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GENDER UNIQUE HUMAN CAPITAL AND LABOUR MARKET RETURNS

Abstract

The purpose of a research* is to better understand the possible reasons behind gender wage disparities, focusing on the unique features of male and female human capital and their labour market returns. The research relies on application of the PIAAC (The Programme for the International Assessment of Adult Competencies) database allowing to measure individual cognitive abilities in literacy, numeracy and problem solving. Several methodological approaches including also non-parametric matching based decomposition are applied towards identifying a role of human capital in wage disparities. The results showed that skills are valued at a labour market often more than formal education, hence men's better numeracy and problem solving abilities help them to attain higher wage, despite lower formal education. Effective policy aiming to support development and efficient use of existing human potential, should consider reasoning of females' "brain drain", e.g. on-job training, welfare system, norms and several non-cognitive factors.

Keywords: human capital, cognitive skills, PIAAC, Nordic region

1.   INTRODUCTION

Good human capital is an essential component of economic competitiveness in globalized world being a core driver of economic prosperity and well-being in every country. Therefore, economic literature continually put emphasis several aspects of human capital including also gender issues and differences in labour market outcome of men and women. Actually, the research focused on the examining various ways in which economic outcomes differ by genders has been stressed interest among mainstream economists surprisingly recently (Eswaran 2014). In the recent decade the scholars started addressing these issues more systematically following often also interdisciplinary research framework (Borghans et al 2008; Polachek, S., Xiang J., 2009; Duflo 2012).

During the recent half-century, the participation of women in the labour market has steadily increased and the gender gap in labour force participation has notably declined, but gender wage gap is still remarkable high. For instance, women's gross hourly earnings were on average 16.3 % below those of men in the EU-28 and 16.8% in the euro area (EA-19) in 2015. Across Member States, the gender pay gap varied by 21 percentage points, ranging from 5.5 % in Italy and Luxembourg to 26.9 % in Estonia (Eurostat Statistics Explained, 2017). There are several reasons why men and women might have on average different earnings. Among them are, working in different occupations with different wages, different attitudes towards degrees of flexibility on working hours and working schedule, differences in education and skill levels, etc.

The purpose of this study is to better understand the possible reasons behind gender wage disparities, focusing on the unique features of male and female human capital and their labour market returns. The empirical part of the paper relies on the PIAAC (The Programme for the International Assessment of Adult Competencies) database allowing to measure individual cognitive abilities in literacy, numeracy and problem solving in technology rich environment. The analysis is conducted based on full-time workers' data. We implement number of methodological approaches including also non-parametric matching based decomposition towards identifying a role of human capital in wage disparities. Due to the substantial difference in skills across genders (Torben et al. 2015, Hanushek et al. 2015) we expect some cognitive abilities and their combinations to be exclusive for men while not always reached by women and vice versa. This proposition creates a foundation for studying the unique or gender specific human capital. We follow the assumption that men's and women's profiles cannot be directly compared, as particular characteristics are exclusive for certain gender.

By conducting empirical analysis, we focus on the European Nordic region countries, namely on Estonia and the neighbour Nordic countries Finland, Denmark, Norway and Sweden. Estonia is a small emerging economy that has implemented liberal social and economic policies during the recent decades. Within the European Union countries, the gender wage gap is the highest in Estonia. The country has numerous economic, political and cultural links with the Nordic countries where gender wage gap has always been remarkably lower

(ca 15-18%). Nordic social democracies have done a great deal in eliminating inequality of opportunity due to income and wealth without paying a cost in terms of economic growth (Roemer and Trannoy, 2016, p. 1328). Thus, we believe that comparative analysis of labour market issues of this region can provide additional valuable information for development of policy measures to achieve better labour market outcome in future.

The rest of the paper is organized as follows. Section 2 gives a short overview of the theoretical framework and research methodology. Section 3 presents the main results of the analysis on skill disparities and wage returns, followed by the summary and discussion of key findings in Section 4.

2. THEORETICAL FRAMEWORK AND RESEARCH METHODOLOGY

Most mainstream economists' studies that examine the gender wage gap rely on human capital theory. Additionally, several theories of discrimination as well theoretical approaches considering the role of various non-cognitive characteristics like risk aversion, competitiveness, gender identity etc. are implemented in literature by analysing gender wage gap (Neumark et al. 1996, Altonji and Blank 1999; Grove et al., 2011, Blau and Kahn, 2016). The implementation of human capital theory for analysing individual labour market returns and gender wage disparities remarkably widened with the well-known contributions of Mincer (1958) and Becker (1962, 1964) works.

