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CHANGE IN EARNINGS INEQUALITY IN RUSSIA FROM 1985 TO 2004

Andriy Rudenko

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Supervisor: Prof. Puerta
Assessor: Prof. Mihalyi

Abstract

In my thesis I investigate the causes of change in earnings inequality in Russia from 1985 to 2004. The basic finding is that the inequality increase was driven mainly by factors other than individual education, experience and occupation characteristics. Besides providing evidence of increased income instability brought by transition, the result of predominant role of within group inequality has an important implication from the point of view of human capital. According to the human capital theory, individuals make investments in their skills, such as education, experience or occupation knowledge, in order to reap future benefits. The basic investment theory says that the value of the asset can be measured by both the average return and the variance of the return of this asset. The results of my thesis suggest that overall the transition increased the variance of workers' investment in human capital while not changing much the return to it. Therefore, on average the transition depreciated the value of their investment.

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Chapter 1

Introduction

Economic transition in Russia in the early 1990s was marked by a series of unsuccessful economic reforms, the effects of which people can still feel in present day Russia. As Stiglitz (2002, 142) puts it: “The first mistakes occurred almost immediately as the transition began. In the enthusiasm to get on with a market economy, most prices were freed overnight in 1992, setting in motion an inflation that wiped out savings, and moved the problem of macrostability to the top of the agenda.” Such rapid macroeconomic change represents good grounds for research in labor economics – it offers a natural experiment that enables to measure the effect of system change from planned to market economy. Hence, economic research on the effects of transition on labor outcomes in Russia and Eastern Europe mushroomed (Brainerd (1998), Rutkowski (1996), Flanagan (1995), Orazem and Vodopivec (1995)).

The basic conclusion of that research is that the real wages in Russia fell dramatically immediately after the transition, and that more educated and less experienced demographic groups were the relative winners of the transition. However, the knowledge of average differences between various demographic groups does not allow seeing the change in returns at every part of wage distribution. My research tries to see the difference between the highest and lowest wage inside certain groups, defined by the education,

experience and occupation characteristics, and how this difference changed with transition.

In my thesis I investigate the change of earnings inequality for Russian workers during the transition, using the data from 1985 to 2004. Following the approach of Juhn et al. (1993) and Lemieux (2006) I decompose the total change in the inequality within group and between-group components, adjusting for the effect of workforce composition. The main result of my thesis is that the change in inequality was driven by factors other than individual education, experience and occupation. However, this result may be partly driven by the aggregation of occupation and education characteristics.

Chapter 2

Literature review

Studies of wage structure and wage inequality may be traced back to the origins of the economic profession itself. In the *Handbook for Labor Economics* that surveys the literature on wage inequality Katz and Autor (1999) start their overview of the corresponding literature with the work of Adam Smith, who as they say provided the comprehensive and elegant analysis of determinants of wage differences among workers[1]. Further they mention several early studies that initiated the analysis of wage difference by certain observable characteristics – by occupation (Douglas (1930), Ober (1948)), by industry (Slichter (1950), Cullen (1956)), and by education and potential experience (Becker (1962), Ben-Porath (1967), Mincer (1974)). The estimation of wage premiums to the characteristics above still remains a popular topic of research nowadays. It provides the measure of between-group inequality, as the differences in wage between groups contribute to overall wage inequality, but the complete analysis of inequality change requires the estimation of within group inequality as well.

[1] According to Smith, wage differentials were determined by competitive factors, individual innate abilities and institutional factors. Adam Smith, *Wealth of Nations*, Book 1, chapter 10.

The two influential studies that account for both components of overall inequality are Juhn et al. (1993) and Lemieux (2006). In my thesis I use the approach of both papers to estimate the components of an increase in wage inequality in Russia during transition.

Juhn et al. (1993) investigates the changes in earnings inequality in the U.S. from 1964 to 1988. Their main finding is that the big increase in inequality that took place mainly in the late 1970s and throughout the 1980s was caused by the inequality increase in both between and within education and experience groups. They decompose the total inequality change into three parts accounting for effects of change in the observable characteristics quantities (1), the returns to observable characteristics (2) and the unobservable characteristics and returns to them (3). Their finding is that during 1964-1979 relative contribution to the change in 90^{th} -10^{th} percentile of wage distribution was about 18%, 9% and 73% of components (1), (2) and (3) respectively. During 1979-1988 the relative contribution was 3%, 54% and 43% of components (1), (2) and (3) respectively. In this way they show that most of the change in observable component in the 1970s was attributed to the change in workforce composition, while in 1980 to the change in the skill premia for observable characteristics. Also they show significant contribution of unobservable part of wage, which they interpret at the increase in the returns to unobservable characteristics.

Lemieux (2006) questions the above conclusion about unobservable part, arguing that not only the change in returns to unobservable characteristics but also the change of workforce composition can explain residual inequality increase. He develops the model that examines within group residual wage variance for 20 education-experience groups and the contribution of each group to the total change of the residual wage variance. By

fixing sample shares of each group he finds that the composition effect in the residual variance change in the U.S. from 1973 to 2003 accounted for 32% if the sample shares are fixed at the 1973 year level and for 53% if shares are fixed at the level of 2003. Therefore, he argues that not all the change in residual inequality should be attributed to the increase in returns to unobserved skill.

The movement in wage structure in Eastern Europe during transition in the early 1990s has been investigated by a number of researchers[2], but they mainly aimed to estimate the average between-group differential. Brainerd (1998) used the method of Juhn et al. (1993) to decompose total change in inequality in Russia from 1991 to 1994. Her findings for male sample are that the returns to observable characteristics, which are the education, experience, marital status and the enterprise ownership status (state of private), accounted for 55% of the total change in 90^{th}-10^{th} percentile in wage distribution. Changes in quantities of these characteristics decreased the 90^{th}-10^{th} percentile change by 20%. Finally the 65% of the increase of the 90^{th}-10^{th} percentile change was attributed to unobservable characteristics and quantities.

Lukyanova (2006) uses similar approach to estimate the within and between variance in Russia from 1994 to 2004 for both genders among industry and ownership groups. In her analysis she accounts both for between and within group inequality change, as well as for the composition effect of each. Therefore, her analysis most closely resembles the type of analysis I do in my thesis, only she studies shorter time period and different set of observable variables. Her results show that the within industry variance increase from

[2] For example Brainerd (1998) for Russia, Rutkowski (1996) for Poland, Flanagan (1995) for Czech Republic, Orazem and Vodopivec (1995) for Slovenia, etc.

1994 to 2000 amounted to nearly half of total variance change, while the between-group variance increase amounted to 70% of total variance increase. Composition effects for between industry variance change were negative 20% in the increase of overall variance and were negligible for within industry variance change. For ownership groups her findings show different signs of within and between components. They imply that between 1994 and 2003 the within ownership variance change amounted to 186% of overall variance decline, but were partially offset by an increase in between ownership variance that in absolute value amounts to 70% of negative change of overall wage inequality. Composition effects were negligible for between ownership variance change but amounted for 27% of total variance change for within ownership variance. Interestingly, she reports the total variance change from 2000 to 2003 that was twice bigger in absolute value as the analogous change from 1994 to 2000, which moved in another direction. This is why in her analysis of industry and ownership components the total change in variance has the same number but a different sign. However, in absolute terms these changes are ten times smaller than the change of total wage variance that occurred from 1985 to 1994, according to the estimates of my thesis. In this study I will estimate inequality change on the 1985-2004 time period and compare my findings with the results of Brainerd (1998) from 1991 to 1994 and the results of Lukyanova (2006) from 1994 to 2003.

Chapter 3

Empirical evidence from Russia

3.1 Data

3.1.1Description of data

In my empirical work I use the data from the second wave of Russian Longitudinal Monitoring Survey (RLMS), rounds 5 through 13, administered in years 1994 through 2004[3]. This is a follow-up household survey, from which both cross-section and panel samples can be created. I use the cross section sample throughout my analysis. Appendix 1 illustrates sample statistics for the variables used my estimations for chosen years. The definitions of these variables are presented later in this section.

