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"Education in transition and job mismatch:
Evidence from the skills survey in non-EU transition economies"

Olga Kupets

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Olga Kupets

Department of Economics, National University of "Kyiv-Mohyla Academy"

Contact information:

National University of "Kyiv-Mohyla Academy",

Department of Economics

10 Voloska Str., office 6-203

04070 Kyiv, Ukraine

Tel.: +38-044-425-60-42

E-mail: kupets@kse.org.ua

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Abstract

This paper explores the incidence and determinants of education-job vertical mismatch in four non-EU transition economies, namely Armenia, Georgia, Macedonia and Ukraine. It uses cross-section data from the recent World Bank's Skills toward Employment and Productivity (STEP) surveys of working-age urban population and applies several methods of measuring the incidence of education-job mismatch. The particular interest is to examine whether the young generation that acquired education in modern economic environment is different from the older generation that studied before or shortly after the onset of transition, and whether overeducated and undereducated workers are different from those who are well-matched in terms of cognitive and non-cognitive skills. Our study shows that although workers from the older pre-transition cohort have relatively higher incidence of overeducation in Georgia and Armenia and lower incidence of overeducation in Ukraine and Macedonia as compared to younger workers from the transition cohort, the effect of cohort and age is rarely significant when other important characteristics are taken into account. Overeducated individuals seem to possess a relatively worse bundle of skills than workers who are adequately matched to their jobs in terms of formal education, undereducated individuals often perform better than well-matched workers, but the differences are not always significant.

JEL Classification: I29, J24, J62, P23, P52

Keywords: education-job mismatch, overeducation, job-relevant skills, credential inflation, transition economies

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1. Introduction

Over the past two and a half decades, transition economies in Europe and Central Asia (ECA) have seen dramatic transformations in virtually all spheres of life, including education and training. Before the onset of transition, the region had a well-developed education system that has been seen as the positive legacy of socialism. The stock of human capital – measured as the proportion of population aged 25 and over that had completed at least secondary education – was equivalent and in some countries even above those in most advanced economies (EBRD, 2013). During transition, ECA countries faced significant challenges to build up fully functioning market economies, restore their competitiveness and ensure fiscal sustainability against the backdrop of slow growth after a deep recession in the 1990-s, remaining structural weaknesses, external vulnerabilities and the mounting demographic pressures (IMF, 2014). Despite these multiple transition challenges, most countries in the region continue to have strong achievements in education. Gross enrollment ratios to primary and secondary education remained remarkably high (over 90 percent) while enrollment ratios to tertiary education have grown rapidly and are quite high relative to the income levels of these countries (Sondergaard and Murthi, 2012). As a result, the proportion of population aged 25 and over that had completed secondary (tertiary) education has increased from the average 33.2 (8.2) percent in 1990 to 54.5 (14.1) percent in 2010.[1]

In spite of these positive achievements in enrollment and attainment rates and in the quality of primary and lower secondary education, an inadequately educated workforce has become one of the important binding constraints to business growth in virtually all ECA countries during the boom years in the 2000s, as documented by the analysis of firm-level surveys in 2002-2008 (Mitra et al., 2010). On average, about 30 percent of firms considered education and skills to be a major or severe constraint to their growth in 2008, with greatest dissatisfaction in Belarus, Kazakhstan, Russia, Ukraine, Moldova, Lithuania, and Romania. This dissatisfaction with the workforce skills at the firm level has transformed into weaker growth performance and lower living standards at the macroeconomic level as deficiencies in important skills inhibited the adoption of new technologies and productivity gains. Although recent economic and financial crisis seems to loosen these constraints, they are likely to reappear once the economies start growing. Hence, it is important to understand the causes of the skills puzzle in transition economies.

One of the possible and most popular explanations in the literature, why highly educated workforce cannot generate economic output at the levels similar to those in advanced economies and why firms complain of a skills shortage despite the high availability of educated workers in ECA countries, is a mismatch between the skills acquired during formal education and on the job and those required in the labor market (e.g. World Bank, 2014; EBRD, 2013; Sondergaard and Murthi, 2012;

[1] Author's calculations based on the Barro & Lee dataset (v. 2.0, 06/14; http://www.barrolee.com) for 20 ECA countries.

ETF, 2011).[2] Some degree of skills mismatch is inevitable even in countries with a well-performing labor market and ongoing restructuring because the task content of jobs changes over time in response to technological and organizational changes, and there is always a lag in adjustment of the skill structure of the labor supply to those of labor demand (OECD, 2013).

The skills mismatch may be a more permanent phenomenon in non-EU transition economies which have been implementing market-oriented reforms with a huge delay. Their labor markets lack dynamism and are characterized by excessive rigidities; the quantity and quality of tertiary education have been moving in the opposite directions leading to grade drift and credential inflation; [3] shrinking and aging populations reinforce existing labor market challenges, including the skills mismatch. Education and skills of numerous older cohorts of workers who acquired education and basic skills at work under the previous centrally planned system depreciated and became obsolete as a consequence of economic restructuring. At the same time, new labor market entrants often lack the necessary skills because of the worsened quality and relevance of professional education. Moreover, the occupational structure of jobs in many "late reformers" changed during the past two decades not in the same way as in advanced economies: instead of employment polarization – that is, rising employment in the highest and lowest-skilled jobs – analyzed within the task-based framework after the seminal study of Autor, Levy and Murnane (2003), these countries witnessed growth of middle-to-low skilled jobs with the high intensity of manual skills, both routine and non-routine, in such sectors as retail trade and repair, hotels and restaurants, land transport, subsistence farming, construction, and individual services.[4]

The mismatch between the educational credentials of workers (i.e. years of education and degree) and those required by their jobs – known in the literature as qualification or vertical education-job mismatch – is by far the most intensely studied type of skills mismatch (Quintini, 2011; Cedefop, 2010; Leuven and Oosterbeek, 2011). Although studies of the other types of mismatch – horizontal (i.e. the field of studies mismatch) and genuine skills mismatch – are also interesting and relevant from the policy and theoretical perspectives, they are less common, mainly because direct information about workers' skills and job requirements in terms of particular skills is less easily available than data on

[2] Another important explanation – that firms do not offer sufficient remuneration and decent working conditions to attract workers with the skills they need – is mentioned far less often.

[3] *Grade drift* refers to the deterioration of educational standards and subsequent devaluation of educational credentials (Smith, 2003). It is similar to *credential (qualification; diploma) inflation* – a situation when employees need to have more certificates and diplomas when were previously needed to qualify for a given job – because it also encourages employers to upgrade the educational requirements of jobs. However, grade drift differs from credential inflation in that it causes a genuine change in the education and skill content of a particular qualification whereas credential inflation is mainly based on a change in the signalling power of education (Quintini, 2011).

[4] Aedo et al. (2012) found for a sample of thirty countries that countries with higher incomes tend to use more non-routine cognitive (analytical and interpersonal) and routine cognitive skills and less manual skills (routine and non-routine) in their overall economic production. An interesting finding is that Estonia and Lithuania tend to use non-routing cognitive skills more intensively that the USA, a country used as a benchmark by the authors. The very first task-based study of employment in Ukraine and Macedonia shows that the intensity of manual skills increased significantly among workers born before 1955 and decreased slightly among those born after 1974 (World Bank, 2014, pp.228-229).

educational attainment.[5] Besides, overeducation – the possession by workers of higher levels of education than their jobs require – has received more attention in the literature than undereducation. This is because overeducation is potentially costly to the individual, the firm, and the economy, and investments in education, whether private or public, do not always pay off (Quintini, 2011). In this case individuals and the government may have to reconsider their investment in education, and firms may have to re-examine their recruitment process and the overall personnel policies and procedures to deal with the problems of overeducation.

This paper examines the incidence and determinants of vertical education-job mismatch in four non-EU transition economies, namely Armenia, Georgia, Former Yugoslav Republic of Macedonia (further – Macedonia) and Ukraine in 2012-2013. Although a considerable body of literature on overeducation exists, it is mainly focused on the analysis of overeducation and its consequences in developed economies (see review in Leuven and Oosterbeek, 2011; Kucel, 2011). To the best of our knowledge, only several studies have been carried out in transition economies,[6] and only three of them – Galasi (2008), Mojsoska-Blazevski and Ristovska (2012) and Bartlett (2013) – provided limited knowledge on the educational mismatch in non-EU transition economies. Most analytical studies on skills mismatch and employability in the ECA region (e.g. Sondergaard and Murthi, 2012; ETF, 2011; Rutkowski, 2010, 2012 and 2013; World Bank, 2009) are focused on the issue of skills mismatch from the demand side using the employer's surveys. Recent country reports on skills in Armenia and Georgia (World Bank, 2015 a, b) touch on the issue of education-job mismatch from the supply side without specific details.

This study fills this gap in the literature and explores whether findings on the patterns and determinants of education-job mismatch in more advanced transition economies and developed countries hold true for the countries stuck in transition ("late reformers"). In order to contribute to the existing mushrooming studies on overeducation, this paper aims answering several important questions. First, is education-job mismatch a more salient feature in "late reformers" than in the countries with more effectively functioning labor and education markets? Second, is vertical mismatch higher and different in the older cohort of population, which was raised under the different system of values and acquired education and skills adapted to a completely different economic system, than in the younger generation? Third, do job-relevant and non-cognitive skills differ significantly between overeducated, undereducated and those who are well-matched to their jobs in terms of formal education? Finally,

[5] Pellizzari and Fichen (2013) suggested the new measure of skills mismatch based on the PIAAC data. The OECD Employment Outlook (2014, see Chapter 5) analyzed total mismatch in the OECD countries using this measure of skills mismatch together with qualification and field of study mismatches.

[6] These are: Bartlett (2013) in EU Neighbourhood Policy Countries, Kiersztyn (2013) in Poland, Lamo and Messina (2010) in Estonia, Morgado et al. (2014) in 30 European countries, including 10 transition countries which joined the EU in 2004 and 2007, Mojsoska-Blazevski and Ristovska (2012) in Macedonia, Kucel et at. (2011) in six Central and Eastern European countries, and Galasi (2008) in 25 European countries, including six transition countries.

what are the determinants of education-job mismatch in non-EU transition countries and whether actual tenure and experience are good substitutes for formal education credentials?

To answer these questions, we make use of the newly available data from the World Bank's Skills toward Employment and Productivity (STEP) household surveys undertaken in Ukraine in 2012 and in Armenia, Georgia and Macedonia in 2013. The STEP target population is the urban population aged from 15 to 64 years. Our sample for the analysis of education-job mismatch is reduced to employed population which reported about their formal education, current job and skills used at work. For comparison of the incidence of mismatch in these four countries with the OECD countries and Russia, we use the OECD Programme for the International Assessment of Adult Competencies (PIAAC) data.[7] This allows us to get comparable estimates of job-education mismatch based on the same measurement approaches and roughly in the same period (between 2011 and 2013) in 25 countries.

The rest of the paper is organized as follows. [8] Next section provides background information on the development of education and labor markets in four countries of our main interest. Section 3 describes the data and methods used for the measurement of education-job mismatch in our paper. Section 4 compares the incidence of mismatch in Armenia, Georgia, Macedonia and Ukraine and OECD countries estimated with the use of three approaches to the measurement of mismatch, and then examines the incidence of mismatch (measured with the self-assessment approach) in selected countries by socio-demographic and job characteristics. Section 5 explores cognitive, job-relevant and non-cognitive skills of workers depending on the match to their job in terms of formal education. Section 6 discusses our empirical results on the determinants of mismatch in non-EU transition economies. The final section summarizes and concludes.

2. Education and labor market trends in Armenia, Georgia, Macedonia and Ukraine

Like the other post-socialist European economies, Armenia, Georgia, Macedonia and Ukraine enjoyed high levels of human capital at the beginning of the transition process, with high literacy levels by international standards (close to 100 percent) [9] and high educational attainment of the adult population.

Despite the economic downturn and limited public investment in education in the 1990-s, all countries experienced an impressive improvement of educational attainment levels of population

[7] See more about PIAAC and the "*OECD Skills Outlook 2013: First Results from the Survey of Adult Skills"* (OECD, 2013) at http://www.oecd.org/site/piaac/publicdataandanalysis.htm.
[8] We do not review the literature on overeducation, its determinants, costs and theoretical perspectives in a separate section (see recent reviews in Quintini, 2011; Leuven and Oosterbeek, 2011; and Kucel, 2011). We mention the relevant studies while discussing our findings. Main theories which offer explanations for the existence of education-job mismatch not only from the economic viewpoint but also from the social mobility perspective are summarized in Table A1 in Annex.
[9] See http://wdi.worldbank.org/table/2.13.

throughout the transition period. For example, according to the Barro and Lee dataset, the share of population aged 25 years and over with completed secondary or tertiary education increased between 1990 and 2010 from 69 to 77.8 percent in Armenia and from 53.7 to 68 percent in Ukraine, compared with the average shares of 35 percent in 1990 and 52.5 percent in 2010 in advanced economies (Table 1). With 27.1 percent of adult population having completed tertiary education in 2010, Ukraine is far above the average for advanced economies (18.8 percent) and lags behind only the USA (30.9 percent), Ireland (30.3 percent) and Canada (27.7 percent).

<Table 1 here>

Georgia also has a large supply of highly educated workers, with 31 percent of the labor force having completed tertiary education and only 9 percent without completed secondary education (Rutkowski, 2013). In Macedonia, the percentage of the total working age population (15-79 years) and its economically active part achieving tertiary education (14.7 and 20.4 percent, respectively, in 2013) is fairly low compared to the other countries, but it has also significantly increased since 2001 (from 9.5 percent of total population and 13.5 percent of the labor force in 2001).[10] According to Mojsoska-Blazevski and Ristovska (2012), the relatively poor educational achievements of the Macedonian population can be mainly attributed to a long period of input-based educational policy and underinvestment in education in the past.

The improvement of educational attainment levels in all countries has been primarily due to the increased participation of young people in tertiary education (Figure 1), particularly in Ukraine where gross enrollment ratio to tertiary education grew from 46.8 percent in 1991 to 79.7 percent in 2013.

<Figure 1 here>

Despite the cross-country differences in enrollment rates in the early 1990-s and in their evolution over the transition period, the national systems of tertiary (higher) education developed in the similar way: with a struggle of public universities for their survival amid the chronic underfunding by the state and emergence of private universities in the 1990-s, and gradual "Europeanization" reforms of higher education associated with the Bologna process in the 2000-s (ETF, 2011; Dobbins and Khachatryan, 2014; Shaw, 2013; Stojanov and Angeloska-Galevska, 2006).

The major innovations in the early 1990-s that have led to a rapid expansion of the higher education system were an introduction of tuition fee-based education in public universities in addition to a common publicly financed education (called "state order" in Ukraine), along with creation of an alternative private education sector. These changes contributed to a still ongoing trend of shifting education costs towards students and their parents and, more importantly, to a declining quality and relevance of education. This is mainly because universities, in pursuit of financial wealth, were

[10] Author's calculations based on the annual data on working age population by economic activity, gender and educational attainment downloaded from the statistical database of the Statistical office of the Republic of Macedonia (http://makstat.stat.gov.mk/pxweb2007bazi/Database/Statistics%20by%20subject/databasetree.asp).

interested in ever-higher enrollment of students for popular fields such as economics and business, law, international relations, and humanities, without corresponding investment into infrastructure, library resources, research laboratories, salaries of teaching staff, etc. And the governments indirectly supported this suboptimal model. As a consequence, universities "came to function as "degree mills" plagued by heavy corruption"; Soviet-type state control of higher education institutions regarding admissions procedures, the content of education, university administration and input-based funding co-existed with academic "anarchy" regarding the personnel policy (Dobbins and Khachatryan, 2014).

In the early 2000-s, all four countries started reforming the education system with the main goal of increasing the quality and relevance of education.[11] Reforms in the higher education system became almost synonymous with the Bologna process, joined by Macedonia in 2003 and by the other three countries in 2005. [12] Although the Bologna process was seen by policymakers as a great opportunity for bringing higher education in line with the European standards, the real outcomes after almost a decade of Europeanization efforts are quite disappointing. Most universities are still ineffectively governed and mired in corruption (with exception of Georgia), providing numerous cohorts of young people with diplomas but not skills and contributing to a negative grade drift and credential inflation. Overall, the national education system have not changed sufficiently to adapt to the new needs whereby contributing to a skills mismatch, with the type of skills reflected by formal education credentials not matched to the labor market needs (ETF, 2011). Among the main reasons for the lack of positive outcomes of education reforms are organizational path dependence, the mismatch between the Soviet-type state-centered model of university governance and the Western university tradition with significant institutional and individual autonomy, and inadequate/ inconsistent implementation of the main Bologna process principles (Dobbins and Khachatryan, 2014; Shaw, 2013).

But the mismatch between a large supply of workers with tertiary education and labor demand is not only due to the weaknesses of the education system but also due to the stagnant labor markets and slow creation of jobs in the modern high-productivity sectors. Tertiary education has expanded rapidly, whereas the labor markets failed to keep pace with such expansion, offering limited number of high-skilled job opportunities and using the available stock of human capital ineffectively. As Figure 2 (panel A) shows, the majority of jobs in Armenia, Georgia, Macedonia and Ukraine are provided either in the traditional low-productivity sectors such as agriculture, industry, distributive trade and repairs,

[11] Basic information about the education systems can be found in UNESCO International Bureau of Education, World Data on Education at: http://www.ibe.unesco.org/en/services/online-materials/world-data-on-education/seventh-edition-2010-11.html.

[12] The new Law On Higher and Postgraduate Professional Education in Armenia and the Law on Higher Education in Georgia were approved in December 2004, with amendments in 2006-2008 within the framework of the Bologna process implementation. Macedonian Law on Higher Education approved in 1997 and Higher Education Act of 2000 were replaced by the new Law on Higher Education in 2008, after the long debates and preparation process. Even more debates and longer preparation process were in Ukraine: the new Law on Higher Education, which replaced the old Law of 2002, was adopted in July 2014.

transport, accommodation and food services or in the public sector jobs which often require tertiary education but do not offer adequate returns to it. Although some higher-productivity modern sectors such as financial and insurance activities, telecommunications, professional, scientific, technical, administrative and support service activities have seen an increase in the share of employment since the early 1990-s, this has not occurred as rapidly as in advanced economies and their share was relatively small (ETF, 2011). Moreover, the recent economic and financial crisis seems to have brought small positive achievements in the sectoral employment structure to a halt.

Thus, transition-induced job reallocation in Armenia, Georgia, Macedonia and Ukraine has not moved towards highly skilled jobs so far. This concern is supported by the occupational structure of employment in 2013 which is skewed to unskilled and semi-skilled jobs (Figure 2, panel B).

