Coordinating Russia’s Vacant Jobs and Work Force Dynamics

A. G. Korovkin

Abstract—This article is a follow-up on a study of problems involved in measuring the imbalance between demand and supply in the Russian labor market (see [1]). It examines a model for assessing the outlook for labor demand with a view to forecasting the sectorwise pattern of the population’s employment. The basic principles of the proposed approach apply to the forecasts of other types of employment patterns (territorial, occupational and job-skill).

The situation that developed in the Russian Federation’s economy by mid-1998 has had a negative impact on both the present state of employment and on the prospects of its dynamics. The national economy shows practically no signs of recovery and in many key areas the situation continues to deteriorate. Most importantly, the overall decline of production continues. Despite a noticeable slowdown of overall recession, it could not be stopped in 1998. An analysis of production dynamics in material production sectors reveals a basically similar picture. The sectors where a trend toward the reduction of output prevails are primarily those engaged in end product manufacture. Although the reduction of output has slowed down, the problem of idle capacities remains particularly acute. The low level of their use may eventually lead to the loss of a basis for an economic upswing due to the wear and tear of the equipment used. It would probably be wishful thinking to speak of the emergence of growth sources that may provide a basis for an industrial and, consequently, overall economic upswing, the more so since competition with imported finished products is becoming increasingly severe and domestic producers are being forced out of the internal consumer goods market.

Structural disproportions between economic sectors are becoming increasingly striking, which is confirmed by an analysis of the dynamic aspects of shifts in the sectoral structure of basic production factors (gross output, fixed assets, wage and employment funds). Let us use for this purpose index $I_E$, characterizing the spread of the sectoral values of a certain indicator (see [2]). For a study of the values of index $I_E$ between 1980 and 1995 see [1]. The values of index $I_E$ between 1980 and 1997 for major macroeconomic indicators whose dynamics were estimated by the RAS Institute of Economic Forecasting are shown in Fig. 1.

Prior to 1989, the fluctuation of basic macroeconomic indices occurred within some limited ranges and was associated with certain priorities and steps of the nation’s socio-economic policy during that period. In the 1990s, the picture changed (for details see [1]). As may be seen from the graph below, the dynamics of index $I_E$ in the past two years was irregular. In 1996, it showed some growth while in 1997 it revealed a downward trend. At the same time, the basically established spread in the numeric values of index $I_E$ has remained unchanged: their highest level is typical of the wage fund, which goes to show a persisting disparity in the wages of various sectors and the lowest characterize fixed assets. It is not surprising in view of the practical absence of investments. It was symptomatic that in 1997 the values of index $I_E$ for gross output and the number of employees also dropped to a level characteristic of fixed assets in the past few years. It could be a sign (in the absence of additional factors such as significant Western “injections”) of a stagnation period beginning in the Russian economy.

Investment activity is slowing down while investments are sorely needed. The dynamics of index $I_E$ for fixed assets with investment activity plunging shows that all sectors are downsizing employment as a result of insufficient investment. The retention of the basic, most viable and effective jobs is an indispensable precondition for an end to the general crisis of the country’s economy. The availability of spare production capacities and their higher level of utilization will provide the conditions necessary for a normal investment process. In the event of a meltdown of production facilities in some sectors vital to economic development, the economy will inevitably enter a long period of stagnation as soon as the decline of production comes to an end.

All this affects the labor market and employment in so many different ways that it is impossible to deal with all of them in a single article. However, a select set of them should be pointed out.

Although most of the people—about 60% of those dismissed—give up their jobs of their own free will and find new ones (or a new source of income) on their own, the trends characterizing the labor market are alarming. The number of officially announced vacancies (500 to 300000) is clearly insufficient and continues to decrease; the number of unemployed, estimated by different methods, is significant, and some fluctuations in official statistics during a socio-economic crisis are bewildering. The average duration of unemployment is
long and getting ever longer; its geography is expanding; as of early 1998, the share of the unemployed population per each announced opening was six persons.

