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Does Worker's Experience Matter for Russian Growth?

Ilya B. Voskoboynikov
(HSE University, Russia)
ivoskoboynikov@hse.ru

Evgenia M. Chernina
(HSE University, Russia)

Vladimir E. Gimpelson
(HSE University, Russia)

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Does worker's experience matter for Russian growth?

Evgenia M. Chernina[1], Vladimir E. Gimpelson[1], Ilya B. Voskoboynikov[1]

[1] National Research University Higher School of Economics

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Abstract

The paper contributes to the literature on the impact of human capital on economic growth, taking into account variations in productivity of different groups of workers. Specifically, the paper focuses on the decomposition of the repeated cross-sectional and age-earnings data of wages into age/experience, cohort, and time contributions (ACT) (Lagakos et al. 2018), and accommodating it into a simple growth accounting framework for the Russian economy in a way it has been done by Fang and Qiu (2022) for US and China. The experience effect captures human capital accumulation over the life cycle, the cohort effect captures inter-productivity growth (relative human capital level of a cohort of workers at the time when they enter the labor market), and the time effect captures changes in the rental price of human capital.

We use data from the RLMS-HSE household survey covering 2000-2019 years and apply a procedure to disentangle the APC effects. Then, using basic growth accounting framework, the Total Economy Database™ and Russia KLEMS data we calculate contributions of each of these effects to Russian growth in 2000-2019. Our study shows that the role of experience accumulation is negligible in comparison with the cohort effect. This makes Russia similar to China. However, in contrast to China with its positive contribution of the experience component, the impact of experience in Russia is small and negative until mid-2010s. These findings are novel and could be interpreted as long run consequences of the shock therapy transition from plan to market, and also as the evidence of institutional environment, unfavorable for economic growth in Russia.

1. Introduction

We contribute to the discussion on human capital accumulation in the post-transition countries by disentangling the effects of experience, cohort, and time for Russia, using recent developments in understanding its heterogeneity (Lagakos et al. 2018) and a growth accounting framework (Fang and Qiu 2022). What is the role of the experience and cohort effects in the Russian growth path in 2000-2019?

Since the seminal work of Mincer (1974) the positive and concave relationship between log earnings and experience has been one of the stylized facts of labor economics. Almost all documented evidence on the wage growth profiles have overwhelmingly verified early findings of the increasing and concave relationship between earnings and age/experience. Lagakos et al. (2018) show the same increasing and concave earnings–experience relationship for a handful of both developed and developing countries. Countries differ in profile steepness, not in shape. The conventional profile was confirmed once again in a large-scale cross-country study of the World Bank (Jedwab et al. 2021). The consensus view has a well-established basis also in theory Rubinstein and Weiss (2006). Theoretical models predict similar shapes of the post-school wage growth.

A problem of exploring the wage-experience profile is strong multicollinearity of age-period-cohort, known as the APC problem. Any cross-sectional wage–experience profile mixes two different effects. One reflects the actual effect of experience (or age with which it correlates) brought by the human capital accumulation and depreciation. The other one reflects the fact that a worker belongs to a certain generation with its own specific education and values, or, in other words, to a specific cohort. So, wage evolution reflects both experience and cohort effects.

While in the developed economies the cohort effect does not change much the observed cross-sectional profiles, in the transition economies it may introduce considerable distortions(Fang and Qiu 2022). Therefore, the wage-experience profiles in post-transition countries are likely to differ from those in both advanced and developing economies.

It is also interesting, what is the impact of experience and cohort effects on economic growth. In this matter little is known. Only Fang and Qui (2022) provide some evidence for US and China, showing the drastic difference in contributions of the cohort and experience components to labor productivity growth. While in US the role of the cohort effect is small and the accumulation of experience dominates, China demonstrates poor performance in experience accumulation. It is the cohort effect, which drives the impact of human capital to growth. In this context a reasonable question is if this pattern is specific for China or it can be found in other transition economies.

This paper focuses on Russia, the largest and most populated country in the post-socialist world, adding the analysis of growth pattern to the study of year-wage profiles of Chernina and Gimpelson (2022). Our analysis utilizes a series of cross-sections from the 2000-2019 Russian Longitudinal

Monitoring Survey of Higher School of Economics (RLMS-HSE), and growth accounting data from the Total Economy Database and Russia KLEMS.

Our study shows that the role of experience accumulation is negligible in comparison with the cohort effect. This makes Russia similar to China. However, in contrast with China with its positive contribution of the experience component, the impact of experience in Russia is small and negative until mid-2010s.

The paper has the following structure. The second section provides the conceptual framework and describes data. The third section adds some background information on Russian growth pattern and labor market developments in recent decades. The fourth section discusses results.

2. Approach and data

We use the conceptual framework, suggested by (Fang and Qiu 2022) for comparisons of growth patterns of the United States and China, and implement it for the Russian economy in 1990-s[1] – 2019. In turn, Fang and Qiu (2022) combine the approach to the life cycle wage growth analysis (Lagakos et al. 2018) with the growth accounting approach (Fernald 2014), suggesting the index of labor composition[2] as the weighted average of human capital returns of each cohort and experience groups. The present report continues the study of Russian labor market in this strand of the literature, started by Chernina and Gimpelson (2022). In this section we discuss this conceptual framework, and describe data.