<Figure 2 here>

Another illustration that supports our argument about the importance of labor demand factors in explaining the existing skills mismatch in non-EU transition economies is that many individuals encounter difficulties in joining the labor market and putting their skills to use, regardless of their level of education. These difficulties are manifested in high unemployment and long duration of job search among the people with tertiary education. For example, in Georgia the proportion of unemployed with tertiary education was over 46% in urban areas, and the incidence of long-term unemployment among jobseekers with tertiary education was the highest compared to the other education groups, exceeding 70 percent in 2010 (Rutkowski, 2013). Moreover, it was estimated by J. Rutkowski, that 22 percent of the unemployed with a university degree would not find jobs requiring their degree even if the economy created enough jobs to provide employment to all of the unemployed but keeping the same demand structure for the level of education as existing jobs. At the same time, 31 percent of jobs requiring vocational training would not be filled because of undersupply of workers with vocational skills. Currently, workers with tertiary education fill many blue-collar jobs requiring vocational training. This finding indicates that the supply of highly educated workers well exceeds labor demand for them in Georgia. The similar patterns are also observed in Armenia, Macedonia and Ukraine.

This situation should raise significant concerns of policymakers and economists because education-job mismatch is likely to be persistently high and associated with high costs, at least until the industrial and occupational structure of jobs in the economy adjusts to the availability of a more highly educated workforce. Although this paper does not directly examine the persistence of overeducation in Armenia, Georgia, Macedonia and Ukraine, it sheds light on the magnitude of education-job mismatch in 2012-2013 in these countries and its relationship with tenure: if many workers with long tenure are found among overeducated, this can be a sign of persistent overeducation meaning that large numbers of highly educated workers appear to be trapped in jobs with low educational requirements.

The next section gives a brief overview of existing approaches to the measurement of mismatch and those used in our paper.

3. Data and measurement issues

3.1. Approaches to the measurement of mismatch in the literature

Vertical education-job mismatch refers to a situation in which workers have an educational attainment that is higher or lower than that required by their job (Cedefop, 2010; Quintini, 2011). Therefore, in order to measure mismatch it is necessary to compare workers' education with educational requirements of jobs or occupations. There are three main approaches in the literature to the measurement of required education (Quintini, 2011; Leuven and Oosterbeek, 2011):

1) *Self-assessment* (*direct approach*), which is based on questions that directly ask workers about the educational requirements of their jobs. The advantage of this approach is that information reported by currently employed workers refers to a particular job and not to its aggregate such as occupational group according to some classification. But its downside is that it is subjective by nature, and therefore the outcome is subject to the respondent's bias as workers may be poorly informed about the actual educational requirements by their employers and the outcomes of the recruitment process, particularly if they were hired many years ago (Quntini, 2014).

2) *Job analysis* (*normative approach*), which uses an *a priori* presumed correspondence between occupations and educational requirements derived from systematic evaluation by job analysts. This approach is attractive because the requirements of different jobs are defined through a "task framework" and take into account technology-driven changes in the skill content of jobs (in line with Autor et al., 2003). The main limitations of this approach are that such evaluations of jobs are expensive and infrequently updated, and that variation in required education across jobs within an occupation and across countries which use the same classification of occupations is largely ignored;

3) *Realized match* (*statistical approach*), which infers about the required amount of education per occupation from the actual distribution of workers by educational attainment and occupations. The required level of education is mainly measured either as a function of the mean of completed education (Verdugo & Verdugo (1989) mean-based approach) or as the modal level of completed education (mode-based approach) of all workers holding the same occupation. It is one of the most popular approaches to the measurement of education-job mismatch because the necessary information is available in many household surveys. However, it is regarded as inferior to the other two methods because (i) it reflects the realized match between supply and demand rather than the educational requirements of jobs; (ii) it ignores variation in required education across jobs within an occupation; and (iii) the cut-off at one standard deviation from the mean in the mean-based approach is arbitrary (Leuven and Oosterbeek, 2011).

3.2. Data

For the analysis of education-job mismatch in non-EU transition economies we make use of the World Bank's Skills towards Employability and Productivity (STEP) household surveys undertaken in Ukraine in 2012 and in Armenia, Georgia and Macedonia in 2013. Target population is the urban population aged from 15 to 64 years, and the original sample varies from 2389 observations in Ukraine to 4009 observations in Macedonia. An important advantage of the STEP household surveys is that in addition to a standard background information on a participating household and individual regarding his or her educational attainment and education history, work status, and family background, the surveys collected information to measure different types of skills: (i) job-relevant skills that the respondent uses in his or her job (see Table A2, Panel A in Annex); (ii) socio-emotional skills (also referred in the literature as non-cognitive or soft skills) such as conscientiousness, extraversion, emotional stability, etc. (see Table A2, Panel B in Annex) as well as risk and time preferences; and (iii) direct assessment of reading literacy designed to identify levels of competence at accessing, identifying, integrating, interpreting, and evaluating information (see more about the survey in Pierre et al., 2014).

Our sample for the analysis of education-job mismatch includes employed population with information about formal education, current job, job requirements in terms of formal education and experience, and skills used at work. Although the country-level sample size is fairly small, particularly for Ukraine, we believe that statistics estimated with sample weights and primary sample units using the Stata Stata's facilities for survey data analysis centered around the *svy* prefix command is reliable and valid.

For comparison of the incidence of mismatch in these four countries with the OECD countries and Russia, we use the OECD Programme for the International Assessment of Adult Competencies (PIAAC) data. Target population is the population aged from 16 to 65 years, and overall around 166,000 adults were surveyed in 24 countries and sub-national regions from 1 August 2011 to 31 March 2012. Our sample is limited to employed working-age population in those countries or sub-national regions which are available in public use files[13] and which have information about educational attainment and occupation. Special Stata module "*repest*" has been used to account for complex survey design in the estimation of sampling variances (with jackknife replicate weights).

STEP and PIAAC surveys are based on the similar data collection process in terms of instrumentation, target populations, survey operations and time of the fieldwork (Pierre et al., 2014). This provides an opportunity to examine comparable estimates of skills and other relevant measures including the incidence of education-job mismatch. However, there are also some concerns, common for international assessments of educational achievements, such as the limited number of countries

[13] See http://www.oecd.org/site/piaac/publicdataandanalysis.htm.

with both assessment and other common data, single cross-sectional designs with no ability to track individuals, and unmeasured cultural factors (Hanushek and Woessman, 2011). Moreover, the difference in target populations – urban in STEP and total (or subnational) in PIAAC – may lead to the predefined differences in the incidence of overeducation and overall education-job mismatch as the quality of match between education, skills and jobs is expected to be higher in denser urban labor markets.

3.3. Measurement of mismatch using STEP and PIAAC surveys

STEP and PIAAC surveys made it possible to construct three different measures of education-job mismatch in non-EU transition economies, selected OECD countries and Russia: one measure is based on the self-assessment approach and two measures are based on the realized match (statistical) approach.

1) *Self-assessment*: Information about required education is taken from the question "What minimum level of formal education do you think would be required before someone would be able to carry out this work?" in the STEP dataset and from the question "Still talking about your current job: If applying today, what would be the usual qualifications, if any, that someone would need to get this type of job?" in the PIAAC dataset. Although these questions differ in important dimension, with the former question asking about the necessary education to carry out work, and the latter asking what is needed to get a similar job, leading to the differences in the measured outcome (Leuven and Oosterbeek, 2011), we believe that these differences are negligible if we use wider classes of educational attainment (see below).

If a worker's highest educational attainment is the same as that defined by him/her as required by a given job, he/she is classified as well-matched. If an educational attainment is higher (lower) than that required by a job, he/she is classified as overeducated (undereducated).

As a starting point for this and the second method we generated a variable containing information about the highest educational attainment and required education in the same scale. Given different classifications of education used in different countries, surveys and time,[14] we find the most appropriate to use the following classification of educational attainment in line with the International standard classification of education – 1997 (ISCED):

1. Lower secondary or less (ISCED 0-2);
2. Upper secondary (ISCED 3, all programmes including vocational);
3. Post-secondary, non-tertiary (ISCED 4);

[14] For example, the Soviet education system mainly distinguished between secondary general education (primary education was a part of compulsory secondary education), secondary professional education and higher (university) education. Although all four countries took steps to reform their education frameworks to be consistent with the Bologna Process in the late 1990-s and in the 2000-s, there is still a mix of Soviet-type and modern-type degrees. Moreover, respondents who acquired education under the Soviet system face difficulties in understanding "bachelor", "master", etc. Hence, STEP questionnaires also included Soviet-type levels of education to minimize the classification error.

4. Tertiary professional (ISCED 5B);
5. Tertiary university degree, including bachelor, specialist, master and PhD (ISCED 5A/6).

Although we can expect significant differences in group 5, we do not distinguish between the holders of bachelor's, specialist's and master's degrees because of the completely different classification used in the Soviet system, with a specialist's degree given to all university graduates. There are only few people with a scientific degree (candidate and doctor of sciences under the Soviet system) in our sample, so there is no sense to separate them as well. Secondary professional, or specialized, education according to the Soviet and Armenian system is classified as tertiary professional education (ISCED 5B). Post-secondary, non-tertiary education (ISCED 4) does not have any equivalence in Armenian, Georgian and Ukrainian systems of education, and therefore this class is empty in these countries.

2) *Realized match, mode-based method.* For each 2-digit occupational group [15] coded according to the International standard classification of occupations – 2008 (ISCO), with at least 10 observations per country, we defined the mode of highest educational attainment using the education classification with five levels defined above. This modal educational attainment is taken as required education for all workers of a given occupational group. Classification into well-matched, overeducated and undereducated is done in the same way as in the first method, from comparison of actual and required levels of education.

3) *Realized match, mean-based method.* As in the second method, we decide about the required education from the educational attainment of workers per each 2-digit ISCO occupation (with at least 10 observations). But unlike our approach in the mode-based method, we use total years of education and follow Verdugo & Verdugo (1989) by calculating the mean years of education and using the cut-off at one standard deviation from the mean for defining well-matched, overeducated and undereducated workers. It should be noted that a variable containing information about total years of education does not refer to actual years of schooling reported by respondents. Instead, it is derived by STEP and PIAAC survey teams from the original variable about the respondent's highest level of education and therefore it refers to adjusted years of schooling. Using actual years of education ignores repeated and inefficient years which do not give significant increments to formal qualifications (Sloane et al., 1999), whereas using adjusted years of schooling ignores the possibility of multiple degrees. Whether actual or adjusted years of education are used, the role of variation in total years of education seems to be overstated as it can emerge simply due to differences in duration of studies between countries and between generations. As a result, the final outcome of education seen by employers, i.e.

[15] Relatively small samples of workers in STEP and PIAAC surveys preclude us from using more disaggregated information about occupation (e.g. at 3 or 4-digit levels).

worker's certificate/ diploma/ degree, is the same, but total years of education may be very different. For this reason, we consider this method inferior to the other two methods.

4. Incidence and characteristics of education-job mismatch in Armenia, Georgia, Macedonia and Ukraine

4.1. Education-job mismatch in transition and developed economies

The comparison of different measures of education-job mismatch between developed and transition economies shows that the phenomenon of overeducation is quite widespread and affects at least 10 percent of the workforce (Figure 3). In most countries, the self-assessment method gives higher estimates of overeducation than the other two methods, whereas the mean-based method gives the lowest estimates. This result is consistent with the findings of the literature on overeducation (see, e.g. Leuven and Oosterbeek, 2011). And it supports concern over measurement error in the years/ level of required schooling variable according to the realized match methods and the implied misclassification of education-job (mis)match.

<Figure 3 here>

Less than 73 percent of individuals in Armenia, Georgia, Macedonia and Ukraine and even lower share in 17 OECD countries are equally classified by self-assessment and mode-based/ mean-based approaches. At the same time, over 40 percent (65 percent) of those classified as overeducated according to the self-assessment method, are well-matched according to the mode-based (mean-based) method in both groups of countries. This discrepancy can be seen as the outcome of the occupational downgrading and bumping down process: in view of the shortage of skilled jobs to absorb the rapidly growing number of college and university graduates in the recent decade, many better qualified workers were forced to accept jobs that less qualified workers could also do and pushed the less qualified workers to even lower level jobs.[16] This raised the share of better qualified workers in lower-level jobs and, therefore, increased the modal and mean levels of education in many occupational groups so that relatively more workers are now classified as well-matched according to the realized match methods.[17] This supports the statement by Verhaest and Omey (2010) that the mean- and mode-based methods could provide good estimates of mismatches resulted from temporary search and

[16] Lene (2011) examined in the comparative static exercise what happens when the supply of young people with higher education increases while the total number of skilled jobs is kept constant (so-called 'segmented' labor market entry regime that corresponds to the current structuring of the labor market). The author showed that as the competition becomes more severe, the bumping down rate increases for both highly and lower educated workers leading to a cascading process of downgrading: highly educated workers become more prone to long-term occupational downgrading, whereas low-educated workers are crowded out into the less skilled jobs, which offer fewer opportunities for training and career development, or into unemployment.

[17] For example, a university educated woman working as a customer service clerk (occupational group 42) or a salesperson (occupational group 52) can be classified as well-matched according to the mode- and mean-based approaches if the share of workers with tertiary education in the same occupational group is very high. At the same time, answering the direct question about required education to carry out this work she is most likely to report a lower level of education. Hence, she is classified as overeducated according to the self-assessment approach.

information frictions but they do not capture more structural overeducation within occupations. For this reason, we focus our further analysis on the estimates of education-job mismatch based on the self-assessment approach.

According to the self-assessment approach, the incidence of overeducation varies from 13.4 percent in Italy to 33 percent or more in Georgia (only urban population), Japan, France and Russia (excluding the population of the Moscow municipal area). In 19 out of 25 countries, at least each fifth worker has higher level of education than required by his/ her job. [18] The incidence of overeducation among urban working-age population in Ukraine and Armenia (29.1 percent) is high in absolute terms but it is on a par with many developed countries. Macedonia compares favorably with many other countries in our sample, with the share of overeducated workers at 20.7 percent. However, like many other Western Balkan countries, Macedonia has persistently high rates of total, long-term and youth unemployment: 29 percent of all labor force participants and 24.6 percent of those with university level education were looking for a job in 2013; 82.5 percent of the unemployed were looking for a job for one year and more. [19] Hence, a lower incidence of overeducation in Macedonia should not be seen as the outcome of more effective functioning of the labor market and better match of workers to jobs compared to Armenia, Georgia and Ukraine. It is rather an indication of general scarcity of any jobs, regardless of the level of education and skills required.

Armenia, Georgia, Ukraine and Macedonia seem to have considerably lower incidence of undereducation and the overall education-job mismatch than in developed countries, but it should be taken into account that we compare urban population in these four countries to the entire population in the OECD countries (Figure 3, Table 2). Analysis of undereducation and its relationship with skills mismatch in literacy in the OECD countries with the use of the PIAAC survey (OECD, 2013; Quintini, 2014) suggests that the overwhelming majority of undereducated workers have the literacy skills required to carry out their jobs or higher levels, even though they do not have the corresponding level of education. The authors conclude that this undereducation can be the outcome of credential (qualification) inflation as employers tend to raise job requirements without upgrading job content. It can also be a sign of widespread informal learning in the workplace when workers acquire the necessary skills on the job, but these skills are not certified by an official educational qualification.

<Table 2 here>

Comparison of the structure of employed by actual and self-reported required education (Figure 4) reveals that there is a relative oversupply of workers with a university degree in most countries, but

[18] Our estimates of the incidence of overeducation in developed countries are somewhat lower than those found in the other studies (see review in Leuven and Oosterbeek, 2011; Quintini, 2011; and Kucel, 2011), probably due to our aggregation of levels of the highest educational attainment into five larger groups for the sake of comparison with post-socialist countries (see Section 3.3).

[19] According to the World Development Indicators, the unemployment rate was 16.2 percent in Armenia, 14.3 percent in Georgia, and 7.9 percent in Ukraine in 2013.

it is particularly large in Georgia, Armenia, and Ukraine. In Austria, Germany, Norway and France this discrepancy in the highest education group is close to zero. This might suggest that the more technologically advanced countries create more complex jobs that require tertiary education and, therefore, they are more able to absorb the rapidly growing supply of highly educated workers than transition economies. But after a closer look at the share of workers in jobs requiring tertiary education (ISCED 5A/6) this statement can be supported only in part, as the proportion of such jobs in Georgia, Armenia and Ukraine according to the workers' self-assessment appears to be much higher than in Austria, Germany and France. Taking into account the sectoral and occupational structure of employment in Georgia, Armenia and Ukraine discussed above, we can conclude that employers requiring a university degree from their new employees are often motivated by the widespread credential inflation and negative grade drift rather than by the actual task complexity of jobs.

<Figure 4 here>

At the same time, there is a relative oversupply of jobs requiring lower secondary education or less in all countries but Italy. However, there is an important difference between Georgia, Armenia and Ukraine and many other countries: in most OECD countries and Macedonia this relative oversupply of jobs requiring the lowest level of education coincides with a relative oversupply of workers having upper secondary education, whereas in Georgia, Armenia and Ukraine as well as in Japan, the US and Ireland workers having upper secondary education are also in high demand (in relative terms). This might point to the different character of overeducation in these two groups of countries, with more severe and long-term occupational downgrading in the latter group than in the former one.

The major conclusion stemming from the comparative analysis of education-job mismatch in non-EU transition economies and developed countries is that the share of overeducated workers is fairly high in Armenia, Georgia and Ukraine but it is on a par with many developed countries. However, overeducation can be seen as a more serious and long-term problem in post-Soviet countries, because production is not redesigned and jobs are not upgraded enough to account for the growing supply of workers with tertiary education. A dramatic shortage of high-skilled jobs and a rapidly growing competition for these jobs push many highly educated workers into jobs for which they are genuinely overqualified, and the longer individuals remain in these jobs, the lower chances they have to move upward due to a state dependence. Lack of the necessary knowledge and skills to perform more complex tasks and more demanding jobs also contributes to the problem of widespread overeducation and its persistence. The next section examines whether the incidence of overeducation and undereducation in Armenia, Georgia, Macedonia and Ukraine systematically differs between workers with different individual and job characteristics, with the main emphasis on the difference between transition-related generations.