Latent unemployment is a salient feature of the Russian economy. Its existence is affected today by the socio-economic and political situation in the country. The decline of production is the main cause of a shrinking demand for labor and latent unemployment. Massive release of employees is restrained by factory managers and union leaders. International experience shows that, all overheads notwithstanding, partial unemployment, part-time work, and all forms of “internal” flexibility of the labor market are socially and economically preferable to “external” flexibility, massive layoffs, stagnant unemployment, loss of job skills, and social degradation of the masses. Latent unemployment makes it possible to defuse social tension by stretching in time the release of the work force. Yet the development of the private sector, structural changes and expected bankruptcies of enterprises will deprive millions of those who are not considered latently unemployed today of their jobs.

Traditional types of unemployment such as cyclical, frictional, and structural and the methods of assessing the latter are examined in [1]. It should be noted at this point that a structural crisis is also manifested in the growth of sectoral and regional structural unemployment. For instance, Tables 1 and 2 show the growth of tension in the labor market and in its structural component. The Central and Northwestern regions alone may be somewhat cautiously described as relatively safe. Present-day Russia is characterized by considerable isolation of regional labor markets. That is one reason for the low mobility of labor. The weak influence of the state on this problem aggravates the isolation of regional labor markets. Under such conditions, the all-Russian labor market is functioning mainly in spontaneous and unorganized forms with all the negative consequences.

When considering structural unemployment and regional labor markets, we should focus, above all, on integral migration because it is actually migration streams that bring about the interregional and intersectoral redistribution of labor.

Thus the labor market situation is aggravated by the development of a structural crisis and production slowdown (the financial crisis in the summer and fall of 1998 was largely due to these circumstances) as well as by the actual abandonment by the state of its regulatory role in the supply and maintenance of jobs and its coordinating function in the development of various processes exerting a decisive influence on employment and labor market dynamics. It is associated, above all, with a decline in investment activity. In a crisis, many mod-

![Fig. 1. The dynamics of structural shift index $I_E$ for major macroeconomic indicators.](image)

<table>
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ern sectors (including high-technology industries, science, and services) requiring highly skilled workers and considerable expenditures are more likely to fall prey to destruction and work force degradation than more traditional industries. Thus the downsizing of personnel in machine-building and metal industries was stepped up as production declined. Slowing the downswing in a sector decelerates the downsizing of personnel. Changes in the work force employment level and structure as a result of cutbacks in military spending and the re-channeling of resources for peaceful purposes merit close attention. The employment of specialists poses a special problem that requires providing them with jobs in line with their qualifications while offering retraining and social protection to “redundant” personnel. Particularly important is the regional aspect in view of the extremely uneven territorial distribution of the defense industry. Defense production is so territorially localized that even in regions with a relatively “undermilitarized” economy there may be cities which are totally geared to a defense industrial facility.

The dynamics and main directions of changes in sectoral and regional population employment structures will be determined in the next few years by continuing critical developments in the economy (a decline in production, shrinking investments, and less effective use of labor) and by further steps toward the development of market relations. The predominant influence on job structure will be exerted by the first group of factors. The economy will have to function in an emergency mode where the advantages of market reforms cannot make themselves felt to the fullest extent.

An inadequate study of employment development prospects may generate regressive processes in employment patterns. Forecasting the population’s employment, its structures, and labor market dynamics should figure prominently in the activities of federal and regional authorities.

The goals of coping with the crisis, further reforms of the economy, its restructuring, and laying the groundwork for an economic upswing necessitate coordinated development of the main production factors. These problems should be resolved with a view to providing effective employment for the population of the country and its regions, based on the availability of enough jobs to meet the population’s demand for them, effective use of labor, the supply of labor meeting the industry’s demand for it, and the development of employment and its structures in line with demographic development.

Territorial, sectoral, job-skill, educational, and other population and labor resource patterns are shaped largely by the various types of job movement determining the demand for labor and that of population and labor resources. Therefore, the forecasting of the population’s employment structures should be oriented toward a mutually coordinated orderly movement of jobs, populations and labor resources taking into account the entire diversity of these processes on all economic levels (country–region–sector–enterprise). Thus, on both federal and regional levels, the above processes can be described in terms of independent sets of forecast models that may be grouped into “forecasts of labor demand” and “forecasts of labor supply.” On the borderline between these groups, national and regional economies are tested in an appropriate form for the correspondence of their prospective demand for labor to the results of future population and labor resource movements, estimated with due allowance for natural and interregional migration on the basis of an exogenous forecast. Attempts have been made to apply this approach (see, for instance, [3–5]). Let us recall its main propositions taking into account the present possibilities of its application.