2.1. Age-earning profiles and the period-age-cohort problem[3]

Starting from the seminal work of Mincer (1974), the positive and concave relationship between log earnings and experience is one of the stylized facts of labor economics. One of methodological problems of exploring the wage-experience profile is strong multicollinearity of age-period-cohort, known as the APC problem. A cross-sectional wage–experience profile contains effects of experience and cohorts. The effect of experience reflects the accumulation and depreciation of human capital. In turn, the cohorts effect reflects differences in skills, ideas, values, and norms of that time when individuals are socialized, educated, and enter the labor market. Growing up during a recession or boom, or under a particular politico-institutional regime can make the difference. We also see a mix when we follow the wage evolution within the same cohort; in this case, the effects of experience and time go closely intertwined.

[1] This version analyses years after 2000s, but the next draft will be extended back to 1994.
[2] Fang and Qui call this “human capital”.
[3] See detailed literature review on this matter in (Chernina and Gimpelson 2022).

Perfect multicollinearity of age/experience, cohort, and period/time prevents explicit interpretation of life-cycle wage growth using cross-sectional or panel data. Indeed, these three variables are combined in the identity P (period) = A(age/experience) + C(cohort). We combine age/experience and cohort effects in any cross-section, while in a panel data, the effect of age/experience is merged with the time effect. Each of these effects has its own interpretation and can contribute to shaping the observed wage profile. Disentangling their contributions becomes an important and non-trivial research task. Therefore, we provide an explanation of how we understand separate APC effects before moving on to the empirical part of the paper.

During working lives, individuals improve their skills by doing and through on-the- job training. The accumulated experience leads to higher personal productivity and, correspondingly, higher wages. We call this the *labor market experience effect*.

Cohorts are defined by birth years. Sherwin Rosen (1975) uses the term "vintage", and in his model the cohort effect reflects conditions in which the initial stock of human capital was generated and utilized and the cohort-specific component of returns to human capital. It borrows the term from the literature on theory and measurement of physical capital (Schreyer 2009). All individuals belonging to a particular cohort grow up at the same time, get educated at the same knowledge frontier, absorb values of their generation, and face the same shocks at the same age. Between-cohort wage differences at particular moments of time, or cohort effects, reflect cohort-specific technological change and accumulation of cohort-specific human capital.

In panel or repeated cross-sectional data, *time effect* captures non-cohort-specific and non-experience/age-specific factors acting over time. It reflects how returns to human capital evolve due to general changes in labor demand and supply, non-cohort specific shocks, technological change, physical capital accumulation, etc. Fast growth of the labor productivity in an economy is likely to lift wages across the spectrum of groups, like "the tide lifts all boats". This time-induced change applies equally to all age/experience and cohort groups.

Any economy will periodically face various shocks that affect wage evolution. Their role in shaping the wage profile deserves special attention. Shocks can hinder the human capital accumulation, decrease its utilization, and reduce potential gains. Those types of shocks that are not selective and hit all cohorts and age groups are part of the time effect.

To shape our empirical research, we rely on the theoretical model of human capital investment over the life cycle. Its important advantage over the alternative theories is in its provision of an intuitively clear and simple identification of the APC parameters.

2.2. Incorporation of age-earning profiles

Separating the APC effects. Ideally, for calculating the effect of human capital accumulation with experience, we need to estimate the equation of the form (1):

(1) $$log\ w_{ict} = \alpha + \sum_{k=1}^{K} \theta_k exp_{kict} + \gamma_t + \lambda_c + \varepsilon_{ict}$$

where w_{ict} – the wage of individual *i*, from cohort *c* in period *t*; exp_{kict} – 5-year bins of labor market experience of individual *i* from cohort *c* in period t, k=1…K; θ_k is the experience effect, k=1…K; γ_t – period *t* effect, *t*=1…T; λ_c – cohort *c* effect, *c* = 1, … C cohorts; ε_{ict} – random error.

Let us briefly discuss the estimation procedure that we are borrowing from Lagakos et al. (2018). Consider the time trend of the average wage growth, g_M, over a period. It is equal to the sum of the time effect, g_γ, and to the change in total productivity due to change in the cohorts' composition of the labor force, g_λ :

(2) $$g_M = g_\gamma + g_\lambda$$

Given that, the iterative estimation goes the following way. First, the wages get deflated by the estimated time trend of wage growth, g_M. Second, equation (3) is to be estimated:

(3) $$logw_{ict}^{d} = \alpha + \sum_{k=1}^{K} \theta_k exp_{kict} + \gamma_t^* + \lambda_c + \varepsilon_{ict}$$

Where w_{ict}^d is the deflated wage of individual *i,* from cohort *c* in period t; exp_{kict} – 5-year groups of labor market experience of individual *i* from cohort *c* in period *t*, k=1…K; θ_k is the experience effect, k=1…K; $educ_{lict}$ – level of education of individual *i* from cohort *c* in period *t*, l=1…L; γ_t^* – transformed period *t* effects such that $\frac{1}{T}\sum_{t=0}^{T}\gamma_t^* = 0$, t=1…T; λ_c – cohort *c* effect, c = 1, …C cohorts; ε_{ict} – random error.

Estimated coefficients θ give the average wage growth in the final *y* years of working life. Let us define it as g_y. According to the assumption borrowed from Heckman et al. (1998), the observed growth, g_y, comes from the time effect and depreciation. So, equation (4) should hold:

(4) $$g_M = d + g_y + g_\lambda$$

The iterative procedure is repeated with the updated value of g_M until equation (4) holds.