4.2. Education-job mismatch in Armenia, Georgia, Macedonia and Ukraine by socio-demographic and job characteristics

Gender differences in the shares of overeducated and undereducated are not systematic across countries: men have higher incidence of overeducation in Armenia and Georgia, whereas in Macedonia and Ukraine the incidence of overeducation is higher among female workers; in all countries except for Georgia men also have higher incidence of undereducation (see Figure A1, Panel 1 in Annex). Existing studies in developed countries that report quite mixed results on gender differences in education-job mismatch expect higher incidence of overeducation among women, particularly if they are married (see, e.g., Leuven and Oosterbeek, 2011). This is usually explained by the more restricted choice of jobs for a woman when the couple decides to change location based on the man's labor market prospects. At the same time, men as the prime income earners in their households have a greater need to fully exploit their education and skills, and therefore, they try to find a more favorable match (Sloane et al, 1999). This line of thought does not fit the post-Soviet countries, in which internal mobility of families is quite low, women bear almost the same financial responsibility as men do, and many workers, regardless of gender and marital status, are pushed to low-level jobs. Higher overeducation of women in Ukraine and Macedonia may reflect the need of extra schooling to compensate for the lack of experience and specific skills due to long child- and household-related career breaks. Besides, many highly educated women may choose to accept jobs which require lower level of education if these jobs provide better opportunities for reconciling work and family life.

The extent of overeducation varies considerably by age group but the pattern is not uniform: overeducation is relatively more prevalent among younger workers in Macedonia and Ukraine; but the completely opposite pattern is observed in Armenia and Georgia, where the incidence of overeducation increases with age and at least each third worker aged 50+ years is overeducated (see Figure A1, Panel 2 in Annex). In Ukraine, the incidence of overeducation among older workers (29.8 percent) is above the average for the entire urban employed population and is higher than among prime-age workers (30-49 years). This relationship between age and the incidence of overeducation observed in Armenia, Georgia and Ukraine is in contrast with expectations of the existing labor market theories and empirical evidence in developed countries, according to which older workers are less likely to be overeducated because they have more experience, better bundle of relevant skills and more opportunities for an upward mobility.[20] However, our finding is consistent with the studies of overeducaton in transition economies – in Estonia (Lamo and Messina, 2010) and in Poland (Kiersztyn, 2013), and suggests that fast structural changes made obsolete many diplomas and qualifications

[20] See Quintini (2014) for the recent estimates of mismatch by age in OECD countries.

acquired by workers in the previous economic and political system, triggering a mismatch between formal education, actual skills held by workers and job requirements.

In order to test this hypothesis we also look at the difference between two transition-related cohorts. For the definition of cohorts two approaches have been applied: 1) following EBRD (2013), the cohorts were defined on the basis of respondents' year of birth so that the older group (born in 1975 or earlier) – so-called pre-transition cohort – would have reached working age by 1991 when the Soviet Union was dissolved; 2) the cohorts were defined on the basis of information about the year of finishing or leaving formal education: those who finished or left formal education before 1995 are classified as "pre-transition" cohort, because almost no significant changes had been done in the national education systems in the early 1990-s. Analysis of the incidence of overeducation by transition-related cohorts shows that, whether we use the first or the second approach, the patterns are the same: workers from the pre-transition cohort have relatively higher chances of working in jobs that require lower levels of education in Georgia and Armenia whereas in Ukraine and Macedonia they are in a relative advantage compared to younger workers from the transition cohort (see Figure A1, Panel 3 in Annex for the cohorts based on the year of birth). At the same time, in all countries except for Macedonia, transition cohort seems to have a higher incidence of undereducation. This may point to a fact that employers, who do not generally trust the diplomas and grades acquired in universities acting as "degree mills", may prefer to test skills and use information other than formal qualifications to select the right candidates among young people entering the labor market. Alternatively, it can be explained by credential inflation: employers raised requirements regarding the minimum level of education as their better-off competitions did, but eventually they tend to hire workers with the level of education which corresponds to the content of jobs.

As regards the level of education, one could expect that individuals with lower levels of education may be more willing to take lower-level jobs as they cannot afford to be unemployed. However, in Armenia, Georgia, Ukraine and Moldova more educated workers are found to be overqualified for their jobs more frequently than less educated workers (see see Figure A1, Panel 4 in Annex). The biggest problem in this respect is a huge mismatch among workers with tertiary professional (ISCED 5B) education which was classified as secondary specialized education under the Soviet system: the proportion of workers with this level of education who are overeducated varies from 40 percent in Ukraine to 65.5 percent in Georgia. Almost 22 percent of all employed university graduates in Macedonia and over 32 percent in Ukraine have jobs in which their education is not fully utilized.

This huge underutilization of available human capital is in part due to a shortage of skill intensive jobs in the modern high-productivity sectors of the economy. It can be also due to the mismatch in the field of study and job-relevant skills resulted from the tertiary education market

distortions. To shed some light on the latter issue, we make use of the STEP question about the usefulness of studies during formal education for respondents' jobs among workers who have post-secondary or tertiary education (ISCED 4-6). As Figure 5 shows, the majority of overeducated workers report about limited or no usefulness of formal education for their current job: 69.9 percent in Armenia, 76.9 percent in Ukraine, 80.8 percent in Macedonia, and 82.5 percent in Georgia. Unlike overeducated, the majority of well-matched and undereducated workers (except undereducated in Georgia) find their studies very useful for current jobs. Nevertheless, at least one in three college/ university graduates in Armenia and almost one in two holders of college/ university diploma in Macedonia, Georgia and Ukraine are quite skeptical about usefulness of studies during formal education for their jobs (see "Total" in Figure 5). This raises concerns about the irrelevance of post-secondary and tertiary education and its alienation from the real labor market needs.

<Figure 5 here>

An analysis of education-job mismatch by employment status and firm size (Figure A1, Panels 5 and 6 in Annex) reveals that self-employed, particularly own-account workers, and those working in microfirms have higher incidence of overeducation than individuals working for larger firms. This suggests that self-employment may be often driven by the inability to find a job and to create a real business with high value added. Therefore, it lends support to the EBRD (2011) argument about "necessity-driven" rather than "opportunity-driven" entrepreneurship in transition economies with delayed reforms. Besides, employment in formal and public sectors is found to provide a relatively better match with workers' education (Figure A1, Panels 7 and 8). The finding that large firms in the formal and public sectors seem to be better at using the skills of their employees than smaller ones could be explained by several factors. First, they are more likely to use effective human-resource policies for the screening of candidates at hiring and they have more opportunities to move workers to more suitable jobs within the internal labor market (OECD, 2014; Quintini, 2014). Second, such firms tend to offer jobs with higher skills content (e.g. white-collar positions in education, health care, public administration, culture and art, industry, construction, and the financial sector), and therefore they are more interested in hiring the most skilled workers.

The incidence of education-job mismatch also varies by economic sector and by occupation (Figure A1, Panels 9 and 10 in Annex). At least each forth worker in trade, accommodation and food service activities, transport, industry and construction has higher level of education than required by his/her job. The booming sector of trade, accommodation and food service activities is the absolute leader in terms of the incidence of overeducation, particularly in Georgia where over 56 percent of all employed workers in the sector are overqualified. As a result, occupational group 5 consisting of service and sales workers has one of the highest shares of overeducated workers, following exactly after group 9 with the lowest skill content (elementary occupations) in Georgia and Armenia and also

after group 4 (clerical support workers) in Ukraine. Unskilled jobs in Armenia, Georgia, and Ukraine are mainly performed by educated workers, which is an evidence of a cascading downgrading process. Figure 6 shows that although there are some differences between countries, overeducated older workers from the pre-transition cohort prevail in most occupational groups, particularly in the lower segment (groups 5-9) but also among professionals (groups 2). At the same time, younger workers from transition generation who are forced to take jobs that require lower formal qualifications prevail among technicians and clerical support workers (groups 3 and 4).

<Figure 6 here>

The residents of the capital cities in Georgia, Macedonia and Ukraine are in a relative advantage as they are more likely to sort themselves into well-matched jobs than their counterparts from other cities and towns where labor markets are smaller and less efficient; but there is almost no significant difference in terms of the incidence of overeducation between Erevan and other urban settlements in Armenia (see Figure A1, Panel 9). Finally, having in mind the conclusion by Bonin et. al. (2007) that risk-averse workers might have a greater preference for occupations with low earnings risk and non-competitive working environments, we examined the relationship between the incidence of overeducation and attitude towards risk (based on questions on hypothetical lotteries) but did not find any statistically significant patterns across countries.

5. Skills use and education-job mismatch

An emerging body of literature argues that cognitive and non-cognitive skills affect a wide range of labor market and behavioral outcomes, including educational achievement, wages, work experience, occupational choice, participation in illegal activities, health, etc. (Heckman et al. 2006; Kautz et al. 2014). But only few studies examined the role of cognitive and non-cognitive skills in education-job mismatch so far. Sohn (2010) found that US workers with higher non-cognitive skills are more likely to be undereducated, and that cognitive and non-cognitive skills seem to be substitutable for education in the case of undereducation. Quintini (2014) found that in most OECD countries covered by the PIAAC survey, undereducated individuals have, on average, higher scores in literacy and numeracy proficiency than their well-matched counterparts, while overeducated workers have lower scores. Furthermore, overeducated workers are found to use numeracy, writing, reading, ICT and problem-solving skills less intensely than well-matched peers with the same level of proficiency.

This section focuses on the analysis of differences in cognitive and non-cognitive skills between over- or undereducated and well-matched workers in Armenia, Georgia, Macedonia and Ukraine without controlling for socio-demographic and job characteristics, while the next section will

examine the role of the most important skills in the incidence of overeducation and undereducation in a multivariate framework. It is expected that if actual skills do matter, individuals with a better bundle of skills in a given education category are more likely to get jobs requiring higher or the same formal qualifications and therefore be undereducated or well-matched. At the same time, workers which lack the key skills are more likely to get jobs that require lower formal qualifications, despite having the same degrees and diplomas as the former group (Quntini, 2014).

Analysis of the mean reading proficiency scores which are based on direct reading assessment carried out within the STEP survey in Armenia, Georgia and Ukraine partly confirms this expectation: the average proficiency in literacy among undereducated workers is generally higher than that among well-matched workers with the same formal education, while overeducated individuals have lower average scores than their well-matched and undereducated peers (Table 3). However, the differences in proficiency scores are surprisingly small, with only two cases of statistically significant differences in Georgia.[21]

<Table 3 here>

Besides, this pattern is not always true when we distinguish between those who were born in 1975 and earlier (pre-transition cohort) and their younger counterparts (transition cohort). Overall, in nearly all education groups and countries the mean score falls into the interval 226 to 275 corresponding to the literacy level 2 out of five levels. Hence, to the extent that literacy can be used as a proxy for a more comprehensive set of competencies and skills, we find only partial support of the argument that overeducation or undereducation is strongly associated with the differences in key skills and competencies within education levels. This finding might also suggest that the direct assessment of reading proficiency is an imperfect proxy for worker's skills, and that overeducated (undereducated) workers can have relatively lower (higher) capacities in other important dimensions than formal education and literacy.

To test the differences in the use of job-relevant cognitive and technical skills as well as in non-cognitive (socio-emotional) skills,[22] we estimated the mean scores for the three types of workers (by education-job mismatch status) and then calculated the differences between overeducated/ undereducated and well-matched (see Figures A2 in Annex). In all four countries, important cognitive and technical skills such as reading, writing, numeracy, computer and interpersonal skills, learning and thinking, making presentations and supervising others appear to be used at work less intensely by overeducated individuals compared with those who are adequate for their jobs. At the same time, both overeducated and undereducated workers tend to have more physically demanding tasks at work than their well-matched peers. However, the observed differences do not necessarily mean that

[21] These results might be driven by the relatively small sample size of education-age-mismatch groups.
[22] See definitions of these skills in the STEP survey in Table A2 in Annex.

overeducated workers lack the basic skills expected for their qualification level, such as reading, numeracy, computer, problem-solving, and communication skills, that would explain their self-selection into jobs that require lower formal qualifications. It may be the case that workers had the necessary skills corresponding to their level of education, but many of them were not able to win in a strong competition for scarce high-skill jobs and were pushed to lower-level and less demanding jobs in which these skills atrophied and became obsolete over time. Another interesting finding that is worth noting is that undereducated workers in Macedonia and Ukraine report about relatively higher frequency of learning new things at work and undertaking tasks that require more thinking than their well-matched peers. This result is in line with the idea that undereducated workers might be willing to challenge themselves and accept more demanding jobs (Sohn, 2010).

In contrast, the differences in the average scores of non-cognitive skills between overeducated/ undereducated and well-matched workers are fairly small, often insignificant and not systematic across countries.[23] For instance, in Armenia overeducated workers on average have significantly lower scores in such important personality traits as Conscientiousness, Openness, Emotional stability, and Grit than well-matched workers. Georgian overeducated workers significantly differ from their well-matched counterparts, with lower scores in Extraversion, Openness, Agreeableness, and Decision Making. In Macedonia, the difference is statistically different and positive only for Grit (in favor of well-matched as opposed to overeducated) and for Extraversion and Openness (in favor of undereducated as opposed to well-matched). Finally, Ukrainian overeducated workers appear to have significantly higher scores in Agreeableness whereas undereducated individuals tend to be relatively more emotionally stable than those who are adequate for their jobs.

Hence, our preliminary analysis shows that overeducated individuals seem to have a relatively worse bundle of skills and abilities than well-matched workers while undereducated individuals often perform better or not worse than those who are adequate for their jobs in terms of formal education, but the differences are not always significant. Whether or not a lower (higher) level of observed abilities and skills is a determinant of being overeducated (undereducated) along with other important determinants is explored in the next section.

6. The determinants of overeducation and undereducation in Armenia, Georgia, Macedonia and Ukraine

Following the common approach in the literature (e.g. Kiker et al., 1997; Sloane et al., 1996 and 1999), the determinants of over- and undereducation are estimated by using a multinomial logit model, where the omitted category, or base outcome, is being well-matched in terms of formal

[23] For the sake of brevity, we do not provide any tables or graphs on non-cognitive skills. They can be provided by the author upon request.

education, while the other two outcomes represent, respectively, over- and undereducation. [24] The literature documents that young, female, unmarried workers, racial/ethnic minorities, individuals with low quantitative skills are more likely to be overeducated (Leuven and Oosterbeek, 2011). Sloane et al. (1999) and Kiker et al. (1997) show that human capital characteristics (such as tenure, time to proficiency, experience) and job characteristics (including part-time vs. full-time work, previous employment experience, location, firm size, sector of activity, occupation, and public vs. private ownership) might be also important determinants of overeducation and undereducation. Based on the findings from empirical studies in developed countries and from our statistical analysis in Section 4.2, we model the likelihood of being overeducated/ undereducated as a function of:

- personal characteristics (gender, marital status, transition-related cohort based on the year of birth, resident of the capital city vs. other city/ town; also tested: transition-related cohort based on the year of education, age, chronic disease, risk attitude);
- job-related human capital (necessary experience in other related work, tenure, time to proficiency (i.e. time needed to do work well), also tested: tenure squared);
- employment characteristics (establishment size, economic activity, informal vs. formal employment interacted with private vs. public sector);
- skills and ability-related indicators (field of studies, literacy proficiency score, number of languages spoken by respondent,[25] and intensity of the use of computer at work).

Besides, to test the validity of social stratification and intergenerational mobility perspectives in explaining the likelihood of overeducation (see Table A1 in Annex), we include two variables for the family background. The first variable is the maximum educational attainment of parents. It is expected, that in view of the facts that tertiary education no longer acts as a social elevator in post-socialist economies due to widespread credential inflation and limited social mobility, but young people traditionally bestow a high value to university diplomas, college and university graduates having parents with lower educational attainment are more likely to be overeducated than their peers with highly educated parents. Another argument in favor of this expectation is that highly educated parents can provide their children with better information regarding the choice of educational

[24] Sohn (2010) used multinomial probit model not explaining the reason for choosing multinomial probit rather than logit model. Although a multinomial probit model is more flexible in a way that it does not require the assumption of irrelevance of irrelevant alternatives, which is not always empirically justified, we prefer using a multinomial logit model which is more computationally tractable with survey data (using "svy" prefix) than a multinomial probit model. Some of the studies (e.g. Verhaest and Omey, 2010; Lamo and Messina, 2010) use binary probit or logit models to define the determinants of overeducation only, and therefore they omit important information about characteristics of undereducated workers.

[25] This variables in derived from the question "In which languages do you speak well enough to work in a job that requires that language?" as a sum of positive answers, including the official language of the country and mother tongue.

institution, field of studies, job opportunities, etc. and with more relevant networks necessary for a favorable job match (Verhaest and Omey, 2010). The second variable is the self-reported socio-economic status of respondent's family when he/she was 15 years old, which is expected to be negatively correlated with the likelihood of overeducation.

According to the studies on the impact of non-cognitive skills on labor market outcomes and job performance (Kautz et al., 2014), of the Big Five personality Traits – Openness to Experience, Conscientiousness, Extraversion, Agreeableness, and Emotional Stability (Neuroticism) – Conscientiousness has the largest predictive power across a variety of outcomes. Moreover, the importance of conscientiousness does not change a lot with job complexity, suggesting that this personality trait is an important determinant of success outcomes for a wide spectrum of jobs. Duckworth et al. (2007) found that although Grit is highly correlated with Big Five Conscientiousness, Grit had incremental predictive validity of various success outcomes in education over and beyond IQ and Conscientiousness, and that grittier individuals made fewer career changes than their less gritty counterparts of the same age. The authors concluded that grit may be as essential as intellectual talent to high accomplishment in every field. Following this line of thought, we include an individual's scores in Conscientiousness and Grit to the vector of explanatory variables to test whether the differences in these personality traits contribute to variance in the probability of being overeducated/ undereducated. We expect that grittier and more conscientious workers have more successful education outcomes and perform better at jobs. Hence, they are less likely to be overeducated as their actual skills – acquired during formal education and on the job – may match better to those needed to do jobs at their own education.

Taking into account that in the STEP samples of urban working-age population the number of self-employed people is fairly small and that completely different factors can contribute to overeducation of people creating jobs for themselves, particularly in non-EU transition economies where small private business faces a lot of constrains for growth, we provide results for the subsample of employees only.

Evidence on the differences in the composition and characteristics of the three groups of employees (by education-job mismatch status) is available from Table A3 in Annex, which reports means of selected variables with incorporated results of *lincom* test for the equality of means among overeducated/ undereducated vs. well-matched. As before, no systematic patterns are observed across the countries. Concentrating on the differences in education and skills, we can see that well-matched employees usually have on average more education and better skills than other graduates, and that undereducated often outperform those who are overqualified for their current jobs. Interestingly, workers with a degree in engineering, manufacturing and construction have significantly larger shares among overeducated employees as opposed to well-matched counterparts in Armenia and Macedonia,

whereas in Georgia workers with some degree or certificate in services and office work, particularly in transport and leisure-related [26] services are overrepresented among overeducated as opposed to well-matched. The former finding suggests that due to restructuring and reallocation of jobs from industry to services many displaced workers with industry-related degrees were forced to accept lower-level jobs in trade, transport and construction that did not require specific training and skills or where retraining did not take a lot of time and efforts. The situation in Georgia is quite different as overeducation of individuals with formal education in services can be attributed to distortions in the modern education system rather than to job reallocation in the past.