To coordinate sectoral demand for labor with its supply, we can use an approach that differs somewhat from the one commonly used which is based on econometric models of the processes under consideration. Let us apply it by using the number of vacant jobs in various sectors because labor demand is actually manifested in the number of announced job vacancies to be filled by workers. The number of vacant jobs in sectors influences, in turn, work force movements.

The effect of vacant job dynamics on the development of the entire population’s sectoral job structure and the number of employees in different sectors is determined by the opening (establishment) and closure (filling or elimination) of vacant jobs.

The latter result from, among other things, the establishment of new jobs (vacancies arising from the expansion, modernization or retooling of production and from new construction projects), the departure of people from a given employment system, their transfer to different jobs within the same sector or to jobs in other sectors.

Vacancies are closed in each sector by filling them with workers from the same sector, by hiring them outside the employment system, and by eliminating vacant jobs.

Let us look at the coordination of the overall vacant job and labor dynamics, because further research should focus on the application of the approach being developed to the modeling of changes in a sectoral and/or territorial job system arising from the intersectoral or interregional work force movement.

The concept of “potential workers” is introduced in [3] to include the entire productive-age population not occupied in the employment system under investigation. (In other words, \( u(t) = N(t) - L(t) \)) where \( u(t) \) is the number of potential workers, \( N(t) \) is the productive-age population, and \( L(t) \) the workers in the employment system under investigation.) Potential workers include the following population groups: unemployed persons with type 1 and 2 disabilities, students over 16 years of age, homemakers, army personnel in need of jobs, etc. It is obvious that in order to proceed from a forecast of potential workers to a practically relevant projection of
the magnitude of unemployment requires an exogenous forecast of prospective dynamics for all the remaining above-mentioned groups. At the same time, the above definition makes it possible to sketch an approach to solving the problem of coordinating the sectoral demand for labor with its supply inasmuch as it simplifies the models of interrelation with demographic processes.

Let us examine the following equation in model (2.21)–(2.26) of the study [3] instead of equation (2.24):

\[ \frac{dw_i(t)}{dt} = (\alpha_i(t) - \beta_i(t))w_i(t) + z_i(t) - y_i(t), \]

where \( w_i(t) \) is the number of vacant jobs in sector \( i \) in the year \( t \); \( \alpha_i(t) \) is the rate of job opening in sector \( i \) in the year \( t \); \( \beta_i(t) \) is the rate of job closure in sector \( i \) in the year \( t \); \( z_i(t) \) is the total number of people who left sector \( i \) in the year \( t \); \( y_i(t) \) is the total number of people who entered sector \( i \) in the year \( t \).

If the admission of potential workers to fill vacancies is described in terms of the encounter hypothesis, used in [6] to model “predator–prey” systems, the following equation should be examined instead of equation (2.24) in [3]:

\[ y_i(t) = p_i(t)w_i(t)u(t), \quad i = 1, \ldots, n, \]

where \( p_i(t) \) is the rate of transfer of potential workers into the employment sphere.

The form of hiring function (2) may be different [7].

The departure of workers from sectors may be modeled in terms of stage-by-stage departure rates. To simplify estimates in model (2.21)–(2.26), a simpler expression may be used in place of equation (2.23):

\[ z_i(t) = q_i(t)y_i(t), \quad i = 1, \ldots, n, \]

where \( q_i(t) \) is the ratio between the workers who left sector \( i \) in the year \( t \) and those who entered it in the same period.

Thus, after simple transformations, the simultaneous equations (2.21)–(2.26) used in the study will take the form:

\[
\begin{aligned}
\frac{dw_i(t)}{dt} &= (\alpha_i(t) - \beta_i(t))w_i(t) \\
&+ p_i^*(t)(q_i(t) - 1)w_i(t)u(t) \\
\frac{du(t)}{dt} &= W(t) - p_o^*(t)u(t) \\
&+ \sum_{i=1}^{n} p_i^*(t)(q_i(t) - 1)w_i(t)u(t).
\end{aligned}
\]