2.3. Growth accounting

The starting point is a standard Cobb-Douglas aggregate production function

(5) $$Y_t = A_t K_t^{\alpha_t} L_t^{1-\alpha_t}$$

where Y is real value added, K and L are flows of capital and labor services, A – total factor productivity. All parameters depend on time t, including factor shares α. We denote the corresponding lower-case variables y and k in per hour terms. In turn, *l* is the flow of labor services per hour worked, or labor composition. Transforming (1) to the lower-case variables we have

(6) $$y_t = A_t k_t^{\alpha_t} l_t^{1-\alpha_t}.$$

These variables, except l_t, can be obtained from the Total Economy Database, discussed in section 2.3. In turn, following Fang and Qiu (2022), we construct labor quality index as

(7) $$l_t = \sum_c \sum_k exp(s_c + r_k) w(c, k; t),$$

where $w(c, k; t)$ provides the employment share of workers of cohort c and experience k at time t and cohort-specific returns to skills s_c and returns to experience r_k. All these parameters can be obtained from the decomposition (3) above, using the RLMS data, discussed in data section.

Taking logarithms and time differences we have the standard growth accounting decomposition

(8) $$\Delta \ln y_t = \Delta \ln \tilde{A}_t + \alpha_t \Delta \ln k_t + (1 - \alpha_t) \Delta \ln l_t.$$[4]

As is evident from equation (4), the decomposition of wage growth is sensitive to assumptions concerning d and y. The more the wage growth relates to depreciation, the less of that is left for the cohort effect. This condition has theoretical grounds. Skills can become obsolete over a career stage (associated with age) and due to a certain cohort affiliation. De Grip and Van Loo (2002) distinguish two types of such obsolescence: technical and economic. The technical – or internal – one affects the current stock of human capital due to consequences of the natural aging process, injuries, and illness, or due to unemployment and career interruptions. The economic – or external – skills obsolescence concerns the unit price of skills. Both types of obsolescence can be incorporated in both experience and cohort effects. Assuming a higher depreciation caused by aging, less is left for the cohort effect.

[4] NOTE ON $\Delta \ln \tilde{A}_t$ from Fang on p. 22.

2.3. Data

Our analysis utilizes the individual micro-data from the Russian Longitudinal Monitoring Survey of Higher School of Economics (RLMS-HSE). The RLMS is a series of nationally representative surveys that covers, over time, around 10,000 adults in approximately 5,000 households.

Our data set covers the 20-year period from 2000 to 2019. The baseline sample we are using in the study consists of male, full-time wage employees. A few additional criteria apply. Workers should be between 20 to 60 years of age, have work experience of up to 40 years, are not currently enrolled in full-time educational institutions, and are not early pension recipients. Below we explain the reasons for this censoring as well as some other details on the composition of the sample. The resulting data set consists of 32,500 observations, with complete information available for 27,500 observations.

For growth accounting exercise we use the April 2022 release of the Conference Board Total Economy Database™ (TED).[5] The TED is a comprehensive database with annual data covering Gross Domestic Product (GDP), population, employment, hours, labour quality, capital services, labour productivity, and total factor productivity for 123 countries in the world, including Russia, at the total economy level. For most countries the TED productivity series start from 1950. For Russia the series of hours worked and capital services are based on Russia KLEMS 2019.[6]

3. Wages and growth patterns of the Russian economy

This subsection summarizes some background information on Russian labor market and growth pattern, and based on (Voskoboinikov 2023) and (Chernina and Gimpelson 2022).

Since 1990 economic growth in Russia was volatile (see Table 1). The transformational recession with the sharp output fall (-8.36 % in 1990-1995) was followed by the post-transition recovery (6 % growth in 2001-2005) and long stagnation (1.7% in 2011-2019). These three periods differ in terms of main sources of growth. Transformational recession of 1990-1998 was caused mostly by productivity fall, caused by initial disorganization, and mass disinvestments. Outstanding growth in years of the post-transition recovery was fuelled by the unique combination of such favourable factors as investments inflow not only from oil and gas exports revenues, but also from global integration. It included FDI, technology catching up in manufacturing and financial services. Also new imported machinery and information and communication (ICT) technologies enhanced growth. Stagnation of 2010th was mostly explained by productivity fall in oil and gas at the background of the lost momentum for technology catching up in manufacturing. It was partially compensated by capital contribution from oil and gas, and some small positive productivity contribution from manufacturing.

[5] The dataset is available at https://www.conference-board.org/data/economydatabase/index.cfm?id=27762. Detailed methodology description is provided by de Vries and Erumban (2017).
[6] The dataset is available at https://www.hse.ru/en/russiaklems/dataklems. See also sources and methodology description at (Voskoboynikov 2012).

Table 1. Growth accounting of the Russian economy in 1990-2019.