Sample observations for years 1985 and 1990 were imputed retrospectively from the survey round of year 2000. In that questionnaire respondents were asked to recollect their monthly salary and occupation separately in 1985 and 1990. Therefore, despite the rich set of variables present in RLMS, only four variables are used to study inequality change from 1985 to 2004: wage, occupation, education and experience. Along with possible inflation identification problems discussed above, another factor that may bias estimation

[3] You can find detailed information about the structure of this survey at https://www.cpc.unc.edu/projects/rlms

results connected to this time period is the “recall bias”. Individuals may not be able to correctly recall their wage 10 and 15 years ago, and this might add additional variance to wage measure in 1985 and 1990. However, this bias appears to be insignificant in RLMS[4] and assuming its homogeneity across demographic groups the results in inequality change presented in this paper would be the lower bound of true results in the presence of this “recall bias”.

Another possible concern with the data imputed in this way may be the representativeness of this sample. The time differences between interview date and the imputed observation date are 15 and 10 years for 1985 and 1990 samples respectively. Therefore, respondents in 2000 may not be the best representation of 1985 and 1990 workforce. For example, more skilled workers may have emigrated by 2000. Also some older workers in 1985 may have died by 2000. Since both higher skilled and more experience workers are associated with higher wages, these factors probably would underestimate wage inequality in the Soviet Russia.

3.1.2Definition of variables.

I used the method of Earle and Sabirianova (2002) in defining the monthly wage variable. For the years 1994-1996 the contractual wage measure is imputed as the ratio of the total wage debt to the number of monthly wages owed, for those observations with wage arrears, and the actual payments received last month for those without wage arrears. For the years 1998-2003 the wage measure is the average monthly contractual wage. Finally,

[4] See Sabirianova (2003)

the wage measures for years 1985 and 1990 are produced retrospectively from the 2000-year round of RLMS. The hourly wage measure was created by dividing the monthly wage measure described above by the number of hours that respondents indicated to have worked in the month previous to the interview month.

For each piece of empirical analysis in the paper I used the deflated wage measure. For the time period 1994-2004 the monthly Consumer Price Index for Russian Federation from the Main Economic Indicators (MEI) database of OECD is used. To account for inflation from 1991 to 1994 I used the annual CPI measure from Goskomstat, the Russian State Statistical Office[5].

The inflation measure form 1985 to 1990 is more complicated to quantify for several reasons. First, technically before 1991 Russian people lived in another country, the USSR. That is why official statistics for Russian Federation tend to avoid any information prior to 1991. Second and more important issue with pre-1991 inflation is methodology. As discussed in the Vlast Journal[6], since prices in USSR were fixed centrally, inflation in consumption also took place in two additional forms, apart from usual price raise present in most of the countries. The first form was the accumulation of large sums of money, which cannot be spent because of deficit of products. The second form was the decrease of the quality of products, which were standardized at the state level. Therefore, the article presents very wide range of inflation estimations in USSR, from 0.9% to 13%. For my analysis I used the official estimate from Goskomstat (2002) concentrating on consumption price increases, which implies an average 3.13% annual inflation in USSR from 1985 to

[5] Information on inflation available at http://www.gks.ru

[6] Infljacija v SSSR: ocenki i mnenija [Inflation in USSR: estimations and opinions]. *Vlast Journal,* no.4(4), (January 29, 1990), (http://www.kommersant.ru/doc-rss.aspx?DocsID=265827)

1990. In every time period the wage variable is deflated by an index assuming the price level in 2005 to be 100%.

Experience and education variables are constructed using the Education questions of the survey, where individuals were asked both the level of highest educational attainment and the number of years spent at each level. In this way I construct dummy variables assigning individuals in one of the six educational groups: less than high school diploma, high school graduates, those who studied in PTU, FZU or FZO (vocational schools), those who studied in technical, medical, pedagogical or art school, those who studied in college or university, those who studied in graduate school. In my empirical estimations I use these dummy variables to account for effect of schooling, as opposed to continuous variable with the number of years of formal schooling, since they better represent individual educational attainment.

The potential experience variable is calculated as individual age minus years of schooling minus six. As neither of RLMS round questionnaires asked directly the total number of years studied, there may be some measurement error connected with the year-of-schooling variable. The round 5 survey (1994) asked only about the highest educational attainment, therefore the number of schooling years are imputed based on the average years of schooling in every education category. In rounds 6 through 9 (1995 – 2000) the schooling variable is computed based on the indicated years of study in each educational category. Surveys from rounds 10 through 13 (2001 – 2004) allow for several educations within the same category (for example, they allow that a person may graduate from two universities), and the number of years studied are recorded for every entry separately within the category. Thus my education variable is defined in this period as the number of

years studied within the first institution in the category, since most of the people holding multiple degrees in the same category did them simultaneously. The definition in this last sub-period is more likely to cause measurement error in schooling variable. However, the use of alternative definition that sums up all years of education within the same category does not change the results of estimation significantly.

Other variables used in estimations correspond to individual occupation, region of residence, firm size and firm ownership. Occupation is coded according to the one-digit International Standard Classification of Occupations (ISCO-88), assigning individual to one of the ten broad occupational categories. Region variable assigns a person into one of the eight geographical regions of Russian Federation. Firm size stratifies observations by the size of the enterprise they are working at, from up to ten employees to more than thousand employees. Firm ownership accounts for three possible ownership categories: public ownership, private domestic ownership and private foreign ownership.

3.2 Stylized facts

Figure1 shows the evolution of median, 10^{th} and 90^{th} percentiles of the distribution of log real monthly wages for men, from 1985 to 2004. The first noticeable feature in this graph is the sudden drop in real wage after the collapse of the Soviet Union, and the fact that the real wages by 2004 still did not recover to pre-transition levels. The second interesting feature that the graph suggests is that the wage dispersion in pre-1991 was not as trivial as it is commonly believed to be. This result, however, falls in line with several studies

documenting significant increase in wage dispersion in the Soviet Union in the 1980s.[7] Figure 1 shows that wage dispersion nearly doubled shortly after price liberalization took place in the early 1990s, and then moved back almost to pre-transition level by 2004. Comparing upper and lower parts of distribution, one can see that the 90-50 percentile differential was significantly higher than 50-10 differential in the Soviet Russia. However, with the transition the picture changed: median wage constituted approximately the average of 90th and 10th percentile wage levels, and stayed somewhere in between thereafter.

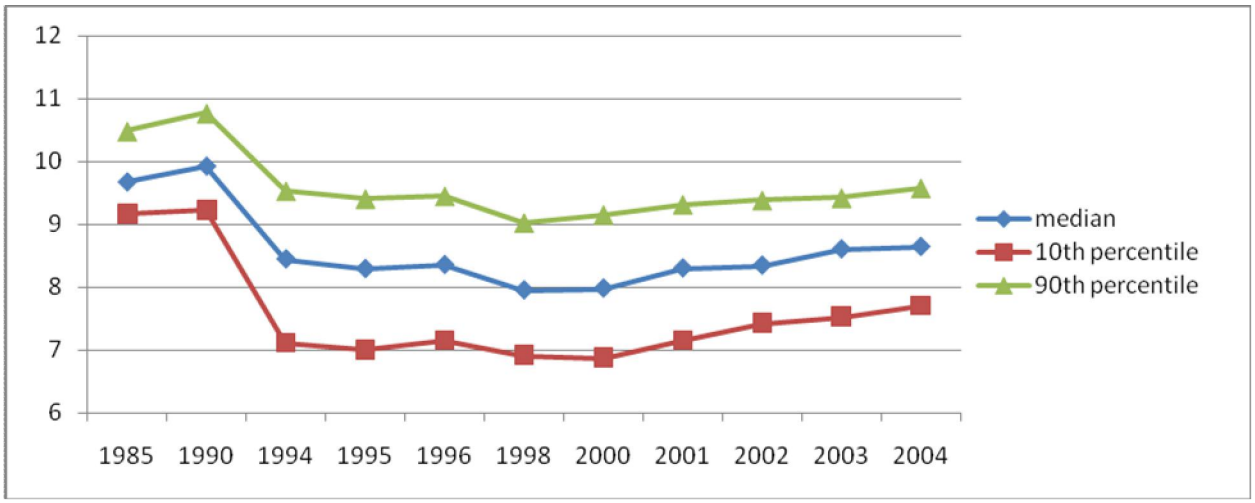

Figure 1: Evolution of monthly wage for men by percentile, 1985-2004 (*Source: own computation from RLMS)*