Assuming that entry into the employment system under investigation from the outside \( W(t) = p_o^*(t)u(t) \) and \( \varepsilon_i(t) = p_o^*(t) - p_o^*(t) \), \( \varepsilon_i(t) = \alpha_i(t) - \beta_i(t) \), \( \mu_i(t) = p_i^*(t)(q_i(t) - 1) \), the simultaneous equations under consideration will be reduced to the form:

\[
\begin{aligned}
\frac{dw_i(t)}{dt} &= [\varepsilon_i(t) + \mu_i(t)u(t)]w_i(t) \\
\frac{du(t)}{dt} &= \varepsilon_0(t) + \sum_{i=1}^{n} \mu_i(t)w_i(t)u(t).
\end{aligned}
\]

These simultaneous equations describe an interrelated change in the number of potential workers (labor supply) and the number of vacant jobs (labor demand) in \( n \) economic sectors (sectors or regions). In a single-sector model it has the form:

\[
\begin{aligned}
\frac{du(t)}{dt} &= \varepsilon_0u + \mu uw \\
\frac{dw(t)}{dt} &= \varepsilon w + \mu uw.
\end{aligned}
\]

The simultaneous equations (5) may be arrived at on the basis of somewhat different reasoning. For this purpose an overall study is made of the variation in number of potential workers \( u(t) \) and the general demand for labor (the total number of vacant jobs) \( w(t) \).

If we assume that the interrelationship between potential workers and vacant jobs, that is, the movement of labor between the sectoral employment system and potential workers, is lacking (or the balance of this movement is zero), the increments in their numbers \( du(t) \) and vacant jobs \( dw(t) \) during some period \( dt \) will be proportionate to \( u(t) \) and \( w(t) \), respectively, regarded as continuous differentiated functions. These increments will also be proportionate to the length of the time interval as long as the latter is small. Thus we obtain

\[
\begin{aligned}
\frac{du(t)}{dt} &= \varepsilon_0u(t)dt \\
\frac{dw(t)}{dt} &= \varepsilon w(t)dt,
\end{aligned}
\]

where \( \varepsilon_0 \) and \( \varepsilon_1 \) are increment rates expressing the relationship of increments \( du/\text{dt} \) and \( dw/\text{dt} \) to numbers \( u \) and \( w \) respectively.

On the macrolevel, \( \varepsilon_0 \) is determined by the processes of demographic development (birth rate, mortality, and migration). The increment rate of the number of vacant jobs \( \varepsilon_1 \) depends on the trends of demand variation, the establishment of new jobs and elimination of old ones. In reality, however, the movement of the population and work force resources affects the numbers of both. It is expressed in increments \( \beta_1 = \mu uw dt \) and \( \beta_2 = \mu_2 uw dt \) for the number of potential workers and vacant jobs, respectively. Then, during the period \( dt \) these numbers change to become respectively

\[
\begin{aligned}
\frac{du(t)}{dt} &= \varepsilon_0u dt + \mu uuw dt \\
\frac{dw(t)}{dt} &= \varepsilon_1 w dt + \mu_2 uw dt.
\end{aligned}
\]

From (7) we obtain simultaneous differential equations, similar to the one obtained earlier (5):

\[
\begin{aligned}
\frac{du}{dt} &= \varepsilon_0u + \mu uw \\
\frac{dw}{dt} &= \varepsilon_1 w + \mu_2 uw.
\end{aligned}
\]
It is clear from equations (8) that coefficient $\mu_1$ characterizes the intensity of the overall work force movement and coefficient $\mu_2$ the intensity of the overall movement of jobs resulting from the work force movement.

It may be assumed (with due allowance for the fact that the share of dismissals resulting from the downsizing of jobs in their total number is relatively small) that $\mu_1 = \mu_2 = \mu$ since the dismissal of a worker leads to an increase by 1 of potential workers and vacancies while the hiring of a potential worker to fill a vacancy results in a decrease of both by 1. The coefficient $\mu$ characterizes variation in the number of potential workers and the respective number of vacant jobs as a result of their interaction.

A different relation of the signs of model parameters determines the character of labor market processes and population employment dynamics. Table 3 lists different variants for $\varepsilon_0 > 0$.