It is also worth noting that job-related human capital characteristics of overeducated and well-matched employees are substantially different: the currently overeducated on average possess less tenure; they are underrepresented in jobs that require work experience of at least 1 year in other related work to be able to carry out current work, given that a hypothetical individual has a minimum required level of education; they are also underrepresented in jobs with a longer time to proficiency, given that a hypothetical individual has the minimum necessary education and experience (see Table A3 in Annex).[27] Sloan et al. (1999) suggest two alternative explanations for the similar finding in the UK: (i) the overeducated have not yet moved for a more challenging job, and (ii) overeducation can substitute for the lack of related work experience and innate ability. These explanations are generally in line with human capital and career mobility theories which consider overeducation as a short-term situation mainly affecting young people at the beginning of their careers. However, as we have already discussed above, overeducation in non-EU transition countries affects a lot of older workers as well. Table A3 in Annex shows that the average age of overeducated employees is higher than among well-matched in Armenia and Georgia, and that workers belonging to pre-transition generation (either defined by the year of birth or the year of finishing education) prevail among the overeducated in all four countries (see also Figure 6 above). Furthermore, a large proportion of overeducated employees (between 37 percent in Armenia and over 53 percent in Macedonia) worked in their current jobs for over five years. Therefore, overeducation is often a trap for qualified workers, both young and old, which are found to be stuck in their current jobs with little chance of moving to more adequate jobs and escaping overeducation as the skills and competences acquired through formal education, if any, become obsolete and irrelevant.

[26] Leisure-related services include hotel and catering, travel and tourism, sports and leisure.

[27] The questions in the background questionnaire used for creation of the latter two variables are formulated as follows: "How many years of work experience in other related work do you think would be required before someone with [NECESSARY EDUCATION] would be able to carry out this work?" and "About how long would it take someone to learn to do this work well if they had [NECESSARY EDUCATION] education and [NECESSARY EXPERIENCE] years of related work experience?", respectively.

The estimates of the multinomial logit model in four countries are shown in Table 4. [28] OE/WM is the mutinomial log-odds of being overeducated relative to well-matched, and UE/WM is the mutinomial log-odds of being undereducated relative to well-matched. Specifications in Armenia and Georgia are the widest as they include literacy proficiency score and seven dummies for the main field of studies; in Macedonia there is no literacy proficiency score and in Ukraine there are no dummies for the field of studies due to data limitations. The estimated coefficients are robust to specification changes, for instance, when we run shorter models with explanatory variables available in all four countries, use the second approach for defining transition-related generation or the direct measure of age, in years or grouped into several age brackets. Some important changes in the significance of coefficients when we add the field of studies are explained below.

<Table 4 here>

For the sake of brevity, Table 4 does not report the estimates for the intercept, gender, marital status, residence in the capital city, and employment characteristics which are also included in the model. Gender is a significant determinant of overeducation only in Georgia (with a lower likelihood of overeducation among women) and Macedonia (with a higher of overeducation among women). In Armenia married individuals are less likely to be overeducated than both single and separated/divorced/widowed; in Georgia the effect of marital status is significant only for the undereducated (single workers are less likely to be undereducated as compared with their married peers) but this effect disappears when the field of studies dummies are included into the model. In Ukraine, there are no significant differences in the likelihood of mismatch by gender and marital status but it is the only country in which residents of the capital city are found to differ significantly in the likelihood of overeducation from their counterparts living in the other cities and towns. Employment characteristics also have different effects depending on the country. For instance, in Armenia, employees of larger companies (20 employees and above) are significantly less likely to be overqualified for their jobs than employees of smaller firms, while those who work in private firms formally are more likely to be undereducated than public sector employees and informally employed workers in the private sector. In Georgia, the firm size and type of employment (private/public and formal/informal) are not important but the economic sector appears to be decisive factor for the match status: employees working in trade, accommodation and food service activities, transport, communication, individual services have significantly higher probability of being overeducated relative to well-matched in comparison compared with workers in the reference sector of public services (education, health care and public administration); industry and construction workers are significantly less likely to be undereducated. In Macedonia overeducation is found to affect private

[28] We used Stata *svy: mlogit* command to produce more appropriate results for complex survey data with sampling weights and clusters (primary sampling units).

sector employees, regardless of the formality status, more than public sector employees. This finding is consistent with an argument about relatively better jobs in the public sector, as a consequence of excessive labor market rigidities and lack of comprehensive structural reforms necessary for development of a vibrant private sector in the Western Balkan countries (IMF, 2014). Finally, neither of employment characteristics is a significant determinant of education-job mismatch in Ukraine.

According to the estimates in Table 4, the patterns regarding the relationship between transition-related cohort and education-job mismatch observed in Section 4.2 are not fully confirmed by the regression analysis. After controlling for different observed characteristics, relatively young employees from transition cohort are equally likely to be overeducated as their older counterparts in all four countries but they are more likely to be undereducated in Georgia and Ukraine. Interestingly, in Georgia the effect of transition cohort with respect to the likelihood of overeducation was significant in shorter specifications without the field of studies, supporting our findings from Section 4.2 that representatives of pre-transition cohort have higher probability of being overqualified for their jobs in terms of formal education. However, once dummies for the field of studies are included in the model, this effect becomes insignificant because the important differences between cohorts are captured by the field of studies dummies.[29]

Examining the effect of the field of studies in Armenia, Georgia and Macedonia, it is clear that the extent of education-job mismatch varies only across some fields of studies. Relative to the omitted category of social science, business and law which is the most popular field of studies among recent graduates, in all three countries workers with general skills (field of studies is general programmes or no field specified) have a significantly lower likelihood of overeducation and a higher likelihood of undereducation. This is mainly attributed to the fact that such workers have secondary education and they are more likely to find jobs that require their level of education or even higher than individuals with a degree or certificate in social sciences, business and law. As regards the other fields of studies, an interesting finding is in Macedonia: holders of degrees in high demand such as natural sciences and IT, health and welfare are less at risk than oversupplied economists, managers, lawyers, etc. of being over-educated; at the same time they are significantly more likely to be undereducated. This result confirms our idea that vertical education-job mismatch is closely related with horizontal mismatch driven by large imbalances between educational supply and occupational demand. From this follows that before choosing the field of studies students should carefully consider the potential for finding a

[29] The comparison of the composition of two cohorts by the field of studies in Georgia reveals that older workers from pre-transition cohort have substantially higher shares in education, humanities and journalism (25.4 vs. 17.6 percent), engineering, manufacturing and construction (17.7 vs. 5.6 percent), health and welfare (13.1 vs. 9.1 percent), and agriculture and veterinary (2.8 vs. 1.9 percent); whereas younger workers from transition cohort are relatively more concentrated in social sciences, business and law (24.7 vs. 13.7 percent), in general programmes (23.3 vs. 9.4 percent) and in services (14 vs. 13 percent). The differences in the composition of two cohorts among overeducated workers are similar to the ones among all employees, but with more sizeable discrepancies among holders of diplomas in services and agriculture.

job related to this field as they are likely to pay a high penalty for the wrong choice in the form of long-term overeducation or even unemployment (Robst, 2007).

Regression results do not support our expectations based on the statistical analysis in the previous section that workers with better skills tend to obtain matched jobs, while their less talented counterparts are more likely to get jobs for which they are overqualified in terms of formal education. Scores in literacy proficiency, conscientiousness and grit appear to be insignificant in most cases. Number of languages spoken used as a proxy for innate ability has significant effect on the likelihood of overeducation in Georgia and Macedonia, but the positive sign in Macedonia is quite unexpected implying that individuals able to speak relatively more languages well enough to work in a job that requires those languages tend to be overeducated more often than less able workers. One of the possible explanations for this result is that fluency in Macedonian together with some of the officially recognized minority languages (Albanian, Turkish, Serbian, Romani, and Bosnian) may be a sign of belonging to minority groups which are at disadvantage in the Macedonia labor market, whereas fluency in English or some other foreign language does not bring expected benefits in terms of a more favorable education-job match due to limited demand from foreign companies and extremely high competition for these jobs. The only skill-related variable which has a significant effect on education-job mismatch in all four countries is the intensity of computer use at work: after controlling for economic activity, field of studies and other observed characteristics, using computer at work more intensely reduces the probability of overeducation in Armenia, Georgia and Ukraine and raises the probability of undereducation in Macedonia. This evidence supports somewhat the argument of Autor et al. (2003) and their followers that the adoption of computer-based technologies altered job skill demands favoring workers who hold a comparative advantage in computer skills.

In line with our earlier findings, job-related human capital measured by tenure, necessary experience at related work and time to proficiency, is an important determinant of the likelihood of overeducation in all fours countries. With the exception of Georgia, more years of tenure decrease the likelihood of being overeducated rather than adequately matched. Besides, workers holding relatively more demanding jobs in terms of the necessary experience at related work and time to become fully proficient in these jobs are less likely to be overeducated (in all four countries) and more likely to be undereducated (in Macedonia and Ukraine). These results can be interpreted in a way that job-education mismatch can result from a trade-off between formal education credentials and the other forms of human capital: deficit in formal education among undereducated can be remedied by relevant work experience and on-the-job training, while higher than required education among the overeducated can give them additional skills compensating for the lack of specific training (Kiker et al., 1997; Sloane et al., 1999). Thus, the hypothesis about the substitutability between different components of human capital, including formal education, related work experience and on the-job-

training observed in developed countries holds in non-EU transition economies as well. There is also some evidence in favor of the Thurow's (1975) job competition theory of overeducation as employers in poorer countries are not willing to invest a lot in their workforce and therefore they may be interested in hiring overeducated workers for which less on-the-job training is required than in the case of adequately matched workers.

Sloane et al. (1996) argued that overeducated workers are expected to minimize tenure in their current jobs and to avoid jobs that require a long time to proficiency in view of potential losses from a bad match. This raises the issue of potential endogeneity as tenure and time to proficiency may depend on the mismatch status of workers. But as we have already discussed before, many overeducated workers in non-EU transition countries have fairly long tenure at their current jobs and, in view of the fact that jobs matching their formal education are less available, they seem to have accepted the situation giving up from unsuccessful search for more adequate employment. Hence, we believe that the causality runs from tenure to the mismatch status rather than in the opposite direction.

Finally, contrary to our expectations consistent with social stratification and intergenerational mobility perspectives, we found no evidence of a systematic effect of family background variables on the likelihood of overeducation or undereducation. Relatively higher educational attainment of parents has marginally significant negative effect on the probability of overeducation in Georgia and significant negative effect on the probability of undereducation in Macedonia, as we expected, but in the other two countries the effects are insignificant. At the same time, Armenian adults who lived in middle socioeconomic status households at the age of 15 and Ukrainian workers who grew up in high socioeconomic status households are less likely to be overeducated than their counterparts originating from the households with low socioeconomic status. Although there is evidence based on the STEP survey in Armenia and Georgia suggesting that parents' educational attainment and family socioeconomic factors affect educational outcomes and skill development of their children and that some of the early skills gaps in the childhood translate into current skills gaps (World Bank 2015 a, b), results of our study are not conclusive that observed overeducation in Armenia, Georgia, Macedonia and Ukraine can be largely explained by the skill gaps associated with the different family backgrounds from which the adult workers come.

7. Conclusions

The main goal of this paper was to analyze vertical education-job mismatch in Armenia, Georgia, Macedonia and Ukraine and compare its incidence, characteristics and determiants to those observed in more advanced economies. To do so, we analyzed data from the World Bank's Skills

toward Employment and Productivity (STEP) household surveys, using several measures of required education and, consequently, of education-job mismatch.

The labor markets in three post-Soviet countries are characterized by highly imperfect job matching and significant skill underutilization, as indicated by the fact that over 33 percent of the urban workforce in Georgia and about 30 percent in Armenia and Ukraine are in jobs for which they are overeducated, and from 5 to 7 percent are classified as undereducated (according to the self-assessment approach). Overeducation in Macedonia affects relatively less urban workers (20.7 percent) than in post-Soviet countries but this is partly because of a trade-off between work at lower level jobs (overeducation) and no work at all (unemployment).

If we compare these four non-EU transition economies to more developed countries, the former are generally on a par with the latter in terms of the incidence of overeducation while having some advantage in terms of lower incidence of undereducation and overall education-job mismatch. Hence, we cannot conclude that education-job mismatch is a more salient feature in non-EU transition economies than in the countries with a longer history of the market economy. However, unlike the developed countries where discrepancy between actual educational attainment and that required for the job largely represents a temporary mismatch, mainly at the beginning of working life, it seems to be a more permanent phenomenon in Armenia, Georgia, Macedonia and Ukraine.

In our opinion, several factors contribute to a high and persistent overeducation in non-EU transition economies. From the supply side, there are large cohorts of older workers with formal education credentials acquired under the previous economic system who often basic skills relevant for the new economic environment and therefore are not able to find an adequate employment. At the same time, young people for whom high educational attainment became almost a norm are at high risk of overeducation because their education no longer carries the same signal to employers about abilities and skills as before, and because they tend to get degrees in the popular fields without taking into account the potential for finding a job related to this field. From the demand side, the labor markets failed to keep pace with a rapidly growing supply of college and university graduates, offering quite limited number of high-skilled job opportunities along with a huge number of jobs requiring lower or upper secondary education. Despite generally low task content of jobs in non-EU transition economies, many employers tend to require higher level of education from their workers because they are not willing to invest a lot in their workforce preferring to hire overeducated workers for which less on-the-job training is required, thereby putting training costs on the government and workers themselves.

To sum up, overeducation in non-EU transition economies is a long-run phenomenon resulting from: high adjustment costs of firms during the period of rapid structural changes and low flexibility of labor demand; distortions of the national education and career guidance systems which lead to an excess supply of professionals with tertiary education (with a bias to some popular fields) and

undersupply of workers with vocational education; observed discrepancies between actual skills of workers and those needed to do jobs at their own education level, because of the alienation of present post-secondary and tertiary education from the real labor market needs and low quality of education, due to obsoleteness of educational diplomas obtained in the previous regime, or because the early gaps cognitive and non-cognitive skills associated with less favorable family background in the childhood translate into current skills gaps.

Regardless of the major explanation for existing education-job mismatch in Armenia, Georgia, Macedonia, and Ukraine, its high incidence and persistent nature raise important political issues regarding justification of public investment in tertiary education in its current shape; performance of the system of adult learning and skills re-training or updating; the labor market functioning and the effectiveness of public employment service in fostering labor market mobility by providing labor market information and matching jobseekers to available jobs; decreasing comparative advantage of post-socialist countries in terms of the stock of human capital; long-term consequences of education-job mismatch in view of demographic challenges; etc.

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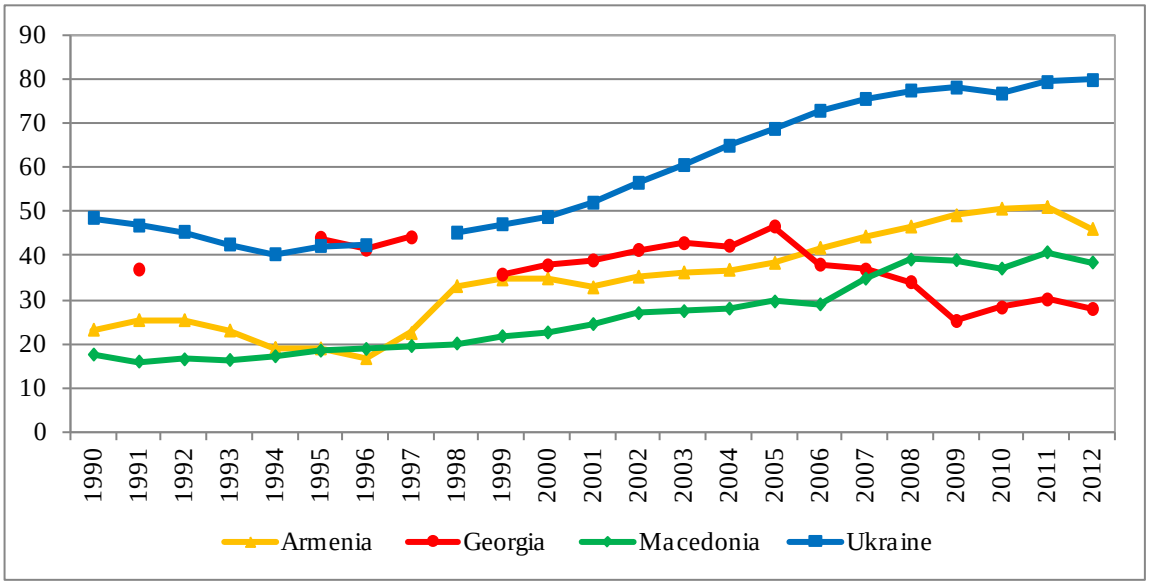
Figure 1. Gross enrollment ratio to tertiary education in Armenia, Georgia, Macedonia and Ukraine (%), 1990-2012

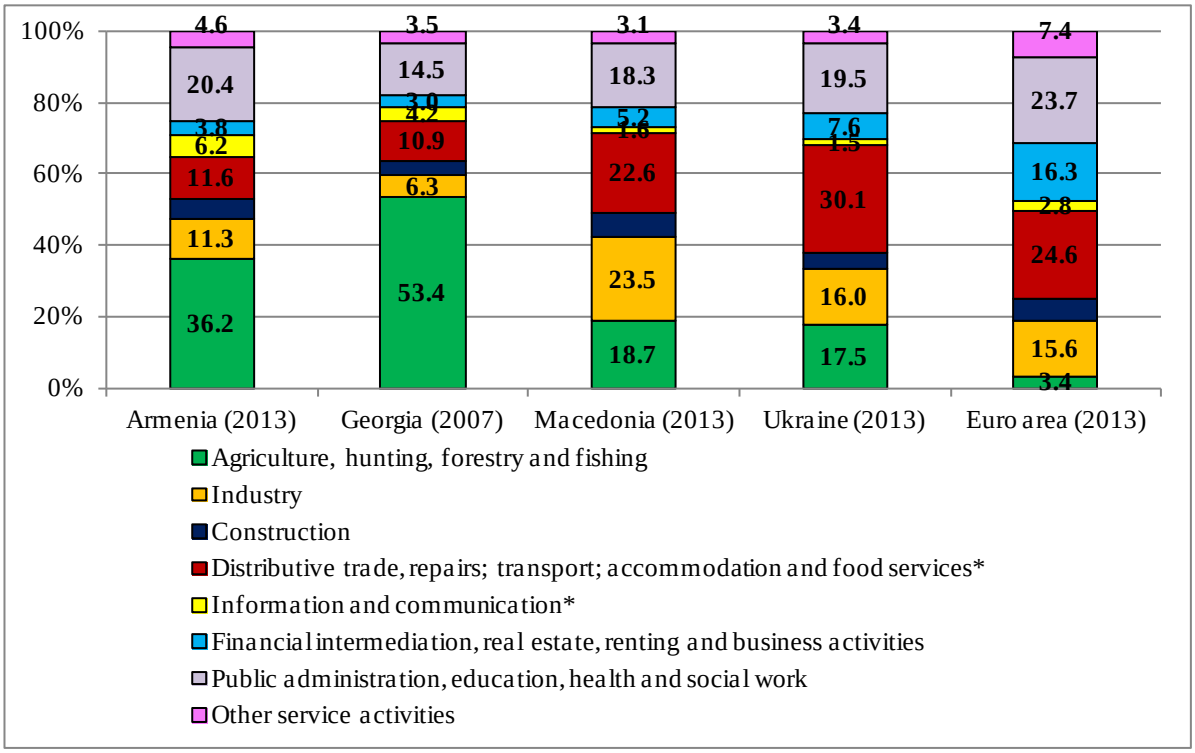


Source: UNESCO Institute for Statistics dataset (http://data.uis.unesco.org), series "Gross enrolment ratio by level of education, both sexes".

