower percentage of migrants taking jobs in missile cities in the 1990s, changes are also affecting migration flow. Whereas in the 1970s and 1980s the percentage of returning local residents working in the cities remained effectively stable at 5 percent, in the 1990s local residents accounted for almost one-third of total migration to the missile cities.

Figure 10-5 details the shift in balance from outsider to local residents in migration to the missile cities. Moreover, the figures show that the trend toward a higher share of local residents is accelerating, the most significant changes taking place in the 1990s.

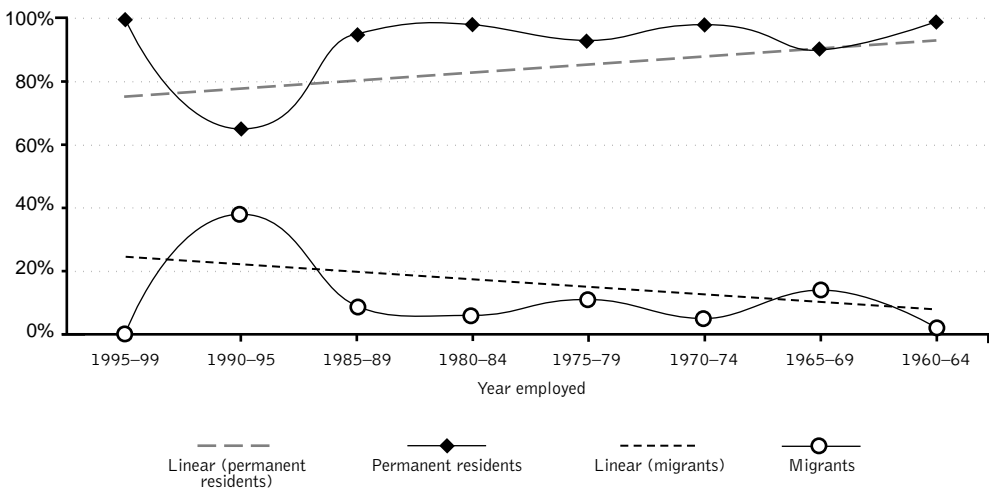
Figure 10-5. Migration to missile cities: Local residents vs. outsiders, %



The lower share of outsiders in the migration flow may be due in part to the unavailability of proper housing in the missile enterprises. At best, outsiders moving to the cities can expect to find housing in hostel facilities, as wages at enterprises are simply too low to cover the cost of renting a house. This inconvenience substantially dissuades many outsiders from accepting employment in the missile enterprises.

Because local residents are divided into migrants and permanent residents depending on where they were educated, it is useful to consider the changing mix of local residents (fig. 10-6).

Figure 10-6. Local residents: Permanent residents vs. migrants, %



As the figure illustrates, a small number of local residents return to find employment in the missile cities after receiving their education elsewhere. Moreover, this percentage is decreasing. This suggests that local residents, forgoing an opportunity to study elsewhere, are increasingly choosing to pursue their education in the missile cities. This decision may have something to do with cost considerations, as the costs of an education outside missile cities can be prohibitive. Expenses, including travel, room and board, and tuition, are generally beyond the economic means of most families in the missile cities. Therefore, fewer local residents leave missile cities to obtain specialized education.

10.4. Local Residents' Role in Providing Specialist Personnel to Missile Cities

We have already seen that local residents are playing an increasingly significant role in the cities' employment patterns. Table 10-3 shows the outcome of such a process, that is, the makeup of newly hired personnel in terms of local residents versus outsiders.

Table 10-3. Specialists taking jobs in missile cities: Local residents vs. outsiders, %

YEAR EMPLOYED	LOCAL RESIDENTS	OUTSIDERS
1990-99	87	13
1980-89	50	50
1970-79	60	40
1960-69	40	60
Total sampling	53	47

Thus, the 1990s witnessed a sea change in the makeup of specialist personnel in missile cities. Today, almost 90 percent of newly hired specialists are local residents, contrasting with the 1970s and the 1980s, when local residents accounted for only 50 percent to 60 percent of all new specialists hired. This trend is also manifest in individual cities (figs. 10-7, 10-8, 10-9).

Figure 10-7. Korolev: Newly hired personnel: Local residents vs. outsiders, %

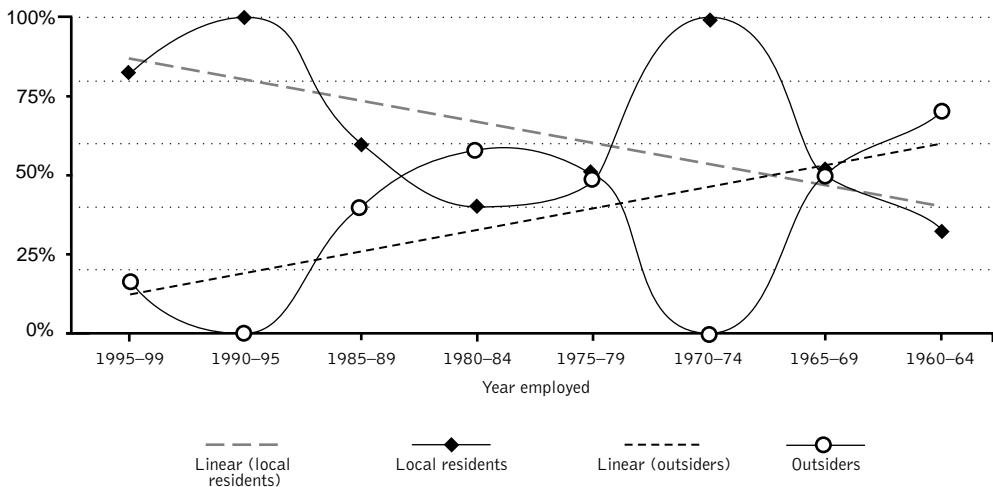


Figure 10-8. Miass: Newly hired personnel: Local residents vs. outsiders, %

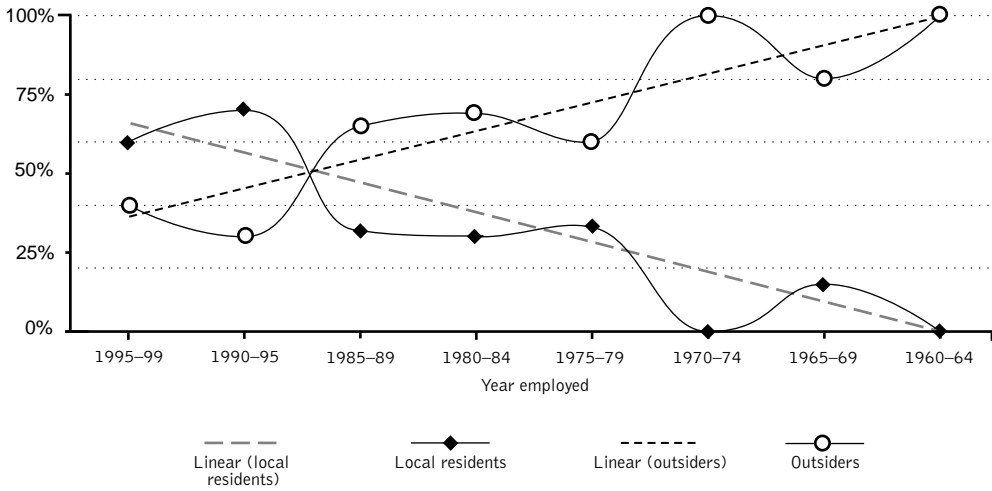


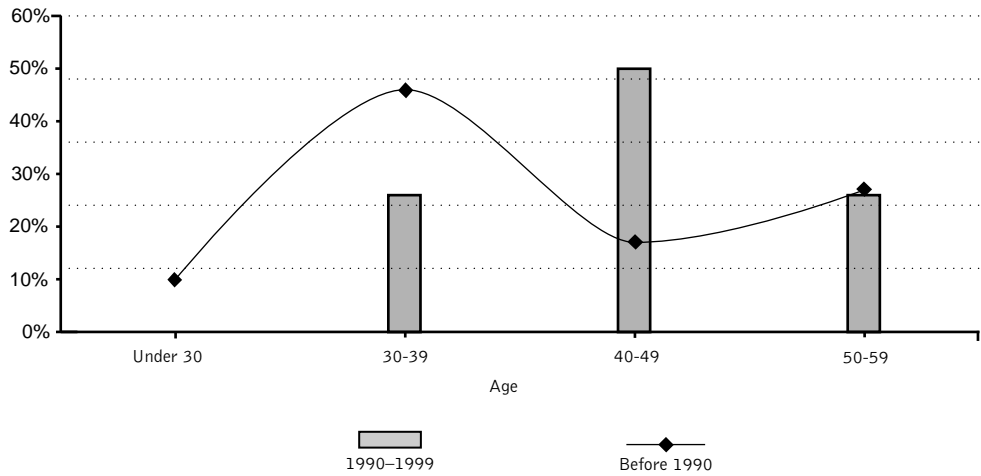
Figure 10-9. Votkinsk: Newly hired personnel: Local residents vs. outsiders, %



11. SPECIALISTS' QUALIFICATIONS

11.1. Changes Affecting Highly Trained Personnel

In the 1990s, some adverse developments affected the best-qualified personnel, and consequently interest in missile-related graduate degree programs has been declining. Only one-fourth of those with postgraduate degrees obtained those degrees in the past decade, mostly prior to 1995. In addition, the average age at which students acquire advanced degrees has been increasing. Whereas prior to 1990, 45 percent of those with advanced degrees obtained them before the age of thirty-nine, only 25 percent fell in that age group between 1990 and 1999 (fig. 11-1).

Figure 11-1. Age of specialists with advanced degrees at the time of thesis defense, %

Interestingly, all of those in the survey who hold a postgraduate degree are outsiders (table 11-1). Table 11-1 illustrates that most of those with postgraduate degrees have moved to the missile cities from Russia, but from a region other than that of the missile cities. Those born in non-Russian former Soviet Republics come in second in the provision of graduate degree holders, while the missile cities lag far behind. Of those holding advance degrees, only one in seven was born locally.

Table 11-1. Birthplace of advanced degree holders, %

BIRTHPLACE	POSTGRADUATE DEGREE		TOTAL SAMPLING
	Yes	No	
Missile city	0	34	31
Missile city's region (Oblast)	15	32	31
Other Russian region	56	28	30
Ex-USSR Republics	29	6	7
Total sampling	100	100	100

In fact, the greatest percentage of advanced degree holders is found among those arriving from outside Russia (30 percent). They are followed by persons born in Russian regions that have no missile cities (table 11-2). The share of postgraduate degree holders among persons born in ex-Soviet Republics is four times above the average and two times above the share of persons born in Russian regions that have no missile cities.

Table 11-2. Percentage of advanced degree holders among persons born in various regions, %

BIRTHPLACE	POSTGRADUATE DEGREE		TOTAL SAMPLING
	Yes	No	
Missile city	0	100	100
Missile city's region (Oblast)	4	96	100
Other Russian regions	14	86	100
Ex-USSR Republics	30	70	100
Total sampling	7	93	100

Ninety percent of all advanced degree holders in the missile cities surveyed work in Korolev, the remainder in Miass. Table 11-2 indicates that individuals born in Moscow and the Moscow Region contribute only a very small number of highly qualified personnel. In the missile industry, most highly qualified employees are from Russia's periphery, including former Soviet Republics. Therefore, the shift in employment pattern from outsiders to local residents has adversely affected the quality of specialists in the cities because outsiders are more likely to have postgraduate degrees.

11.2. The Changing Geography of Specialist Training

Table 11-3 shows that 59 percent of all specialists working in Miass and 81 percent of those working in Korolev graduated from colleges and universities located either in the missile city itself or in the region where such cities are located. The role of Moscow-area institutes in educating missile industry specialists is significant only in Korolev, which is located in the Moscow Region. Only 1 percent of those working in Votkinsk and 6 percent of those employed in Miass graduated from colleges and universities in Moscow or the Moscow Region. In Votkinsk and Miass, one-third of all specialists were educated in Russian regions other than the Chelyabinsk Region, Moscow Region, and the Republic of Udmurtia. Accounting for only 1 or 2 percent of the share of specialists in missile cities, educational institutions in ex-USSR Republics play a very minor role in training missile industry specialists. From this, one might conclude that the collapse of the Soviet Union has had little impact on the system of specialist training for research and development, manufacturing enterprises, and even for the missile industry.

Table 11-3. Location of colleges and universities attended by specialists, %

COLLEGE/UNIVERSITY LOCATION	CITY			TOTAL SAMPLING
	Korolev	Miass	Votkinsk	
Missile city and its local region	81	59	65	78
Moscow and Moscow Region	81	6	1	67
Other Russian regions	18	33	33	20
Ex-USSR Republics	1	2	0	1
Total sampling	100	100	100	100

Let us consider the changes experienced during the 1990s in the geographical pattern of higher education, as compared with previous periods. Clearly, in the 1990s, as the population's financial capabilities were dramatically reduced, an increasing number of students could pursue their education only close to home because they could not afford the expense of going elsewhere. In Korolev, where 85 percent of all currently employed specialists studied in the Greater Moscow Region, including Moscow City, the share of those educated in the Moscow Region shows a steady upward trend. Thus, while 69 percent of all specialists were educated in Moscow and the Moscow Region in the 1970s, the figure increases to 100 percent in the 1990s. Simultaneously, the share of specialists educated in other Russian regions dropped from 27 percent to zero. Specialists educated outside Russia were hired only during the 1970s, and their share remains insignificant (table 11-4).