At $\varepsilon_0 > 0$ (estimated for the productive-age population as it corresponds to the present situation), let us analyze the interrelated changes of magnitudes $u$ and $w$ in two instances: $\varepsilon_1 > 0$ and $\mu < 0; \varepsilon_1 < 0$ and $\mu > 0$.

For $\varepsilon_1 > 0$ and $\mu < 0$, it may be shown [6, pp. 37, 38] that with $C = C_0 = \min(u^{\varepsilon_1/\mu} w^{\varepsilon_0/\mu})$, point $(u, w)$ tends toward point $p(u = -\varepsilon_1/\mu, w = -\varepsilon_0/\mu)$ corresponding to a stationary state of the potential workers–vacant jobs system. At point $p$, derivatives $du/dt = 0$ and $dw/dt = 0$ are reduced to zero. It can be seen from (8) that the entire increment of potential workers is transferred to occupy vacant jobs and the entire increment of vacancies is filled by potential workers. It is obvious that $\varepsilon_{1,w} = \varepsilon_{0,u}$ or, in other words, the increment of vacant jobs as a result of the introduction and withdrawal of fixed assets, is equal to the increment of potential workers. However, if $C \neq C_0$, either $u$ or $w$ continuously rises or both magnitudes rise at the same time.

The coefficient of potential workers’ increment, $\varepsilon_0$, lends itself to indirect control only through factors determining the processes of birth, mortality and migration. Parameter $\mu$ is subject to controlling influence, either direct (by limiting hiring) or indirect (changing the values of factors underlying the movement of the population and labor resources). Increment rate $\varepsilon_1$ may be varied by changing the policy of opening new and/or reducing old jobs.

At $\varepsilon_1 < 0$ and $\mu > 0$, these equations are nonstationary [6, pp. 37, 39] or, in other words, the development of the process leads to a steady rise in the number of potential workers and a decrease in the number of vacancies. In that case, controlling influences should first be directed toward changing the sign of coefficient $\mu$. It can be achieved, above all, by changing coefficient $\varepsilon_1$ (that is, by increasing the demand for labor) as well as by altering the values of the factors affecting the movement of the population and labor resources. In the latter case, it is necessary to increase $\varepsilon_1$ in accordance with the relationship $\varepsilon_1 > \varepsilon_0 \ln w/\ln u$. Otherwise it is necessary that $\varepsilon_1 < \varepsilon_0 \ln w/\ln u$.

All the other sign relations of model parameters can be analyzed on similar lines.

It should be pointed out that coefficient $\varepsilon_1$ is negative today while $\mu$ is positive. The adverse effects of interaction between potential workers and vacant jobs make themselves felt in the reproductive situation, and enterprises seek to remedy the situation by reducing the number of employees.

The above approach makes it possible to formalize the procedure of selecting controlling influences by assessing the desirable values of parameters $\varepsilon_1$ and $\mu$ and possible ways of their achievement. Its application makes it possible to coordinate the supply of labor (with due allowance for its movement) and economic sectors’ demand for labor.

Estimates have been made in line with the proposed approach in order to analyze the way employment is maintained in the Russian Federation as a whole as a result of the interaction of the processes determining its change.

The use of the proposed tools for the projection of the prospective development of the population’s employment and its structures makes it possible to work out several types of forecasts. The first type should proceed from the assumption of the need to maintain the main trends of socio-economic policy. The other types should imply some sort of adjustment—for instance, toward stimulating domestic production and protection of the internal market. The variability of estimates enables them to be evaluated in terms of changes in macroeconomic indicators, structural shifts, and production efficiency as well as the maintenance of

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**Table 3**

<table>
<thead>
<tr>
<th>No.</th>
<th>$\varepsilon_0$</th>
<th>$\varepsilon_1$</th>
<th>$\mu$</th>
<th>Basic characteristics of the option</th>
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<tr>
<td>1</td>
<td>$+$</td>
<td>$+$</td>
<td>$+$</td>
<td>Growth of structural unemployment. Those dismissed due to low mobility, inadequate skills or lack of information cannot fill existing vacancies</td>
</tr>
<tr>
<td>2</td>
<td>$+$</td>
<td>$+$</td>
<td>$-$</td>
<td>Economic growth. The growth of employment does not absorb the entire increment of vacancies,</td>
</tr>
<tr>
<td>3</td>
<td>$+$</td>
<td>$-$</td>
<td>$+$</td>
<td>Economic recession. A decrease in vacancies is accompanied by a decline in employment,</td>
</tr>
<tr>
<td>4</td>
<td>$+$</td>
<td>$-$</td>
<td>$-$</td>
<td>Apart from all incremental openings, higher employment absorbs some of those previously available</td>
</tr>
</tbody>
</table>

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STUDIES ON RUSSIAN ECONOMIC DEVELOPMENT Vol. 10 No. 2 1999
employment and the preservation of the human resources potential of the national economy.