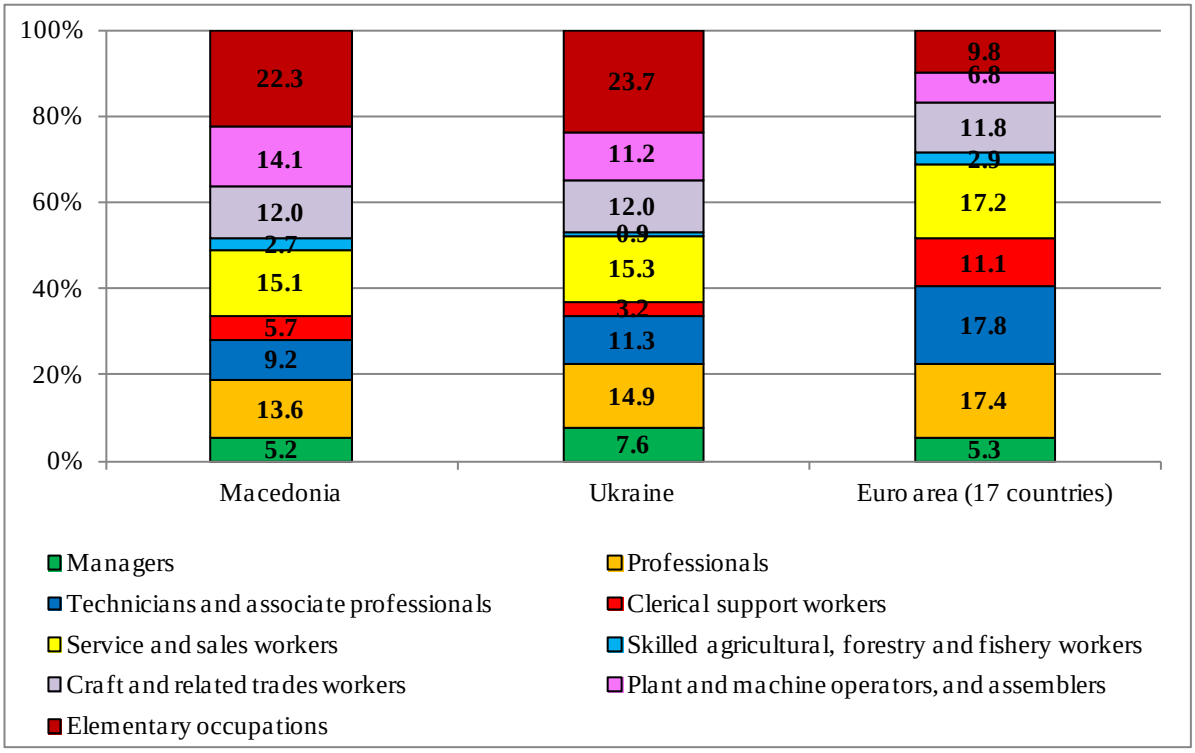
Notes: Gross enrollment ratio is defined as the number of students enrolled at a certain level of education as a percentage of the population of the age group that officially corresponds to that level. It can be above 100 percent if some enrolled students are older or younger than the age group that officially corresponds to that level of education.

Figure 2. Employment by economic sector and occupation in Armenia, Georgia, Macedonia, Ukraine and Euro area (% of total employment)

A) Employment by sector, 2013 (2007)



B) Employment by occupation, 2013

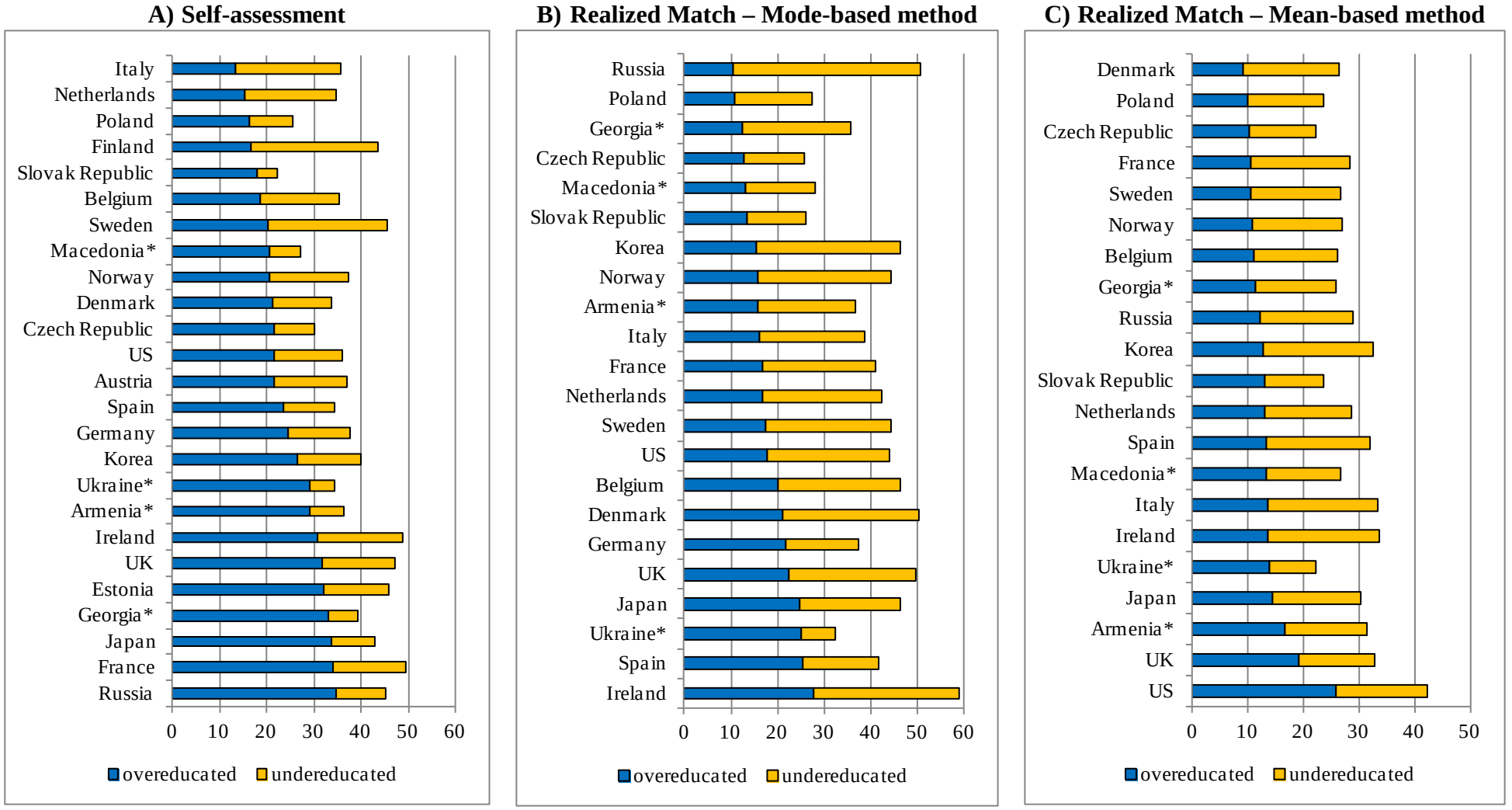


Source: A) Author's calculations based on the data from the OECD for Euro area, 17 countries (http://stats.oecd.org/Index.aspx?DataSetCode=SNA_TABLE3#; Employment by main activity, ISIC Rev. 4, in persons); and the National Statistical offices for non-EU transition economies: on-line databanks in Armenia (http://armstatbank.am) and Macedonia (http://makstat.stat.gov.mk/pxweb2007bazi/Dialog/Saveshow.asp), and statistical publications in Georgia ("Labour market in Georgia", 2009, p.18) and Ukraine ("Economic activity of population in 2013", Table 2.3); B) Author's

calculations based on the data from Eurostat and Ukrainian State Statistics Service.

Notes: The most recent available data are presented. Definitions of employed and age limits for working-age population are those used by the National Statistical offices: Armenia (15-75 years), Georgia and Macedonia (15 years and above), Ukraine (15-70 years). * Possible classification mismatch should be taken into account. In Armenia and Georgia "Transport and storage" is included in "Information and communication" (in line with NACE Rev.1 classification).

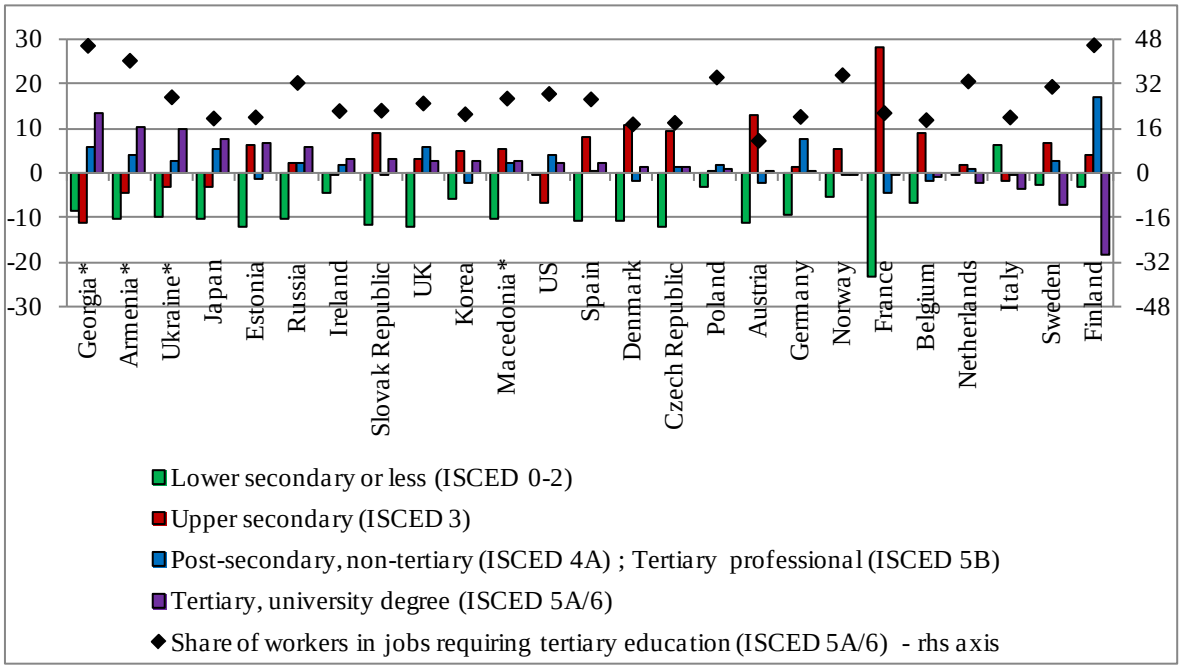
Figure 3. Incidence of education-job mismatch in developed and transition economies (% of total employment)



Source: Author's calculations based on PIAAC Survey of Adult Skills for OECD countries and Russian Federation (2011-2012); STEP Skills Measurement Surveys for Ukraine (2012), Armenia (2013), Georgia (2013), and Macedonia (2013). The PIAAC Survey was conducted subnationally in Belgium (Flanders) and in the UK (England and Northern Ireland). The sample for Russia does not include the population of the Moscow municipal area.

Notes: Countries are ranked in ascending order of the share of overeducated workers. *Statistics based on the STEP survey is representative of employed population aged 15-64, urban population only. The PIAAC survey used for the other countries provides statistics representative of employed population aged 16-65, both rural and urban population.

Figure 4. Discrepancy between actual and required education among working-age employed population in developed and transition economies (%)

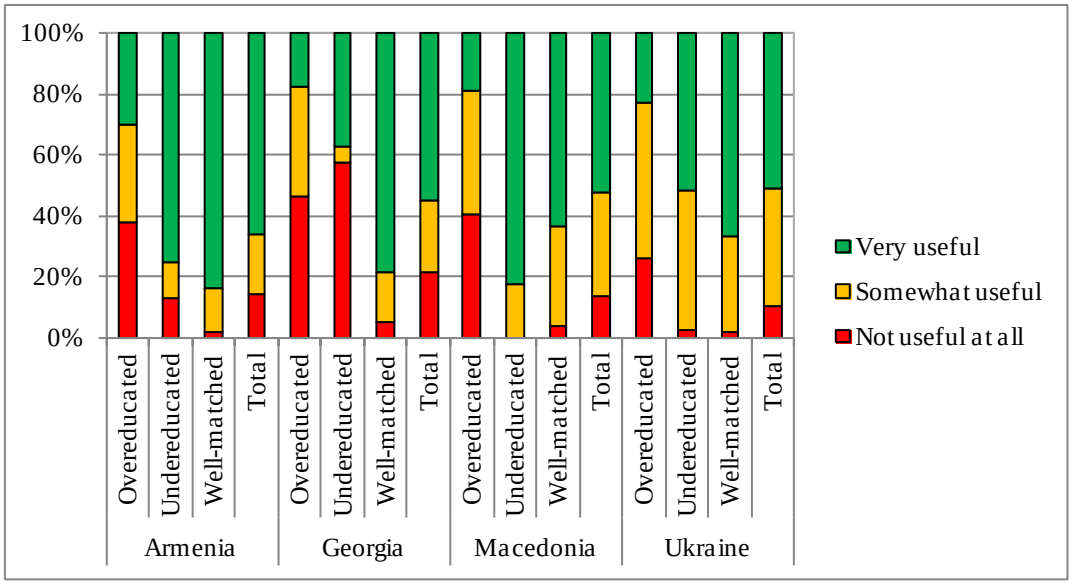


Source: Author's calculations based on PIAAC Survey of Adult Skills for OECD countries and Russian Federation (2011-2012); STEP Skills Measurement Surveys for Ukraine (2012), Armenia (2013), Georgia (2013), and Macedonia (2013).

Notes: Required education is measured according to the workers' answers to the question "What minimum level of formal education do you think would be required before someone would be able to carry out this work?" in the STEP survey and "Still talking about your current job: If applying today, what would be the usual qualifications, if any, that someone would need to GET this type of job?" in the PIAAC survey. Countries are ranked in descending order of the estimated discrepancy in tertiary education (ISCED 5A/6). Positive values mean that the share of workers having a certain level of education is higher than the share of workers in jobs requiring the same level of education, and vice versa.

* See notes to Figure 3.

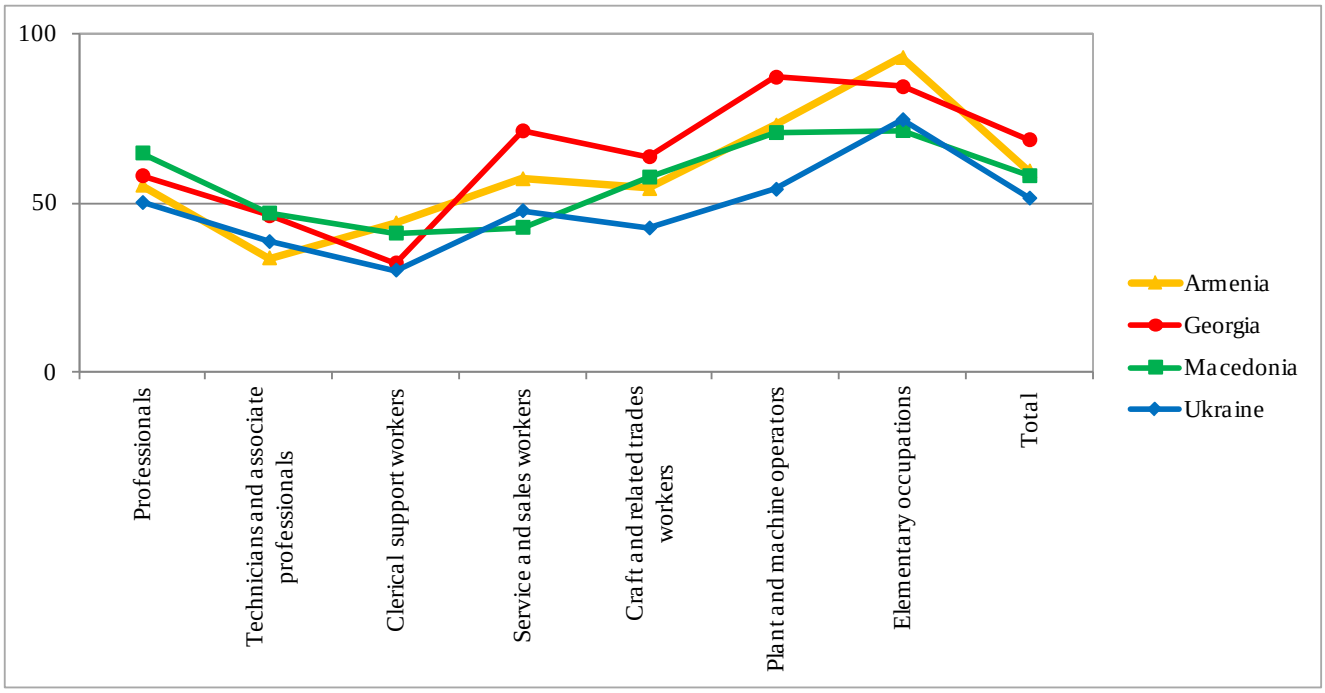
Figure 5. Assessment by workers with post-secondary or tertiary education of the usefulness of their studies during formal education for current work (%)



Source: Author's calculations based on STEP Skills Measurement Surveys (year 2012 in Ukraine; year 2013 in Armenia, Georgia and Macedonia) targeted at urban residents only.