One peculiar aspect of Russia in the 1990s was that, unlike in some other transition counties in the region, unemployment in Russia remained relatively stable after transition. It was achieved mainly by cutting wages and/or working hours for some workers. Therefore, in this setting it would be important to look at hourly wages as well, since the

[7] For example, Atkinson and Micklewright (1992) find that the Gini index of inequality in income per capita in USSR in the late 1980s equaled 29%, which is very similar to the U.K.'s 30%

difference between earnings and wage inequality could be impactful. Unfortunately, the RLMS database does not have the hours worked variable prior to 1994, so I can try to assess the effect of transition on hourly wage only after 1994. Figure 2 plots the evolution of hourly wage by median, 90th and 10th percentile from 1994 to 2004. Surprisingly, the shape of the graph strongly resembles the one from Figure 1, suggesting small effect of hours worked on the distribution of earnings from 1994 to 2004. In the Soviet Russia hours worked were much more standardized than in the Russian Federation during transition, therefore, it is safe to assume that hours worked did not significantly influence the total distribution of earnings in 1985 and 1990.

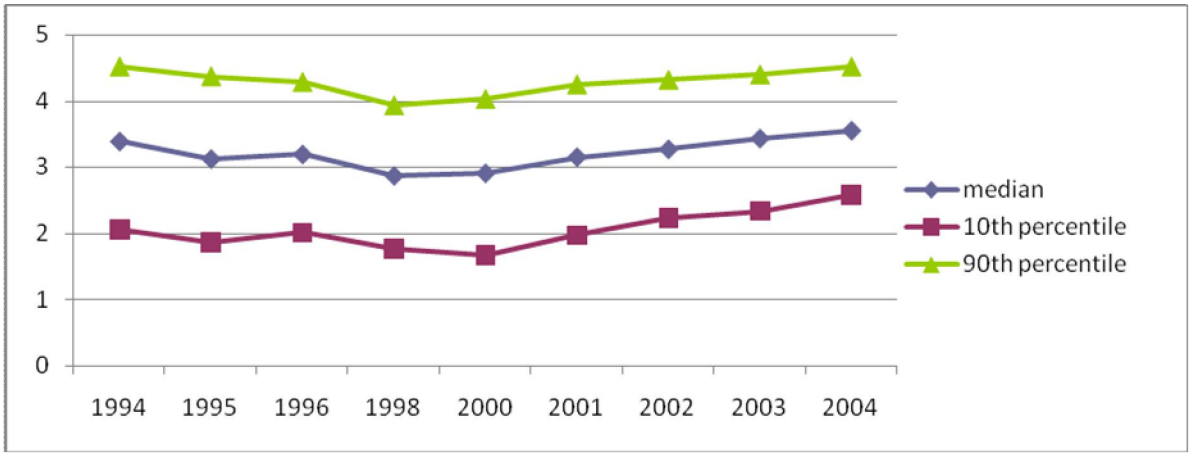

Figure 2: Evolution of hourly wage for men by percentile, 1994-2004 (*Source: own calculation from RLMS)*

Figure 3 investigates the percentile-by-percentile change in distribution of monthly wages for men. Panel A depicts corresponding change from 1985 to 1994. Consistently with Figure 1, it shows that real monthly wage decreased for every[8] percentile of its distribution throughout this period, and that the amount of this decrease was almost a linear function

[8] From practical considerations I present the 5th-95th percentile interval instead of full distribution, in order to account for outliers and possible coding mistakes. Also on the rest of the graphs illustrating wage change by distribution.

of percentile, with lower percentiles experiencing the biggest decline of real earnings. Panel B shows that real earnings continued declining from 1994 to 1998, but in this period higher wage percentiles had the biggest losses in real wage terms, compared to lower percentiles observations which practically did not lose much. Panel C shows that the period from 1998 to 2004 was the time of recovery of real wage, representing an almost parallel upward shift in wage distribution, with lower percentiles gaining slightly more. Finally, panel D concludes by illustrating the overall shift in earnings distribution from 1985 to 2004. As one can see, in every percentile of distribution there is significant decline in real earnings of workers, and for lowest percentiles this decline was larger than for middle and upper tail of distribution.

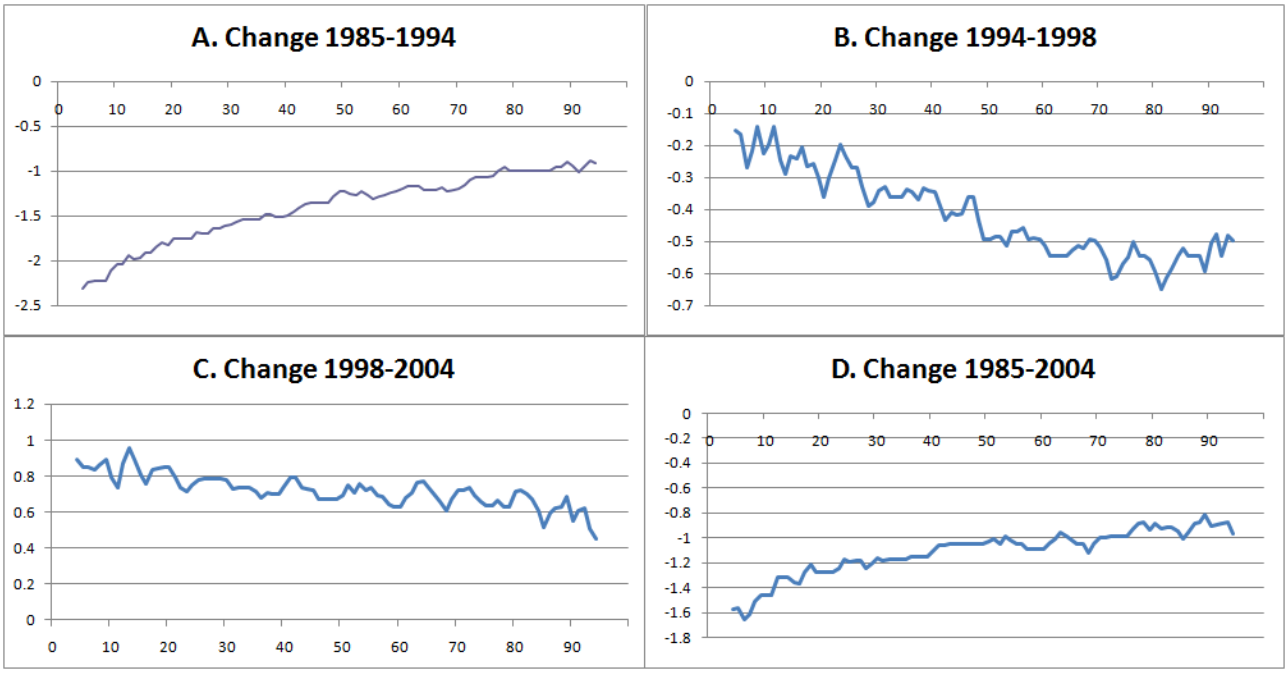

Figure 3: Change in monthly wage for men by percentile (*Source: own calculation from RLMS*)

Alternatively, Figure 3 illustrates the percentile change in real hourly wages from 1994 to 2004. Again, this shows the schedule of change in hourly wage that is similar to that of

monthly wage, which suggests few differences between earnings and wage inequalities. The only clear difference can be seen whencomparing panel C of Figure 3 and panel B of Figure 2. One can notice that in period 1998-2004 the change of real hourly wage varied more across percentiles of distribution, with lower percentiles gaining more relatively to middle and top of distribution. The corresponding change for monthly wage measure was more homogeneous across percentiles of distribution. Such difference across wage measures probably comes from the decrease of working hours for less skilled workers.[9] These and other results are summarized in Appendix 2.