The estimates applied the term “potential workers” to the productive-age population, not occupied in the economy.

Since 1991–1992, statistics have made it possible, in applying the proposed approach, to use the vacant jobs data from reports submitted to Russia’s Goskomstat, and the data on enterprises’ demand for workers reported to the Federal Employment Service (FSZ). They differed somewhat from each other in the early period of such statistics but of late they have come closer to each other. At the same time, both types of data underestimate the real demand for labor. The Goskomstat provides data on large and medium enterprises. (There also seems to be a problem with discipline in statistical recording and reporting.) The FSZ is in a formative stage, and it will take some time before the service enjoys the full trust of enterprise managers and the population.

As was pointed out in [1, 4, and 5], since the extensive economic growth of the early 1970s, there has been a lack of coordination between the development of the employment system, on the one hand, and population and labor resources dynamics, on the other. The manifestation of the above-mentioned trends shows a number of specific regional and sectoral features.

The number of vacant jobs in the Russian Federation’s economy prior to reform was estimated on the basis of studies [3–5]. The estimates drew on the data of labor resource shortages in the USSR, calculated as the difference between the number of blue- and white-collar workers according to enterprise plans, and their actual number, as well as on the basis of vacancy dynamics. For instance, the number of vacant jobs in the USSR industry was assumed to be equal to its shortage of human resources divided by the average sectoral changeability ratio. The results are reflected in Table 4.

<table>
<thead>
<tr>
<th>Year</th>
<th>Increment of potential workers</th>
<th>Increment of vacancies</th>
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<tbody>
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<td>1975</td>
<td>9.6</td>
<td>21.4</td>
</tr>
<tr>
<td>1980</td>
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<tr>
<td>1985</td>
<td>18.8</td>
<td>88.3</td>
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</tbody>
</table>

Parameter values in single-sector model (8) were determined on the basis of available statistical data and the above-mentioned assessments. Parameter $\varepsilon_0$ is assumed to be equal to the relation between the increment of the productive-age population and the number of potential workers. Parameter $\mu$ is equal to the relation of the increment of those occupied in the economy (with the opposite sign) to the product of the number of potential workers and vacant jobs. Finally, $\varepsilon_1$, characterizing variation in the number of vacant jobs (the demand for labor), is found as the relation of the total vacant job increment and the increment of those occupied in the economy to the total number of vacancies. It will be readily seen that equations (7) are interpreted as follows: the increment of potential workers is equal to the difference between that of the productive-age population and that of occupied workers and the increment of vacancies to the difference between that of jobs and that of occupied workers. (It is assumed that jobs are downsized primarily by eliminating vacancies.)

The joint forecasting of the number of vacant jobs and potential workers necessitates the forecasting of parameters $\varepsilon_0$, $\varepsilon_1$, and $\mu$. An attempt has been made to use for this purpose econometric models of their assessment. Multiple regression equations showing the interdependence of parameters in model (8) and basic macroeconomic indicators (gross output, fixed assets, the labor remuneration fund, the deviation of the average wage in the sector from the average wage in the economy as a whole, etc.) were used as the tools of such forecasting.

Fig. 2. The potential workers–vacancies curve in the Russian Federation.
Parameter $\varepsilon_0$ may be forecast with high accuracy because changes in the size of the productive-age population within the next fifteen years will be determined by those who live today. The forecasting methods being used (age shifts and survival rate) have proved to be sufficiently valid. At the present stage of research, it was suggested that parameter $s$ should be forecast on the basis of the productive-age population’s increment rate, set by a demographic forecast (see, for example, [8]). The following regression was obtained: $\varepsilon_0(t) = -7.15 T$ where $T$ is the productive-age population’s increment rate. The determination rate was 0.99, the value of $t$ statistics 77.78, and the value of F statistics 3553.16.