Table 11-4. Korolev: Location of college/university attended by specialists joining the enterprise in various years, %

COLLEGE/UNIVERSITY LOCATION	YEAR EMPLOYED				TOTAL SAMPLING
	1990-99	1980-89	1970-79	1960-69	
Missile city	12	7	10	8	8
Missile city region	88	79	80	69	77
Moscow and Moscow Region	100	86	90	77	85
Other Russian regions	0	14	5	23	14
Ex-USSR Republics	0	0	5	0	1
Total sampling	100	100	100	100	100

In Votkinsk, 75 percent of all specialists presently employed were educated either in the city itself or in the Republic of Udmurtia, where the city is located, while 20 percent were educated in other Russian regions. The role of Moscow and the Moscow Region in personnel training is relatively insignificant. The enterprise employs virtually no graduates of colleges and universities located outside Russia proper. In Votkinsk, the personnel training profile has remained rather stable over a long period, with an obvious trend toward an increasing reliance on Udmurtia. This trend began in the 1970s and 1980s and gathered momentum to a point where, in the 1990s, Udmurtia graduates accounted for 89 percent of new employees. Prior to 1970 they made up only 58 percent of new employees.

Table 11-5. Votkinsk: Location of college/university attended by specialists joining the enterprise in various years, %

COLLEGE/UNIVERSITY LOCATION	YEAR EMPLOYED				TOTAL SAMPLING
	1990-99	1980-89	1970-79	1960-69	
Missile city	67	50	64	50	57
Missile city region	22	25	18	8	19
Moscow and Moscow Region	0	4	0	0	1
Other Russian regions	11	21	18	42	22
Ex-USSR Republics	0	4	0	0	1
Total sampling	100	100	100	100	100

In Miass, graduates of colleges and universities located in the city and the local Chelyabinsk Region account for 66 percent of new employees. Six percent of all employees studied in Moscow and the Moscow Region, whereas only 2 percent were educated outside Russia proper. The trend toward a drastic decrease in the share of those educated in the country's regions (other than the Chelyabinsk Region) is most noticeable in Miass. While prior to 1970, 35 percent of new hires were educated in Russia's regions (except for the Chelyabinsk Region), the figure dropped to a mere 13 percent during the 1990s.

Table 11-6. Miass: Location of college/university attended by specialists joining the enterprise in various years, %

COLLEGE/UNIVERSITY LOCATION	YEAR EMPLOYED				TOTAL SAMPLING
	1990-99	1980-89	1970-79	1960-69	
Missile city	13	0	15	8	9
Missile city region	75	70	42	60	57
Moscow and Moscow Region	0	0	8	12	6
Other Russian regions	13	30	35	32	32
Ex-USSR Republics	0	0	8	0	2
Total sampling	100	100	100	100	100

11.3. Trends in Migrants' Education Profile

In Korolev, 69 percent of all migrants employed by the enterprise were educated in Moscow and the Moscow Region. The percentage of those trained in the region where Korolev is located displays a clear upward trend, whereas the other two cities show the opposite trend. Whereas prior to 1970, two-thirds of all migrants were educated in Moscow and the Moscow Region, this figure grew to 100 percent in the 1990s.

Table 11-7. Korolev: Location of college/university attended by migrants joining the enterprise in various years, %

COLLEGE/UNIVERSITY LOCATION	DECADE EMPLOYED				TOTAL SAMPLING
	1990-99	1980-89	1970-79	1960-69	
Missile city region	100	73	75	67	69
Moscow and Moscow Region	100	73	75	67	69
Other Russian regions	0	27	12	33	28
Ex-USSR Republics	0	0	12	0	3
Total sampling	100	100	100	100	100

In Votkinsk, 45 percent of all migrants were educated in the Republic of Udmurtia. The rest studied outside the Republic. Of these, Moscow/Moscow Region and the former Soviet Republics each account for only 3 percent of qualified employees. Votkinsk shows a clear trend toward a greater number of migrants being educated in Udmurtia. The share of migrants educated in Udmurtia rose from 17 percent in the 1970s to 67 percent in the 1990s.

Table 11-8. Votkinsk: Location of college/university attended by migrants joining the enterprise in various years, %

COLLEGE/UNIVERSITY LOCATION	DECADE EMPLOYED				TOTAL SAMPLING
	1990-99	1980-89	1970-79	1960-69	
Missile city region	67	50	50	17	45
Moscow and Moscow Region	0	8	0	0	3
Other Russian regions	33	42	50	83	52
Ex-USSR Republics	0	8	0	0	3
Total sampling	100	100	100	100	100

In Miass, 62 percent of all migrants were educated in the Chelyabinsk Region, 7 percent in the Moscow region, and 3 percent outside Russia. The shift of personnel training to the Chelyabinsk Region was seen for the first time in the 1980s. Meanwhile, the falling share of graduates from other Russian regions, including Moscow and the Moscow Region, is another visible trend. Prior to 1970, 35 percent of all migrants were educated in Russia's regions outside Chelyabinsk. In the 1980s this figure dropped to 30 percent, falling further in the 1990s to a mere 14 percent.

Table 11-9. Miass: Location of college/university attended by migrants joining the enterprise in various years, %

COLLEGE/ UNIVERSITY LOCATION	DECADE EMPLOYED				TOTAL SAMPLING
	1990-99	1980-89	1970-79	1960-69	
Missile city region	86	70	50	65	62
Moscow and Moscow Region	0	0	9	13	7
Other Russian regions	14	30	41	35	35
Ex-USSR Republics	0	0	9	0	3
Total sampling	100	100	100	100	100

The composition of newly hired personnel in the missile enterprises has shown a continuous replacement of migrants with permanent residents of missile cities. These experts generally hold diplomas from locally established institutions of higher education. The missile industry, which in its prime used to employ personnel from the entire country, relying on a broad network of educational institutions, now meets its modest demands for specialist personnel mostly by hiring graduates of local colleges and universities who reside in the missile city regions. Throughout the 1990s, employment at missile industry enterprises has been visibly declining.

11.4. Demand for Specialists

The following section reviews the specialist mix in terms of length of service at the missile-related enterprises (table 11-10).

Table 11-10. Specialists' length of service at the enterprises, %

YEAR EMPLOYED	LENGTH OF SERVICE, YEARS	CITY			TOTAL SAMPLING
		Korolev	Miass	Votkinsk	
1990-99	Under 10	12	11	14	12
1980-89	10-19	37	26	33	36
1970-79	20-29	28	31	33	29
1960-69	30-39	23	33	19	24
Total sampling		100	100	100	100

If the total number of personnel at an enterprise remains stable, each subsequent length-of-service group should be smaller than the previous one. At the enterprises we surveyed, this holds true only for employee groups with ten or more years of service. Specialists with length of service under ten years (that is, hired in the 1990s) number three times fewer than specialists joining the enterprises in the 1980s. This reflects the fact that the enterprises had fewer employees in the 1990s than in the 1980s.

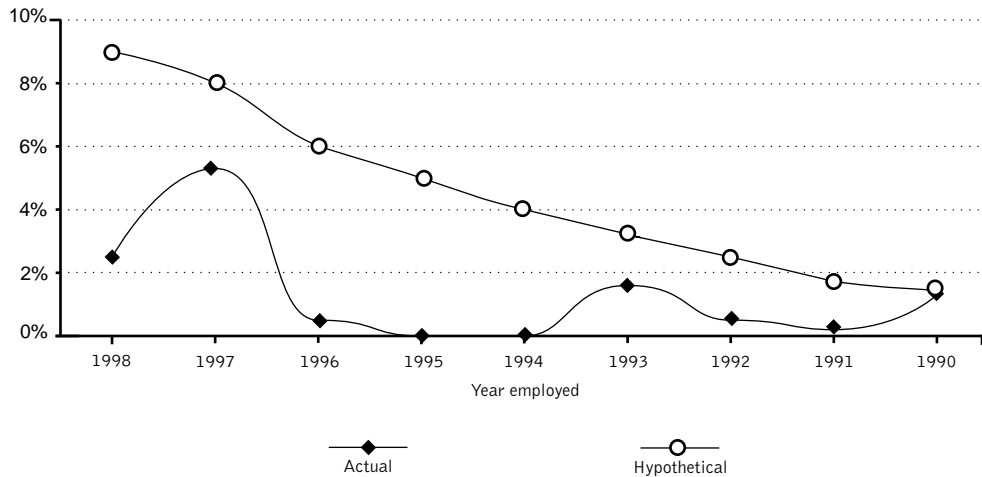
Overall, the enterprises have an annual personnel attrition rate of 20 percent during an employee's first decade on the job. Therefore, the probability of an employee staying with the company after a year on the job equals 80 percent. With a 20 percent annual attrition rate, in ten years only eleven employees of the original one hundred employed would remain on the job.

During the 1990s the annual rate of attrition at the enterprises we surveyed was estimated at about 12 percent. In order to prevent a decline in the overall number of employees, enterprises have had to hire new employees at a rate of 12 percent a year. Given that only 80 percent of those originally employed will stay on the job with every passing year and presuming the enterprises' employment has remained stable throughout the 1990s, a 12 percent annual recruiting rate would bring about the projected length-of-service mix shown in figure 11-2.

In fact, the actual length-of-service mix, which includes employees hired in the 1990s, differs greatly from the projected length-of-service mix that would have occurred if employment rates had stayed stable throughout the 1990s. The fact that the actual employee length of service is well below our projections clearly demonstrates a rapid decline in the number of specialists working at the enterprises.

A drastic fall in the demand for specialists at these enterprises has tilted the hiring profile of the 1990s in favor of local residents, reflecting a consequently dramatically reduced rate of migration to the missile cities.

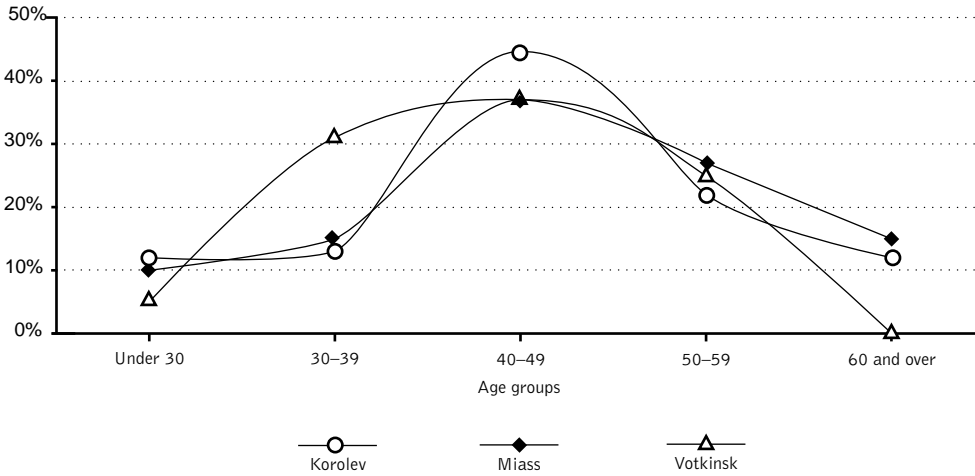
Figure 11-2. Actual vs. hypothetical length-of-service profiles, %



11.5. Age Mix

Figure 11-3 presents data on the age mix of those surveyed in individual cities. There is a clear similarity in the age mix in Korolev and Miass and in both cities the age profiles are bell-shaped. The modal age interval is forty to forty-nine years. About 40 percent of all specialists fall in this age group, while a considerable number are either younger or older than this group.

Figure 11-3. Age of specialists presently employed in various cities, %



In Votkinsk, the specialists' age profile is parabolic. The modal interval here is the same, forty to forty-nine years; it accounts for almost as many specialists as in Miass. There are no specialists in Votkinsk over sixty, whereas in Miass and Korolev about 15 percent of specialists fall in that age range. On the other hand, Miass and Korolev have twice as many specialists under thirty as Votkinsk, and half as many specialists as Votkinsk who fall in the thirty to thirty-nine age group.

The 1992 and 1999 age profiles of Energia Corporation employees (fig. 11-4) provide some indication of the changes in age profiles in missile enterprises during the 1990s. In the early 1990s, the average age was much higher than it is today. In 1992, 40 percent of all specialists belonged to the fifty to fifty-nine age group. Today, this age bracket accounts for only 20 percent of all specialists. In the absence of active recruitment policies during that period, 1999 would have had the age profile shown in figure 11-5. If that had occurred, 70 percent of all specialists would have been fifty and older.