Human capital theory forms a baseline for studies seeking explanations for differences in human capital formation and returns describing the relation between choices on investment into human capital and their effect on productivity and earnings. Gender wage gap studies are also tightly related to considerations on the division of labour within the family, pioneered by Becker (1981, 1985). An implication of division of work within the family often results in women staying partly or even fully away from the labour market. That is also considered as the reason why women accumulate less human capital in the form of labour market experience (Erosa et al. 2016). Although the explanatory power of human capital theory in the gender wage gap analysis somewhat declined over the recent years, the variables suggested by this theory are still relevant for empirical analysis. To what extent human capital theory can explain a gender wage gap also depends on the country specific characteristics, like level of economic development, institutional framework, labour market regulations, cultural background etc.

Assessment of human capital often relies on measuring education output like average years of schooling and formal degree completed; also on-job training and work experience are important factors of human capital accumulation, along with formal education. Additionally, estimates of individual cognitive skills and abilities are used to approximate a human capital in Mincer-type (Mincer 1958) wage equations (Heckman et al. 2006, Hanushek et al.

2015). The data of International Adult Literacy Survey (IALS) conducted by the OECD (the Organization of Economic Co-Operation and Development) in the 1990s have been among the earlier data sources allowing assessment of individual skills in literacy, numeracy and problem solving. In this paper, we use data coming from the Survey of Adult Skills, collected within the OECD Programme for the International Assessment of Adult Competencies (PIAAC). Respondents of the survey were assessed in the domains of literacy, numeracy and problem solving in a technology rich environment (OECD 2012 and 2013).

Since we aim to conduct a comparative study of Estonia and four Nordic countries, the research is based on Estonian, Finnish, Danish, Norwegian and Swedish public use data files of the recent PIAAC survey. The country-specific data files include a random sample of individuals aged from 16 to 65 years; however, we focus our research on full-time employed respondents. Since the PIAAC survey was conducted as either a computer- or paper-based assessment, the measure of the problem-solving skill is accessible only for computer-based responses, namely: 68% of the total sample for Estonia, 82% for Finland and Denmark, 84% for Norway and 88% for Sweden. These data restrictions left us with a sample of 4,347 respondents for Estonia, 3,079 for Finland, 3,721 for Denmark, 2,843 for Norway and 2,486 for Sweden. Given that a variable of monthly earnings is available for all countries except Sweden, the latter will be omitted in the wage gap estimation.

We performed a non-parametric Ñopo-type (Ñopo, 2008). decomposition to get an insight into the gender wage gap issue in the cross-Nordic context. The functional from of decomposition is as follows:

$$\Delta = \Delta_M + \Delta_x + \Delta_O + \Delta_F. \qquad (1)$$

Thus, overall wage gap, denoted by Δ is split into four components, namely:[1]

- Δ_M represents a part of the gap arising from a difference in characteristics of males with a male-female matched profile and those with a male-specific profile, thus comparing "out-of-common-support" and "in-common-support" males. A positive sign of the component indicated superior earnings of men with a male-specific profile relative to males with male-female matched characteristics;

- Δ_x captures the fraction of the wage gap explained by the observable difference in male and female characteristics, hence solely estimated on the "in-common-support" sample of males and females;

- Δ_O represents the share unexplained by observable characteristics and attributed to both difference in unobservable characteristics and discrimination, measured on the "in-common-support" sample similarly to the previous component;

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[1] For a detailed description of the derivation procedure and the functional form of wage gap components, see Ñopo (2008)

– Δ_F part of the wage gap resulting from a difference in "in-common-support" and "out-of-common-support" female characteristics. A positive sign of the component indicated superior earnings of women with a woman-specific profile relative to males with male-female matched characteristics.

Implemented matching procedure resamples females without replacement, matching them to a synthetic male with average characteristics of men from original sample, having similar profile to a chosen woman. This matching procedure does not rely on propensity scores, but performs matching on observable characteristics. The matching outcome eventually comprises both matched ("in-common-support") and non-matched ("out-of-common-support") men and women. The latter part of the sample is of key research interest, as it includes respondents possessing characteristics specific for their gender (gender uniques)[2].