		1990-1995	*1996-2000*	*2001-2005*	*2006-2010*	*2011-2015*	*2016-2019*
	Annual average growth rates, %						
1	*Real value added (7 + 8 + 9 + 10)*	*-8.36*	*1.59*	*5.96*	*3.48*	*1.72*	*1.70*
2	*Labour*	*-2.91*	*-0.43*	*0.84*	*0.17*	*0.07*	*-0.43*
3	*Capital*	*-4.56*	*-3.31*	*0.29*	*2.20*	*2.36*	*1.89*
4	*Labour quality*	*0.86*	*0.89*	*0.49*	*0.53*	*0.66*	*0.54*
	Average share of value added, %						
5	*Labour share (%)*	*44.5*	*45.6*	*43.4*	*47.1*	*45.9*	*47.2*
6	*Capital share (%)*	*55.5*	*54.4*	*56.6*	*52.9*	*54.1*	*52.8*
	Contributions (p.p.)						
7	*Labour (2 × 5)/100*	*-1.30*	*-0.20*	*0.36*	*0.08*	*0.03*	*-0.20*
8	*Labour quality (4 × 5)/100*	*0.38*	*0.40*	*0.21*	*0.25*	*0.30*	*0.25*
9	*Capital (3 × 6)/100*	*-2.53*	*-1.80*	*0.16*	*1.17*	*1.28*	*0.99*
10	*Total Factor Productivity*	*-4.92*	*3.18*	*5.22*	*1.99*	*0.10*	*0.65*

Source: The Conference Board Total Economy Database™, August 2021; (Voskoboinikov 2023).

Note: Labor quality indicator is used from TED and inconsistent with the one, defined by equation (7).

Taking into account volatile growth pattern, it is not a surprise that Russian labor market was also extremely turbulent with multiple negative and positive shocks (Gimpelson and Kapelyushnikov 2013). The labor market absorbed each of these shocks largely by price for labor, and these wage adjustments could be not cohort or experience neutral. The first decade (the 1990s) started with the collapse of the Soviet Union, and it marked the beginning of the transition from the planned economy to market economy. During this decade, the Russian economy faced three strong macro-shocks, which caused a deep and prolonged recession. By the end of the decade, the Russian GDP made only about two-thirds of what it was at the start in 1991, and the real wage plummeted following the GDP path.

The transformation crisis had a varied and possibly prolonged effect on the cohorts in the labor market at that time. The human capital of the labor force obtained before the transition experienced a strong hit. The realities of the emerging market economy made the education and skills accumulated within the planning system largely obsolete.

The second decade, which we date as the 2000 to 2008 period[7], was markedly different when compared to the first one. It brought a real economic boom that was reflected in all major indicators.

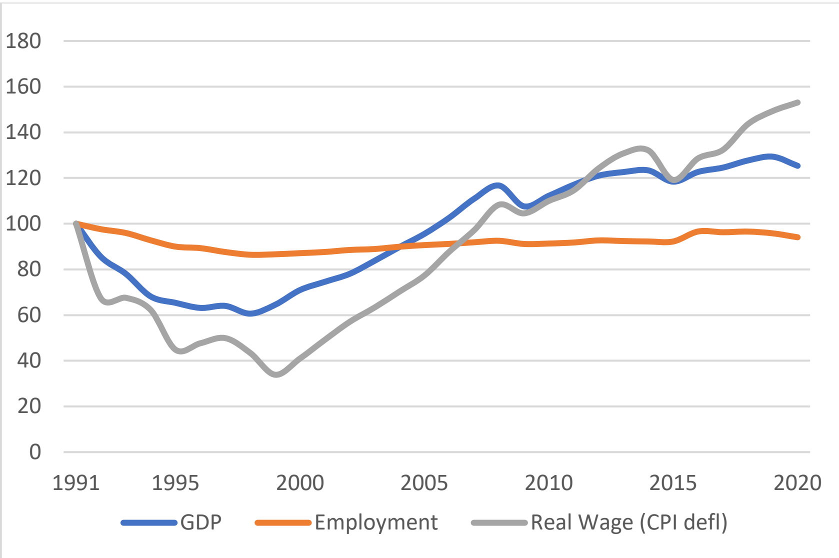
[7] The 2008 world financial crisis hit Russia in 2009.

The Russian GDP nearly doubled within this period, and the real wage increased even more (see Figure 1). The fast growth generated many new job openings and created optimistic expectations about the future. Much of this gain was acquired by the cohort that entered the labor market during these years. In the 2000s, investments in technological modernization and R&D intensified (Granville, Leonard 2010). This accelerated the natural process of human capital accumulation as well as obsolescence due to technological change, which was likely cohort-specific. However, the positive development did not last long and was stopped by the financial crisis that trimmed the GDP by 8.5% in 2009 (see Figure 1).

During the third decade, from 2009 to 2019, the path of development took a steep turn once again. Although the losses in terms of GDP and wages brought about by the crisis were recovered within a few years, the annexation of the Crimean Peninsula, followed by Western sanctions and Russian counter-sanctions, coinciding with a deep plunge in the world hydrocarbon prices, pushed the Russian economy towards the new recession and stagnation. The accumulated GDP growth over this decade barely reached 9.5% (or less than 1% annually) and the real wage growth was 28%, primarily during the recovery in 2010-2013. These rates were insubstantial after 2013 (Figure 1).

Summing up this short and highly stylized description, we can say that this 30-year period contains the events of the recession, the boom, and the stagnation. Unsurprisingly, they have affected the accumulation of human capital, its utilization, and wage returns accrued to workers. Though all age/experience and cohort groups face the common time trend, they have been exposed to shocks and stagnation to a different degree. If experience can bring additional skills regardless of the business cycle phase, negative shocks causing technological and structural change speed up the process of human capital obsolescence.

Figure 1. GDP, Employment and Real Wage, 1991-2020



Source: (Chernina and Gimpelson 2022).

4. Results and discussion

The advantage of the ACT approach in comparison with other measures of human capital is the explicit consideration of the experience and cohort effects. Being combined with growth accounting this approach has a potential for quantifying contributions of experience and cohort effects to economic growth and productivity. Not surprisingly, such attempts have already been made in the literature (e.g. Fang, Qui 2022).

