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## Evolution of a Large-Scale Agglomeration Labour Market (Based on the Example of the Krasnoyarsk Agglomeration)

**Irina P. Vorontsova\***,  
**Alexander N. Pozdeev and Tatiana A. Samylkina**  
*Siberian Federal University*  
*79 Svobodny, Krasnoyarsk, 660041 Russia*<sup>1</sup>

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*The article presents a methodical solution of the problem of Krasnoyarsk agglomeration labour market research in compliance with OECD methodology, under deficiency of official statistical information on municipalities. Besides that, we analysed the tendencies of Krasnoyarsk agglomeration labour market within the period from 1999 to 2011, examined territorial asymmetry of the agglomeration labour market and came to the conclusion on the way this asymmetry influences the dynamics of the labour market key indicators.*

*Keywords: labour market, economic activity of population, territorial employment structure, employment by economic sectors, part-time job, hourly workforce productivity, wage.*

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### Introduction

To prepare a territorial review for the Organisation for Economic Co-operation and Development (OECD), the authors have analysed the evolution of labour market of Krasnoyarsk agglomeration in connection with the evolution of the labour markets of Krasnoyarsk region, Siberian Federal District (SFD) and the Russian Federation (Russia or the RF). The analysis revealed the key trends, problems and points of increase of agglomeration economy as an effective model of sub-national region development.

Krasnoyarsk agglomeration is a monocentric metropolitan agglomeration (where the nucleus is the city of Krasnoyarsk), that is usually mentioned in connection with the following municipalities: Krasnoyarsk, Sosnovoborsk, Divnogorsk among urban districts, and Berezovsky, Yemelyanovsky, Mansky and Sukhobuzimsky districts among non-urbanized territories.

The labour market evolution plays an important role in creation and development of the agglomeration. Speaking of “labour market evolution”, the authors mean the process of

\* Corresponding author E-mail address: [vip64@mail.ru](mailto:vip64@mail.ru)

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change of the labour market within a certain period of time. The labour market acts as a mechanism of distribution and re-distribution of labour force between economy sectors, types and forms of economic activities according to its efficiency within the system of social demands and ownership patterns.

Our analysis of Krasnoyarsk agglomeration labour market evolution performed for the period from 2000 to 2011 was carried out in compliance with the OECD methodology and covered the following areas: economic activity of population; territorial employment structure by economic sectors and genders; part-time employment; employment in informal economic sectors; workforce productivity and wage in the basic economic sectors.

The research problem was to form an analysis information base under the conditions of deficiency or total absence of official statistical information on the agglomeration and its municipalities. According to ILO methodology, the analysis of many indicators of labour market evolution can be performed by sampling statistical analysis of population aged 15-72 on the two levels: the RF and constituent entities of the RF. However, municipal statistics as an information base of labour market of the agglomeration does not assume carrying out any sampling social investigations. This problem determined the approach to forming information base for the research on basis of authors' methods of calculating indicators and using assessments provided by experts.

### Methods

For the research of the labour market evolution we turned to the methods of economic statistics, along with studying opinions of some experts (heads and specialists of municipality administrations).

As evaluation indicators for the labour market evolution we used the following: labour

force; labour force gender; number of employees (counting by their main workplace) from six sectors of economy and industry; number employed people (counting by their residence); unemployment by ILO methodology in absolute values; employment rate and unemployment rate by ILO; number of continuous unemployment by ILO (more than 1 year); youth unemployment by ILO (the age category 15-24); informal employment rate; hourly workforce performance; average monthly nominal wage.

Methodical approach to determination of the indicators consists of the following steps:

1. Defining the main ratios of demographic and labour market indicators of Krasnoyarsk region.

2. Developing the system of labour market indicators determination for municipalities, considering the regional ratios.

3. Determining reference points by correcting the indicators of economic activity evaluated by means of documents analysis (particularly manpower resource balances, reports on actual hours worked and expert publications).

