THE ROLE OF INFORMATION PROCESSING SKILLS IN DETERMINING THE GENDER AND LINGUISTIC WAGE GAP IN ESTONIA

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Based on data from the PIAAC study, several overviews have been compiled regarding the relationships between skills and different labour market outcomes, including wages/ salaries. The role of skills in explaining wage gaps has not been dealt with as actively. Nevertheless, Estonia has for many years stood out from other European countries due to its higher gender wage gap indicator, and some authors have also highlighted the unequal positions of ethnic Estonians and non-Estonians on the labour market. Among other conclusions, the OECD in its Economic Survey of Estonia recently reprimanded Estonia for the high gender wage gap[1]. Due to the extent and salience of the problem as well as the opportunity to overcome the limitations of the analyses performed thus far, it was decided that the PIAAC study's fourth thematic report would namely be on the topic of the wage gaps.

This report focuses on the question of whether and to what extent the information processing skills measured by PIAAC[2] can shed light on hitherto unexplained components of the gender and linguistic wage gap. The need for a linguistic instead of ethnic treatment of the wage gap stemmed from the fact that the PIAAC study did not collect data on ethnicity. Instead, it ascertained the person's native language and primary language spoken at home; a third possible linguistic indication was the language in which the respondent solved tasks and/or filled in the background questionnaire in the study. Of these options, the language spoken at home most often was ultimately used, based on the categories "Estonian as the language spoken at home most often" (hereafter Estonian-speakers) and "Russian as the language spoken at home most often" (hereafter Russian-speakers). In addition, descriptive analyses showed that the conclusions drawn regarding the size of the wage gaps between Estonian- and Russian-speakers varied when tackling the Russian-speakers with different level of Estonian language skills, and thus this dimension was also added to the analysis.

Besides the role of numeracy, literacy and problem-solving in a technology-rich environment, which is studied using three different model specifications, the role of the usage of information processing skills (literacy, numeracy, and ICT skills, and solving complicated problems) and other skills (e.g. persuasion and planning skills), as well as the level of Estonian and English proficiency in explaining wage gaps is analysed. The latter were not measured directly in the study; rather, information was gathered from the respondents through self-assessment questions. The language proficiency characteristics were country-specific and lacked international comparability.

The results of analysis showed that:

According to PIAAC data, the gender wage gap in Estonia in the last two quarters of 2011 and the first quarter of 2012 (the period during which the data for the PIAAC study were gathered) was 25.4-30.7%[3] from the vantage point of females – in other words, women earned an average of 25.4-30.7% less than men. By adding all of the so-called conventional control variables and additional PIAAC dataset indicia to a Mincer-type wage equation, it was possible to explain 27.4% of the entire unadjusted gender wage gap. The point-estimate of the gender wage gap determined on the basis of a model that used all control

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1   OECD. (2015). *OECD Economic Surveys: Estonia 2015.* OECD Publishing.

2   Programme for the International Assessment of Adult Competencies

3   Instead of point-estimates, 95% confidence intervals are reported.

variables is lower than the estimate found on the basis of a model that only includes conventional controls, but because of the impreciseness of the scores due to the relatively low number of observations in contrast to such a large set of control variables, this could not be considered a statistical reduction of the gender wage gap. Numeracy, where an increase of one standard deviation is associated on the basis of a comprehensively controlled model with a 1.7-9.1% higher wage, reduces the point-estimate of the gender wage gap by 5% on the basis of comparison of various regression models.

The remuneration of various characteristics is different for men and women. Among men, higher wages are more strongly related to the numeracy proficiency[4] and work autonomy; in the case of women, to frequency of ICT use at work and the educational attainment. Of these differences, numeracy and educational attainment may well raise the most questions in terms of their relationship with income. One can only suppose that these skills may be acquired differently and that, due to the different channel of acquisition, the skills may be different in content. Analysis by Ishikawa and Ryan (2002) supports this interpretation, finding that in the case of men, cognitive skills acquired outside of school are correlated with income, while for women it is skills acquired in school. The correlation of skills acquired via different channels with wages has not been analysed in Estonia, but the results of this research signal that there might be a possible correlation here. As to why this relationship exists in such a form, this remains an open question. Presumably skills acquired outside of school were picked up during practical work, perhaps also on the job; and presumably because of their more practical nature, they are seen by employers as meriting higher remuneration.