However, the ACT approach is based on assumptions about human capital depreciation d and the number of years y before retirement, when a person stops investing to his/her human capital. As can be seen from the previous sections and also from Appendix A1, reasonable alternative assumptions lead to substantial variations in wage profiles. This section reports results of growth accounting exercise for Russia for alternative assumptions on d and y, and answers the following questions.

(i) What is the impact of these variations on growth accounting and on our understanding of sources of growth?

(ii) If such variations are high, what can we take away then for understanding the Russian pattern?

(iii) What developments in methodology do we need to make ACT-based growth accounting more informative?

Labor quality level on the basis of index (7), as well as its “cohort” and “experience” components are presented in Figure 2. The cohort effect seems to be sensitive to the assumptions. It is sound for the “no-depreciation case” and becomes negligible and slightly negative with 1% human capital depreciation and y = 10. It seems, new cohorts do not overperform the old ones, once we suggest some depreciation of skills.[8] What drives growth is the cohort effect. Indeed, older generations with the Soviet period education and early working experience in planned economy seem to be less prepared to the job market. Younger generations are more productive. Entering job market, they perform better than their predecessors.

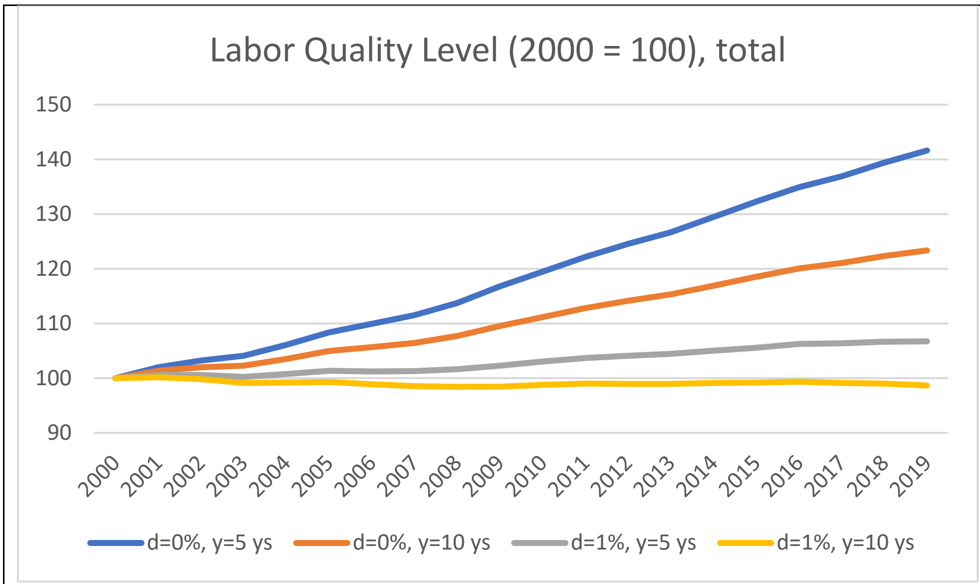
[8] From this perspective it the dominant role of the cohort effect for China, reported by (Fang, Qui 2022), is robust to the assumptions on d and y.

How can this be explained? Like in China, some Russian workers entered the job market in planned economy period, while younger generations started working in the competitive environment of market economy. If this younger generation is more acceptable to experience, and capable to transform it into personal productivity growth, this can explain the reversal trend. Unfortunately, this cannot be observer and reported explicitly on the basis of labor quality index (7).

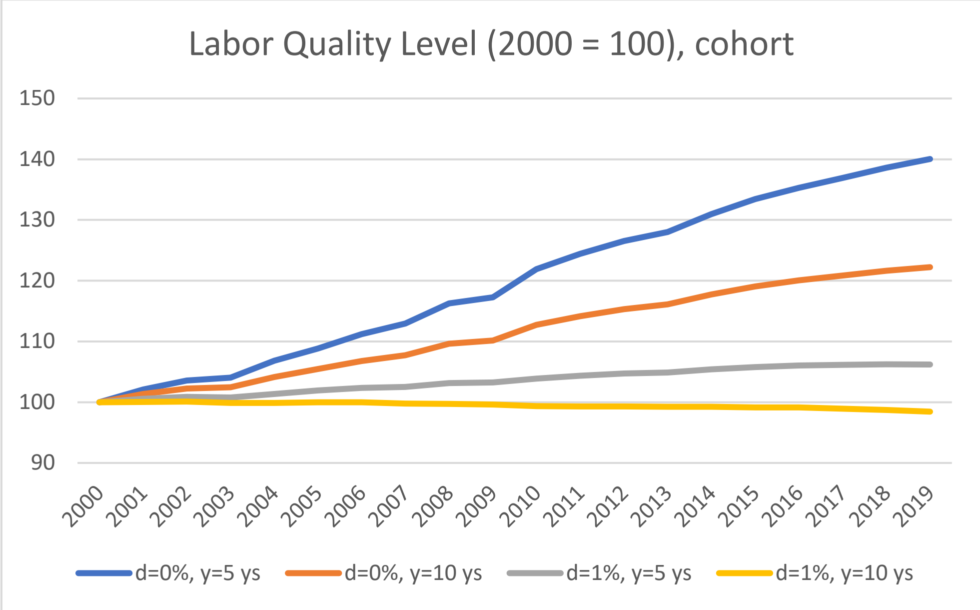
The experience effect (Figure 2c) is small and mostly negative. However, in all four cases the negative trend reverses in mid-2000-s, and becomes slightly positive by the second half of 2010-s.