The baseline matching procedure controlled for age, immigrant status and skills in three domains. Choosing this set of characteristics allows emphasizing the gender difference in human capital attainments solely. Relying on the measures of cognitive abilities, we oppose men and women, extracting those for whom a counterpart with a similar set of skills was found in the opposite gender and those for whom there was no match. It allows to directly compare male and female capabilities in literacy numeracy and problem solving, as a key components of human capital. By controlling for age we ensure that age effect on accumulation of cognitive skills is accounted for.

To check the hypothesis that distributions of male and female characteristics do not fully overlap, we focus on "out-of-common-support" or non-matched (unique) respondents. We analyze their profiles and estimate wage regressions to quantify aggregate returns to male- and female-specific profiles and to separate components of gender-specific profiles. Namely, we estimate wage returns following Mincer-type OLS wage regressions:

$$logW_i = \alpha + \beta_1 UM_i + \gamma'X_i' + \varepsilon_i$$
$$logW_i = \alpha + \beta_1 MM_i + \gamma'X_i' + u_i, \qquad (2)$$

where W_i denotes monthly earnings, UM_i and MM_i are dummy variables taking values 1 if respondent is respectively "out-of-common-support" (non-matched, unique) or "in-common-support" (matched) male, X_i' is a vector of other controlled included in regression with respective estimated coefficients γ', while ε_i and u_i are residual terms.

The coefficients of primary importance are UM_i and MM_i as they capture wage return to male-specific (unique) and male-female matched human capital for men, relative to "out-of-common-support" and "in-common-support" women respectively. Additionally, we also addressed the question of individual

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[2] Terms "male-"and "female-specific", "-exclusive" and "-unique" are used interchangeably in the paper

contributions of gender-specific human capital components on earnings of males with male-specific profile and females with female-specific characteristics. This approach allows us to see whether returns to gender-specific characteristics are heterogeneous and which of these are associated with highest earnings on the national labour markets. These equations are estimated in samples of "out-of-common-support" and "in-common-support" males and females in Estonia, Finland, Denmark and Norway.

3. EMPIRICAL RESULTS

PIAAC database provide valuable information for analysing gender human capital in sense of education and in literacy, numeracy and problem solving skills in a technology rich environment. Every individual result in three skill domains was scaled from 0 to 500 points. The initial continuous skill variables were recoded to interval variables, grouping respondents according to their test achievements in the following categories: below 176, 176-226, 227-276, 277-326, 327-376, above 376 points. To avoid remarkable burden for technical calculations, we similarly to some other authors (e.g. Hanushek et al., 2015; Anspal, 2015), use the first plausible value to proxy individual cognitive abilities in literacy, numeracy and problem solving domains. We also check for the stability of the results using other ten assessed values of the skill domains and recognised that the results are robust. These additional calculation and results are not presented in the paper.

Following descriptive evidence, we recognised that the skills' patterns for men and women are rather similar in the Nordic countries and in Estonia (Figure 1). As a rule, skills of men are higher allowing to assume that labour markets provide more challenges for skills' development to men comparing to women. The highest scores in all three skills domains for both males and females were observed in Finland. The same evidence was found by Torben et al. (2015) in their PIAAC-based report on adult skills in the Nordic region. The largest gender gaps in skills are also detected for Finland (12 and 5 points in favour of men in numeracy and problem solving respectively).