The results of Oaxaca-Blinder decomposition showed that numeracy contributes positively to the explained component of the gender wage gap. The model, constructed using literacy proficiency, did not indicate that literacy contributed to the explained component of the wage gap. Problem-solving skills in technology-rich environments contribute negatively to the explained component. In the case of all of the constructed models, it became evident that positive contributions to the explained part of the wage gap also stemmed from the distribution of men and women in occupations, managing positions, different industries and different sectors. The gender wage gap would be even greater if women were similar to men in terms of use of literacy skills at work, educational attainment and work hours. **As a result of Oaxaca-Blinder decomposition, it was possible to explain 30.2% of the unadjusted gender wage gap.**

The unadjusted wage gap based on home language fell within a range of 13.2-19.8% based on regression analysis performed on PIAAC data, showing that the wages of Russian-speakers were on average this much lower than the wages of Estonian-speakers. Yet it emerged from the analysis that **the incomes of Russian-speakers clearly vary depending on how proficient they are in Estonian.** As a result, the wage gap based on home language was examined more closely, in three segments:

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4   Still, the results should be interpreted with the understanding that although the correlation between numeracy and wage is positive and statistically significant for men, it is relatively modest. Numeracy higher by one standard deviation is correlated with 3.1-16.1% higher wages, but it should be kept in mind that one standard deviation on the numeracy scale corresponds to about seven years of schooling.

1) the wage gap between Estonian-speakers and Russian-speakers with very good Estonian proficiency;

2) the wage gap between Estonian-speakers and Russian-speakers with average Estonian proficiency;

3) the wage gap between Estonian-speakers and Russian-speakers with poor Estonian proficiency.

Analysis conducted in these groups showed that **the incomes of Russian-speakers with very good Estonian proficiency were no different to those of Estonian-speakers.** In other words, there is no real wage gap between these two groups. There were wage gaps in the other two comparisons, however. Russian-speakers with average Estonian proficiency earned an average of 5.9-15.9% lower wages than Estonian-speakers; and Russian-speakers with poor Estonian proficiency earned 7.5-20.1% less than Estonian-speakers. By plugging the so-called conventional control variables and additional PIAAC dataset indicia into a Mincer-type wage equation, it is possible to explain 26.7% and 35.6% of the wage gaps between these groups, respectively. Adding numeracy to the model reduced the point-estimate of the wage gap between Russian-speakers with average Estonian proficiency and Estonian-speakers by 5.6%, and between Russian-speakers with poor Estonian proficiency and Estonian-speakers by 6.7%.

The results also showed that alongside Estonian proficiency, **English proficiency is at least as important (if not more) when it comes to wages**. However, the descriptive overview presented by home language showed that the share of people with good English proficiency is lower among the Russophone population than it is among people with Estonian as their home language, pointing to the need to raise English proficiency among this group.

Detailed analyses by regions and age groups point to a correlation between Estonian proficiency with wages first and foremost in regions where the share of people with Russian as their home language is greater – Tallinn, northern Estonia in general, and north-eastern Estonia. In central Estonia and Tartu, the wages of Russian-speakers did not vary from the wages of Estonian-speakers at any Estonian proficiency level. **English language proficiency is important in northern Estonia (including Tallinn), southern Estonia (including Tartu) and central Estonia.** The models assessed on the basis of regional samples indicate no correlation between English language proficiency with wages in western and north-eastern Estonia. For all of these analyses, potential imprecision should be assumed, stemming from the relatively small size of the sample against the number of control variables included in the analysis.

A comparison by age groups indicates that low English proficiency correlates negatively with wages in all groups besides the oldest one (55-65). The same is true for the proficiency in Estonian – no statistically significant differences could be seen in this age group between people with Estonian and Russian as their respective home languages. However, Russian-speakers aged 25-54 with average or poor Estonian proficiency clearly earn lower wages than Estonian-speakers with otherwise similar background characteristics.

The results of quantile regression showed that the correlation of both numeracy and literacy with income is relatively modest in all parts of wage distribution, and statistically insignificant at the upper end of wage distribution. On the other hand, problem-solving

skills in a technology-rich environment were more strongly correlated with wages at the upper end of distribution. The same is true of English and Estonian proficiency: at the upper end, lacking or very low English proficiency level is associated with a greater wage 'penalty' and Russian-speakers with very good Estonian proficiency even have a slight wage advantage over people with Estonian as their home language. As regards the estimates of the gender wage gap, the analyses confirmed the findings of previous research: **the gender wage gap is greater at the upper end of wage distribution.** Whereas at the 10th percentile, women earn 11.4-19.2% lower wages than men, the difference at the 90th percentile is 21.6-29.7%.

The most important policy recommendations are as follows:

- Mathematics education and, more broadly, other scholastic knowledge should be adapted to give them a clearer value on the labour market and make employers see them as meriting higher pay. Analyses conducted showed that women with higher educational attainment do not acquire sufficiently good (or sufficiently applied) mathematical skills or are unable to productively apply the skills on the job market. Both scholastic mathematics education and teaching strategies for success in a technology-rich environment should make a stronger move 'into real life' so that women with a lengthy educational path acquire maths skills valued on the job market.