The economy sectors were analysed according to the International Standard Industrial Classification (ISIC, version 3.1).

To determine the labour market indicators for municipalities, the authors of the present article derived the following formulae (see Table 1):

### Results

**Labour force of the agglomeration increased by 15.3 % within the considered period.** According to our calculations, labour force dynamics within the agglomeration can be divided into four periods, 3-4 years each. During all of them except the last one (2009-2011) the labour force increased.

The influence rate of agglomeration on the regional indicators increases: contribution of the agglomeration to the regional labour force

Table 1. Formulae for determination municipal labour market indicators \*

Indicators	Formulae
Economic activity of the population	$L_{Lr}(a) = \frac{LF(a)}{P_{15-74}(a)} \cdot 100\%$ <p>where: <math>L_{Lr}(a)</math> – level of economic activity of the population resident within a certain agglomeration territory;  <math>LF(a)</math> – labour force of a certain agglomeration territory;  <math>P_{15-74}(a)</math> – population aged 15-74 of a certain agglomeration territory.</p>
Economic activity of the population by gender	$LF_m(a) = LF(a) \cdot \frac{LF_m(Kk)}{LF(Kk)} \cdot \frac{P_m(a)}{P(Kk)}, \quad LF_f(a) = LF(a) - LF_m(a),$ <p>where: <math>LF_m(a)</math> – male labour force of a certain agglomeration territory;  <math>LF_f(a)</math> – female labour force of a certain agglomeration territory;  <math>LF_m(Kk)</math> – male labour force of Krasnoyarsk region;  <math>LF(Kk)</math> – labour force of Krasnoyarsk region;  <math>P_m(a)</math> – resident male population of a certain agglomeration territory;  <math>P_m(Kk)</math> – resident male population of Krasnoyarsk region.</p>
Number of employees by their place of residence	$E(a) = P_{15-74}(a) \cdot L_c(Kk),$ <p>where: <math>E(a)</math> – number of employees by their place of residence in a certain agglomeration territory;  <math>L_c(Kk)</math> – employment level in Krasnoyarsk region</p>
Number of employees by their main work place	$E_{main}(a) = N_r(a) \cdot \frac{E_{main}(Kk)}{N_r(Kk)},$ <p>where: <math>E_{main}(a)</math> – number of employed workers by their main work place in a certain agglomeration territory;  <math>N_r(a)</math> – average roll number of workers of organizations in certain agglomeration territory;  <math>E_{main}(Kk)</math> – number of employees by their main work place in Krasnoyarsk region;  <math>N_r(Kk)</math> – average number of workers of organizations in Krasnoyarsk region.</p>
Number of main work place employees by economic sectors	$E_{main}(s)(a) = N_r(s)(a) \cdot \frac{E_{main}(s)(Kk)}{N_r(s)(Kk)},$ <p>Notations are similar to the previous formula, (s) implies certain economic sector.</p>
Unemployment by ILO methodology and unemployment rate	$U(a) = U_{reg}(a) \cdot \frac{U(Kk)}{U_{reg}(Kk)}, \quad L_u(a) = \frac{U(a)}{LF(a)}$ <p>where: <math>U(a)</math> – number of unemployed people by ILO methodology in a certain agglomeration territory;  <math>U_{reg}(a)</math> – number of registered unemployed people in a certain agglomeration territory;  <math>U(Kk)</math> – number of unemployed people by ILO methodology in Krasnoyarsk region;  <math>U_{reg}(Kk)</math> – number of registered unemployed people in Krasnoyarsk region;  <math>L_u(a)</math> – unemployment rate in a certain agglomeration territory.</p>
Number of continuous unemployment	$U_c(a) = U_{c,reg}(a) \cdot \frac{U_c(Kk)}{U_{c,reg}(Kk)},$ <p>Notations are similar to the previous formula, index “c” implies continuous unemployment.</p>
Youth unemployment	Calculation formula is similar to continuous unemployment for ages 15-24
Workforce performance	$WTF_r = WTF_{nom} \cdot k_t,$ <p>where: <math>WTF_{nom(t)}</math> – nominal (actual) work time fund;  <math>k_t = (k_{2007} + k_{2009}) / 2</math>, where <math>k_{2007}</math> and <math>k_{2009}</math> – coefficients for 2007 and 2009 – ratio of nominal work-time funds by data of Rosstat (Russian Statistics Body) and the evaluated fund</p>
Part-time job	Ratio of nominal wage funds of external by-workers and engaged with contractor’s agreement to nominal wage fund of workers on payroll