The gender pattern in education is also similar in all Nordic countries and Estonia: women are as a rule better educated comparing to men. The share of the women with higher education is bigger in all analysed countries. Despite similar or even higher education of Estonian workers, their cognitive skills are as a rule lower than in the neighbour Nordic countries. Thus, in spite of high education, people of Estonia probable did not have sufficient challenges for development their skills during their working life. Additional explanation to this situation can also be high level of international mobility of the Estonian people. Lot of well skilled and more active people are working in the neighbour Nordic countries.
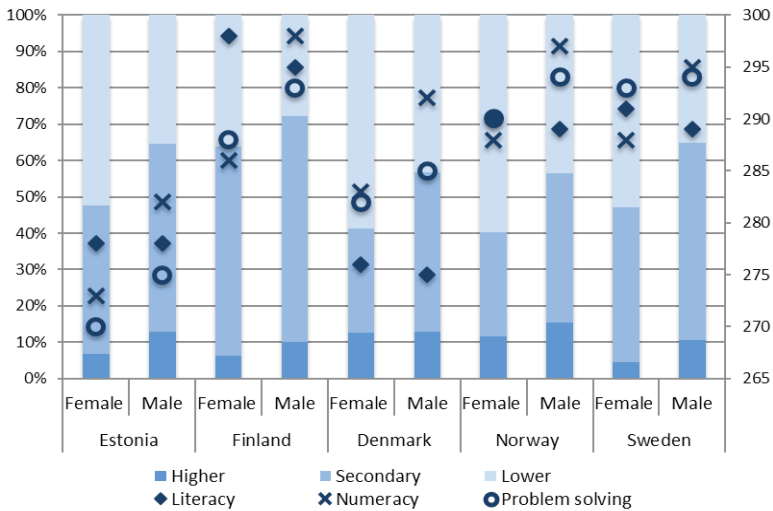
Figure 1. Educational profiles and average skills of males and females across Estonia and Nordic countries

Source: Authors' calculations based on PIAAC data

We further focus on the analysis of gender human capital comparing the assessment results across matched and non-matched (unique) samples. The key variables of interest when evaluating gender-specific human capital are measures of cognitive abilities and educational attainments. The descriptive characteristics of both matched and non-matched (unique) samples are presented in the Figure 2. We found that there is the common pattern for all countries: matched males and females are much less different from each other with respect to characteristics controlled for in the matching procedure (age, immigrant status and cognitive skills), compared to non-matched.

As it is shown in Figure 2, there is a substantial difference in educational and skill profiles of males and females having no counterparts in the opposite gender and those with counterparts found (e.g. non-matched or unique individuals). The results presented in Figure 2 confirm the common labour pattern of all analysed countries indicating that women are better educated but as a rule men have better cognitive abilities in both assessed samples, matched and non-matched. This evidence is particularly visible in the case of numeracy abilities in non-matched sample.
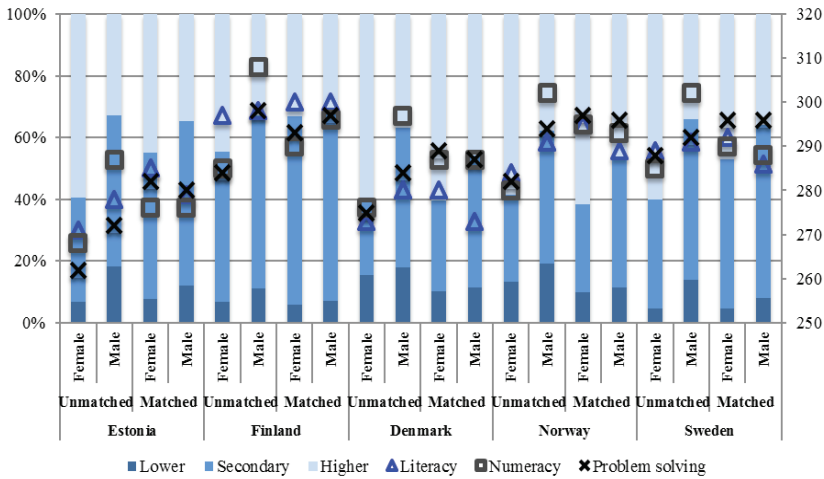
Figure 2. Non-matched and matched male-female skill differences across countries.

Source: Authors' calculations based on PIAAC data

Again, the situation is somewhat different in Estonia in comparison with other Nordic region countries. If analysing more precisely Estonian samples and considering Estonian men, those who have females matched in a set of controlled characteristics are holding a marginally better educational degree relative to those who are non-matched. Namely, the share of men those with the lowest degree in the matched sample is 11.9%, while in non-matched it is 18.2%, although the share of the most highly educated is 34.6% and 33%, respectively (thus, almost the same). The extensive difference is revealed when comparing matched and non-matched educational profiles of males relative to respective females. Surprisingly, gaps in education of non-matched men and women are drastically larger: among unique (non-matched) females, 59.5% hold the highest degree, yielding 26.5 p.p. statistically significant difference with non-matched men, while among matched women, 44.9% hold a complete university education, implying only a 10.3 p.p. statistically significant differential from matched men. Thus, females non-comparable to males in a set of human capital characteristics on average have a remarkably better formal education profile in Estonia.