Figure 11-4. Korolev: Age profiles of specialists in 1992 vs. 1999, %

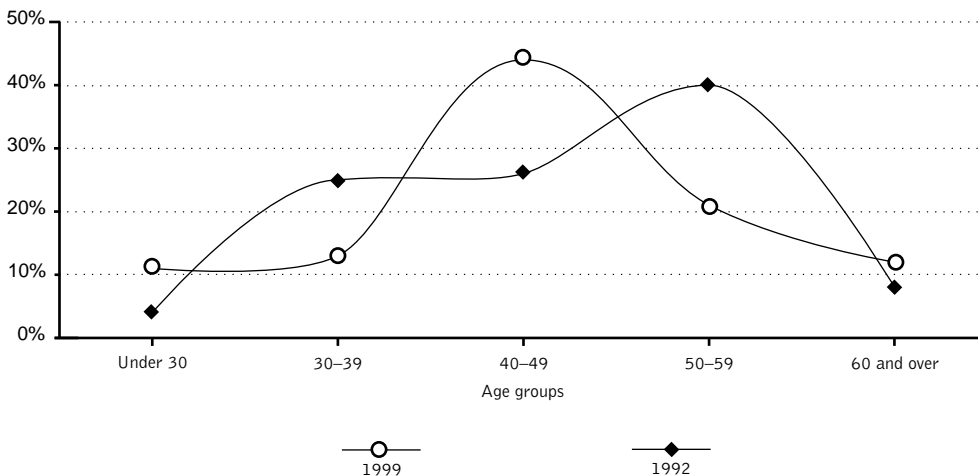
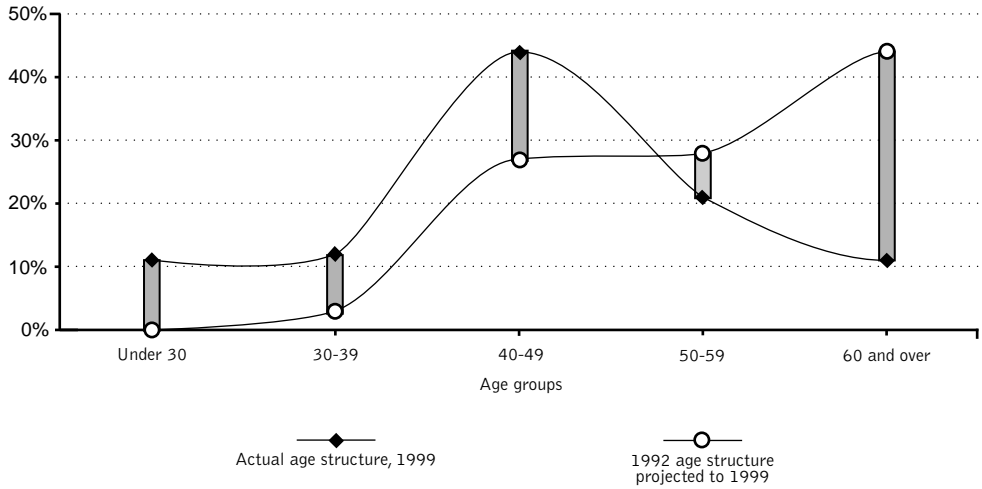
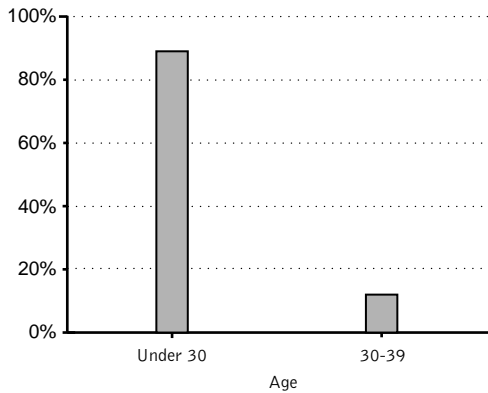


Figure 11-5. Korolev: Actual age mix of 1999 vs. 1992 age mix projected to 1999, %



Due to economic circumstances, management in the missile industry had to take specific steps to prevent a dramatic rise in the average age of employees. Surprisingly, the economic crisis has been instrumental in helping maintain a younger work force in the cities. In the inevitable downsizing, companies have primarily laid off older workers, who could demand somewhat higher salaries. They have been replaced by younger employees, though in smaller numbers (fig. 11-6).

Figure 11-6. Korolev: Age profile of newly hired specialists, %



Thus, in the 1990s, the economic crisis and consequent dramatic reduction in employment levels in the missile industry have helped normalize the specialists' age profile. If not for the forced retrenchment, which heavily favored younger employees, the industry would have found itself with a work force predominantly at or beyond retirement age. Such a development could have crippled the industry.

12. WAGES AND SALARIES

12.1. Actual Wages

Wages are a basic determinant of labor mobility. In this regard, missile cities have failed to attract labor.

As figure 12-1 shows, wages vary significantly from city to city. In Votkinsk, 80 percent of all specialists have wages in the range of US\$25 to US\$50 per month. In Miass, only 50 percent of specialists fall in this earnings bracket. Monthly wage levels in Miass average US\$40 to US\$50. Workers in Korolev are in better circumstances: there the average wage is US\$115; 40 percent of all specialists earn between US\$100 and US\$150, and 35 percent make between US\$50 and US\$100. Korolev's proximity to Moscow is partly responsible for the city's higher incomes, compared with outlying regions. A more important factor, however, is that specialists in Korolev are not confined to working for the government, but can work also on international space cooperation projects.

Figure 12-1. Monthly wages of specialists in the cities surveyed (June 1999), %

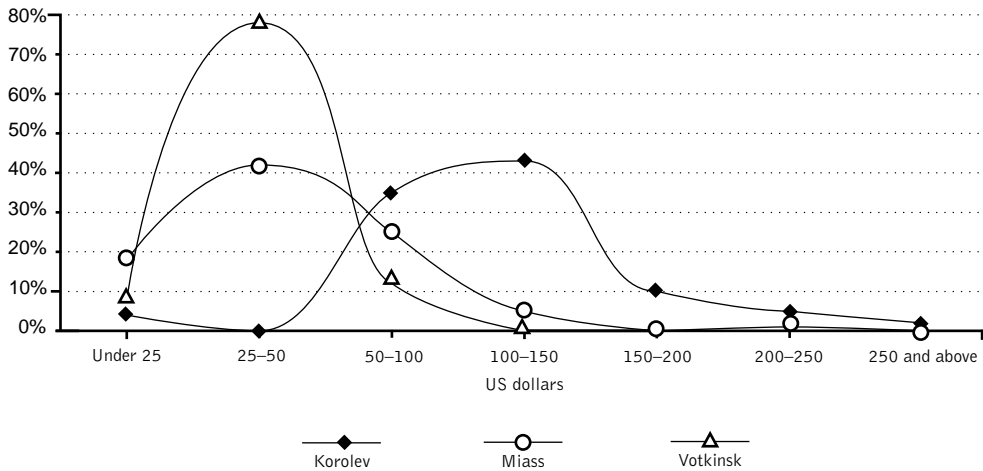
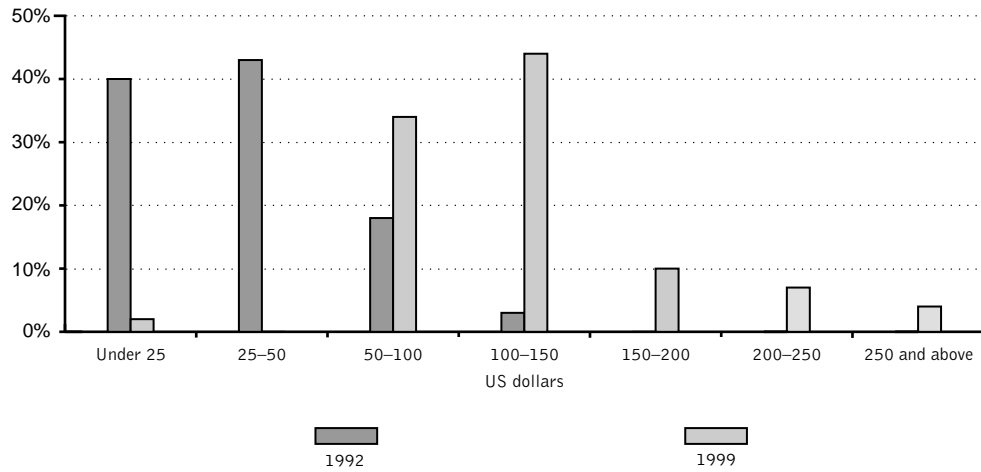


Figure 12-2 shows data on wages in Korolev in 1992. The wage profiles of 1992 and 1999 differ significantly. Over this period, the average wage tripled, although it remains quite low nevertheless. On the other hand, the wage profiles in Miass and Votkinsk have remained at Korolev's 1992 level.

Figure 12-2. Wage profiles of specialists in Korolev, 1992 vs. 1999, %

12.2. Wage Delays

The economic conditions of specialists are made even worse by the fact that wages in Miass and Votkinsk, low as they are, are not paid on time (table 12-1). Of the missile cities surveyed, Miass has had the most difficulty paying its workers regularly, with an astounding 99 percent of wage earners owed back wages. Votkinsk follows with 47 percent still owed back pay. Korolev, on the other hand, has managed to pay a large majority of its employees on time.

Table 12-1. Wage delays, %

COMPLAINTS OF WAGE DELAYS	CITY		
	Korolev	Miass	Votkinsk
Yes	6	99	47

Compared to Miass, Votkinsk has a much better record on payment of delayed wages (fig. 12-3). Fifty percent of all specialists do not have their salaries delayed by more than one month, while 90 percent experience no delays in excess of two months. In Miass, however, the situation is different, as the average delay in wage payment is six months. Respondents pointed out that their wages and salaries are paid as “one-sixth of the accrued overdue wage amount.”

Figure 12-3. Duration of wage delays, %

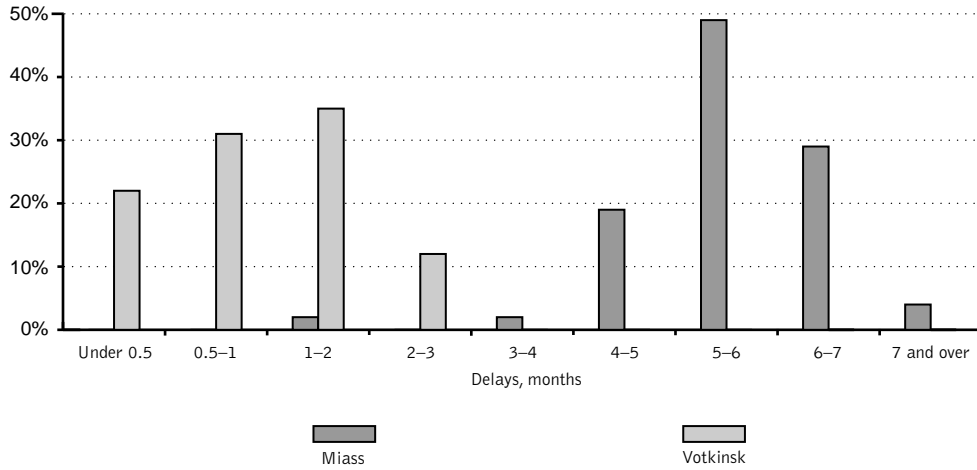


Table 12-2. Average duration of wage delays, months

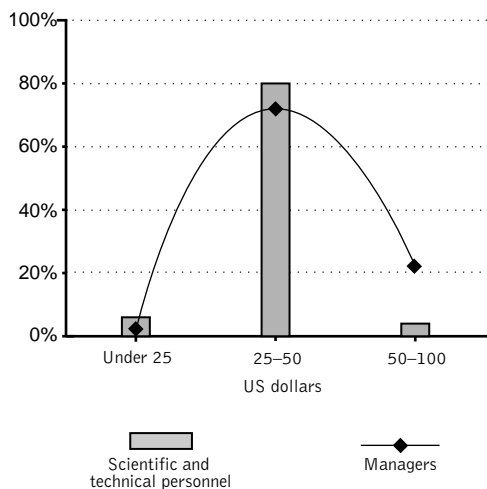
	CITY	
	Votkinsk	Miass
Average duration of wage delays, months	1.1	5.6

12.3. Wage Differentiation by Position

Wages should differ significantly depending on the specialist’s position, but this is not always the case. Consider the cases in the following cities:

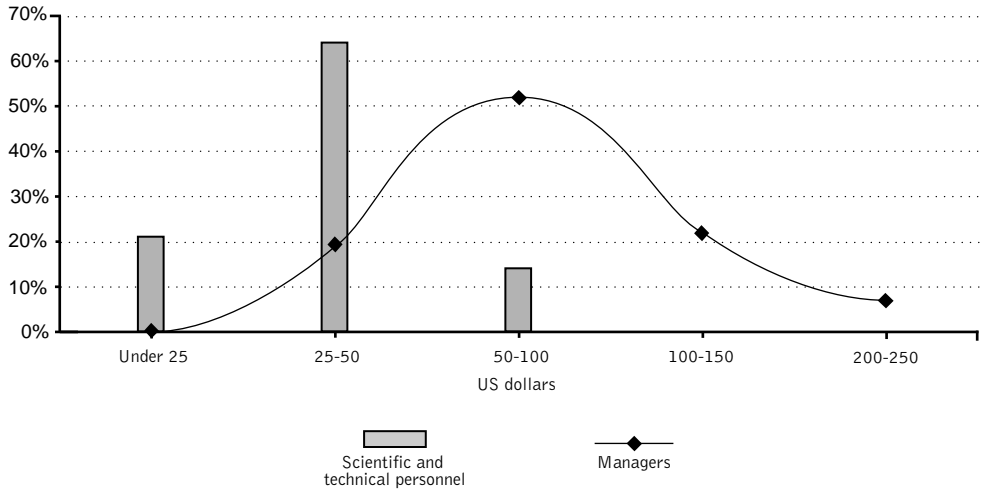
Votkinsk. In Votkinsk, wage differentiation by position is minimal (fig. 12-4). The modal interval for all position groups is US\$25–US\$50, and over 80 percent of specialists across the spectrum of positions fall into this salary range.