\* derived by the authors

Table 2. Economic activity level in Krasnoyarsk region and the agglomeration

Level of economic activity of the population	Russia*	SFD*	Krasnoyarsk region*	Krasnoyarsk agglomeration**
minimal level of economic activity, %	64.2	62.5	66.1	64.0
maximal level of economic activity, %	68.3	67.1	69.8	71.9
rate of level change	4.1	5.4	3.7	7.9

\* according to Rosstat and Krasnoyarskstat

\*\* calculated by means of the methods derived by the authors

increased from 36 % in 1999 to 42 % in 2011 and reached 43 % in 2008.

**Level of economic activity of the agglomeration territories' population exceeded general levels of Russia and the region.** In 2002, economic activity of the agglomeration territories' population approached the regional level (falling behind by 0.5 %), in 2005 reached it, and in 2008 exceeded it almost by 5 %. Though this indicator has decreased within the past years, it still remains higher than in the region, Siberian Federal District or Russia in general. The evolution of the agglomeration labour market has a more intricate pattern. It is characterised by some dramatic changes within the considered period (see Table 2).

Krasnoyarsk has determining influence on the agglomeration labour force market. The total influence of other agglomeration territories constitutes no more than 18 %.

The level of economic activity of municipalities' population is quite high within the whole period, and fluctuates within a short range. Since 2007, the level economic activity of all municipalities' population has been insignificantly varying due to some development of intra-regional migration.

**The gender structure of labour force is characterized by insignificant male dominance along with increasing of the female share.** The male share of labour force in all the municipalities of agglomeration has decreased

within the considered period. The maximal decrease can be observed in Sosnovoborsk town, and the minimal in Yemelyanovsky district. The reduction tendency is caused by some changes in the economic structure of agglomeration territories.

**The number of employees by main work place remains relatively constant under the flexuous dynamics.** It had been increasing before 2006 inclusively, but then gradually decreased during the next years. Drastic influence over the dynamics was asserted by the city of Krasnoyarsk. Its share in the agglomeration employment structure varies around the ratio of 85 %. Other municipalities influence the general situation in a less insignificant way, but main work place employment state is considerably different (see Table 3).

The most difficult situations are those in Divnogorsk and Sosnovoborsk towns. In non-urbanized territories the ratio of employment by main work place is more stable in comparison with towns. Appreciable decrease of employment, by 15.2 %, occurred in Yemelyanovsky district only.

The ratio of employment in the agglomeration is mainly equal to that in Krasnoyarsk. Since 2006 there has been a significant increase of employment ratio in Sukhobuzimsky district. The most unfavourable situation of employment by main work place is in Sosnovoborsk town (see Fig. 1).

Table 3. Dynamics of the number of employees by main work place in agglomeration municipalities\*

Indicators	Agglomeration	Cities and towns			Districts			
		Krasnoyarsk	Divnogorsk	Sosnovoborsk	Berezovsky	Yemelyanovsky	Mansky	Sukhobuzimsky
Number of employed workers in 1999, thousands of people	503.6	425.9	14.6	10.4	13.7	23.1	5.8	10.1
Number of employed workers in 2011, thousands of people	455.5	390.0	9.3	7.0	13.5	19.6	4.3	11.9
2011 / 1999, %	90.4	91.6	63.7	67.3	98.5	84.8	74.1	117.8