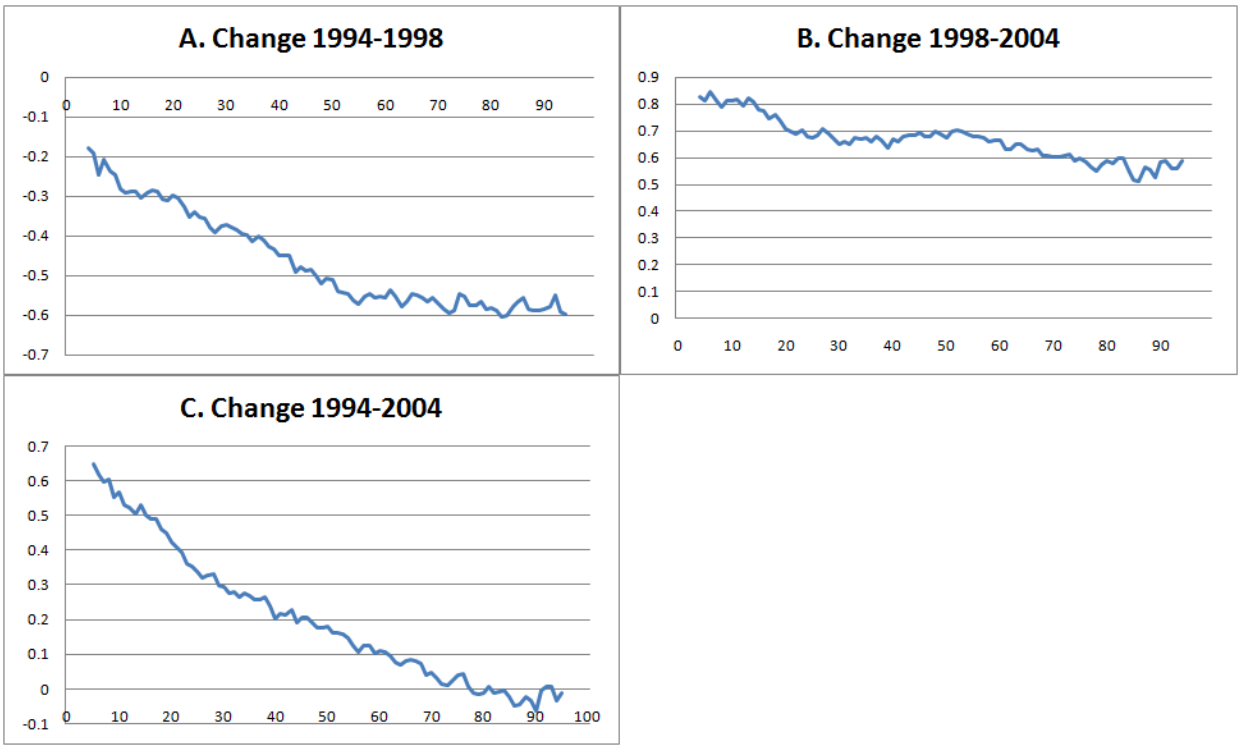

Figure 3: Change in hourly real wage for men, 1994-2004 (*Source: own calculation from RLMS*)

[9] Where the individual's percentile in total wage distribution can be perceived as a proxy measure for skill: the logical assumption is made that higher skill is rewarded by higher wage.

3.3 Inequality changes between and within education, experience and occupation demographic groups

Given the stylized facts about the movement in total earnings inequality presented above, one may be interested to see if unequal change by position in distribution was changed by observable or unobservable characteristics, and what is the relative contribution of each part at every segment of distribution. In this section I present several graphs that plot the change in real wage against the percentile of wage distribution for different groups of observable characteristics, such as education, experience and occupation. As in Juhn et al. (1993), this analysis enables to assess visually the impact of between- and within-group inequality change in the overall inequality change. If the inequality change is, for example, a linear function of percentile, then any changes in overall wage inequality attributed to between-group inequality could be seen on a graph by different intercepts for different groups, while the part attributed to the within-group inequality would be represented by the slope(s) of their graphs.

Figure 4 presents the change of men's monthly wages for two education groups – those with university diploma and those with high school diploma or less. Panel A shows the change from 1985 to 1994. Consistently with Brainerd (1998) and other related literature, it shows significant increase in university premium for most part of the distribution. Only the upper part of wage distribution shows little difference in absolute wage change for higher and lower educated demographic groups. Also, by looking at the graphs of two groups one can conclude that the within-group inequality change for education is larger than the

corresponding change in the between-group inequality. For example, although the sensitive university premium is observed in the most part of the wage range, the 90th percentile of high school graduates appear to have lost much less in terms of real wage than the 10th percentile of university graduates. Panel B illustrates corresponding change for two education groups between 1994 and 2004. It shows different results at the upper and lower halves of wage distribution. Within the first 40 percentiles of the distribution the graph shows practically no difference between the two education groups in the change of real wage level, suggesting negligible between-group inequality change, but the slope of both graphs is sensibly negative, suggesting significant change in the within-group inequality. In the upper 60 percentiles within-group inequality change appears to be tiny, but there is clearly relative gain for less educated workers. However, in absolute terms these gains for less educated workers are smaller than relative losses during the early period of transition from 1985 to 1994, compared with more educated workers. Panel C illustrates this by summing up changes from 1985 to 2004. Similarly to Panel A, it shows that there was significant positive change in returns to education at lower part of distribution, but this effect attenuates closer to the top of wage distribution. Also by looking at Panel A one may conclude that the within-group inequality change was much smaller for more educated people, compared to less educated demographic groups.

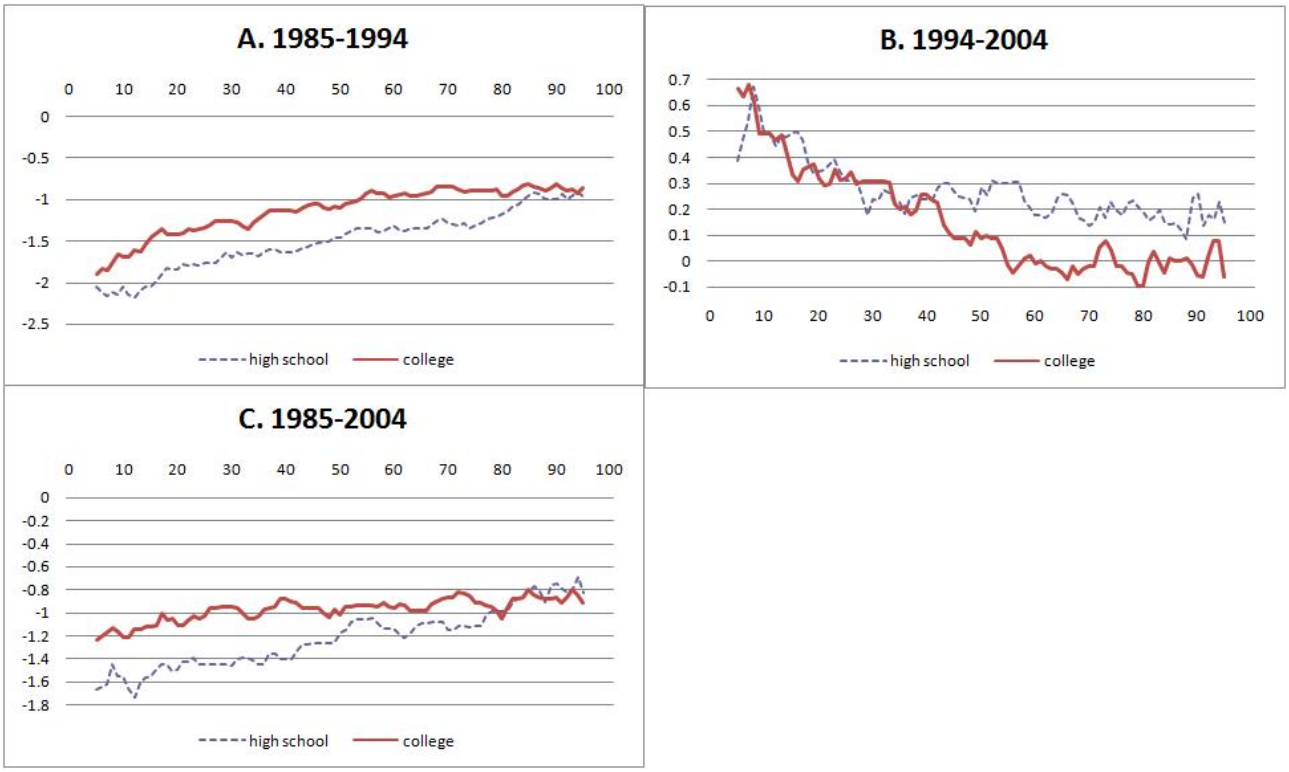

Figure 4: Change of monthly wage for education groups by percentile, 1985-2004 (*Source: own calculation from RLMS*)