We can summarise, that if limiting the analysis with formal education as a key measure of human capital, previously discussed evidence would suggest that Estonian females more often reach high human capital attainments than males. In the case of Nordic countries, this pattern is not so clearly visible. However, the results of descriptive analysis (see also Figures 1 and 2) would not recognize the fact that despite a positive correlation of cognitive abilities and educational attainments, higher education does not inevitably result in better

cognitive skills and vice versa. Next we rely on PIAAC estimates of literacy, numeracy and problem-solving capacities to get a more robust proxy of human capital endowments.

We analyse overall wage returns for male-specific and male-female matched human capital by estimating the ordinary OLS wage regression separately in both samples across the Nordic countries and Estonia. Table 1 reports wage coefficients of non-matched and matched males, along with returns for education and four domains of skills in the both samples. Figure 3 reports wage coefficients with 99% confidence intervals of non-matched and matched males, along with returns to education and three domains of skills in respective samples.

Table 1

Wage regression coefficients of male-specific and male-female matched human capital in Nordic countries and Estonia

	Estonia	Finland	Denmark	Norway
Non-matched sample	0.416 (0.037***)	0.206 (0.021***)	0.146 (0.022***)	0.158 (0.026***)
Sample size	1292	1009	1237	1401
Adjusted R-squared	0.319	0.411	0.372	0.461
Matched sample	0.401 (0.034***)	0.209 (0.020***)	0.162 (0.018***)	0.174 (0.018***)
Sample size	1112	1069	1605	1022
Adjusted R-squared	0.325	0.468	0.360	0.366

Source: Authors' calculations based on PIAAC data

Notes: Dependent variable is log monthly earnings. Standard errors are estimated using Jackknife replication methodology. Coefficients and standard errors are reported. The model additionally controls for, age squared, immigrant status, formal education, cognitive skills in literacy, numeracy, problem solving and occupation.

Thus, controlling for several characteristics, including age, immigrant status, formal education, skills in three domains and occupation, male-unique human capital is still attributed to higher wage gain than male-female matched, however, differences are not statistically significant (see also Figure 3). Despite the difference in absolute terms, the difference in wage effects is rather small in both samples, matched and non-matched. That is in line with our previous assumption of a superior wage effect for the male-specific profile relative to matched.
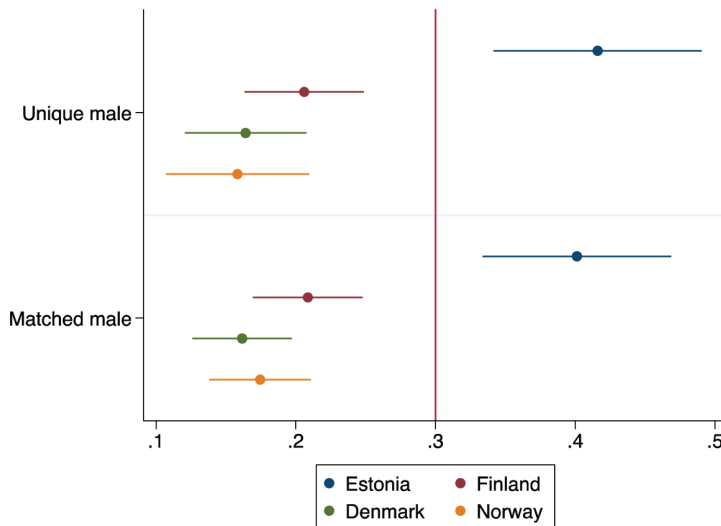
Figure 3. OLS wage regression coefficients (with 99% confidence intervals) of
male-specific and male-female matched human capital in Nordic countries

Source: Authors' calculations based on PIAAC data

The results presented in table 1 indicate again, that gender wage gap is remarkable higher in Estonia in comparison with Nordic countries. Following the regression results (table 1), males possessing the male-specific human capital profile earn on average 41.6% more than females possessing female-specific characteristics, whereas male-female matched human capital is associated with a 40.1% wage gain for males relative to their peer females with a similar male-female matched profile.