Notes: Self-assessment approach is used for the definition of education-job mismatch. The question is formulated as follows: "How useful were your studies during your formal education for this work?"

Figure 6. Share of pre-transition cohort among overeducated workers by occupational group (%)



Source Author's calculations based on STEP Skills Measurement Surveys (year 2012 in Ukraine; year 2013 in Armenia, Georgia and Macedonia) targeted at urban residents only.

Notes: Self-assessment approach is used for the definition of education-job mismatch. Pre-transition cohort refers to urban workers born in 1975 and earlier.

Table 1. Highest educational attainment and average years of total schooling of the population aged 25 and over

Country/Group	Indicator	1990	1995	2000	2005	2010
Armenia	Secondary completed (%)	56.4	58.3	61.2	62.9	63.3
	Secondary total (%)	67.7	69.1	70.7	73.0	73.1
	Tertiary completed (%)	12.6	13.2	13.9	13.4	14.5
	Tertiary total (%)	18.9	19.5	20.4	19.8	21.4
	Avg. years of total schooling	10.08	10.44	10.81	10.80	10.87
Ukraine	Secondary completed (%)	39.6	39.2	34.8	39.5	40.9
	Secondary total (%)	56.7	55.6	48.5	53.5	53.6
	Tertiary completed (%)	14.1	19.2	25.1	26.0	27.1
	Tertiary total (%)	20.9	28.2	36.7	38.2	39.9
	Avg. years of total schooling	9.14	10.04	10.68	11.16	11.34
ECA (average)	Secondary completed (%)	33.2	40.1	45.9	51.2	54.5
	Secondary total (%)	50.6	59.2	64.3	69.3	70.9
	Tertiary completed (%)	8.2	9.2	11.0	12.2	14.1
	Tertiary total (%)	12.8	14.5	17.2	19.1	22.0
	Avg. years of total schooling	8.98	9.79	10.49	11.01	11.42
Advanced economies (average)	Secondary completed (%)	24.8	27.4	29.8	33.1	33.6
	Secondary total (%)	42.1	45.8	48.2	49.9	49.9
	Tertiary completed (%)	10.2	11.8	13.6	16.1	18.8
	Tertiary total (%)	16.7	19.3	22.4	26.2	30.2
	Avg. years of total schooling	9.12	9.65	10.14	10.76	11.25

Source: Barro & Lee dataset (v. 2.0, 06/14; http://www.barrolee.com) and author's calculations of the regional unweighted averages.

Notes: "ECA" includes 20 countries; "Advances economies" includes 23 countries (excluding Turkey) according to the Barro & Lee classification. There is no statistics on Georgia and Macedonia in the dataset.

Table 2. Average incidence of education-job mismatch by country group (% of total employed)

Group	Countries	Overeducated	Undereducated	Well-matched
Developed	Austria, Belgium (Flanders), Denmark, Finland, France, Germany, Ireland, Italy, Japan, Korea, Netherlands, Norway Spain, Sweden, UK (England and Northern Ireland), US	23.4	16.5	60.0
Transition, EU	Czech Republic, Estonia, Poland, Slovak Republic	22.0	8.9	69.1
Transition, non-EU*	Armenia, Georgia, Macedonia, Ukraine	28.0	6.4	65.7

Source: Author's calculations, simple averages of country-level estimates shown in Figure 3, panel A (self-assessment method).

Notes: * See notes to Figure 3.

Table 3. Mean literacy proficiency scores (based on direct reading assessment) by highest educational attainment, education-job mismatch and transition-related cohort

Education	Mismatch status	Armenia			Georgia			Ukraine		
		Total	Pre-trans. cohort	Trans. cohort	Total	Pre-trans. cohort	Trans. cohort	Total	Pre-trans. cohort	Trans. cohort
Upper secondary and less (ISCED 0-3)	Overeducated	244.0	240.6	250.2	225.7	220.2	232.2	263.0	258.4	271.1
	Undereducated	251.6	257.3	246.1	**254.2**	230.9	262.5	270.5	273.6	267.9
	Well-matched	247.8	246.5	249.2	234.9	227.5	240.8	265.6	262.5	271.0
Post-secondary or tertiary professional (ISCED 4/5B)	Overeducated	252.4	250.4	257.2	233.3	234.6	227.0	261.8	260.9	262.9
	Undereducated	266.7	269.3	261.1	236.5	239.0	230.0	279.2	277.7	279.7
	Well-matched	252.3	251.2	255.0	235.0	232.2	256.3	262.1	270.5	248.4
Tertiary, university degree (ISCED 5A/6)	Overeducated	262.7	268.5	258.5	254.4	253.4	256.0	278.3	281.2	275.9
	Well-matched	265.0	261.4	269.5	259.4	258.1	261.3	285.2	290.5	279.1
Total	Overeducated	255.2	254.4	256.3	**243.6**	242.3	246.4	269.0	267.5	270.6
	Undereducated	254.1	259.6	247.6	250.5	234.3	259.6	272.9	274.4	271.9
	Well-matched	258.5	255.7	262.2	251.8	249.6	254.7	272.5	274.2	269.9

Source: Author's calculations based on STEP Skills Measurement Surveys (year 2012 in Ukraine; year 2013 in Armenia, Georgia and Macedonia) targeted at urban residents only.

Notes: Self-assessment approach is used for the definition of education-job mismatch. Literacy proficiency score ranges from 0 to 500. The score from 226 to 275 corresponds to the Reading proficiency level 2 (out of 5 levels). There is no data on literacy proficiency scores in Macedonia because in this country only the partial literacy assessment has been implemented (see more in Pierre et al., 2014).

Pre-transition cohort refers to urban workers born in 1975 and earlier, while transition cohort includes urban workers born in 1976 and later.

Statistically significant difference in the mean proficiency score with well-matched workers at 5 % level is boldface.

Table 4. Determinants of education-job mismatch among employees: multinomial logit estimates

Variable	Armenia		Georgia		Macedonia		Ukraine	
	OE/WM	UE/WM	OE/WM	UE/WM	OE/WM	UE/WM	OE/WM	UE/WM
Personal characteristics and family background								
Transition cohort (Born in 1976 and later)	0.294	0.135	-0.468	1.519***	-0.376	-0.100	0.306	1.087*
	(0.307)	(0.448)	(0.320)	(0.432)	(0.235)	(0.363)	(0.285)	(0.615)
Middle-educated parents (ISCED 2-3)	0.952	1.091	-1.581*	-1.758	-0.191	-0.932***	-0.507	-0.345
	(0.640)	(0.870)	(0.929)	(1.588)	(0.226)	(0.278)	(0.412)	(1.270)
Highly educated parents (ISCED 4-6)	0.587	1.385	-1.149	-1.914	-0.426	-1.279***	-0.095	-0.250
	(0.674)	(0.939)	(0.920)	(1.550)	(0.283)	(0.462)	(0.470)	(1.327)
Middle economic status at age 15	-0.539*	-0.119	-0.289	3.074**	-0.168	-0.216	-0.001	0.549
	(0.318)	(0.530)	(0.511)	(1.278)	(0.324)	(0.471)	(0.271)	(0.594)
High economic status at age 15	-0.331	0.031	-0.748	2.122*	-0.108	-0.440	-0.689**	0.418
	(0.330)	(0.574)	(0.510)	(1.231)	(0.338)	(0.513)	(0.351)	(0.842)
Education and skills								
General programmes	-0.847**	1.522*	-2.278***	1.109*	-1.621***	2.206***		
	(0.360)	(0.846)	(0.462)	(0.580)	(0.414)	(0.471)		
Education, human., journalism	-0.174	0.272	-0.096	-0.201	-0.320	0.609		
	(0.367)	(0.778)	(0.344)	(0.645)	(0.348)	(0.544)		
Natural sciences, maths and IT	0.061	0.491	-0.767	-20.82***	-0.982**	1.592**		
	(0.411)	(1.051)	(0.542)	(0.847)	(0.466)	(0.709)		
Engin., manuf., construction	0.364	-0.249	-0.506	-0.539	-0.164	0.037		
	(0.370)	(1.022)	(0.376)	(0.936)	(0.240)	(0.554)		
Agriculture and veterinary	-0.826	1.067	0.205	-19.47***	-0.052	-0.210		
	(0.990)	(1.192)	(0.973)	(1.083)	(0.570)	(1.156)		
Health and welfare	-0.100	1.382*	-0.442	0.568	-1.149**	1.721***		
	(0.504)	(0.785)	(0.473)	(0.684)	(0.505)	(0.503)		
Services and office/secret. work	0.336	1.685*	-0.070	0.030	-0.242	-0.025		
	(0.490)	(0.880)	(0.425)	(0.891)	(0.347)	(0.884)		
Literacy proficency score	0.003	-0.001	-0.000	0.004			0.002	-0.004
	(0.004)	(0.006)	(0.003)	(0.005)			(0.003)	(0.008)
Number of languages spoken	-0.158	-0.106	-0.503***	-0.709*	0.173***	0.018	0.179	-0.582
	(0.119)	(0.206)	(0.157)	(0.378)	(0.063)	(0.112)	(0.193)	(0.476)
Intensity of computer use at work (score)	-0.338***	-0.259*	-0.335***	-0.032	-0.066	0.314***	-0.355***	-0.242
	(0.100)	(0.136)	(0.103)	(0.168)	(0.070)	(0.110)	(0.096)	(0.187)
Conscientiousness (score)	-0.170	0.077	-0.031	0.224	-0.082	0.237	0.439*	0.388
	(0.218)	(0.331)	(0.275)	(0.448)	(0.195)	(0.312)	(0.226)	(0.604)
Grit (score)	-0.261	-0.103	0.156	0.449	-0.218	-0.471*	-0.126	0.439
	(0.168)	(0.269)	(0.206)	(0.344)	(0.149)	(0.259)	(0.187)	(0.438)
Job-related human capital								
Tenure (years)	-0.035**	0.032	-0.027	0.024	-0.038***	0.001	-0.047***	-0.024
	(0.016)	(0.022)	(0.017)	(0.021)	(0.012)	(0.015)	(0.017)	(0.034)
Experience of at least 1 year needed	-1.012***	-0.283	-1.164***	0.076	-0.562***	0.934**	-0.739**	0.092
	(0.231)	(0.449)	(0.283)	(0.552)	(0.216)	(0.393)	(0.293)	(0.678)
Time to proficiency (1-6 months)	-0.412	0.560	-0.366	-0.340	-0.629**	0.796**	-0.402	1.441
	(0.267)	(0.469)	(0.307)	(0.576)	(0.245)	(0.398)	(0.271)	(0.909)
Time to proficiency (over 6 months)	-0.491*	-0.115	-0.364	-0.004	-0.694***	0.396	-0.468	1.729*
	(0.285)	(0.510)	(0.327)	(0.605)	(0.227)	(0.480)	(0.345)	(0.897)
N	912		820		1438		755	

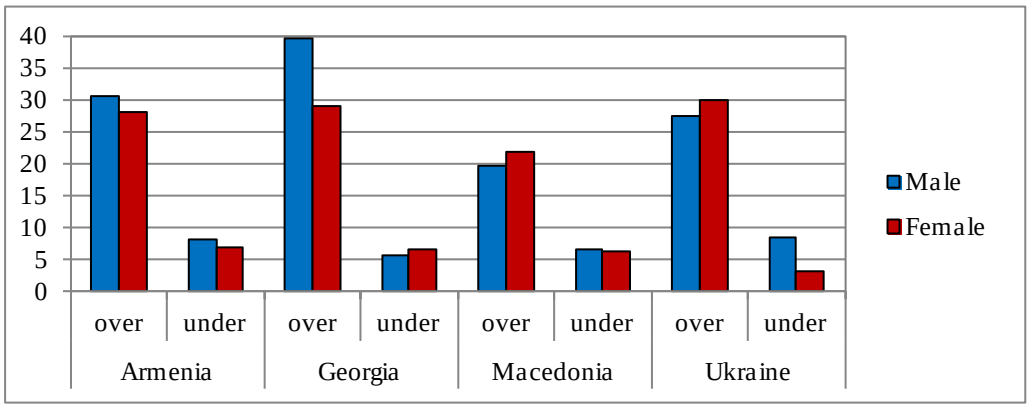
Source: Author's calculations based on STEP Skills Measurement Surveys (year 2012 in Ukraine; year 2013 in Armenia, Georgia and Macedonia) targeted at urban residents only.

Notes: Self-assessment approach is used for the definition of education-job mismatch. OE/WM is the mutinomial log-odds of being overeducated relative to well-matched, and UE/WM is the mutinomial log-odds of being undereducated relative to well-matched. Other variables included in the regressions but not reported are: intercept, gender dummy, marital status (2 dummies), capital city dummy, firm size (2 dummies), private/public sector interacted with formal/informal employment (2 dummies), economic sector of employment (4 dummies). The reference categories for the reported dummy variables are: Pre-transition cohort (born in 1975 and earlier), Low-educated parents (ISCED 0-1), Low economic status at age 15, Social sciences, business and law (field of studies), Experience of less than 1 year needed, Time to proficiency (up to 1 month). Sampling weights and clusters (primary sample units) are applied with the use of *svy: mlogit* command in Stata. Standard errors are in parentheses. Significance at * p<0.10, ** p<0.05, *** p<0.01.

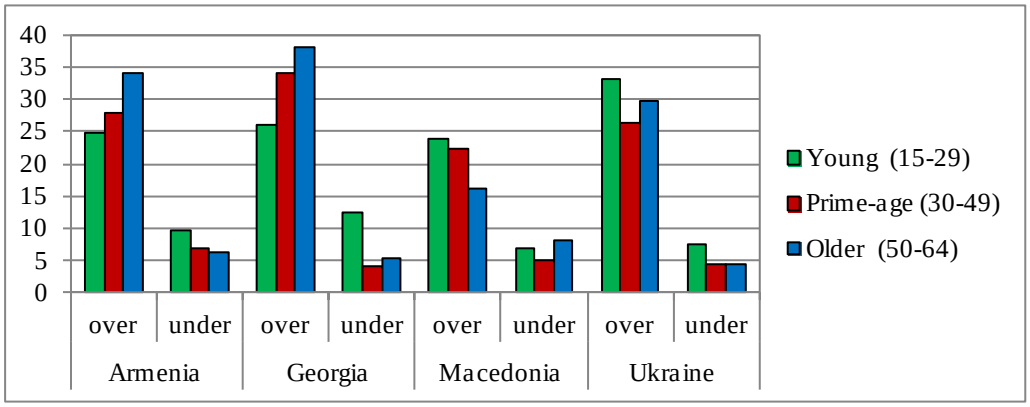
Annex

Figure A1. Incidence of education-job mismatch in non-EU transition economies by socio-demographic characteristics (% of total employment)

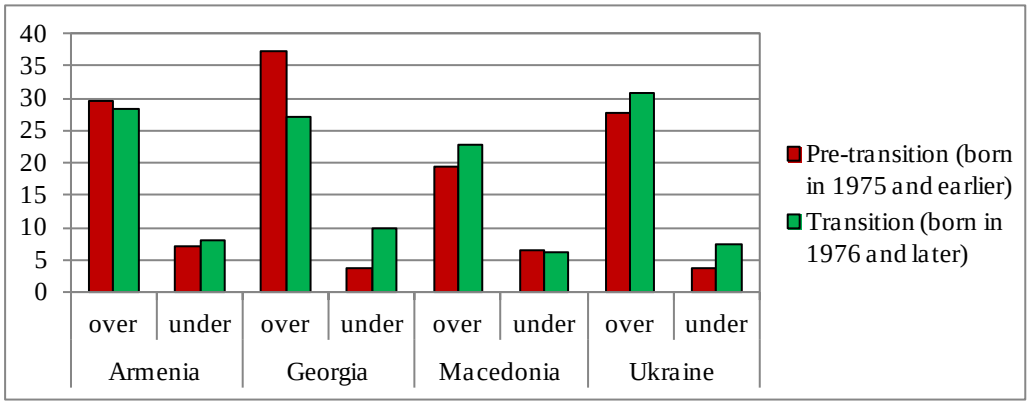
1) Gender



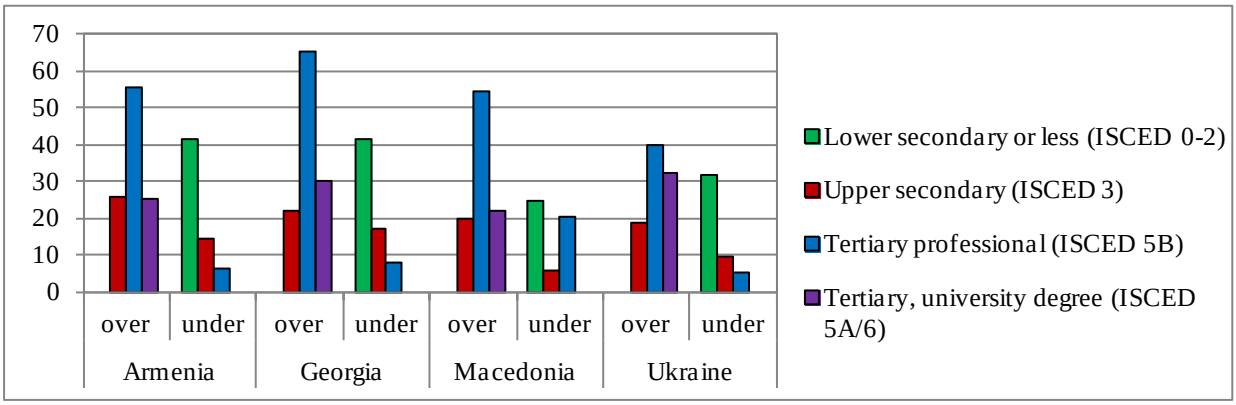
2) Age



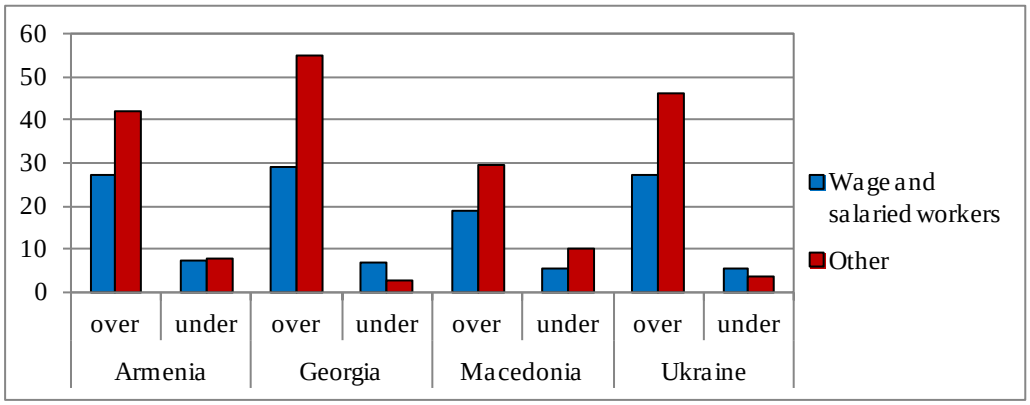
3) Transition-related cohort



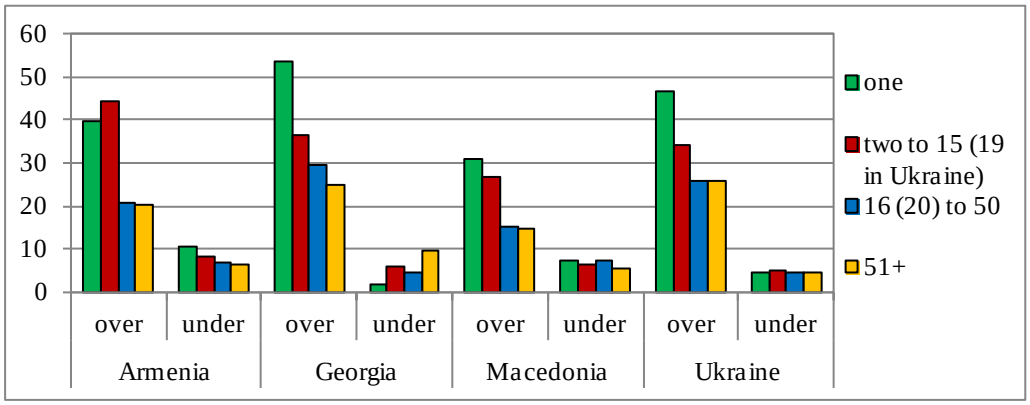
4) Education (highest level completed)