In modeling the dynamics of parameter $\varepsilon_1$, it was assumed that it depends on changes in the dynamics of fixed assets and gross output in material production sectors. Estimates showed that during the period from 1980 through 1995, such an interdependence did exist and could be modeled by the following statistical dependence:

$$
\varepsilon_1(t) = -1.43 + 10.26 X_1(t) + 18.84 X_2(t), \quad (10)
$$

where $X_1$ is the increment rate in material production and $X_2$ the increment rate of fixed assets.

The determination coefficient is 0.929; the values of $t$ statistics appear in parentheses under the equation; the value of F-statistics is 85.34.

The aggregate analysis of the temporal dynamics of model $\varepsilon_1$ and $\mu$ parameters points to their strong statistical dependence. The estimates fully confirm the assumption that in 1980–1995, such interdependence did exist and could be modeled by the following statistical dependence: $\mu(t) = -0.000075 \varepsilon_1(t)$.

The determination coefficient is 0.983; the value of $t$-statistics is $-37.5$, and that of F-statistics, 1408.16. Statistical characteristics permit the equation to be examined without the constant. The behavior of estimated values as compared to real ones is shown in Fig. 3.

An analysis of statistical dependences showed that the model parameters could be forecast with sufficient accuracy, and the values of $u$ and $w$ could be produced for each step of the forecast. The dynamics of model parameters are forecast in this article year by year, and each step naturally corresponds to a single year.

The forecasting of model parameters for a number of years seems to be inexpedient for two reasons. First, the development of the potential workers—vacancies system does not proceed along some averaged trajectory but shifts from one trajectory to another. Secondly, the relation of parameters, while gradually changing within some segments, sometimes changed abruptly. In that case, an analysis of the changes and a new specification of equations were required. At the same time, the study showed that the proposed approach proved to be sufficiently promising under present conditions both for an analysis of interrelation between supply and demand on the labor market with due allowance for the movement of labor and for their forecasting.

As was mentioned above, parameters $\varepsilon_1$ and $\mu$ can be controlled: parameter $\varepsilon_1$ by the introduction and withdrawal of fixed production assets and $\mu$ by the movement of the population and labor resources. It pre-determines their role in coordinating the movement of the population and labor resources and the movement of jobs.

A forecast of employment seems to be primary in the process of coordination. If potential workers include the entire productive-age population unemployed in the economy, it means that, while forecasting employment, we thereby forecast both $\mu$ and $u$. The resultant employment values $\mu$ and $u$ are in a sense “ideal,” not related to the movement of vacant jobs, determined by the introduction and withdrawal of fixed production assets. The presumable magnitudes of introduction and withdrawal enable the values of $\varepsilon_1$ to be restored.

In other words, all the necessary information is available to estimate the number of vacancies that will remain unfilled in the period covered by the forecast (or, otherwise, the level of labor release from the economy). The movement of jobs and labor can be coordinated by changing the proposed introduction and withdrawal of fixed production assets or movement of the work force. The extent of this change may be accurately determined according to the values of $\varepsilon_1^*$ and $\mu^*$ for which the stability of the potential workers—vacancies system is achieved with the optimal value of $w$. As a result, a forecast of employment, resulting from the coordination of labor demand and supply, can be made and specific steps can be mapped out to achieve such coordination.

At this stage of research, the goal was to construct models and make experimental estimates on their basis. Therefore the forecast estimates made in the study are to some extent preliminary and tentative. The main purpose of the article was to show the dependence of vari-

![Fig. 3. Actual and estimated values of $\mu$ depending on $\varepsilon_1$.](image-url)
ation in the dynamics and structure of the population’s employment on the major parameters of socio-economic and demographic development. The resultant qualitative estimates of the prospective dynamics of the population’s employment give, in our view, a general idea of the consequences of different economic policies in Russian conditions. The results may serve as a point of departure for further studies in forecasting the population’s employment and its structures in the context of Russia’s general economic development. Therefore, assessing the consequences of different economic policy measures for the population’s employment and its sectoral structure and revealing the most likely development scenarios are the goals of further studies.

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