\* calculated by means of the methods derived by the authors

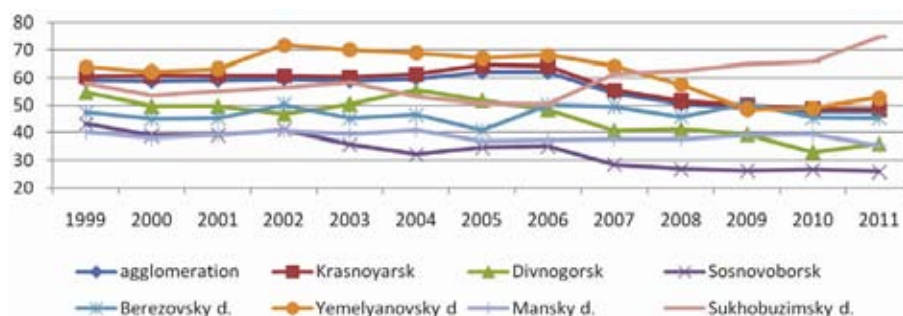


Fig. 1. Ratio of employment by main work place, among population aged 15-74, %

The tendency of employment development within the agglomeration is different from the general trends of Russia, Siberian Federal District and Krasnoyarsk region (see Table 4).

**Within the employment structure, the dominant sector is usually Sector 6 (public administration and other services): its share constitutes about 34 % of the whole.** The share of Sector 4 (trade, catering, transport, communication) is also significant: it reaches up to 31.4 % in non-urbanized districts. The employment structure by economic activities in urbanized and non-urbanized territories corresponds to the one of the region as a whole. However, the ratio of employment in agriculture and industry is 23:15 for non-urbanized territories and 1:23 for urbanized ones (see Fig. 2).

Within the considered period, the most significant alteration was observed in Sector 6 (public administration and other services), where the accession rate was +3.3 % (mainly due to Krasnoyarsk). Besides, the share of Sector 4 (trade, catering, transport and communication) suffered a little decrease, by 2.4 %. The shares of other sectors hardly changed at all.

**Processing industry is the leader among industry sectors by employment share.** Generally, the share of workers engaged in industry (Sector 2) of the agglomeration and region is almost equal (22.3 % and 20.8 % respectively). However, the structure of employment in industry sectors is significantly different from that of the region (see Table 5).

Table 4. Changes in the ratio of employment by main work place

Indicators	Russia*	SFD*	Krasnoyarsk region*	Krasnoyarsk agglomeration**
1 Number of employed workers, thousands of people				
1999	63963.4	8680.8	1401.4	503.6
2010	67576.7	9027.0	1439.3	451.8
2 Relative alteration (2010 / 1999), %	105.6	104.0	102.7	89.7

\* by data of Rosstat and Krasnoyarskstat

\*\* calculated by means of the methods derived by the authors

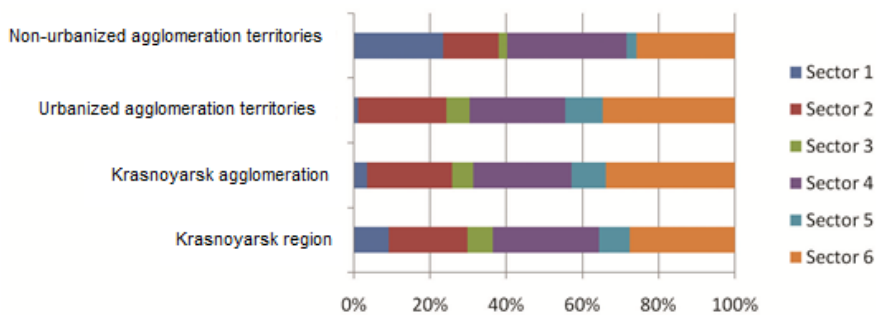


Fig. 2. Employment structure by ISIC (average values from 2006 to 2009)

Table 5. Structure of employment by sectors of industry (average, 2006-2009)\*

Territory	Sectors of industry by ISIC		
	Sector 2.1	Sector 2.2	Sector 2.3
Krasnoyarsk region	11.3%	70.5%	18.2%
Krasnoyarsk	1.1%	84.7%	14.2%
other municipalities of the agglomeration	4.1%	76.4%	19.5%

\* calculated by means of the methods derived by the authors

**The structure of employment by industry sectors has hardly changed within the past 10 years.** Processing industry enjoys the main share in the total number of employed workers (84.7 % in Krasnoyarsk and 76.4 % in other territories).