Figure 12-4. Votkinsk: Wages of specialists by position, %



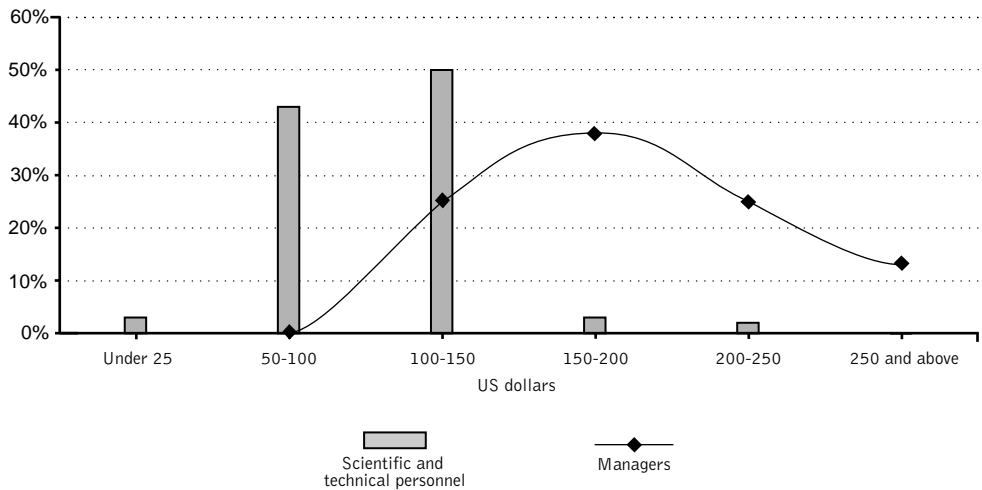
Miass. Unlike salaries in Votkinsk, those in Miass do differ by position (fig. 12-5). Over 60 percent of researchers and engineers make US\$25–US\$50, whereas only 20 percent of executives make that much. The modal interval of executive salaries is US\$50–US\$100. Notably, unlike the asymmetric wage profile of engineers and technicians, the executives feature a normal distribution in the US\$25–US\$150 wage range. The average executive wage is US\$85, while lower-level employees average US\$38.

Figure 12-5. Miass: Wages of specialists by position, %



Korolev. The situation in Korolev is similar to that in Miass (fig. 12-6). While a disproportionate wage distribution exists among rank specialists (over 90 percent of them receive salaries in the range of US\$50 to US\$150), there is a more uniform distribution among executives, with a range of US\$100 to US\$250. Meanwhile, the average executive salary is US\$143, or double the salary of engineers and technicians, which averages US\$78.

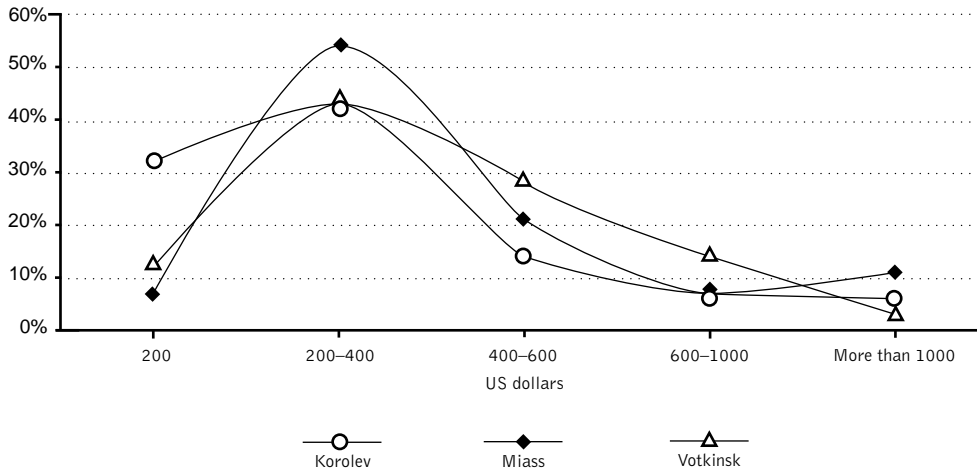
Figure 12-6. Korolev: Wages of specialists by position, %



12.4. Wages Commensurate with Specialists' Occupation and Qualifications

Specialists clearly recognize that their salaries cannot be regarded as commensurate with their occupation and qualifications in present-day Russia. As can be seen in figure 12-7, a remarkably similar number of specialists in the different cities believe they deserve higher salaries to more accurately reflect their qualifications and positions.

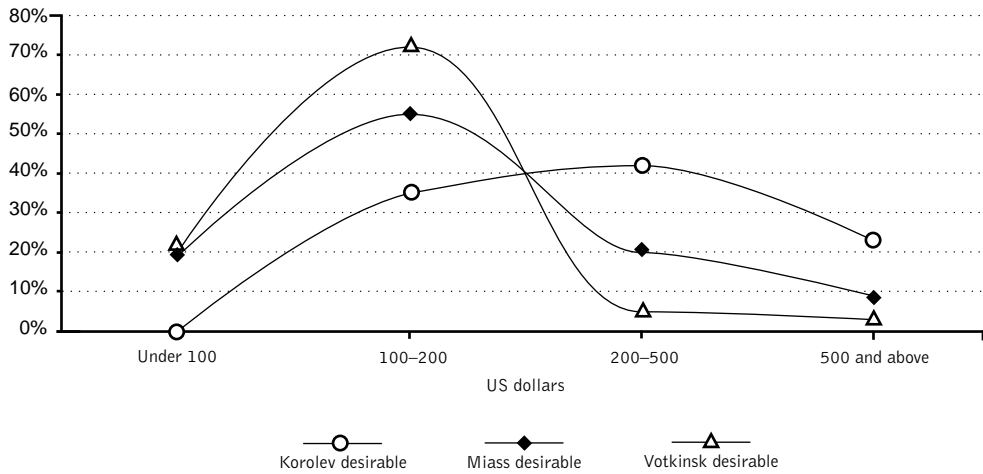
Figure 12-7. Wages presently matching specialists' occupation and qualifications in Russia, % of actual wages



In sum, 40 percent to 55 percent of all specialists believe that their actual salary is two to three times lower than the amount warranted by their occupation and qualifications. This holds true despite substantial differences in actual wages from city to city. The difference between actual salaries and salaries commensurate with respective occupations and qualifications varies from the average ratio of 3.7 in Korolev to a ratio of 4.3 to 4.5 in Votkinsk and Miass.

There is no standard by which to compare the salaries that specialists believe they deserve, given their qualifications and employment position. The specialists we surveyed are approximately equal in terms of labor quality. Therefore, if salaries reflected this fact, salary levels for similarly qualified specialists would have been roughly equal across different missile cities. Yet, as figure 12-8 illustrates, this is not the case: salary profiles differ significantly from city to city.²

2. All the enterprises we surveyed belong to the Russian Space Agency (RSA); similarly, all of them used to belong to the USSR's Ministry of Medium Engineering. However, in the Soviet era, salaries of industry specialists were centrally regulated; in other words, all specialists of similar quality (occupation, qualification, and position) received approximately similar wages. Today this is not the case. Being a part of the RSA is not the same as being a part of the Ministry of Medium Engineering. These days, each enterprise fends for itself, doing its best to survive. There is no centralized redistribution of funds from some enterprises to others. Presently, the missile industry is not a single organism but rather a collection of enterprises that compete with each other. Whereas previously, technological achievements of some enterprises were automatically made available to other enterprises of the Ministry, today they become a trade secret. So far, in our opinion, the present approach of de-monopolizing the industry by splitting it into absolutely independent enterprises has produced only negative results. Whereas in the West, missile and aerospace corporations strive to attain the consolidation level achieved in the ex-USSR, Russia, as usual, takes its special path. Apparently this path leads nowhere.

Figure 12-8. Wages presently matching specialists' occupation and qualifications in Russia, %

The difference in wages paid to specialists of the same level reflects the varying economic situations of the missile cities. Thus, in Korolev, the economic position of Energia Concern is strong enough to allow it to pay its specialists much higher salaries than enterprises in Votkinsk and Miass. Still, local specialists in all three cities believe that their occupation and qualifications merit a much higher salary.

Differences of wages commensurate with occupation and qualifications across specialists working in various cities are closely related to actual wage differentiation (table 12-3). While the average amount of actual wages in Miass and Votkinsk equals 35–43 percent of Korolev wages, average salaries commensurate with specialists' occupation and qualifications in these cities are nearly similar, at 40–53 percent.

Table 12-3. Average monthly actual salary vs. salary commensurate with specialists' occupation and qualifications, US\$ and %

CITY	ACTUAL SALARY, AVERAGE		SALARY COMMENSURATE WITH SPECIALISTS' OCCUPATION AND QUALIFICATIONS, AVERAGE	
	US\$	%	US\$	%
Korolev	121	100	420	100
Miass	50	43	225	53
Votkinsk	40	35	170	40

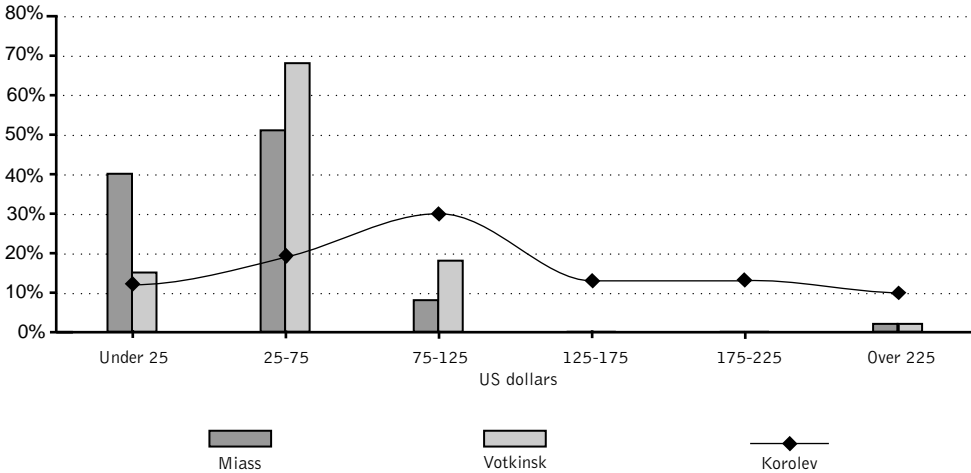
Table 12-3 shows the relatively low remuneration Russian missile specialists believe is “presently commensurate with their occupation and qualifications.”³

3. Some people are of the opinion that low wages in Russia are evidence of poor labor quality. With regard to missile specialists, this suggestion is disputable. The quality of strategic missiles and space stations that Russian missile specialists have created are unparalleled even in countries where the pay scales for such specialists are much higher.

12.5. Income of Specialists' Family Members

There is evidence that actual wages in different cities are unrelated to the qualifications of specialists, but depend rather on the economic situation of the respective enterprises and the regions' level of economic development. This assessment is borne out by data on incomes received by members of specialists' families (fig. 12-9).