Figure 5 investigates the differences in wage change between two age groups – those up to 30 years old and those who were 50 or more. Panels A, B and C show that in both sub-periods, from 1985 to 1994 and from 1994 to 2004, younger workers were relative winners at all parts of wage distribution, compared with older workers. However, this effect is not as significant as the effect of increased returns to education, described in previous paragraph. Also, Figure 5 shows significant movements in the within-group inequality from 1985 to 1994 and from 1994 to 2004, but since in the first period the within-group inequality change favored more skilled workers and in the second period – less skilled, the total picture from 1985 to 2004 show much smaller contribution of the within-group inequality to overall inequality change.

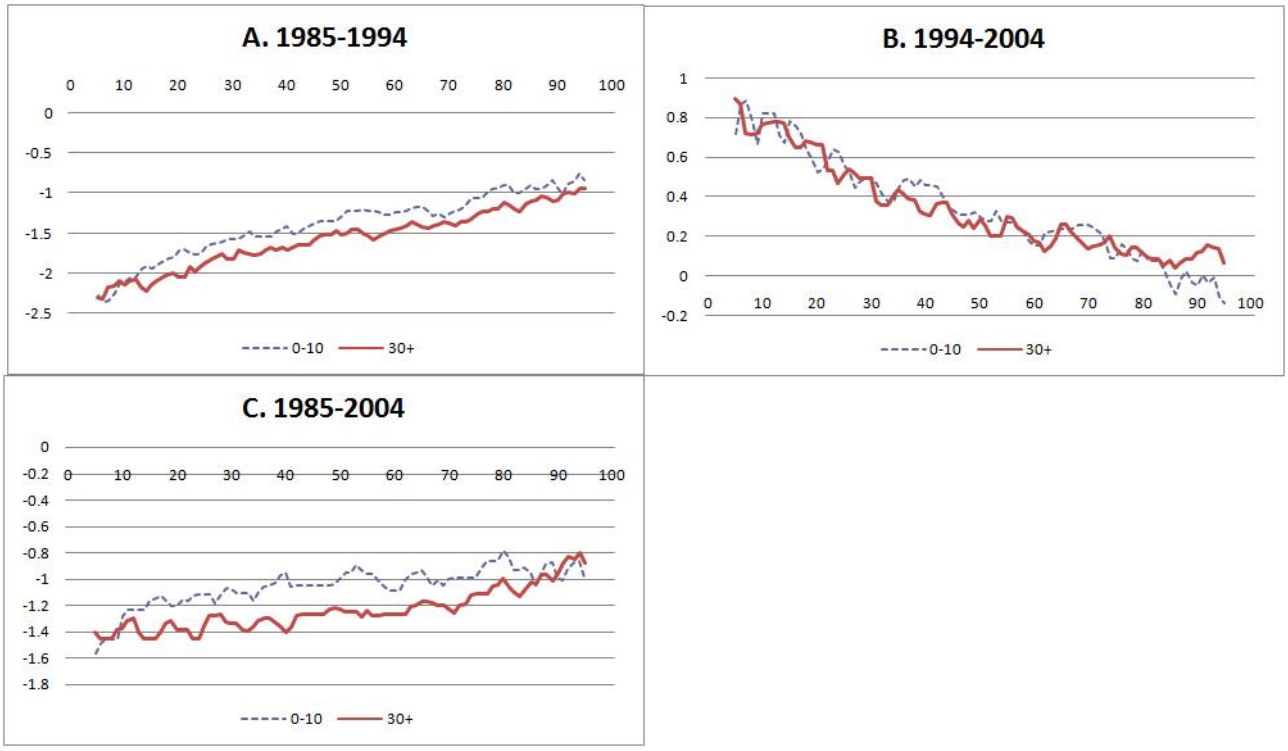

Figure 5: Change of monthly wage for experience groups by percentile, 1985-2004 (*Source: own calculation from RLMS*)

Figure 6 demonstrates the differences in wage dynamics among occupations. Changes in monthly wages for men are presented by percentile for four occupation groups: clerks, service and market workers; technicians and associate professionals, plant and machine operators and assemblers; elementary (unskilled) occupations. Panel A illustrates the change among the occupation groups from 1985 to 1994. It clearly shows significant between-group changes in inequality. Service and market workers appear to be relative winners in early transition period, while plant and machine operators and assemblers (mainly workers in manufacturing and drivers), as well as unskilled workers, appear to be relative losers in the transition. This empirical finding falls in line with common belief that the industrial structure of USSR was skewed in favor of manufacturing and defense

industries. As economic liberalization took place in the early 1990s, there was oversupply of manufacturing workers, and it must have been reflected on their relative wages. Also the graph shows that the occupation differential tends to remain relatively stable at every part of wage distribution for most occupation groups. Exception is the technicians and associate professionals group, probably because this occupation groups is defined too widely. Panel B show the corresponding wage change for occupation groups from 1994 to 2004. It implies small between-group inequality for most of the occupation groups presented, with the exception of unskilled workers who gained relatively to other occupations in the middle of wage distribution. Looking at the total change in real wage from 1985 to 2004 across occupations presented in Panel C one can see that the occupation premium changes significantly throughout the period investigated, with some occupations like service or market workers losing practically nothing in terms of real wage at every percentile of wage distribution, while manual and unskilled occupations appear to have lost much more in relative and absolute terms. This result in is line with the findings in Sabirianova (2003). Also one can notice the wide difference across groups in relative contribution of the within-group component to the change in overall wage inequality. For example, for service and market occupations the within-group inequality practically did not change from 1985 to 1990, while for the other occupation groups presented in the table the within-group inequality increased significantly.