The share of processing industry has decreased by 2.2 %; the growth of extractive industry is +0.8 %, while the share of employment in power industry has increased by 1.4 %.

**The number of workers employed in their place of residence is continuously increasing.** In 2010, the number of workers employed in their place of residence exceeded the number of workers employed by their main work place. The growth rate of number of workers employed in their place of residence is also higher than that of workers employed in their main work place.

**The level of employment in the agglomeration territories varies from 30 % to 80 %.** The rate of workers employed in their place of residence is comparable with the general trends of Siberian Federal District and Russia as a whole.

**In the agglomeration territories, the share of male workers is decreasing, though it is still dominating in comparison with the female share.** Male employment in the place of residence is also dominant in Russia, Siberian Federal District and Krasnoyarsk region, along with the territories of Krasnoyarsk agglomeration.

**Unemployment among agglomeration citizens has reduced 2.3 times within the past 10 years.** Unemployment boom occurred in 2009 as a result of the world financial crisis. During the post-crisis period, the number of employed decreased, and now (in 2012) it counts up to 96 thousand people. Krasnoyarsk city is the main contribution to the unemployment ratio in the agglomeration. Other territories influence it much less. Unemployment rate is high in Sosnovoborsk town and Mansky district. Other territories exceeded average regional rate in some certain years (see Fig. 3).

**The share of continuous unemployment in Krasnoyarsk agglomeration is**

**significantly less than the average regional and Russian ones,** and does not exceed 10.0-16.1 %, whereas, during some certain years, in Russia it was 28.7-36.7 %, and in the region it was 22.3 – 32.2 %.

**The share of young people among the unemployed in the agglomeration is about 2 times less than in Russia or Krasnoyarsk region.** As a whole, the dynamics of youth unemployment in the agglomeration is the same as in the region (see Fig 4).

A more favourable situation with continuous and youth unemployment is determined by the high business activity (especially in the agglomeration nucleus, Krasnoyarsk city) and quite wide opportunities for application of skills and labour power.

**Hourly workforce performance within the agglomeration has positive dynamics; its level is higher than in RF and the region.** In 2011 it was 489.63 roubles per man-hour. In the agglomeration, the leader in labour performance is Krasnoyarsk city: in 2011 this indicator reached 554.23 roubles per man-hour.

In the year 2009, the growth of workforce performance in Krasnoyarsk agglomeration reached the lowest level, which was -10.06 %. This tendency was typical for both Krasnoyarsk