Figure 12-9. Distribution of specialists by total monthly income of their family members, %

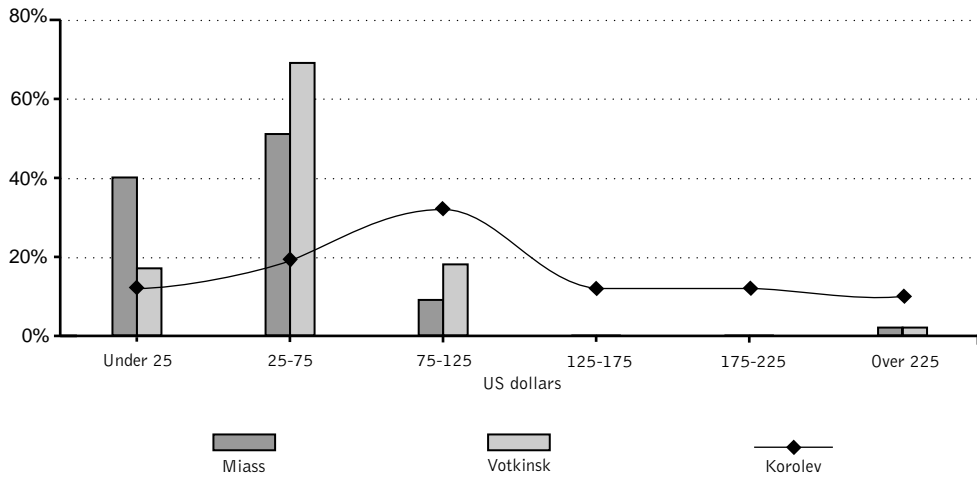


Incomes of members of specialists' families vary across cities as much as the salaries of specialists themselves. In Votkinsk and Miass, the income profiles are similar, while in Korolev wages differ significantly. Not all members of specialists' families are employed by missile manufacturers; in fact, most work outside missile companies. Therefore, incomes earned at other enterprises in these cities are as strongly differentiated as the salaries of missile enterprise specialists. This confirms the idea that, given the existing economics and organizational conditions faced by the missile enterprises, specialists' salaries do not depend on the quality of their work. Rather, they are driven by the economic situation of the enterprises and the local regions.

13. INCOME AND HOUSING

13.1. Total Income of Specialists' Families

Incomes of specialists' families are an even more important indicator of specialists' standard of living than their salaries.

Figure 13-1. Total monthly income of specialists' families, %

Votkinsk and Miass have similar profiles of total family income (fig. 13-1). Over 50 percent of families in those cities have total monthly incomes between US\$25 and US\$75. The Miass missile center has the lowest level of total family income, 40 percent of all families there having incomes below US\$25. Only 15 percent in Korolev and Votkinsk fall into this total income range. Against such a background, Korolev stands out. While 2 percent of families have income in excess of US\$125 in Votkinsk and Miass, over one-third of families in Korolev fall within this income bracket. The modal income interval in Korolev is US\$75 to US\$125; for Votkinsk and Miass, this represents the highest income interval.

13.2. Per Capita Income

Given a certain level of total family income, the per capita figure depends on family size (table 13-1). Family size is larger in Votkinsk and Miass than in Korolev. Votkinsk and Miass families tend to be small. The average family size in Votkinsk and Miass is effectively similar at 3.6 to 3.7 persons, while in Korolev it is lower, at 3.4 persons. In Korolev, therefore, not only are family incomes higher than in Votkinsk and Miass, but, because families there are smaller, so is per capita income.

Table 13-1. Distribution of specialists' families by size, %

FAMILY SIZE, PERSONS	CITY			TOTAL SAMPLING
	Korolev	Miass	Votkinsk	
2	13	4	5	7
3	43	25	32	33
4	40	61	62	54
5 +	4	9	2	5
Average family size	3.4	3.7	3.6	3.5

Figure 13-2 shows the survey sample distribution by total income per family member. As can be seen, the profile is effectively identical in Votkinsk and Miass. In Korolev, the distribution is shifted toward high-income groups. This is borne out by the data on average family income. In Miass and Votkinsk, the figure amounts to about US\$33; in Korolev, it is US\$80.

Figure 13-2. Distribution of specialists by actual monthly average income per capita, %

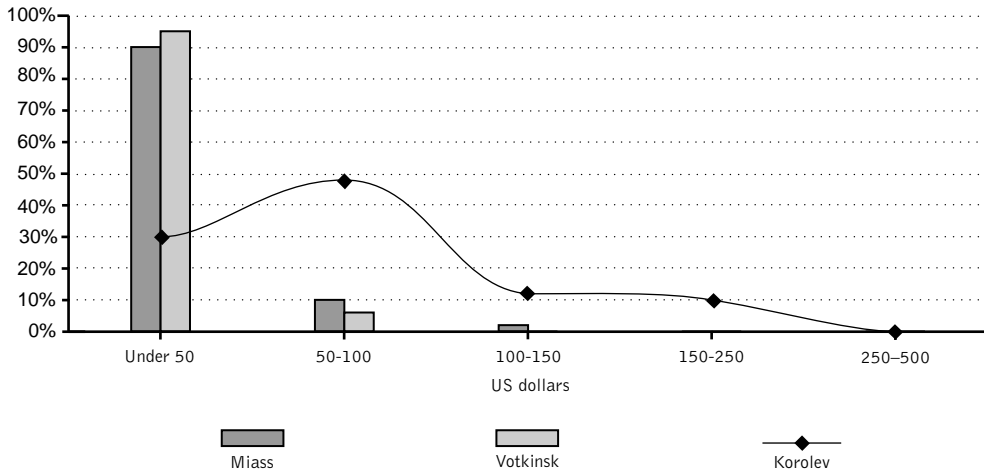
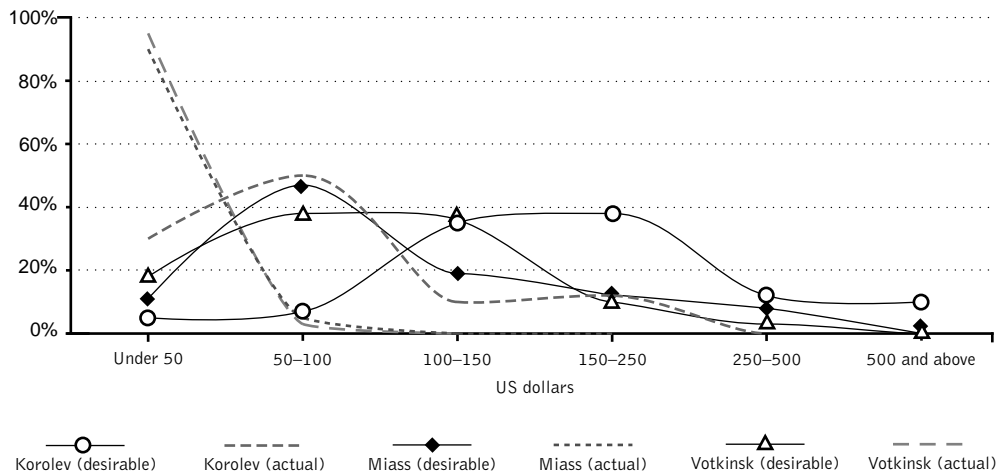


Figure 13-3 profiles the specialists according to the amount of monthly average family income per capita that they wish to earn. Clearly these income objectives differ significantly from actual income. The modal interval of actual income in Korolev falls between US\$50 and US\$100, whereas the desired income interval is US\$150 to US\$250, representing a difference of US\$100. In Votkinsk and Miass, the modal interval variance is of a similar magnitude with actual earnings falling under US\$50 and desired earnings ranging from US\$50 to US\$150. Interestingly, the Miass profile of desired per capita income is almost the same as the actual per capita income in Korolev. This indicates the degree to which both actual and desired incomes vary across different missile cities.

Average figures of desired family income per capita are as follows: Korolev US\$214, Miass US\$123, and Votkinsk US\$110. The desired per capita income in Korolev is 2.7 times the actual, while the Miass and Votkinsk ratios are 3.7 and 3.3, respectively.

Figure 13-3. Distribution of specialists by desired monthly average income per capita, %

13.3. Housing Conditions

Housing ranks as one of the most pressing problems affecting migration. The level of housing available in missile cities remains quite high; over 80 percent of specialists we surveyed live in individual apartments (table 13-2). The share of so-called communal apartments, those shared by several families, is insignificant. Indeed, there is no difference in housing standards between missile cities located in outlying regions (Miass and Votkinsk) and those right outside Moscow (Korolev).

Table 13-2. Housing situation of specialists, %

PRESENT HOUSING	CITY			TOTAL SAMPLING
	Korolev	Miass	Votkinsk	
Individual apartment	89	87	83	85
Freehold house	4	0	9	4
Communal apartment	3	2	0	2
Hostel	4	9	5	6
Privately rented housing	1	2	3	2
Total sampling	100	100	100	100

Over 90 percent of families live in individual apartments. Divorced people either rent residential space privately or live in communal apartments, since the rights to individual apartments are divided in the divorce settlement.

Leaving a missile city, however, effectively means losing one's residential space because low demand limits the chances of "selling" it at a good price (even though an apartment is owned by a company, residents typically charge a potential new resident for the right to move in). Moreover, the company owns the residence in the missile city. These circumstances seriously constrain migration out of the missile city because leaving means giving up a rent-free apartment and then finding housing in the new city, which is bound to be expensive. Under

prevailing wage levels, it is very difficult for wage earners to save enough money to buy, or even rent, a house. Therefore, the unavailability of comfortable housing is a major disincentive for residents to migrate out of a missile city. On the other hand, availability of corporate residential space and opportunities for obtaining such housing for comparatively modest amounts of money may be one of the few factors encouraging migration into the missile cities.

14. MOONLIGHTING

14.1. Extent of and Reasons for Moonlighting

In order to supplement low salaries many specialists choose to take a second job. Overall, 28 percent of specialists in the cities we surveyed moonlight (table 14-1).

Table 14-1. Specialists who moonlight, %

	CITY			% OF SAMPLE
	Korolev	Miass	Votkinsk	
Moonlighters	29	33	19	28

The lowest incidence of moonlighting is found in Votkinsk, where wages are lowest. Korolev and Miass are close in terms of the percentage who moonlight, with about one-third of all specialists taking second jobs.

As table 14-2 illustrates, between 67 percent and 83 percent of all moonlighters cited economic difficulties alone as the reason for choosing to work an additional job. Notably, in Votkinsk and Miass, where wages are lowest, most moonlighters cite economic difficulties as the chief reason for moonlighting. Between 8 percent and 24 percent take a second job primarily because it is interesting work. The highest share of those moonlighting for this reason is found in Korolev and Miass.

Table 14-2. Reasons for moonlighting, %

REASON	CITY			TOTAL SAMPLING
	Korolev	Miass	Votkinsk	
Economic difficulties only	67	83	79	69
Interesting job only	24	8	21	23
Economic difficulties and interesting job	10	8	0	9
Total sampling	100	100	100	100

As table 14-3 shows, missile city residents usually take second jobs that are unrelated to their primary occupation, jobs in which their primary professional skills are irrelevant. Only 21 percent to 29 percent of specialists have second jobs that are totally in line with their regular occupation.

Table 14-3. Nature of moonlighting jobs, %

IF YOU ARE MOONLIGHTING, IS JOB IN LINE WITH YOUR REGULAR OCCUPATION?	CITY			TOTAL SAMPLING
	Korolev	Miass	Votkinsk	
In line	29	28	21	28
Mostly in line	24	28	0	22
Mostly out of line	10	4	21	10
Totally unrelated	34	40	57	32
Close	5	0	0	4
Total sampling	100	100	100	100

14.2. Opportunities for Moonlighting

Most specialists who take an additional job do so in a field unrelated to their primary professional occupation because well-paying jobs in their primary fields are hard to find. Given that a desire for a higher total income motivates their decision to take a second job, they are driven to jobs that have little to do with their specialized skills. Most moonlighters are workers and technicians, while most moonlighting jobs are found in private business in such areas as sales, where technological expertise is irrelevant.

More than 90 percent of specialists believe that it is difficult to earn additional income (table 14-4). This percentage is virtually constant across all cities.

Table 14-4. Whether additional earnings are difficult to come by, % of all replies

DOES A PERSON OF YOUR OCCUPATION AND SKILL FIND IT DIFFICULT TO IDENTIFY ADDITIONAL EARNING OPPORTUNITIES?	CITY			TOTAL SAMPLING
	Korolev	Miass	Votkinsk	
Difficult	89	97	97	90
Easy	11	3	3	10
Total sampling	100	100	100	100

14.3. Moonlighting Potential

Table 14-5 shows the moonlighting intentions of specialists who do not have a second job.

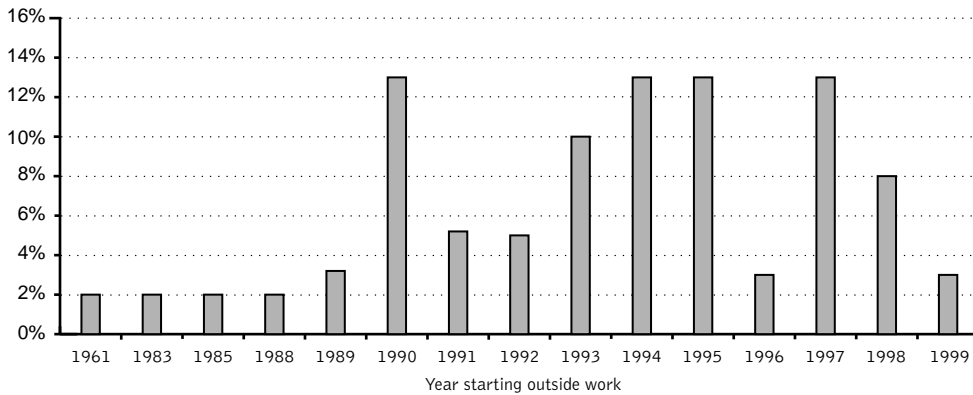
Table 14-5. Non-moonlighting specialists intending to moonlight, %

IF NOT MOONLIGHTING, WOULD YOU LIKE TO BE?	CITY			TOTAL SAMPLING
	Korolev	Miass	Votkinsk	
Yes	45	53	39	44
No	36	28	38	36
Undecided	19	19	23	20
Total sampling	100	100	100	100

14.4. Time of Taking Moonlighting Jobs

Figure 14-1 profiles moonlighters by the duration of their second job. It is reasonable to assume that moonlighting existed even before the current economic crisis began. The number of moonlighters, however, was very low (about 10 percent). Most specialists began moonlighting between 1990 and 1997. This development was driven both by progressively worse economic conditions and an expanding base of typical moonlighting jobs.