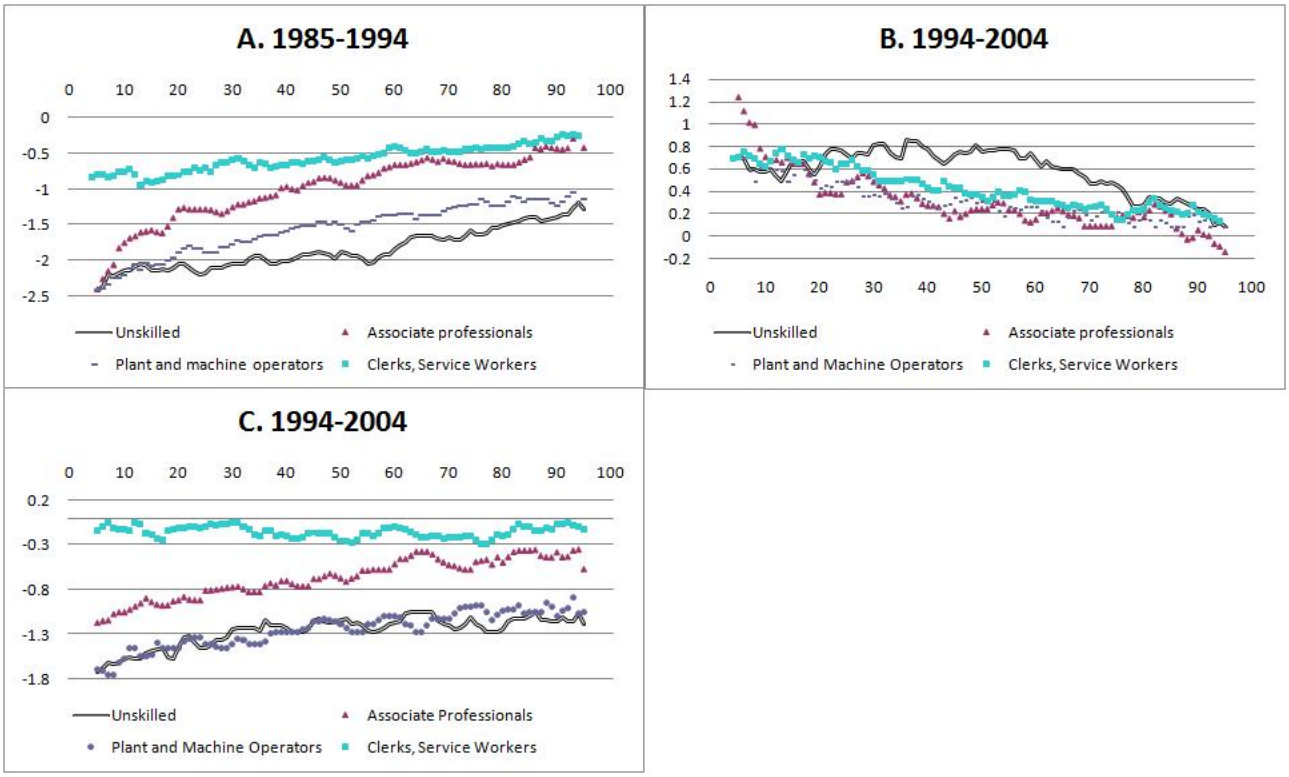

Figure 6: Change of monthly wage for occupation groups by percentile, 1985-2004 (*Source: own calculation from RLMS*)

To sum up, the analysis presented in this section show that between-group inequality changes were sizable for education and occupation groups, but changed little across experience groups. Within-group inequality was substantial for most of the demographic groups reviewed above, with the exception of university graduates and service workers.

3.4 Contribution of observable characteristics, observable prices and unobservables to the overall change in inequality

Analysis presented in previous section gives an idea how inequality moved within and between certain demographic groups. What it does not give, however, is the measure of relative weight of each group in the workforce and how it changed over time. For example, it is possible that the return to some very specific occupation increased tremendously during transition, such as lawyers, but the sample share of this occupation was and remained relatively small in total population to account itself for the large increased wage inequality. Therefore, it is important to account for the absolute change in the shares of different demographic groups, defined by observable characteristics. Also one might want to see the combined contribution all observable characteristics to the widening of wage distribution. In this section I quantitatively estimate contributions of the change of observable characteristics quantities, the change of returns to them and the change in unobservable part of wages to the change in overall inequality.

I use the method developed by Juhn et al. (1993) to assess the contribution of changes in observable characteristics, observable prices and unobservable characteristic and prices to the changes in inequality.

Let Y_{it} be the measure of wage compensation for individual *i* in year *t*, X_{it} be the vector of observable characteristics. Then the simple wage equation would look like:

$$Y_{it} = B_t X_{it} + u_{it} \quad (1)$$

where B_t is the vector time-variant returns to observable characteristics and u_{it} is the unobservable component of individual wage. In this setup it is useful to think of u_{it} as:

$$u_{it} = F_t^{-1}(\Theta_{it}|X_{it}) \quad (2)$$

where Θ_{it} is the individual percentile in the wage distribution and F_t^{-1} is the inverse cumulative distribution function of distribution of residual wage component at time *t.*

With this model I can impute the counterfactual wage variable, holing observable characteristics fixed. For example, I can fix returns to observable characteristics and residual distribution on the level of 1985, allowing variation only in observable characteristics. The corresponding wage equation would be:

$$Y_{it}^1 = B_0 X_{it} + F_0^{-1}(\Theta_{it}|X_{it}) \quad (3)$$

where B_0 is the vector of returns to observable characteristics and inverse residual distribution function in the base year, respectively.

The following wage equation imputes individual wage measure by fixing only the distribution of residual component of the wage and allowing both observable characteristics and returns to them to be variable:

$$Y_{it}^2 = B_t X_{it} + F_0(\Theta_{it}|X_{it}) \quad (4)$$

In this way one can estimate the contribution of change in both observable characteristics and return to them to the overall change in wage dispersion.

Finally, by allowing observable characteristics, observable prices and distribution of residuals to change in time one would get:

$$Y_{it}^{3} = B_t X_{it} + F_t^{-1}(\Theta_{it}|X_{it}) = B_t X_{it} + u_{it} = Y_{it} \quad (5)$$

which corresponds to factual wage observation for an individual in that year.

After imputing these counterfactual wage measures for each individual based on his observable characteristics it is possible to estimate the contribution of each component to the changes in the earnings and wage inequality. The contribution of variation in observable characteristics would equal $Y_{iT}^{1} - Y_{i0}^{1} = \Delta Y_i^1$, where subscripts *T* and *0* correspond to the end and beginning of period studied, respectively. The contribution of change in returns to observable characteristics could be calculated as $Y_{iT}^{2} - Y_{i0}^{2} - \Delta Y_i^1 = \Delta Y_i^2$. Finally, the part of change in the inequality attributed to unobservable characteristics and prices would be estimated as $Y_{iT}^{3} - Y_{i0}^{3} - \Delta Y_i^2 - \Delta Y_i^1$.

In my analysis I used this method to decompose the change in earnings inequality. I estimate the vector of returns to observed characteristics *B* by OLS regression using the full set of education and occupation dummy variables and continuous experience variable, as well as the constant and the square in experience that controls for concave age profile. Similarly to Juhn et al. (1993), to improve the preciseness of estimates I pooled the observation from two years when making estimates for a specific point in time: 1985 and 1990, 1994 and 1995, 1998 and 200, 2003 and 2004. I fixed the distribution of residuals and the vector of observed prices at the base period level of 1985/1990.

The results of decomposition are presented in Table 1. First conclusion that it suggests is that in every sub-period investigated the unobservable component of the change in inequality comprised the lion's share in the overall inequality change. Panel A illustrates

how the inequality changed from 1985 to 1995. It shows that there was practically no effect of observed quantities variation on inequality change. The main contribution of observable part to the change was coming from observable price change, which amounts to nearly 12% of total inequality change as measured by $90^{th} – 10^{th}$ percentile differential. Similarly to the total change measure, the observable prices also show higher widening of inequality at the lower part of the distribution than at the higher part. Panel B shows how each part contributed to the change on inequality from 1994 to 2004. It show that each composition part contributed to the narrowing of the wage distribution in this time period. The composition effect of observable characteristics increased in this period relative to the previous one. Nevertheless, changes in observable characteristics together with returns to observable characteristics still contributed little to the narrowing of wage distribution, compared to the unobservable part. Panel B also show that the contribution of observable characteristics to the decrease in inequality was much higher at the top of the distribution than at the bottom of it. It may be due to the fact that workers re-qualified themselves either in terms of education or occupation, which allowed them to enter the higher-wage positions, and therefore, decrease the inequality at the top. Changes in the observed prices again contributed nearly to 12 percent of wage dispersion narrowing, and this effect was proportional to at the top the overall change in inequality at the top and at the bottom of distribution. Panel C concludes the analysis by presenting the total contribution of each composition part from 1985 to 2004. As noted before, the main message of this table is that the within group inequality accounts for the largest part of the change in total wage inequality throughout the whole period studied. While the change in observed prices increased overall inequality, changes in composition of workforce decreased the

observable part of inequality mainly at the top of the distribution, but this effect took place in the later transition period, from 1985 to 2004.