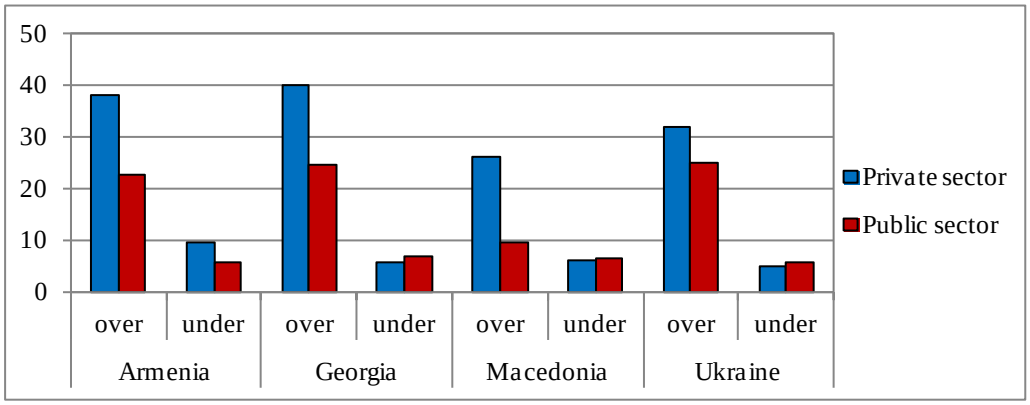
5) Employment status



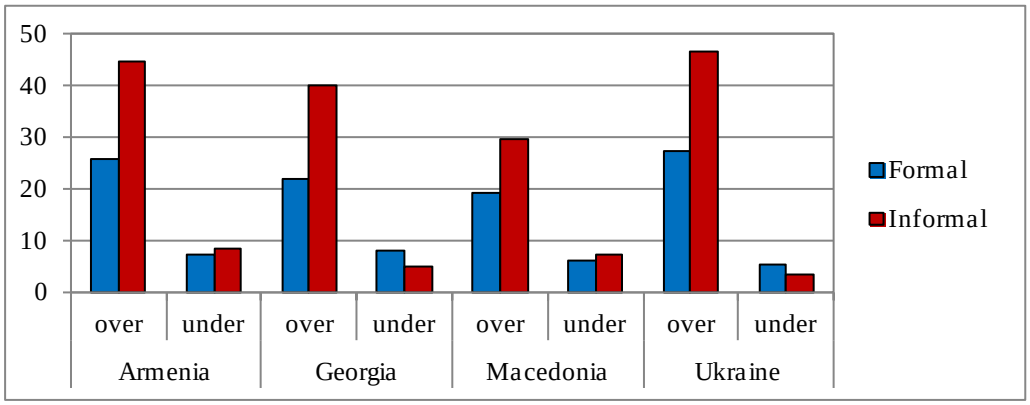
6) Firm size



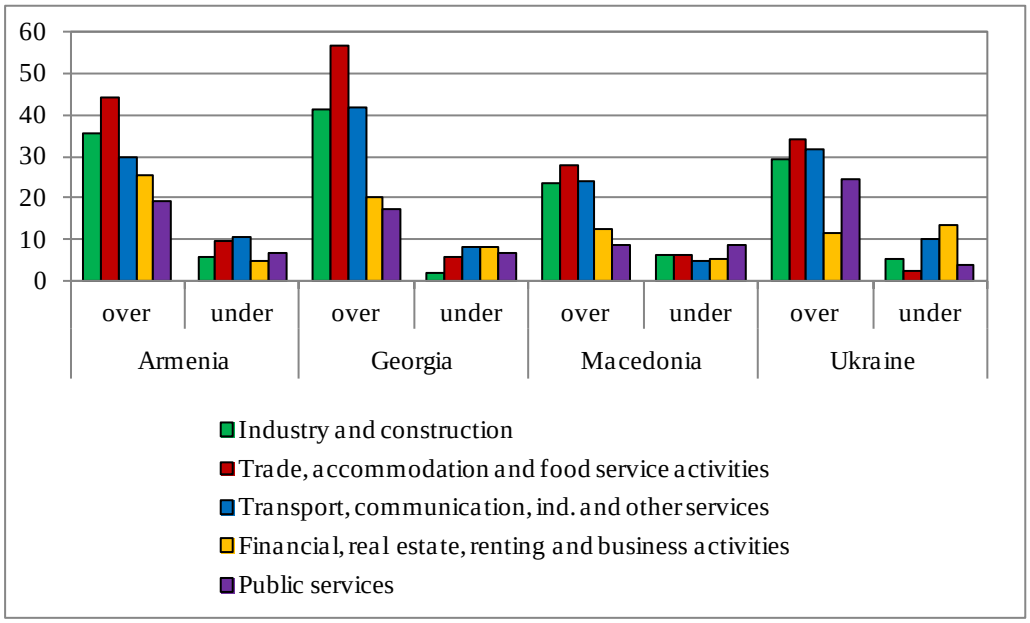
7) Public vs. private sector



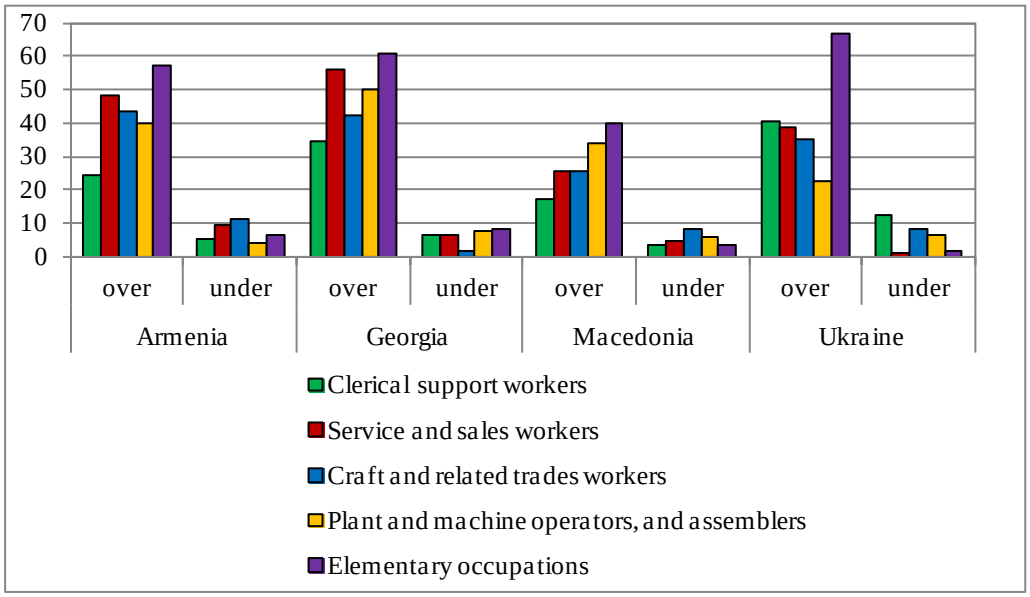
8) Formal vs. informal employment



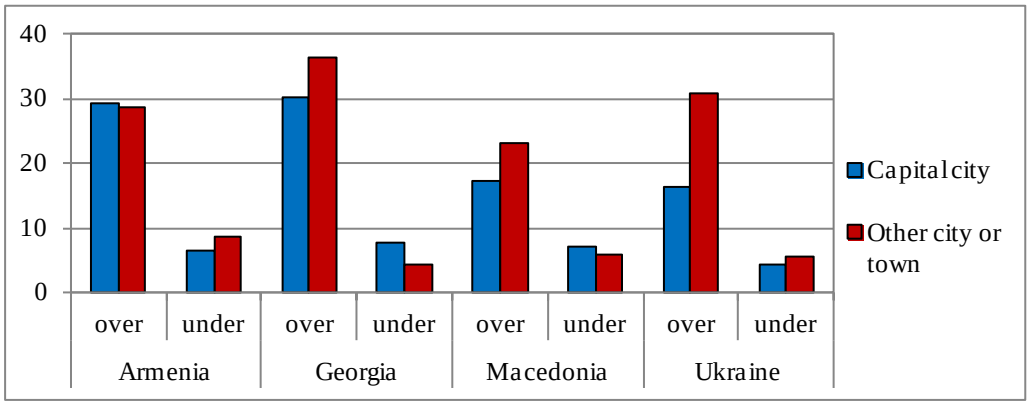
9) Economic activity



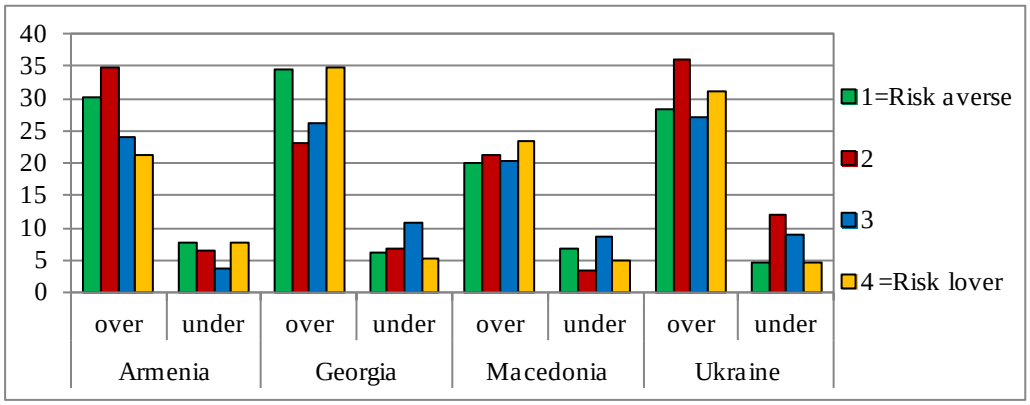
10) ISCO-2008 1-digit occupation*



11) Living in the capital city vs. other urban settlement



12) Attitude to risk

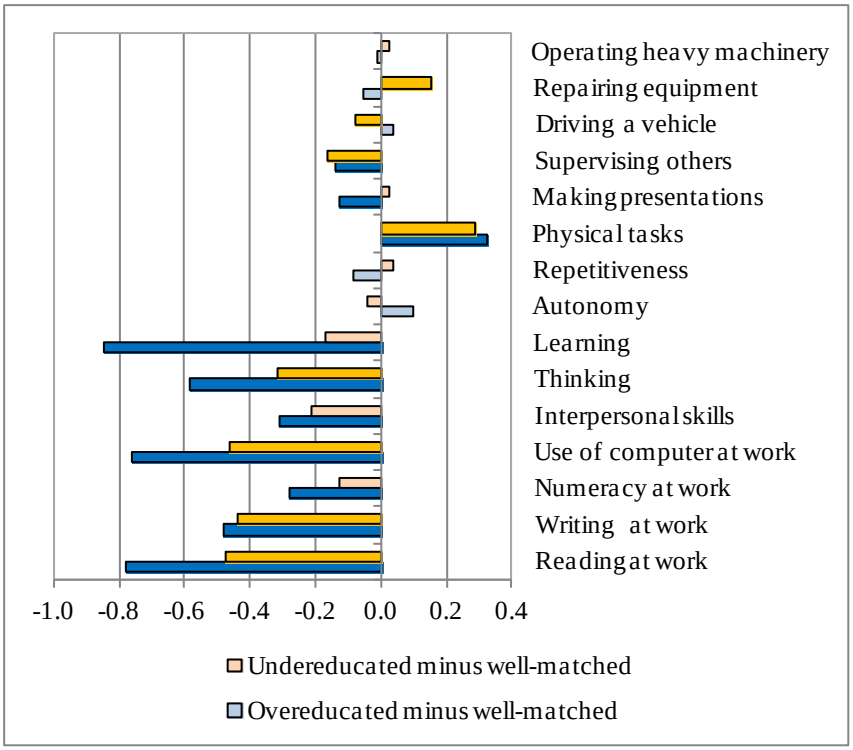


Source: Author's calculations based on STEP Skills Measurement Surveys (year 2012 in Ukraine; year 2013 in Armenia, Georgia and Macedonia) targeted at urban residents only.

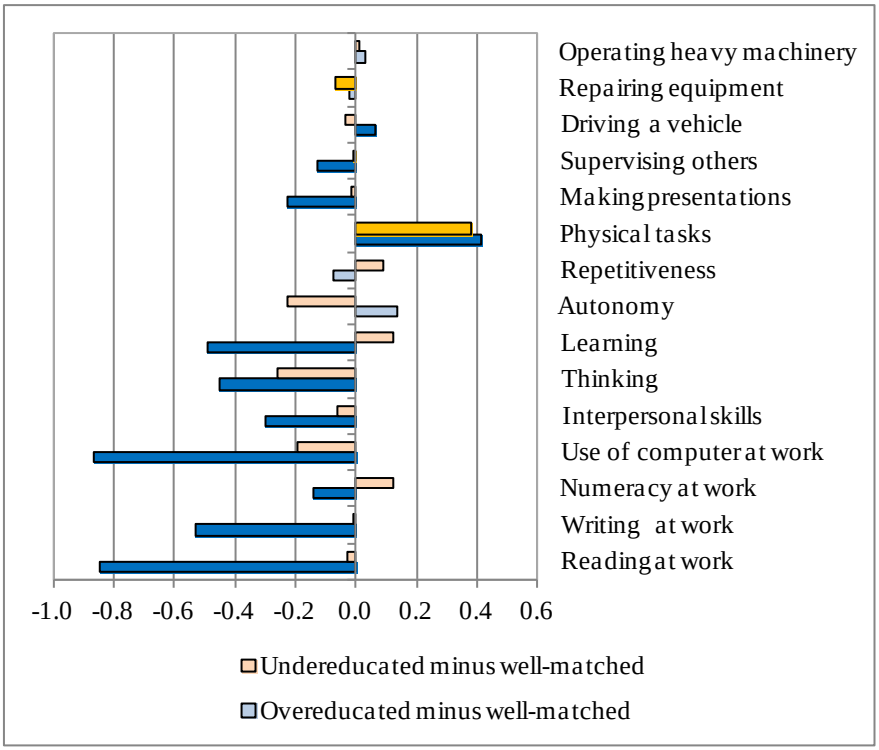
Notes: Self-assessment approach is used for the definition of education-job mismatch. * Only selected occupational groups with high incidence of mismatch are shown here.