Figure 14-1. Duration of moonlighting, % of total moonlighters



14.5 The Nature of Moonlighting Jobs in Missile Cities

As is evident from table 14-6, different moonlighting activities predominate from city to city. Overall, business is first among the enterprises we surveyed. In Votkinsk and Korolev, approximately 75 percent of moonlighters are involved in this sector, and in Miass about 60 percent. Domestic grants and orders of Russian enterprises, especially in Korolev and Miass, are second. In Votkinsk, only 7 percent of moonlighters service domestic orders. The third most common moonlighting job is teaching. In Miass, one in every four moonlighters is teaching.

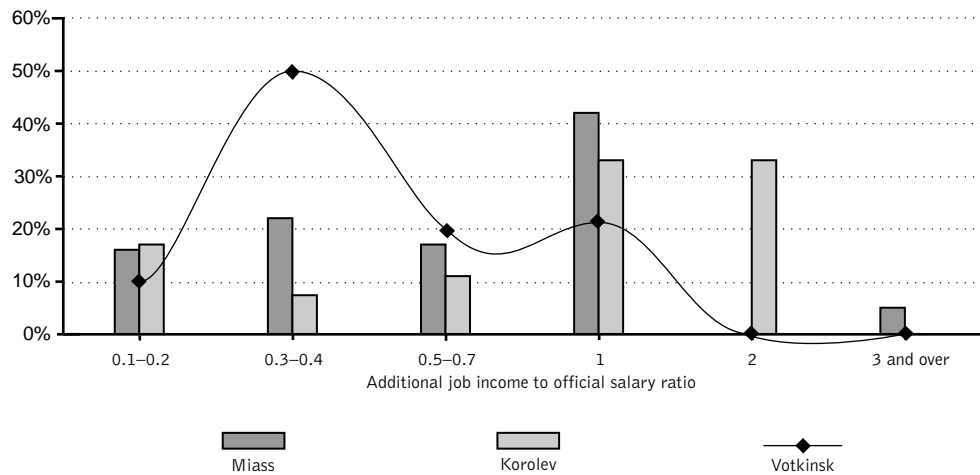
Table 14-6. Major types of moonlighting jobs, %

ACTIVITY	CITY			TOTAL SAMPLING
	Korolev	Miass	Votkinsk	
Business (selling, work for private businesses)	75	59	79	75
Domestic orders (contracts and research grants)	20	14	7	18
Teaching (college professors and after-hours tutors)	5	27	14	7
Total sampling	100	100	100	100

14.6 Moonlighting Earnings

What level of income do moonlighting jobs provide? As can be seen from figure 14-2, incomes vary significantly across different cities. Forty percent of moonlighters in Miass earn secondary incomes comparable to their regular wages; the rest earn lower moonlighting incomes. In Korolev, the situation is more favorable, about 70 percent of moonlighters earning secondary incomes that are either comparable to their regular wage or twice as high. The most difficult situation prevails in Votkinsk, where the overwhelming majority of moonlighters make only 30 percent to 70 percent of the lowest wage among all cities surveyed.

Figure 14-2. Moonlighting earnings vs. regular wages, %



15. FINANCIAL SITUATION

15.1. Changes in Specialists' Financial Situation during the Reform Period

Table 15-1 shows that between 4 and 22 percent of those surveyed believe their financial situation has improved during the period between 1992 and 1999. Across every missile city, only 3 percent to 4 percent see a dramatic improvement. The financial position of 1 percent to 5 percent of all respondents has remained at pre-1992 levels. A large majority (66 percent to 86 percent) has experienced a dramatic decline in living standards. In Korolev this included 48 percent of workers, while in Miass and Votkinsk the figures are 72 percent and 79 percent, respectively.

Therefore, overall, missile city specialists have been disadvantaged by economic hardships. This is particularly true in Miass and Votkinsk, which are far from Moscow; but also applies to Korolev.

**Table 15-1. Changes in specialists' financial situation during the reform period (1992-99),
% of definitive answers**

CHANGE	CITY			TOTAL SAMPLING
	Korolev	Miass	Votkinsk	
Dramatic improvement	4	4	3	4
Slight improvement	18	2	1	15
Unchanged	4	1	5	4
Slight decline	18	7	13	16
Dramatic decline	48	79	72	52
Undecided	10	6	6	9
Total sampling	100	100	100	100

6.2. Current Financial Situation of Specialists

Table 15-2 reflects the respondents' view of their current financial situation. None of the respondents considered their current financial situation to be very good, and virtually no one referred to it as good. Between 8 percent and 21 percent viewed it as normal, whereas the majority considers their current financial position difficult or dire. Specialists in Miass and Votkinsk have a more negative view of their financial situation than those in Korolev. In those two cities, 27 percent describe their financial situation as dire or desperate. In Korolev this figure is half that of Miass and Votkinsk.

Table 15-2. Respondents' views of their financial situation, %

CURRENT FINANCIAL SITUATION	CITY			TOTAL SAMPLING
	Korolev	Miass	Votkinsk	
Good	1	0	0	1
Good, compared to the country in general	1	0	0	1
Normal	21	9	8	19
Difficult	58	62	60	58
Dire	14	26	27	16
Dire and desperate	0	1	0	0
Undecided	5	2	5	5
Total sampling	100	100	100	100

16. POTENTIAL EMIGRATION

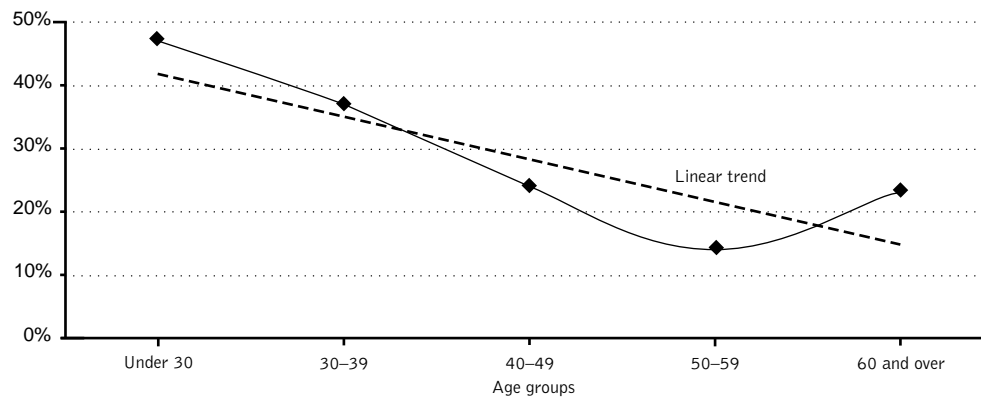
16.1. Emigration Intentions

Table 16-1 presents data on the percentage of those willing to work abroad, by individual cities. The figures vary from 12 percent at the strategic missile plants in Votkinsk to 28 percent to 32 percent in Korolev and Miass. In principle, such intentions display a typical trend across age brackets: the share of those wishing to emigrate quickly declines with age.

Table 16-1. Desire to work abroad, % of definitive answers

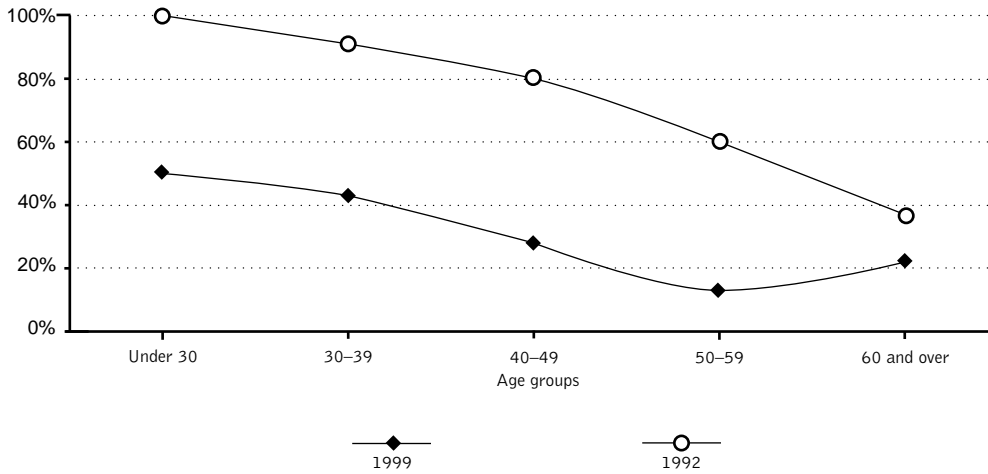
DESIRE TO WORK ABROAD	CITY			% OF SAMPLE
	Korolev	Miass	Votkinsk	
Yes	28	32	12	25

Figure 16-1. Persons wishing to work abroad, by age group, %



A comparison of the Korolev data with a similar survey taken seven years earlier (fig. 16-2) indicates differences in the percentage of persons willing to work abroad, virtually across all groups.

Whereas in 1992, 72 percent of persons giving definitive answers would have liked to work abroad, 72 percent of those polled in 1999 had no such desire. This represents a decline of more than two and a half times in seven years. On the other hand, we see very similar age profiles in the two surveys. While the age distribution of those willing to emigrate in 1992 and in 1999 is roughly the same, the desire is two and a half times less intense in 1999 than in 1992.

Figure 16-2. Korolev: Persons willing to work abroad, 1992 vs. 1999, by age group, %

16.2. Steps Taken to Realize Desire to Go Abroad

Generally, those who would like to take a job abroad are very passive when it comes to trying to realize that desire (table 16-2).

Table 16-2. Steps taken by specialists to realize desire of going abroad, % of total number wishing to emigrate

ARE YOU TAKING ANY SPECIFIC STEPS TO GET A JOB ABROAD?	%
Yes	20
No	74
Undecided	6
Total sampling	100

Only one person in five of those willing to emigrate takes any action to succeed in that desire, while 74 percent of persons willing to emigrate do not actively pursue a job abroad.

Table 16-3. Measures taken to realize desire of going abroad, % of persons taking any measures

IF TAKING SPECIFIC MEASURES TO GET A JOB ABROAD, WHAT DO YOU DO?	PERCENT
Establish useful contacts	49
Approach foreign companies	24
Rely on relatives and friends	1
Only daydream	1
Work for a foreign company	24

For the most part, specific efforts made toward realizing the desire to work abroad are rather abstract, such as relying on relatives and friends or establishing useful contacts. Only 24 percent of persons who claim to take measures to secure a job—that is, 5 percent of those wishing to work abroad—actually approach foreign companies. Generally speaking, most persons willing to emigrate merely dream about emigration.

16.3. Countries of Destination

As a rule, specialists would like to emigrate to developed countries in Europe and America (table 16-4). While the global community holds the view that developers and manufacturers of missile weapons should not go to countries with aggressive and totalitarian regimes, the opinions of specialists surveyed are at odds with this sentiment.

Table 16-4. Countries and regions to which persons wishing to work abroad would like to go, % of definitive replies

COUNTRIES AND REGIONS	%
North America	63
Western Europe	79
Israel	9
Others	6

Table 16-5 presents the attitudes of persons wishing to work abroad to emigrating to selected countries, some of which are characterized as aggressive or totalitarian. It is worth noting that almost 60 percent of respondents did not mention any of the countries listed in table 16-5 as an undesirable place to work.

Table 16-5. Countries flatly rejected by persons willing to work abroad, % of definitive answers

COUNTRIES TO WHICH SPECIALISTS WOULD NOT EMIGRATE UNDER ANY CIRCUMSTANCES	%
Mentioned none of the countries listed below	56
Israel	18
China	17
Pakistan	16
Iran	11
Iraq	7
India	6
North Korea	5
Libya	1

It turns out that Israel, China, and Pakistan have the highest rejection rate, as between 16 percent and 18 percent of respondents would never go to those countries. Between 5 percent and 7 percent would not go to Iraq, India, or North Korea, while 1 percent of the respondents would not go to Libya.