Table 1: Observable and unobservable components of change in inequality

Differential	Total Change	Observed Quantities	Observed Prices	Unobserved Prices and Quantities
		A. 85-5		
Variance	0.617	0.000	0.052	0.566
90-10	0.948	-0.004	0.117	0.834
90-50	0.275	-0.005	0.030	0.250
50-10	0.673	0.001	0.087	0.584
		B. 5 - 13		
Variance	-0.389	-0.003	-0.022	-0.363
90-10	-0.589	-0.023	-0.073	-0.492
90-50	-0.245	-0.017	-0.032	-0.196
50-10	-0.344	-0.007	-0.041	-0.297
		C. 85-13		
Variance	0.228	-0.003	0.029	0.202
90-10	0.359	-0.027	0.044	0.342
90-50	0.031	-0.022	-0.002	0.054
50-10	0.329	-0.005	0.046	0.288

Given the significant between-group inequality increase by education and occupation separately, illustrated by Figure 1 and Figure 3, the finding of tiny contribution of observable factors to the widening of wage distribution come somewhat at surprise. There may be two possible explanations for this.

Firstly, it maybe that the workers with lower educational attainment switched to higher rewarded occupation. From anecdotal evidence of the 1990s there is enough evidence that high school graduates moved to higher rewarded occupations that required little formal training, such as retail sales for example, but more educated people stuck to traditional occupations that were losing their competitiveness in terms of compensation.

Second potential explanation to small within group inequality is the aggregation of education and experience characteristics. The 6 characteristic variables for education and the 10 for occupation cannot entirely capture the variability by school quality and the variability by specific occupation within the larger categories. And even thought Figures 1 and 3 do imply significant differences between education and occupation characteristics separately even in the presence of aggregation within these groups, it may be possible that the aggregation effects hide the between-group differences if the corresponding groups are determined by education, experience and occupation characteristics all together. So the aggregation effect may distort the main conclusions of the small significance of between-group component in the overall widening of earnings distribution from 1985 to 2004.

3.5 Residua variance decomposition

The main result of previous section, that the increase in residual inequality was the main driving force behind the overall inequality increase in Russia from 1985 to 2004, poses additional question: was this due to the increase of within group inequality for all observable groups studied by this analysis, or was it simply a shift in a composition of groups that resulted in higher proportion of groups with higher residual inequality?

To address this issue in my study I use the approach of Lemieux (2006), which decomposes the change in overall residual variance into the two parts: composition of work force groups and variance of these groups. For the purposes of this analysis I concentrate on the variance analysis, which is an alternative measure of inequality. In the

Table 1 presented in the previous section one can see that the basic result of predominant role of unobservable part in the increase of total wage inequality holds for variance as well – the residual variance change accounts for about 88% of total variance change of wages.

Let δ_{jt} be the residual wage variance within a separate demographic group *j* at time *t*. Then it is possible to write the overall residual variance as the average over residual variances of separate groups:

$$V(u_{it}) = \sum_j \theta_{jt}\delta_{jt} \quad (6)$$

where u_{it} is again the unexplained part in individual's wage and θ_{jt} is the sample share of a demographic group *j* at time *t*.

This would represent the actual residual variance at any time *t.* However, the changes in sample share of any particular demographic group may lead to changes in overall residual variance, not necessarily changing the variability within groups. To control for such composition effect it may be helpful to construct the counterfactual residual variance, by fixing sample shares of different demographic groups on the base year level. Assuming that the change of skill composition has no general equilibrium effect[10], the counterfactual residual variance would be written as:

$$V^*(e_{it}) = \sum_j \theta_j^* \delta_{jt} \quad (7)$$

where θ^*_j is the base-year sample share of group *j*.

[10] See Lemieux (2006) for more discussion.

This method enables to adjust for the composition effect on the change in residual variance over time, which would be simply the difference between actual and counterfactual variance in any given year.

For this analysis I also use the OLS estimation of individual male monthly wage, with the same set of explanatory variables as in previous section. Data restrictions do not allow to efficient estimating residual variance within each education-experience-education category. Therefore, I investigate workforce composition effects by separate analysis of experience-education groups (created by interacting education and experience categorical variables; also used in Lemieux (2006)) and occupation groups. Like in previous section, I pull together years 1985 and 1990, 1994 and 1995, 1998 and 2000, 2003 and 2004.

Panel A of Table2 shows the change of within group residual variance of experience-education groups, and well as the change in the sample proportion of these groups, from 1985 to 2004. Within group residual variances greater than overall residual variance are presented in bold. One can easily notice that within group variance for less educated workers increased greatly, sometimes twice as much as it did on average, but the sample proportion of these groups decreased from 1985 to 2004. In turn, the proportion of university graduates, who have small change in residual variance, has increased. So the movements in these two groups seem to have offsetting effect on the change in residual variance. Panel B shows the numerical estimate of composition effect, by fixing within group sample share on either the 1985-1990 or on the 2003-2004 year level. It reveals negligible composition effect when sample shares for different groups are fixed at 1985-1990 year level and zero composition effect when the corresponding shares are fixed at the 2003-2004 year level.

Table 2: Within group variance of wages by experience-education cell, 1985-1990 and 2003-2004

	Within-group variance			Work-force share		
	1985-1990	2003-2004	Change	1985-1990	2003-2004	Change
A. By education and experience						
Dropout:						
1-10	0.401	0.670	0.269	0.003	0.007	0.004
11-20	0.524	0.673	0.149	0.006	0.007	0.001
21-30	0.277	0.715	0.438	0.012	0.004	-0.008
31 +	0.352	0.454	0.103	0.071	0.013	-0.059
High-school graduates						
1-10	0.352	0.808	0.456	0.018	0.010	-0.008
11-20	0.234	0.659	0.425	0.029	0.014	-0.015
21-30	0.304	0.604	0.300	0.018	0.016	-0.002
31 +	0.295	0.477	0.181	0.014	0.024	0.010
PZU, FZU & FZO						
1-10	0.312	0.536	0.224	0.098	0.067	-0.031
11-20	0.342	0.566	0.224	0.120	0.098	-0.022
21-30	0.270	0.547	0.277	0.072	0.100	0.028
31 +	0.310	0.524	0.214	0.100	0.096	-0.003
Technical school						
1-10	0.332	0.483	0.152	0.058	0.043	-0.016
11-20	0.319	0.525	0.207	0.081	0.061	-0.020
21-30	0.322	0.463	0.142	0.049	0.066	0.017
31 +	0.335	0.524	0.189	0.037	0.064	0.026
University						
1-10	0.353	0.559	0.207	0.077	0.100	0.023
11-20	0.301	0.459	0.158	0.065	0.069	0.004
21-30	0.312	0.428	0.116	0.039	0.074	0.035
31 +	0.367	0.461	0.094	0.021	0.052	0.031
Graduate school						
1-10	0.16982	0.439659	0.270	0.002485	0.006077	0.004
11-20	0.182624	0.318421	0.136	0.003018	0.002668	0.000
21-30	0.161909	0.71509	0.553	0.004261	0.002816	-0.001
31 +	0.119816	0.228324	0.109	0.00213	0.005336	0.003
B. Weighted average (using alternative shares)						
Actual shares	0.319	0.519	0.200			
1985-1990 shares	0.319	0.528	0.209			
2003-2004 sharess	0.31852	0.518764	0.200			

Table 3presents the results of similar analysis across occupation groups. Panel A shows some variation in within group inequality change as well. For example, agricultural and fishery occupations experienced the largest increase in variance amounting to 0.339, while the military occupations had only 0.009 increase in within group variance. However, small sample share changes suggest tiny composition effect. Panel B this prediction – fixing sample shares at both the beginning and the end of the period levels do not bring any noticeable composition effects.