- This research did not devote separate study to the selection of men and women, including men and women with different numeracy proficiency, for various occupations. As career choices can be strongly influenced by gender roles (with the share of male students in the sciences continuing to be higher than that of women in spite of the general popularisation of the subjects), the low remuneration of maths skills among women can stem from the fact that a large share of women are hired for positions where such skills are used less frequently. The descriptive overviews of this report showed that women use maths skills less frequently at work. A 2013 Praxis study on actions popularising science and technology in Estonia[5] also showed that when boys and girls are compared and other background characteristics are kept constant, young men have a 29% greater probability of wishing to continue studies in the fields of science and manufacturing and construction. As a result, the importance of public awareness efforts aimed at scrapping gender roles should not be underestimated.

- As a separate topic, the intergenerational transfer of wage gaps should be analysed, as this can stem from a similar transfer of gender roles. In other words, study should be devoted to whether women who were raised according to traditional family models (where the mother did the housework and received lower wages and with the father being the main breadwinner) are also more likely to choose an analogous profession, thus deepening the continuation of the trend of women receiving lower wages.

- Even though the PIAAC study lacked information on people's risk aversion and other non-cognitive skills, earlier research has demonstrated that the differences between men and women as well as between e.g. ethnic groups with regard to these

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5 **Kirss, L., Haaristo, H.-S., Nestor, M., Mikko, E.** (2013). *Teadust ja tehnoloogiat populariseerivad tegevused Eestis*. http://www.praxis.ee/tood/teadust-ja-tehnoloogiat-populariseerivate-tegevuste-tulemuste-ja-valjundite-uuring/.

characteristics may be correlated with the wage gap. The same applies to differences in reservation wages, which may in turn be due to e.g. poorer negotiating skills and higher risk aversion in women. This analysis does not enable confirmation of these hypotheses, but previous knowledge suggests that it could be important to introduce aspects such as development of negotiating skills to career counselling. In essence, this would first mean conducting an analysis of negotiation strategies by gender and, on this basis, compiling materials (instructional videos etc.) to increase knowledge and awareness of how to be a successful negotiator at the wage negotiations. Also not to be underestimated when it comes to the issue of fair wages is the existence of transparent salary information for various professions and areas of activity.

- As the results indicated that Russian-speakers had poorer English proficiency, additional English training should be aimed specifically at these people. At the same time, English proficiency correlates with wages in the case of Estonian-speakers too, indicating that it is important to improve English proficiency among Estonian-speakers with low English language proficiency as well. It should be borne in mind in this connection, however, that low English skills does not mean lower wages in all regions of Estonia. Specifically, superior English ability appears to be more important in Tallinn, Tartu (and northern and southern Estonia in general) and for people living in central Estonia with an average or lower level of English proficiency. It cannot be ruled out that a higher level of English proficiency among e.g. residents of north-eastern Estonia could open up new career opportunities for inhabitants with Russian as their home language.

- By age group, the focus in English language learning should be placed on quite a broad group – those aged 16-54. In this analysis, only in the case of those aged 55-65 were no wage differences apparent depending on English proficiency.

- Acquiring good Estonian proficiency is also key to improving the labour market outcomes (as measured in this research by wages) of the Russophone population. Although the wages of Russian-speakers with various levels of Estonian proficiency were not statistically different from those of Estonian-speakers among the youngest and the oldest age group, poor or average Estonian proficiency is associated with noticeably lower wages among those aged 24-54.

The most important methodological implications of the analysis are as follows:

- Questions pertaining to reservation wages should be added to the background questionnaire of the second round of the PIAAC study (or other relevant study conducted regularly). In addition, the conditions under which people in various socio-demographic groups would be prepared to earn somewhat lower wages should be examined – for example, could greater flexibility in organising working time be one incentive for women asking for significantly lower wages than men?

- To make the analysis of wage gaps more comprehensive, it will be important to deal, among other factors, with information about people's non-cognitive skills. This analysis revealed that information about people's numeracy, literacy and problem-solving skills in a technology-rich environment – information that was not previously known from comparison of Estonian men and women and people with Estonian

and Russian as their respective home language – did not reduce the unexplained components of the wage gap all that extensively. This does not mean, however, that variations in other skills that for various reasons were not built into the analyses could not explain the unexplained components. One such characteristic is information about people's non-cognitive skills (personality traits, self-management skills etc.).

- Subsequent analyses will certainly benefit from a larger sample size, which would yield more accurate assessments according to a large set of background characteristics. This analysis addressed (horizontal) educational mismatch cursorily (only in the descriptive overviews). It was not possible to take this into consideration in the more thorough analyses. This would be possible with a larger sample.