It appears that specialists in the Russian missile industry have their own view of missile technology nonproliferation; and it differs significantly from the perspective shared by most countries in the international community. The difference is easy to explain: Specialists in

present-day Russia face a heretofore unknown problem, that of survival. Had the financial situation of specialists in the Russian missile industry been the same as or better than before, their opinions on where to seek work and whether to emigrate at all would have definitely been much closer to the generally accepted views of the international community.

16.4 Reasons for Interest in Working Abroad

For two-thirds of respondents, the main reasons for an interest in working abroad (table 16-6) are related to economic situation. Purely professional motivations are claimed by 40 percent of persons seeking work abroad, while 10 percent are interested for political reasons.

Table 16-6. Main reasons for interest in working abroad, %

REASON	%
Economic	66
Professional	39
Political	10

16.5. Work Abroad

Fewer than half of respondents answered with a definitive no when asked if they would work in foreign defense industries (table 16-7). One person in five did say they would work for such industries, and the rest are either undecided or qualify their reply in some way.

Table 16-7. Willingness to work for foreign defense industries, %

WILLINGNESS TO WORK FOR DEFENSE INDUSTRIES	%
Agreed	21
Disagreed	46
Undecided	29
Agreed, provided it is not against Russia	5

About two-thirds of those willing to work abroad said they would accept a job unrelated to their occupation, provided that they are able to perform well in it. The rest would work only within their occupation.

16.6. Attitude toward Others' Emigration

In our opinion, specialists' potential willingness to emigrate may be more accurately gauged from their attitude toward other emigrants. Generally, persons with negative attitudes toward emigration and emigrants would be unlikely to go abroad to work. Alternatively, persons who approve of emigrants or who feel neutral (considering it a personal matter) might work abroad under certain circumstances. Table 16-8 presents some data on respondents' attitudes toward emigrants.

Table 16-8. Specialists' attitudes toward emigrants, %

ATTITUDE TOWARD EMIGRANTS	%
Negative	16
Neutral (haven't given it much thought because it is a personal matter)	42
Positive (approval or envy)	42
Total sampling	100

Only 16 percent of respondents have a negative view of people leaving Russia. Therefore, as a matter of principle, this percentage may not be regarded as potential emigrants. Forty-two percent are neutral, having never thought much about emigration or viewing it as a personal matter; a like number approve of emigrants or even envy them. Emigration potential, therefore, is much higher than the answers regarding intentions to work abroad might suggest.

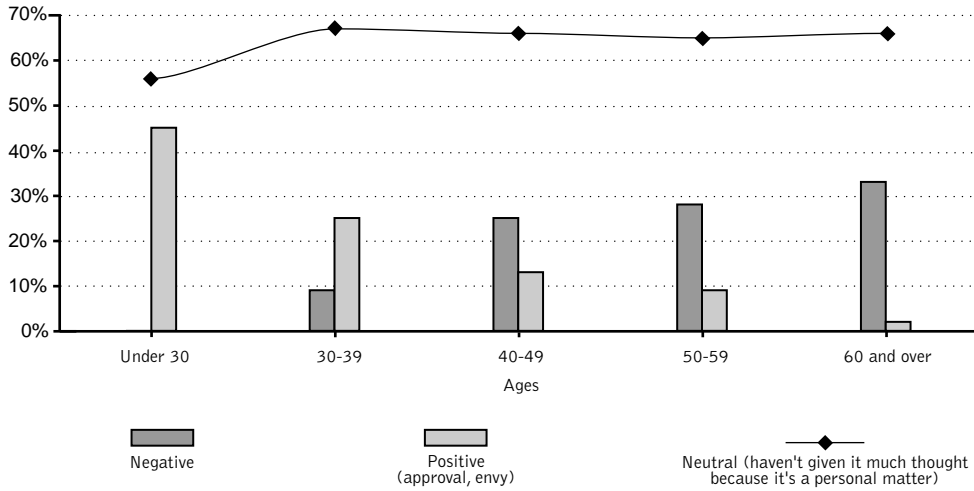
Engineers, technicians, and scientists have the lowest percentage of neutral responses regarding emigration (59 percent). The rest are almost evenly split among those holding negative and positive views of emigrants. Among executives, approximately 80 percent are neutral, while virtually all the rest have negative attitudes toward emigrants.

Table 16-9. Specialists' attitudes toward emigrants, by position held, %

POSITION	ATTITUDE TOWARD EMIGRANTS			TOTAL SAMPLING
	Negative	Neutral (haven't given it much thought, as it is a personal matter)	Positive (approval or envy)	
Researchers, engineers, and technicians	23	59	19	100
Executives	18	81	2	100
Total sampling	22	64	15	100

Both negative and positive attitudes toward emigrants are closely related to age (fig. 16-3): the share of specialists holding negative views of emigrants increases with age. The percentage of neutral views is constant across all age groups.

Figure 16-3. Attitudes toward emigrants, by age, %



17. ACTUAL EMIGRATION

17.1. Emigration from Missile Cities

Although difficult to measure, some emigration from missile cities is clearly taking place. The extent of migration may be approximately gauged by respondents' answers to whether any ex-coworkers of theirs have gone abroad (table 17-1). Presumably the data thus obtained generally reflect emigration-related processes in missile cities.

Table 17-1. Emigrants from missile cities, %

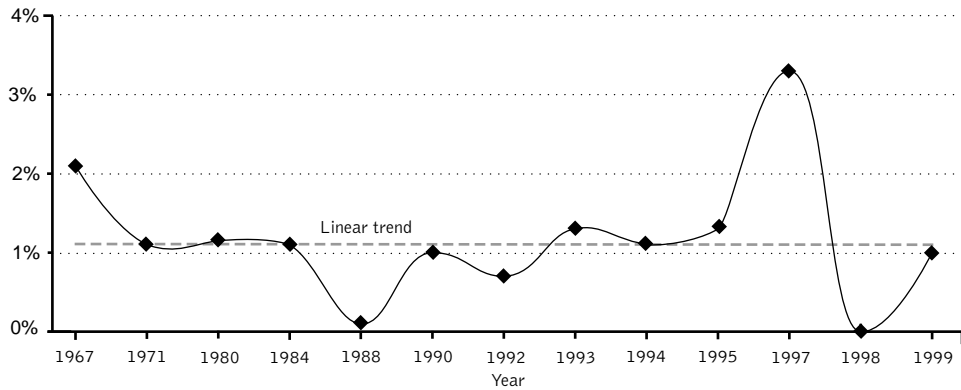
HAVE ANY EX-COWORKERS EMIGRATED?	CITY			% OF SAMPLE
	Korolev	Miass	Votkinsk	
Yes	19	21	8	18

Table 17-1 shows that 18 percent of the surveyed respondents at the enterprises indicate that some of their former coworkers have gone abroad. The figure is highest in Miass, at 21 percent, and lowest in Votkinsk, at 8 percent.

17.2 Emigration Dynamics

Figure 17-1 shows the time profile of emigration flows. Emigration started in 1967, peaked in 1997, and then began to decline. Over the period in question, emigrants averaged about 1 percent of all specialists employed by the enterprises we surveyed.

Figure 17-1. Dynamics of emigration from missile cities, % of total sampling



17.3. Emigrants' Demographics

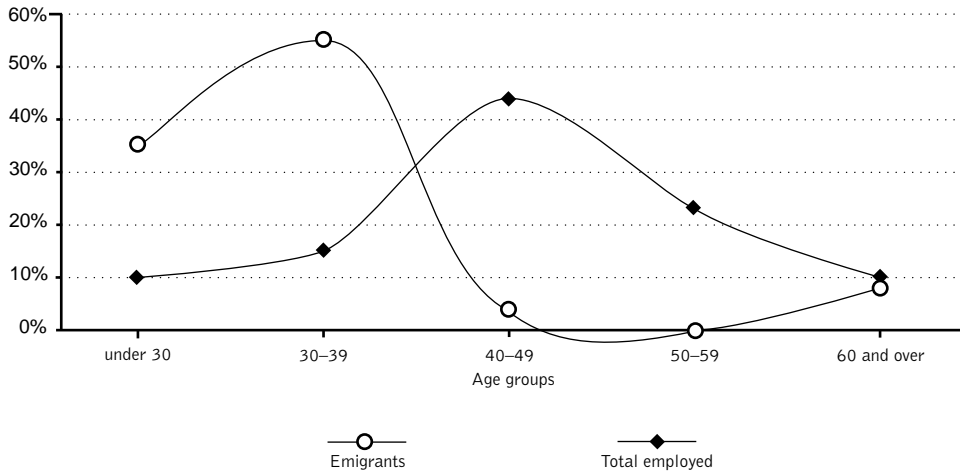
Males account for 80 percent of emigration flow. Sixty percent of emigrants are ethnic Russian, and the majority of the remaining 40 percent are Jewish (table 17-2).

Table 17-2. Ethnic composition of emigrants, by sex, % of total

ETHNICITY	SEX			TOTAL SAMPLING
	Male	Female	Married couple	
Russian	55	86	11	59
Jewish	45	8	0	37
German	0	0	78	2
Ukrainian female	0	6	0	1
Jewish female and Ukrainian male	0	0	11	0
Total sampling	100	100	100	100

Emigrants tend to be younger than average compared with all current employees: 90 percent are under the age of forty (fig. 17-2).

Figure 17-2. Emigrants vs. total current employees: Age profile, %



17.4. Reasons for Emigrating

According to respondents, economic considerations are the main reason for emigrating. One person in three emigrated for family reasons, one in five for political motives, and a small proportion of emigrants, 8 percent, emigrated for occupational reasons (table 17-3).

Table 17-3. Reasons for emigrating, %

REASON	%
Economic	56
Career	8
Political	22
Family	36
Total sampling	100

17.5. Country of Destination and Reason for Emigrating

Forty-three percent of all emigrants emigrated to North America, 15 percent to Israel, one in three to Western Europe, and the rest to Australia and New Zealand. We are not aware of any cases in which specialists from missile cities have traveled to countries with so-called aggressive regimes.

Table 17-4. Country of destination, %

COUNTRY	%
Canada	28
Israel	15
USA	15
Italy	14
Germany	13
France	7
Australia	7
New Zealand	2
Total sampling	100

An overwhelming majority of cases involve persons leaving missile cities to take up permanent residence abroad. Only specialists going to France and Italy went to those two countries to take temporary jobs (table 17-5).

Table 17-5. Country of destination and reason for emigrating, %

COUNTRY	REASON			TOTAL SAMPLING
	Permanent residence	Temporary job	Undecided	
France	0	100	0	100
Germany	100	0	0	100
Israel	100	0	0	100
USA	100	0	0	100
New Zealand	80	0	20	100
Canada	100	0	0	100
Australia	100	0	0	100
Italy	0	100	0	100
Total sampling	79	20	0	100

Whereas 100 percent of Jews and Germans emigrated for good, only two in every three Russians, who make up the bulk of specialists at the enterprises we surveyed, go abroad for permanent residence (table 17-6). Thus, the emigration of Jews and Germans may reflect repatriation, that is, a return to their historic homelands. The emigrants from the remaining ethnic groups represented in the survey also tended to emigrate permanently.

Table 17-6. Reason for emigrating and ethnicity, %

ETHNICITY	REASON			TOTAL SAMPLING
	Permanent residence	Temporary job	Unclear	
Russian	65	35	1	100
Jew	100	0	0	100
German	100	0	0	100
Ukrainian	100	0	0	100
Jewish female and Ukrainian male	100	0	0	100
Total sampling	79	20	0	100

18. PERSONNEL SHIFT TOWARD PRIVATE BUSINESS

18.1. Extent, Composition, Dynamics

It is not emigration that hits the enterprises' human resources worst—in fact, its incidence is quite low—but rather migration of specialists to private business jobs and self-employment (table 18-1).

Table 18-1. Colleagues who have taken jobs with private businesses or started their own businesses, %

DO YOU HAVE COLLEAGUES WHO HAVE TAKEN PRIVATE BUSINESS JOBS OR HAVE STARTED A BUSINESS OF THEIR OWN?	CITY			TOTAL SAMPLING
	Korolev	Miass	Votkinsk	
Yes	58	75	48	58
No	42	24	52	42
Yes, many	0	1	0	0
Total sampling	100	100	100	100

Overall, 58 percent of respondents had colleagues who moved to private business entities or started a business of their own. This share is highest in Miass, at 75 percent. In Korolev and Votkinsk, the figures are much lower, at 48 percent and 58 percent, respectively.

Let us consider the types of cities chosen by persons moving to private business entities (table 18-2). In Korolev, located right next to Moscow, the number of those working in the open city is six to seven times higher than the number of those working in the missile city proper. Therefore, the high percentage of persons opting for private business jobs in Korolev, in fact, has to do with Moscow's proximity. The lower percentage in Miass and Votkinsk is due to the fact that the relatively fewer business entities set up in the missile cities offer fewer possibilities.