Table 3: Within group variance of wages by occupation, 1985-1990 and 2003-2004

	Within-group variance			Work-force share		
	1985-1990	2003-2004	Change	1985-1990	2003-2004	Change
A. By Occupation						
Legislators, Senior Managers, Officials	0.421	0.616	0.195	0.044	0.043	-0.002
Professionals	0.276	0.514	0.238	0.155	0.159	0.004
Technicians and Associate Professionals	0.302	0.539	0.236	0.123	0.145	0.022
Clerks	0.332	0.502	0.170	0.050	0.049	0.000
Service Workers and Market Workers	0.305	0.446	0.141	0.047	0.078	0.031
Skilled Agricultural and Fishery Workers	0.435	0.774	0.339	0.004	0.006	0.002
Craft and Related Trades	0.329	0.446	0.117	0.193	0.172	-0.021
Plant and Machine Operators and Assemblers	0.306	0.548	0.242	0.268	0.213	-0.054
Elementary (Unskilled) Occupations	0.394	0.605	0.210	0.105	0.126	0.021
Army	0.221	0.230	0.009	0.014	0.010	-0.004
B. Weighted average (using alternative shares)						
Actual shares	0.320	0.522	0.202			
1985-1990 shares	0.320	0.520	0.200			
2003-2004 sharess	0.322	0.522	0.200			

Table 4 traces the change of residual variance throughout the 1985-2004 year period and the importance of composition effect at each sub-period investigated. Panel A presents corresponding analysis for the education-experience subgroups. It shows that the sample shares being fixed at 1985-1990 year level the composition effect acted in direction opposite to the average residual variance change, but this counterbalancing effect was small – 3% on average from 1985 to 1995, from 1994 to 2000 and from 1998 to 2004. Panel B illustrates corresponding role of composition effect in sub-periods for different occupation groups. Similarly to Panel A, it shows that composition effect was acting contra general movement of within group inequality, if the sample shares are fixed by 1985-1990 year level, but this counterbalancing effect of composition is again small, ranging from 1% to 3.5% of overall residual variance change. To sum up, Table 4 shows that the composition effect of the change in residual variance from 1985 to 2004 between education-experience and occupation groups was insignificant both during the whole period investigated and within its sub-periods.

Figure 1: Composition effects and changes in the residual variance, 1985-2004

	1985-1995	1994-2000	1998-2004	1985-2004
	A. Education and Experience			
actual change	0.562	-0.221	-0.142	0.200 88%
1994 skill distribution	0.581	-0.228	-0.145	0.209 91%
2004 skill distribution	0.572	-0.233	-0.139	0.200 88%
Total variance	0.617	-0.228	-0.161	0.228 [100%]
	B. Occupation			
actual change	0.565	-0.220	-0.143	0.202 88%
1985 skill distribution	0.571	-0.223	-0.148	0.200 88%
2004 skill distribution	0.573	-0.228	-0.145	0.200 88%
Total variance	0.617	-0.228	-0.161	0.228 [100%]

3.5 Comparing results with finding in other literature.

In this section I compare main findings of this study with those established in other related literature, in particular with Brainerd (1998) and Lukyanova (2006), and discuss potential sources of differences, as well as possible shortcomings of my analysis.

My findings at the early period of transition, from 1985 to 2000, differ somehow from Brainerd's (1998) results from 1991 to 1994. I document the decisive role of unobservable part to the total change in inequality, while she finds significant role of the between-group

component. This difference probably comes from the fact that we use slightly different time horizons and the set of observable characteristics in our analysis, in particular the ownership status of the employer. Clarke (2000) finds the average wages in the private sector grew faster than in the public sector during the early transition period. The fact that privately owned enterprises appeared on large scale only from 1991 and the observation of increased returns to private business employees may explain the difference in our estimates.

Similarly, my results and the results of Lukyanova (2006) diverge on the relative contribution of observable and unobservable component to the overall change in variance. However, in our analysis we use completely different observable characteristics. She looks at differences across industry and ownership, the characteristics that appear unobservable in my analysis, so it is consistent with the result of predominant role of unobservable component in the variance change from 1994 to 2004.

Chapter 4

Conclusion

In my thesis I have investigated the movements in the total earnings inequality of Russian workers from 1985 to 1990. I used the methods of Juhn et al. (1993) and Lemieux (2006) to assess the relative importance of between and within group inequality, by looking at individual education, experience and occupation profile. The changes in sample proportions of each group were accounted for, in order to track any composition effect in the observed or unobserved inequality change based on these individual characteristics.

The empirical finding of the paper suggests that the wage inequality, as measured by the 90^{th}-10^{th} percentile differential of wage distribution and the variance of wage, first increased greatly from 1985 to 1994 and then decreased from 1994 to 2004 by more than a half of original increase. Although separately education and experience groups do show significant between-group inequality, the groups created by interaction of individual education, experience and occupation characteristics show only small contribution of between-group inequality change component. The main change in inequality happens within these groups, and this result is robust to the composition effect of these groups by education, experience and occupation characteristics, but may include some distortion due to the aggregation of these variables.

Besides providing evidence of increased income instability brought by transition, the result of predominant role of within group inequality has one important implication from the point

of view of human capital. According to the human capital theory, individuals make investments in their skills, such as education, experience or occupation knowledge, in order to reap future benefits. The basic investment theory says that the value of the asset can be measured by both the average return and the variance of the return of this asset. The results of my thesis suggest that overall the transition increased the variance of workers' investment in human capital while not changing much the return to it. Therefore, on average the transition depreciated the value of their investment.

Appendixes

Appendix 1: Descriptive statistics of variables used in estimations for chosen years

	1985		1994		1998		2004	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Log monthly wage	9.774	0.527	8.322	0.978	7.925	0.800	8.649	0.733
Log hourly wage	-	-	3.273	1.024	2.845	0.871	3.506	0.799
Potential experience	19.99	12.88	22.49	11.81	21.29	11.95	20.18	11.94
Education dummies:								
1. Less than high school	0.088	0.284	0.047	0.212	0.033	0.178	0.029	0.168
2. High school	0.070	0.254	0.090	0.287	0.057	0.232	0.061	0.239
3. Vocational school	0.462	0.498	0.470	0.499	0.462	0.499	0.435	0.496
4. Technical/medical/art school	0.181	0.385	0.162	0.369	0.190	0.392	0.197	0.398
5. University	0.183	0.387	0.200	0.400	0.238	0.426	0.261	0.439
6. Graduate school	0.014	0.120	0.017	0.130	0.017	0.129	0.017	0.128
Occupations:								
1. Legislators, Senior Managers, Officials	0.051	0.221	0.023	0.150	0.021	0.143	0.050	0.218
2. Professionals	0.102	0.303	0.157	0.364	0.128	0.334	0.102	0.303
3. Technicians and Associate Professionals	0.092	0.289	0.055	0.228	0.086	0.280	0.091	0.287
4. Clerks	0.006	0.080	0.009	0.093	0.014	0.118	0.013	0.113
5. Service Workers and Market Workers	0.019	0.137	0.039	0.194	0.051	0.220	0.045	0.208
6. Skilled Agricultural and Fishery Workers	0.004	0.066	0.007	0.080	0.005	0.068	0.005	0.072
7. Craft and Related Trades	0.256	0.437	0.302	0.459	0.271	0.445	0.264	0.441
8. Plant and Machine Operators and Assemblers	0.368	0.064	0.314	0.464	0.298	0.457	0.295	0.456
9. Elementary (Unskilled) Occupations	0.064	0.244	0.077	0.266	0.107	0.310	0.119	0.324
10. Army	0.019	0.137	0.015	0.120	0.018	0.133	0.016	0.124
Men proportion in total sample	0.557	0.496	0.541	0.498	0.548	0.497	0.551	0.497
Number of observations	1843		3302		3093		3768	

Appendix 2: Inequality measure for log wages of men, 1985 - 2004

	1985	1990	1994	1998	2004
	A. Monthly Wages				
Variance	0.278	0.383	0.955	0.672	0.561
Percentile differential:					
90-10	1.322	1.540	2.422	2.113	1.872
75-25	0.629	0.875	1.256	0.974	0.831
90-50	0.811	0.847	1.088	1.077	0.936
50-10	0.511	0.693	1.335	1.036	0.936
75-50	0.405	0.470	0.563	0.504	0.450
50-25	0.223	0.405	0.693	0.470	0.381
	B. Hourly Wages				
Variance	-	-	1.039	0.763	0.637
Percentile differential:					
90-10	-	-	2.472	2.169	1.938
75-25	-	-	1.234	1.033	0.957
90-50	-	-	1.136	1.062	0.973
50-10	-	-	1.336	1.107	0.965
75-50	-	-	0.576	0.533	0.459
50-25	-	-	0.658	0.500	0.498

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