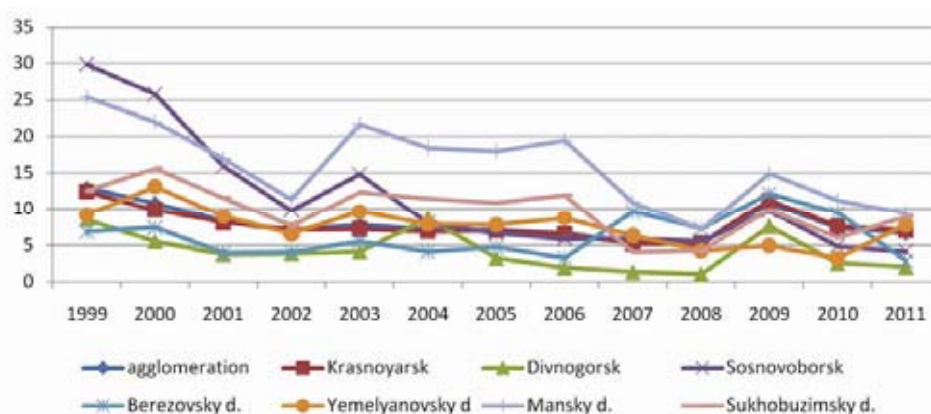


Fig. 3. Unemployment level by ILO methodology, %

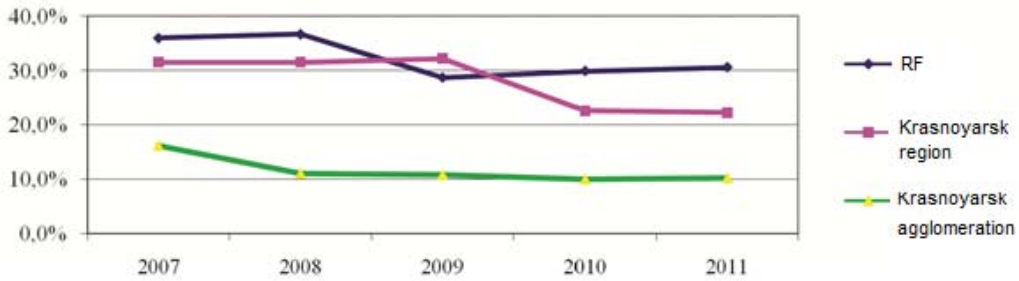


Fig. 4. The dynamics of youth unemployment

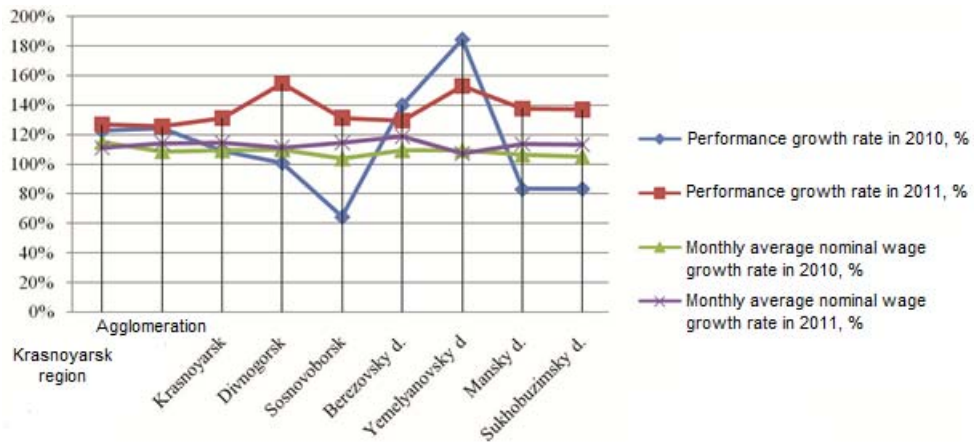


Fig. 5. Comparative dynamics of workforce performance and nominal wage in Krasnoyarsk agglomeration and Krasnoyarsk region, %

region and Russia as a whole, and was caused by the sequences of the world financial crisis.

During the pre-crisis years (2005-2008) workforce performance was increasing by around 7.2 % every year. The heaviest effect was asserted on hotel and restaurant businesses, construction industry and trade. The most considerable performance growth occurred in extractive industry, agriculture and forestry in the year 2009. That is why in 2009 the leaders of workforce performance growth were agricultural territories, Mansky and Sukhobuzimsky districts.

In the post-crisis years (2010-2011), labour performance was continuously growing, and by the year 2012 it had exceeded the pre-crisis

level by 40 %. In this period the leaders of workforce performance were Divnogorsk town and Yemelyanovsky district.