Table 18-2. Cities in which former specialists have jobs in private business, %

LOCATION OF SPECIALISTS' NEW JOBS	CITY			TOTAL SAMPLING
	Korolev	Miass	Votkinsk	
City in question	43	91	91	51
Closed city	5	2	0	4
Open city	52	7	9	45
Total sampling	100	100	100	100

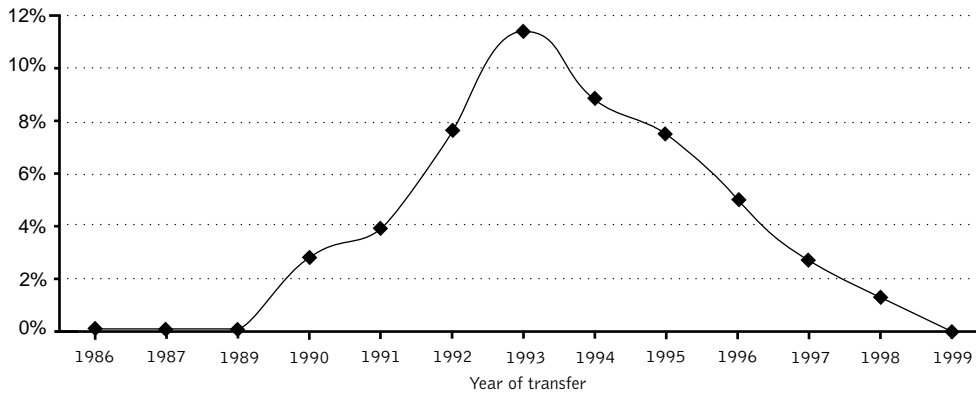
As follows from table 18-3, specialists who leave missile enterprises play an important role in developing new economic structures. Of all specialists who moved to the private sector, 48 percent to 53 percent have their own businesses, while the rest remain hired employees. Interestingly, the share of former missile specialists running their own business is higher in Miass and Votkinsk than in Korolev. This may indicate that specialists in Miass and Votkinsk have to create jobs for themselves, whereas those in Korolev have less need to establish a business of their own because nearby Moscow offers ample job opportunities.

Table 18-3. What ex-specialists of missile enterprises do for a living, %

PLACE OF WORK	CITY			TOTAL SAMPLING
	Korolev	Miass	Votkinsk	
Working for hire in private business	52	37	47	51
Running own business	48	63	53	49
Total sampling	100	100	100	100

As can be seen from figure 18-1, specialists' movement to business entities and self-employment has had some temporal cycles. Between 1989 and 1993, the number of specialists moving to the private sector rose; in 1993, the numbers started to fall. From 1990 to 1998, 58 percent of specialists left the surveyed enterprises to work in the private sector, meaning that about 6 percent of all specialists leave enterprises for business entities every year.

The outflow of human resources from missile enterprises to private businesses between 1991 and 1998 was almost six times greater than the 1 percent of outflow due to emigration over the same period.

Figure 18-1. Time of specialists' move to business entities, % of total sampling

18.2 Reasons for Moving to Business Entities

As follows from table 18-4, some 94 percent of the job shifts are driven by economic considerations, while only 6 percent are career-related.

Table 18-4. Reasons for moving to business entities, %

MAIN REASON	%
Economic	94
Boredom	4
Space industry degradation	2
Total sampling	100

18.3. Becoming Employed in Business Entities vs. Profession

As a rule, becoming employed in a business entity involves a change of profession (table 18-5). Less than 25 percent of persons taking business jobs do so in the same profession they had at the public enterprise.

Table 18-5. Business jobs of ex-specialists: Professional profile, %

PRIVATE BUSINESS JOB VS. MISSILE ENTERPRISE PROFESSION	CITY			TOTAL SAMPLING
	Korolev	Miass	Votkinsk	
Same profession	24	16	6	22
Different profession	71	82	91	74
No information	5	2	3	4
Total sampling	100	100	100	100

Having to change profession, however, does not deter specialists from moving to business entities. This is evidenced by data showing that people are generally satisfied with their shift to private business (table 18-6). Because the overwhelming majority of those moving to business entities are forced to change the profession they used to have at the missile enterprise,

the success or failure of such change ought to be affected by their satisfaction with the new job. In fact, almost nine-tenths of specialists joining business entities are happy to have left their government enterprise for private business. It is no coincidence that over 50 percent of those wishing to leave the enterprises we surveyed would like to move to business entities.

Table 18-6. Satisfaction with new jobs, %

	CITY			% OF SAMPLE
	Korolev	Miass	Votkinsk	
Satisfied	86	100	92	88

19. PERSONNEL TRAINING FOR THE MISSILE INDUSTRY

19.1. Selection of Students

Currently, the enterprises hire graduates who started their higher education at least six years ago (table 19-1).

Table 19-1. Competition for admittance to colleges and universities, %

COMPETITION	YEAR ADMITTED		TOTAL SAMPLING
	1993	1994	
Less than 1 person per vacancy	35	31	33
2-3 persons per vacancy	65	56	61
3-5 persons per vacancy	0	6	3
Over 5 persons per vacancy	0	6	3
Total sampling	100	100	100

Most students were admitted to colleges and universities when competition was still quite limited, less than one person per vacancy or two to three persons per vacancy. In fact, a trend toward stiffer competition has appeared only in recent years. Clearly, a low competition rate at colleges and universities translates into low standards for newly admitted students and generally poor quality of graduates.

19.2. Occupational Choices

Over half of all students chose their occupation deliberately because they regarded it as an interesting career (table 19-2). In fact, the percentage of college and university students that chose their occupation deliberately is higher among students admitted in 1994 than among those admitted in 1993. The share of students selecting their occupation by chance falls from 19 percent among 1993 admittees to 10 percent in 1994. Simultaneously, there was a rise in the percentage of students attributing more importance to higher education than to occupation. While 6 percent of students admitted in 1993 felt that higher education mattered more than occupation, this opinion was held by 14 percent of students admitted in 1994.

Table 19-2. Reasons for students' occupational choices, %

REASON FOR CHOOSING OCCUPATION	YEAR ADMITTED		TOTAL SAMPLING
	1993	1994	
Consider it promising and interesting	55	66	60
Random choice	19	10	15
Occupation does not matter, higher education does	6	14	10
Other reasons	19	14	17
Total sampling	100	100	100

Deliberate occupational choices are closely related to the academic achievements of would-be specialists (table 19-3). Almost all respondents (92 percent) with mostly excellent academic records believed their chosen occupation to be promising and interesting. This compares with 59 percent of students with mostly good academic records and 22 percent of students with mostly satisfactory academic records who considered their chosen occupation to be promising and interesting. The highest percentage among students with satisfactory academic records are persons choosing their occupation by chance (44 percent) and those who care more about earning a diploma than securing an occupation (33 percent).

Table 19-3. Determinants of students' occupational choices vs. academic record, %

REASON FOR OCCUPATIONAL CHOICE	GENERAL ACADEMIC RECORD AT COLLEGE/UNIVERSITY			TOTAL SAMPLING
	Mostly satisfactory	Mostly good	Mostly excellent	
Consider it promising and interesting	22	59	92	60
Random choice	44	14	0	15
Occupation does not matter, education does	33	8	0	10
Other reasons	0	22	8	17
Total sampling	100	100	100	100

20. MISSILE SECURITY AND PERSONNEL

20.1. Aging of the Work Force

Respondents believe that among the major developments adversely affecting the personnel profile at missile enterprises are an aging work force (61 percent) and a reduced inflow of young workers (48 percent).

For the most part, the reasons for the aging of the work force are unrelated to the natural rollover of generations (that is, the process by which older workers retire and are replaced by fewer younger workers). Largely, it is caused by an inadequate inflow of young workers, which is due in turn to an ongoing decline in missile enterprise employment.

The drop in employment level in missile enterprises has occurred not just through pre-planned retrenchments. In addition to the retrenchments, many promising specialists have left the enterprises to join the private business sector. Specialists in the particularly productive

years of thirty to forty move to private business in the largest numbers and highest percentage compared to any other age group. Even those under thirty are half as likely to leave for private business jobs.

Even the few young workers hired by missile enterprises face a lot of difficulties, some arising from poor engineering training of young graduates. The following is a sampling of respondents' perspectives on newly hired young specialists: "young workers of poor engineering education"; "well-connected easy riders (children of higher-ups)"; "many have jobs unrelated to their professions"; "the enterprise has no inflow of personnel trained in core occupations"; and "inadequately trained specialists are hired."

Over 45 percent of those polled named the shift of specialists to private business as being among the causes most detrimental to the personnel profile. Meanwhile, only 1 percent of respondents considered emigration abroad as an adverse factor. Clearly, specialists themselves believe that the main threat in terms of human resources comes not from emigration, but from the movement of specialists to private business.

20.2. Surveyed Attitudes

Asked to name the potential consequences of the various developments adversely affecting the employee mix at missile enterprises, 37 percent of respondents referred to a slowdown in scientific research, while 62 percent point to a dearth of new ideas and an overreliance on older research and development projects.

Such deficiencies are a troubling indication that the missile industry is likely to fall hopelessly behind contemporary standards. The following list of some typical statements made by specialists will convey a better idea of their thinking on these issues (table 20-1). The statements are, in fact, a cry of desperation.

Table 20-1. Respondents' personal opinions on the consequences of adverse developments affecting the enterprises

Slowdown of scientific research
Dearth of new ideas and overreliance on earlier R&D projects
We largely work for some upstart overseas
Work quality has gone downhill
They don't apply themselves at work
Operations are unstable
There will be no one to carry out routine work
Bedlam
We live one day at a time; there is no prospect for the future
The enterprises' potential is in decline
Sudden increase in the number of bosses with no responsibilities
The government does not care
We won't be able to redo anything the way we used to
Gradual decline in work efficiency
Lost parity in terms of military hardware would be hard to regain
Production of submarine missiles is dying with a corresponding dearth of designers and technology experts

Table 20-1. Respondents' personal opinions on the consequences of adverse developments affecting the enterprises (Continued)

No chance for passing on our knowledge and experience to young workers
New R&D projects are few and far between; young workers are not properly taught, as we have nothing to teach them with; some of them have gone away. The older generation is going, some leave for private business; new R&D projects, if any, would be difficult to see through. Older workers knew a lot; they remembered our flops. The young ones would have to start from scratch
The enterprise is quietly decaying
Loss of crucial information that might be needed to develop similar systems
Decline in the enterprise's R&D potential
Lack of funding
Lack of priorities in the government's technology policy, if the things happening in Russia may even be called a policy
Complex technological problems would be harder to address
There is no line of succession
Further retrenchments would cripple the work force
The enterprise has collapsed
The remaining specialists have heavier workloads, with one employee doing the work of two or three. This leaves little time for young workers who once again have started joining the enterprise. For this reason, the experience sharing fails to reach deep enough, only skimming the surface
Fearing layoffs, many pensioners try to become indispensable and deliberately avoid sharing their experience with younger workers. Yet, sooner or later, they will have to go, while young employees would make poor specialists or simply go away, having no interest in manufacturing
They will have to start from square one
Management has no fresh ideas

20.3. Nuclear Security and Personnel

Table 20-2 shows that 41 percent of respondents believe that adverse developments in the makeup of specialist personnel have already affected nuclear security, while 42 percent expect negative consequences to be felt in the near term or longer term. One in every four respondents is either undecided or believes that the current changes will not affect Russia's nuclear security.

Table 20-2. Can changes in the specialist personnel makeup adversely affect the nation's nuclear security?, %

	%
Adverse effects already present	41
It may be affected in the near term	32
It may be affected in the longer term	10
Such changes will have no effect	3
Adverse effects already present, as operational reliability declined	1
Given ten more years of such policies, the nuclear security issue would be irrelevant	1
Undecided	18
Total sampling	100

20.4. Who Is Threatened?

Who is threatened most by the decline of the missile cities? As can be seen in table 20-3, most respondents (81 percent) believe that the situation in missile cities endangers Russia. Only 10 percent of respondents cite a global threat.

Table 20-3. Who is under the worst threat from adverse developments affecting the specialist personnel of missile cities?, %

IN CASE ADVERSE CHANGES CONTINUE TO AFFECT SPECIALIST PERSONNEL, WHO WOULD BE THE MOST THREATENED?	%
Russia	81
Entire world	10
Nobody	2
Undecided	8
Total sampling	100

These results should not be surprising. Missile specialists have been making weapons to deter, not commit, aggression. Therefore, they view the signs of weakness in the nation's missile potential as threatening Russia and its security.

ABOUT THE AUTHOR

Valentin Alexeevich Tikhonov is a leading research fellow with the Institute of Economic Forecasts of the Russian Academy of Sciences, a position he has held since 1993. He received his Ph.D. from the Russian Academy's Institute of Sociological Sciences in 1978. Prior to joining the Institute of Economic Forecasts, he worked for the Institute of Problems of Employment and the Institute of Social and Economic Problems of Population and Labor Resources, both affiliates of the Russian Academy of Sciences.

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- "Russia's Atomic Cities: Migration Phenomena," *Nuclear Proliferation Journal*, Issue 28, February 1999 (in Russian), Carnegie Moscow Center.
- "Closed Cities in Open Society," March, 1996 (in Russian), Institute of Economic Forecasts.
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