Thus, if using additionally to education also PIAAC estimates of literacy, numeracy and problem-solving capacities for the assessment of human capital, we can confirm that human capital patterns across genders are in general similar in the Nordic countries and Estonia. But there are also some noticeable differences in Estonia comparing Nordic countries. Estonian people have good education but their cognitive abilities are less developed and that is particularly evident for women. Also, gender wage gap of full time working people is remarkable higher in Estonia after controlling for several socio-demographic characteristics and for education and cognitive abilities. Consequently, there are other explanations for huge gender wage gap in Estonia additionally to the traditional human capital endowments, and those need future investigations. These explanations can also be related to the different political and economic background of these countries in the Nordic part of Europe.

4.   CONCLUSIONS AND DISCUSSIONS

This paper addressed the issue of the gender wage gap as an essential aspect in studying labour market outcome of developed as well emerging economies. While the classical human capital theory focuses on the increasing comparability of male and female characteristics, we pursue an assumption that characteristics specific for either men or women remain. Gender-specific human capital may be one of explanatory factors besides of other determinants in the gender wage gap analysis. Relying on the PIAAC data, we built up a cross-Nordic comparison of gender variation in human capital profiles, accounting for both formal education and cognitive skills as important components of human capital. Introducing a concept of gender-unique human capital within the wage gap framework, we proved the proposition that men's and women's profiles cannot be directly compared, as particular characteristics are mostly attained by certain gender. We applied the matching technique to disentangle initial country-specific samples into sub-samples with respect to gender and the possession of a male-/female-specific and male-female matched profiles. Additionally, we estimated wage regressions to quantify aggregate returns to male- and female-specific profiles and to separate components of gender-specific profiles.

Research results show that human capital patterns across genders are in general similar in the Nordic countries' and Estonia's labour markets. The share of women with higher education is bigger in comparison with men in all analysed countries, at least among the full-time workers. At the same time, measured cognitive abilities of men are as a rule higher comparing to women. Male-specific characteristics, rarely reached by females, are embodied in superior numeracy and problem solving abilities (individual and combined), albeit low formal education. The highest scores in all three skills domains (literacy, numeracy and problem solving) for both genders were observed in Finland. The results also show that skills are valued at a labour market often more than formal education, hence men's better numeracy and problem solving abilities help them to attain higher wage, despite lower formal education. Low association between formal degree and actual skills in the case of men may be enforced by other factors of the human capital accumulation process, including on-job training and real work experience, which are known to be strong driving forces of human capital/skills accumulation. However, this situation may be exploited by men to a higher extent than by women, due to labour supply decisions and different gender roles. Thus, further in-depth investigations with a special focus on the role of formal education and skills in the human capital accumulation of males and females are necessary. However, considering substantial gender differences in labour supply decisions, along with other factors by gender roles, it appears quite natural that on-job human capital accumulation is more important for men.

In some aspects, the situation in the Estonian labour market is different comparing to the Nordic countries. Despite similar average level of education average cognitive skills of Estonian workers are lower comparing to neighbour Nordic countries' workers. This indicates that Estonian people might not have sufficient challenges and possibilities for the development of skills during

their working life. Presumably, some of better skilled and active people are also working outside Estonia, often in the neighbour Nordic countries. The study also confirmed that gender wage gap in Estonia is remarkably higher in comparison to Nordic neighbours, and that conclusion is also valid in the case of gender-specific and matched samples. The specific result for Estonia provides an evidence that formal education is valued at Estonian labor market less than actual skills – men's better numeracy and problem solving abilities help them to attain higher wage, despite lower formal education.

Nordic social democracies have implemented socio-economic policies diminishing inequality and giving equal opportunities and consequently labour also market returns can be more equal. In Estonia, as in small emerging country liberal socio-economic policies have been implemented during the recent decades. Estonia succeeded rather quickly to restructure its economy and to achieve good economic growth. At the same time, inequality increased and people did not always have equal opportunities for their individual development and involvement in the socio-economic processes. In the condition of tense demographic situation and luck of good labour resources, current situation may create risks for long-run and sustainable economic growth.

In conclusion, even when controlling for "non-comparability" of male and female human capital profiles and accounting for skills as important proxies for actual human capital – significant share of pay gap remains unexplained indicating on the necessity to look for explanations of gender wage gap beyond labour market and human capital theories. Future policy implications aiming to support development and efficient use of existing human potential, should consider multiple reasoning of diminishing gender wage gap, e.g. welfare system, norms and several non-cognitive factors. They should also contain special measures for development of life-long training possibilities and improvement of family benefit systems.

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