Growth accounting decomposition (table 2) with index (7) as a measure of labor quality, with assumptions of no human capital depreciation and y = 5 years show the picture, similar to what we see on table 1 and common in growth accounting literature for Russia. The contribution of labor quality seems to be relatively modest, and TFP slowdowns in 2010-s. At the same time, in line with Figure 2a, the contribution of labor quality disappears, once we adapt different assumptions on d and y. So, the Russian growth pattern changes substantially, depending on assumptions on depreciation of human capital and y.

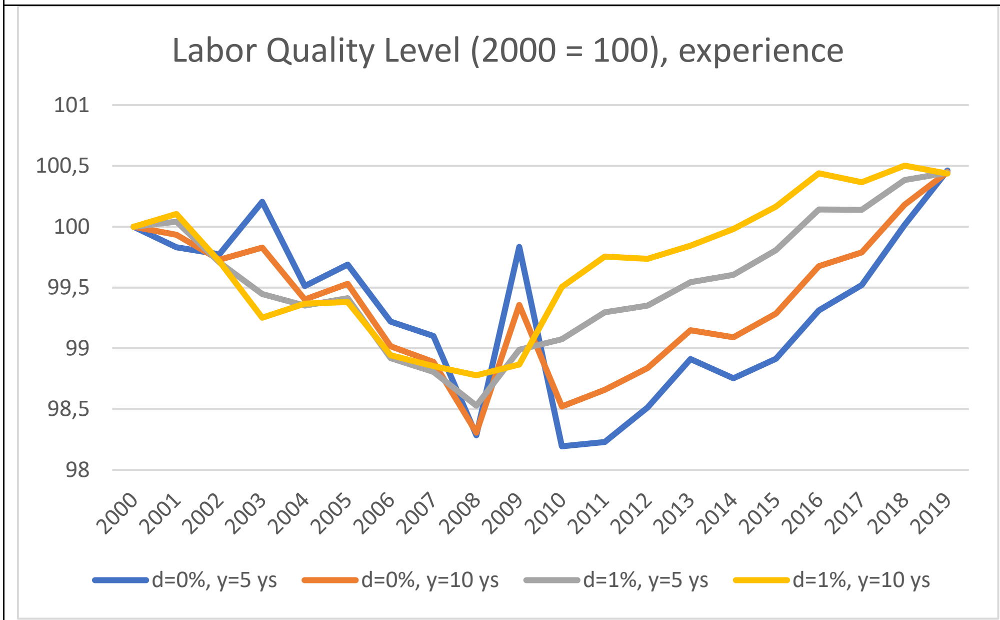
Figure 2. Labor quality level and its components (2000 = 100)



a. Total effect



b. Cohort effect



c. Experience effect

Source: own calculations.

Note: Growth of labor composition (7), and contributions of the cohort (red) and experience (green) components relative to the level of 2000.

Table 2. Growth accounting decomposition of labor productivity growth.

	2000-8	2010-19	2000-19
Labor productivity	5,56	1,99	3,10
Capital Intensity growth	0,27	2,18	1,47
Labor Quality growth	0,73	0,91	0,85

Average capital share (%)	54,8	52,0	55,3
Capital intensity contribution (pp)	0,15	1,13	0,82
Labor quality contribution	0,33	0,44	0,38
TFP	5,08	0,43	1,91

Note: Labor quality corresponds to the case of d = 0%, y = 5 years.

Table 3. Growth accounting in 2000-2019 and alternative labor quality indices.

	d=0%, y=5 ys	**d=0%, y=10 ys**	**d=1%, y=5 ys**	**d=1%, y=10 ys**
Labor productivity	3,10	3,10	3,10	3,10
Capital Intensity	1,47	1,47	1,47	1,47
Average capital share	55,3	55,3	55,3	55,3
Capital intensity contribution (pp)	0,82	0,82	0,82	0,82
Labor quality contribution	0,38	0,23	0,07	-0,01
TFP	1,91	2,06	2,21	2,30

In comparison with the US and Chinese patterns the Russian experience seems to be the extreme case of China, if we neglect human capital depreciation. Indeed, in both countries the role of experience is relatively small in comparison with the cohort effect. However, in China it is substantial and growing, while in Russia it is small.

A possible explanation comes from the long standing debate on consequences of gradual transition (China) versus the Shock Therapy approach (Russia) (see, e.g., (Popov 2007)). Although, it seems, the difference between the two transition paths is negligible for long run growth (Wyplosz 2014), the shock therapy has echoed in the process of experience accumulation.

All in all, as it stands now, the role of experience accumulation in Russian growth seems to be modest.

Finally, we would highlight some methodology limitations of labor quality index (7) in comparison with, say, labor quality measure, which is used in TED and can be traced back to Denison-Jorgenson-Griliches studies of 1960-s. Labor quality growth rates on the basis of (7) cannot be decomposed exactly into experience and cohort components. So, we are not allowed to see the reallocation of the flow of labor services between cohorts.