Figure A2. Use of job-relevant skills and education-job mismatch*

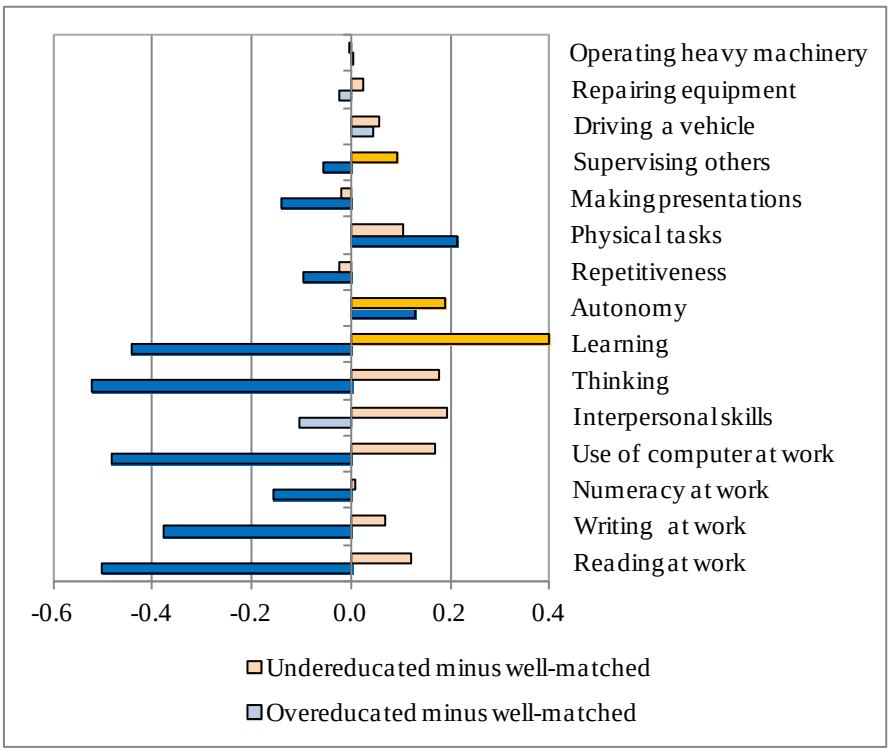
1) Armenia



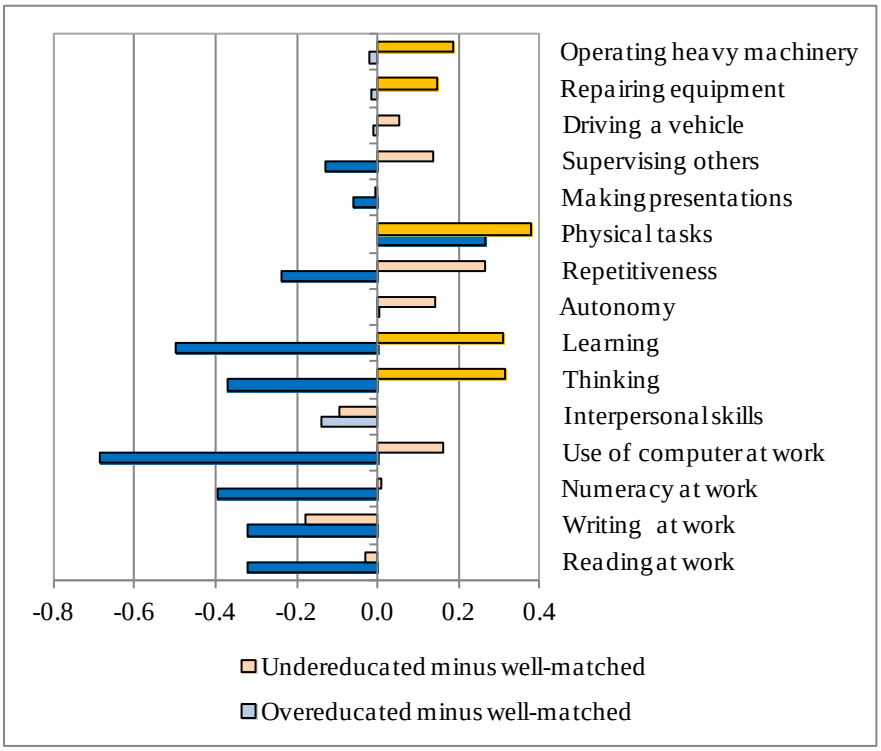
2) Georgia



3) Macedonia



4) Ukraine



Source: Author's calculations based on STEP Skills Measurement Surveys (year 2012 in Ukraine; year 2013 in Armenia, Georgia and Macedonia) targeted at urban residents only.

Notes: Differences in the mean values of skills use scores between overeducated (undereducated) and well-matched are shown. Statistically significant values (up to the 10% level) are shown in darker tones. See definition of skills in Table A2 in Annex (Panel A). Self-assessment approach is used for the definition of education-job mismatch.

Table A1. Theoretical explanations for education-job mismatch and overeducation

Theoretical approach/ explanation	Author(s)	Key ideas
Labor market (economic) theories		
Human capital theory	Becker (1964)	The basic human capital model does not allow for the existence of an overeducated workforce. Over-education is seen as a temporary phenomenon which can arise in the short run while firms adjust their production processes in order to fully utilize the individuals' human capital. Adapted versions of the human capital model add that overschooling may substitute for other components in a person's stock of human capital, such as training, experience, and innate ability.
Matching theory	Pissarides (2000)	Temporary mismatch may occur because the job search and matching is costly for both employees and employers. This mismatch is eventually corrected, as mismatched workers change jobs in order to improve their match and obtain a higher salary.
Signaling/screening theory	Spence (1973)	Workers may overinvest in education because it serves as a signal, particularly if signaling costs are negatively correlated with the individual's unknown productivity.
Job competition theory	Thurow (1975)	Individuals compete for jobs based on their position in the order of trainability, with the more highly qualified seen as more able and therefore requiring less training by the firm.
Career mobility theory	Sicherman and Galor (1990)	A worker with a given innate ability may prefer to start in a job below his ability level if this is compensated by a higher probability to be promoted.
Assignment model	Sattinger (1993)	Productivity is maximized when workers are allocated top-down according to their skills, i.e. the most skilled are assigned to the most complex jobs and the least skilled to the simplest jobs. Overeducation is explained then by the difference in the shares of complex jobs and skilled workers.
Differences in individual preferences	Gottschalk and Hansen (2003) Leuven and Oosterbeek (2011)	Workers may voluntarily choose occupations on the basis of their heterogeneous preferences and the education-specific wages in each occupation. People may also differ in their taste for schooling, some will overinvest more than others. Workers may also differ in the degree to which they value leisure on the job and other characteristics of jobs (e.g. autonomy, flexibility, compatibility with personal or family life).
Signaling of relative position in matching tournaments	Hopkins (2012)	Under flexible wages, the signaling effect of education is stronger and investment is everywhere too high; increased labor market competition leads to lower and more efficient investment. In contrast, when wages are not flexible, low-ability workers tend to invest below the social optimum whereas high-ability workers can overinvest; greater competition leads to even lower investment among low-ability workers and even higher investment of high achievers.
Social stratification and intergenerational mobility perspective		
Relative risk aversion theory Rational action theory	Boudon, (1974) Van de Werfhorst and Andersen (2005)	The main goal of children is to avoid downward social class mobility. If certain education credentials decrease in value from one generation to the next (credential inflation), children will need more education than their parents to achieve the same social class.
Reproduction hypothesis	Breen (2004)	The social origins of persons play an important role in their both educational and occupational attainments; individuals from lower social classes often may not achieve adequate occupational position despite attaining high levels of education and consequently end up overeducated.
Hysteresis of habitus	Bourdieu (1984)	Hysteresis of habitus is a structural lag between aspirations and changing opportunities. "*Holders of devalued diplomas become, in a sense, accomplices in their own mystification, since, by a typical effect of allodoxia (misapprehension), they bestow a value on their devalued diplomas which is not objectively acknowledged*".

Source: Author's compilation based on Leuven and Oosterbeek (2011), Quintini (2011), Kucel (2010, 2011) and own literature review.

Table A2. Definition of job-relevant and non-cognitive skills in STEP Skills Measurement Survey

A) Job-relevant skills

Job-relevant skill	Items (Questions in the background questionnaire)
Reading at work	Among the things that you normally read at this work, what is the size of the longest document that you read?
Writing at work	Thinking about all the things you normally write (wrote) at work, what is the longest document that you write (wrote) ?
Numeracy at work	As a normal part of this work, do you (did you) do any of the following: Measure or estimate sizes, weights, distances; calculate prices or costs; perform any other multiplication or division; use or calculate fractions, decimals or percentages; use more advanced math, such as algebra, geometry, trigonometry, etc. ?
Use of computer at work	As a part of your work do you (did you) use a computer? How often do you (did you) use a computer at work?
Interpersonal skills	As part of this work, do you (did you) have any contact with people other than co-workers, for example with customers, clients, students, or the public? Using any number from 1 to 10, where 1 is little involvement or short routine involvements, and 10 means much of the work involves meeting or interacting for at least 10-15 minutes at a time with a customer, client, student or the public, what number would you use to rate this work?
Thinking	Some tasks are pretty easy and can be done right away or after getting a little help from others. Other tasks require more thinking to figure out how they should be done. As part of this work, how often do you have to undertake tasks that require at least 30 minutes of thinking?
Learning	How often does (did) this work involve learning new things?
Autonomy	How much freedom do you (did you) have to decide how to do your work in your own way, rather than following a fixed procedure or a supervisor's instructions? Use any number from 1 to 10 where 1 is no freedom and 10 is complete freedom.
Repetitiveness	How often does (did) this work involve carrying out short, repetitive tasks?
Physical tasks	Using any number from 1 to 10 where 1 is not at all physically demanding (such as sitting at a desk answering a telephone) and 10 is extremely physically demanding (such as carrying heavy loads, construction worker, etc.), what number would you use to rate how physically demanding your work is?
Making presentations*	As part of this work, do you (did you) have to make formal presentations to clients or colleagues to provide information or persuade them of your point of view?
Supervising others*	As a normal part of this work do you direct and check the work of other workers (supervise)?
Driving a vehicle*	As part of this work, do you drive a car, truck or three-wheeler?
Repairing equipment*	As part of this work, do you (did you) repair/maintain electronic equipment (for example, cell phones, computers, printers, other electronic equipment)?
Operating heavy machinery*	As part of this work, do you (did you) operate or work with any heavy machines or industrial equipment (for example, machines/equipment in factories, construction sites, warehouses, repair shops or machine)?

Source: Author's compilation from the STEP background questionnaire.

Notes: Skills marked by "*" are measured by an index having two values: 0 (No) and 1 (Yes). The other skills are measured by an index ranging from 0 (almost no use of a given skill) to 3 (high intensity/complexity of use of a given skill).

B) Non-cognitive (socio-emotional) skills

Socio-emotional skill (behavior and personality trait)	Items (Questions in the background questionnaire)
Openness to experience	Do you come up with ideas other people haven't thought of before? Are you very interested in learning new things? Do you enjoy beautiful things, like nature, art and music?
Conscientiousness	When doing a task, are you very careful? Do you prefer relaxation more than hard work?* Do you work very well and quickly?

Socio-emotional skill (behavior and personality trait)	Items (Questions in the background questionnaire)
Extraversion	Are you talkative? Do you like to keep your opinions to yourself? Do you prefer to keep quiet when you have an opinion?* Are you outgoing and sociable, for example, do you make friends very easily?
Agreeableness	Do you forgive other people easily? Are you very polite to other people? Are you generous to other people with your time or money?
Emotional Stability (Neuroticism)	Are you relaxed during stressful situations? Do you tend to worry?* Do you get nervous easily?*
Grit	Do you finish whatever you begin? Do you work very hard? For example, do you keep working when others stop to take a break? Do you enjoy working on things that take a very long time (at least several months) to complete?
Hostile Bias	Do people take advantage of you? Are people mean/not nice to you?
Decision-making	Do you think about how the things you do will affect you in the future? Do you think carefully before you make an important decision? Do you ask for help when you don't understand something?

Source: Pierre et al. (2014).

Notes: Response categories range from 1 "almost never" to 4 "almost always". The aggregation process was based on a simple average across items. Negatively scored items marked by "*" were recoded with a score of 4 assigned for "almost never" and so on, prior to the aggregation.

Table A3. Descriptive statistics: means of variables by education-job mismatch status among employees

Variable	Armenia			Georgia			Macedonia			Ukraine		
	OE	UE	WM	OE	UE	WM	OE	UE	WM	OE	UE	WM
Personal characteristics and family background												
Female	0.59	0.58	0.62	**0.53**	0.64	0.66	0.56	0.52	0.49	0.67	**0.40**	0.65
Married	0.66	**0.51**	0.69	0.66	0.54	0.68	0.69	0.77	0.74	0.64	0.74	0.70
Single (never married)	0.23	0.32	0.25	0.20	0.37	0.21	0.25	0.19	0.21	0.16	0.20	0.14
Divorced/widowed	**0.11**	0.17	0.07	0.14	0.08	0.10	0.06	0.04	0.05	0.20	**0.05**	0.17
Age (years)	41.04	38.70	40.70	41.19	**33.55**	39.95	**39.34**	42.72	41.77	38.48	37.13	40.35
Born in 1976 and later	0.44	0.44	0.43	0.38	**0.66**	0.43	0.43	0.34	0.39	**0.51**	**0.63**	0.41
Finished education in 1996 and later	0.46	0.46	0.46	0.46	0.67	0.52	**0.47**	0.31	0.39	0.52	0.58	0.44
Capital city (Other city)	0.59	0.52	0.60	0.54	0.66	0.56	**0.33**	0.47	0.43	**0.07**	0.10	0.15
Low-educated parents (ISCED 0-1)	0.05	0.04	0.04	0.03	0.01	0.01	0.38	**0.50**	0.33	0.10	0.03	0.05
Middle-educated parents (ISCED 2-3)	**0.44**	0.37	0.35	0.26	0.24	0.21	0.47	**0.34**	0.45	0.41	0.39	0.46
Highly educated parents (ISCED 4-6)	**0.51**	0.59	0.62	0.71	0.75	0.78	**0.15**	0.16	0.23	0.49	0.57	0.49
Low economic status at age 15	**0.13**	0.12	0.08	0.09	0.05	0.06	0.11	0.11	0.09	0.20	0.07	0.14
Middle economic status at age 15	0.46	0.50	0.50	**0.57**	**0.65**	0.46	0.60	0.63	0.61	0.69	**0.81**	0.65
High economic status at age 15	0.40	0.38	0.43	**0.34**	**0.30**	0.48	0.30	0.26	0.30	**0.11**	0.12	0.21
Education and skills												
Years of schooling	14.05	**10.41**	14.52	**15.45**	**11.72**	16.04	14.05	**10.89**	13.74	13.76	**11.71**	13.62
Lower secondary or less (ISCED 0-2)		**0.33**	0.04		**0.22**	0.02		**0.33**	0.08		0.10	0.01
Upper secondary (ISCED 3)	0.24	**0.54**	0.23	0.15	**0.56**	0.19	0.57	0.52	0.58	**0.24**	**0.62**	0.36
Tertiary (ISCED 5B)	**0.31**	0.13	0.10	**0.31**	0.22	0.07	**0.12**	**0.15**	0.01	**0.37**	0.28	0.22
Tertiary (ISCED 5A/6)	**0.45**		0.63	**0.54**		0.72	0.29		0.32	0.39		0.40
General program	0.20	**0.40**	0.18	0.11	**0.37**	0.15	**0.09**	**0.38**	0.17			
Education, humanities, journalism	**0.20**	**0.15**	0.28	0.19	0.14	0.24	0.09	0.12	0.11			
Social sciences, business and law	0.16	**0.05**	0.20	0.21	0.16	0.18	0.27	**0.11**	0.23			
Natural sciences, maths and IT	0.08	0.04	0.07	0.03	0.03	0.05	0.03	0.07	0.05			
Engineering, manufacturing, construction	**0.20**	0.06	0.10	0.13	**0.03**	0.14	**0.39**	**0.12**	0.28			
Agriculture and veterinary	0.00	0.03	0.02	**0.05**		0.02	0.04	0.01	0.03			
Health and welfare	0.11	0.17	0.11	0.10	0.13	0.12	**0.02**	**0.17**	0.07			
Services and office/secretarial work	0.06	0.10	0.05	**0.19**	0.14	0.11	0.09	**0.02**	0.06			
Literacy proficency score	254.76	255.25	259.46	**244.02**	251.88	252.70				269.10	272.09	272.20
One language spoken				**0.15**	0.22	0.07	0.13	0.09	0.10	0.24	0.36	0.22
Two languages spoken	**0.70**	**0.74**	0.55	**0.59**	0.40	0.47	0.22	0.16	0.20	0.69	**0.47**	0.72
Three and more languages spoken	**0.30**	**0.26**	0.45	**0.26**	0.38	0.46	0.65	0.75	0.70	0.08	0.17	0.07
Intensity of computer use at work (score from 0 to 3)	**0.74**	**0.85**	1.53	**0.80**	1.37	1.62	**1.29**	1.94	1.76	**0.69**	1.53	1.43
Conscientiousness (score from 1 to 4)	3.27	3.36	3.36	3.21	3.23	3.24	3.06	3.12	3.09	3.11	2.99	3.03
Grit (score from 1 to 4)	3.15	3.19	3.23	2.92	2.95	2.96	**2.97**	3.01	3.08	2.72	2.92	2.77

Variable	Armenia			Georgia			Macedonia			Ukraine		
	OE	**UE**	**WM**	**OE**	**UE**	**WM**	**OE**	**UE**	**WM**	**OE**	**UE**	**WM**
Job-related human capital												
Tenure (years)	**6.11**	10.69	10.31	**6.81**	7.49	9.12	**7.91**	14.37	12.32	**6.95**	8.38	10.58
Experience of at least 1 year needed	**0.30**	**0.48**	0.65	**0.44**	0.61	0.73	**0.26**	**0.65**	0.51	**0.24**	0.69	0.54
Time to proficiency (up to 1 month)	**0.59**	0.37	0.29	**0.51**	0.38	0.29	**0.52**	**0.17**	0.28	**0.53**	0.17	0.27
Time to proficiency (1-6 months)	0.22	0.35	0.27	0.27	0.26	0.32	0.25	0.35	0.29	0.27	0.27	0.27
Time to proficiency (over 6 months)	**0.19**	**0.28**	0.44	**0.22**	0.36	0.39	**0.23**	0.48	0.43	**0.20**	0.57	0.46
Employment characteristics												
Micro firms (< 15(19))	**0.46**	**0.34**	0.19	0.33	0.25	0.25	**0.47**	0.28	0.30	0.30	0.29	0.23
Small firms (16(20)-50)	**0.24**	0.30	0.35	0.30	**0.16**	0.31	0.19	0.29	0.24	0.20	0.20	0.22
Medium and large firms (50+)	**0.30**	0.36	0.45	0.37	0.59	0.44	**0.35**	0.42	0.46	0.51	0.50	0.55
Public services	**0.31**	0.41	0.48	**0.28**	0.46	0.53	**0.14**	0.40	0.32	0.26	0.21	0.31
Industry and construction	**0.30**	0.21	0.22	**0.23**	**0.05**	0.14	0.36	0.30	0.29	0.39	0.35	0.34
Trade, accommodation and food service activities	**0.18**	0.17	0.08	**0.22**	0.14	0.09	**0.30**	0.15	0.17	0.19	**0.05**	0.16
Transport, communication, ind. services	0.14	0.16	0.12	**0.22**	0.23	0.15	0.14	0.07	0.12	0.15	0.27	0.14
Business service activities	0.08	0.06	0.10	0.05	0.12	0.09	**0.06**	0.09	0.11	**0.02**	0.11	0.05
Public (formal & informal)	**0.54**	**0.50**	0.72	**0.44**	0.53	0.56	**0.20**	0.46	0.43	0.41	0.48	0.46
Private formal	**0.34**	**0.37**	0.22	0.12	0.28	0.17	**0.72**	0.50	0.52	0.59	0.52	0.54
Private informal	**0.12**	0.13	0.06	**0.43**	0.18	0.27	**0.08**	0.04	0.04			

Source: Author's calculations based on STEP Skills Measurement Surveys (year 2012 in Ukraine; year 2013 in Armenia, Georgia and Macedonia) targeted at urban residents only.

Notes: Self-assessment approach is used for the definition of education-job mismatch. OE= overeducated, UE= undereducated, WM= well-matched. Sampling weights and clusters (primary sample units) are applied with the use of *svy: mean* command in Stata. Statistically different (at 5%) means of overeducated/undereducated vs. well-matched are boldface.