**In the year 2011, the growth of hourly workforce performance rate in the agglomeration exceeded the rates of wage and level of investment into basic capital.**

Within 2010-2011, the workforce performance increased by 55.4 %, and nominal wage grew by 23.9 % (see Fig. 5). Along with this, the growth of investment into basic capital also rose up to 23.7 %, whereas in 2008-2009 these indicators were growing by around 6 % per year. This tendency was broken in 2010, as a result of the world financial crisis except for the



two territories of the agglomeration (Berezovsky and Yemelyanovsky districts), where in the year 2010, some agricultural complex objects reached their project capacities and where the major units of transport infrastructure are located.

The drop of the performance growth rate in an industrial town Sosnovoborsk is caused by reorganization of engineering industry in the region within the considered period. The decrease in the performance growth rate in some non-urbanized territories (Mansky and Sukhobuzimsky districts) is caused by the modernization of agricultural technology that took place in the post-crisis year 2010. As they implemented the programs for development of the agglomeration territories in 2011, the positive tendency of the growth rates proportion between the labour performance and wage was restored.

**By the level of monthly average wage Krasnoyarsk agglomeration traditionally takes over the average Russian level and the level of Siberian Federal District, and, since 2006, this indicator has overcome the average one of Krasnoyarsk region as well.**

The monthly average wage in the agglomeration, in comparison with the regional one, is the largest for all economic sectors except for extractive, engineering and power industries. The average wage in the engineering industry sub-sector gets behind the regional one by 10-15 % within one time period.

Branch-wise wage differences, specific for Russian economy, are also typical for the whole agglomeration. Employees engaged in some financial activities and real estate operations (about 10 % of employment) enjoy the highest wage level. The wage in this sector is almost 1,5 times higher than the average among all sectors. The lowest monthly average wage level is maintained in agriculture: about 60 % of average agglomeration value. During the last five years

the wage in state-financed branches pulled up to the regional average value.

The distribution of resource base and productive force cause asymmetry of the agglomeration labour market development. The wage in the nucleus of the agglomeration, Krasnoyarsk city, is 1.5-2 times higher than in its periphery. The lowest wages are found in Sukhobuzimsky district, Mansky district and Sosnovoborsk town.

**The share of jobs that allow part-time employment takes up around 3 % of all jobs in Krasnoyarsk agglomeration.** During the crisis, the amount of time worked was reduced because of the workers who had to change from their regular job to a temporary one. In the years 2009 and 2010, the share of jobs that allow part-time employment in Krasnoyarsk agglomeration was 3.6 %. In non-urbanized territories of the agglomeration this indicator is slightly less than in towns: only 1-2 % less. Sector specificity assumes different use of part-time employment. The possibility of part-time employment is less than 1 % in extractive industry and public administration, 6 % in restaurant and hotel businesses and counts up to 11 % in education.

### Conclusion

Thus, in the present state of Krasnoyarsk agglomeration labour market one can see some positive tendencies, which can push it towards some social and economic development in the following key points:

- regular growth of labour force;
- increase of economic activity of the population;
- rise of employment in the place of the workers' residence;
- decrease of unemployment rate;
- increase of workforce performance and wages.

It gives us ground to suppose that the forming model of the agglomeration is enabling us to smoothen the negative effects of territorial asymmetry observed in the labour market in both urbanized and non-urbanized territories.

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## Эволюция рынка труда крупной агломерации на примере Красноярской агломерации

**И.П. Воронцова,  
А.Н. Поздеев, Т.А. Самылкина**  
Сибирский федеральный университет  
Россия, 660041, Красноярск, пр. Свободный, 79

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*В статье представлено методическое решение проблемы исследования рынка труда Красноярской агломерации в соответствии с методологией ОЭСР в условиях дефицита официальной статистической информации по муниципальным образованиям. Проанализированы тенденции изменения состояния рынка труда Красноярской агломерации за период с 1999 по 2011 год. Рассмотрена пространственная асимметрия рынка труда агломерации и сделаны выводы о её влиянии на формирование динамики ключевых индикаторов рынка труда.*

*Ключевые слова: рынок труда, экономическая активность населения, пространственная структура занятости, занятость по секторам экономики, неполная занятость, часовая производительность труда, заработная плата.*

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