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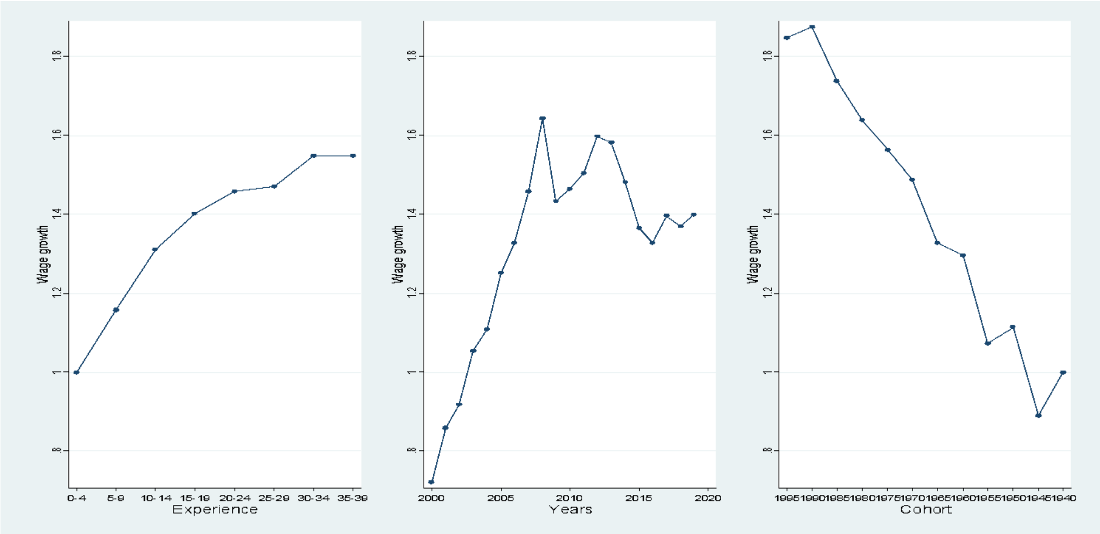
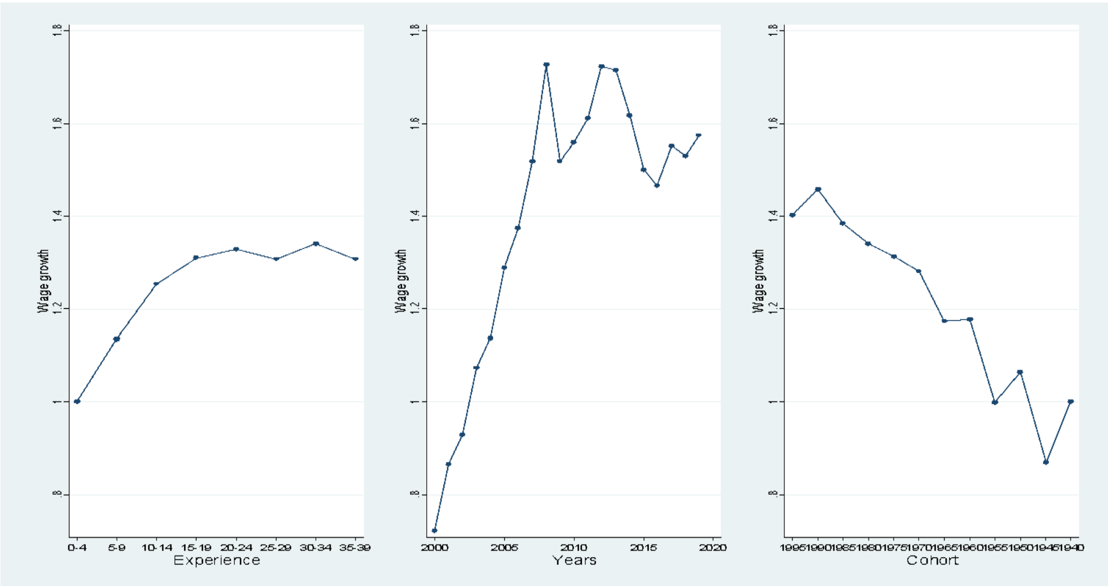
Appendix A1. Hourly wage growth due to experience, cohort, and year effects

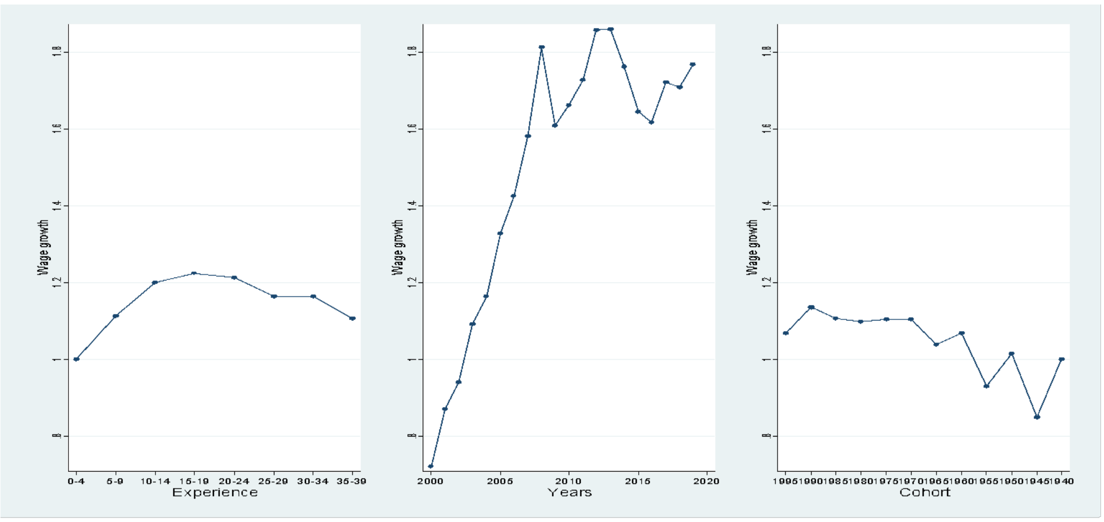
(A) $d = 0\%$, y = 5



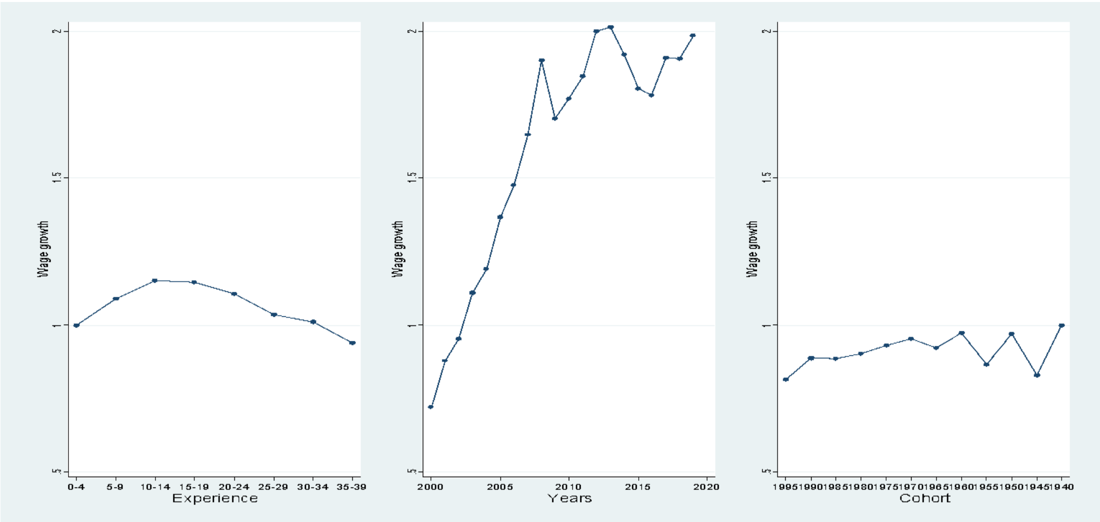
(B) $d = 0\%$, y = 10



(C) $d = 1\%$, $y = 5$

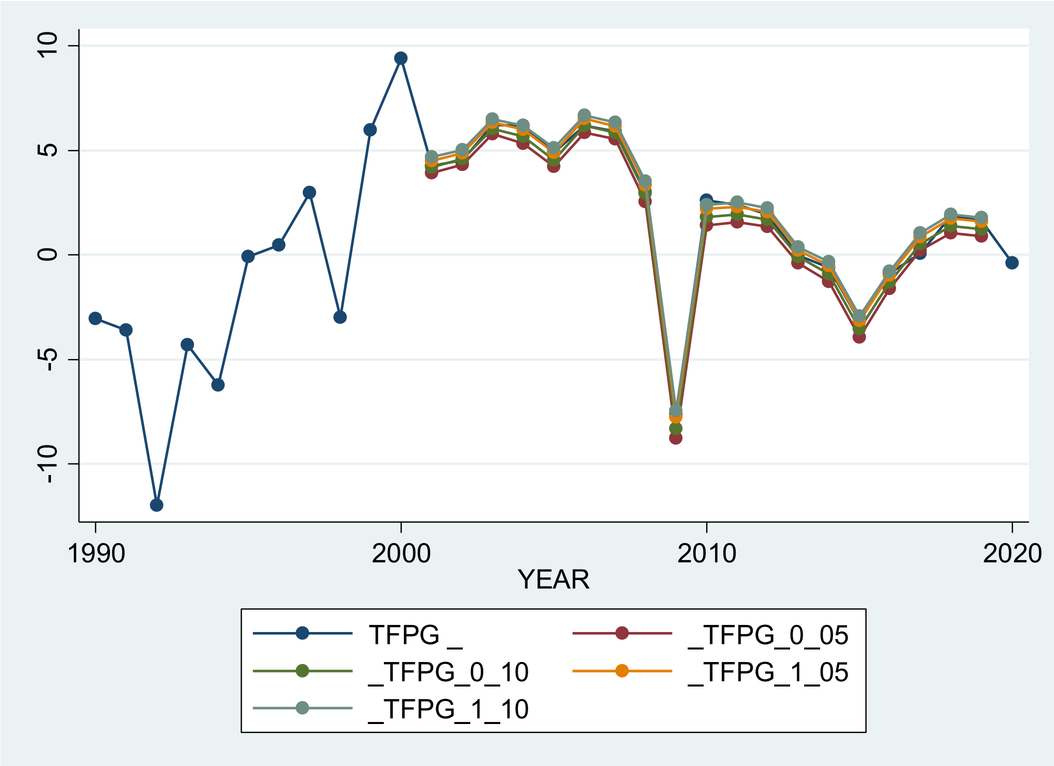


(D) $d = 1\%$, $y = 10$



Source: (Chernina and Gimpelson 2022).

Appendix A2. TFP growth rates. Sensitivity analysis



Source: own calculations.

Note: calculations for various assumptions on labor composition: basic, accepted in TED (blue), d = 0%, y = 5 years (red), d = 0%, y = 10 years (green); d = 1%, y = 5 years (orange); d = 1%, y = 10 years (gray).