Influence of education-job mismatch on wages among higher education graduates

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Abstract

Our paper explores the way in which the education-job mismatches impacts the working benefits of higher education graduates. In order to estimate the “wage penalty”, we analyse REFLEX data set, which includes information on early career outcomes of school leavers graduating ISCED 5 in 1999/2000. The survey was carried out in 2005 among higher graduates from 14 countries. Our cross-country analysis compares the wage distribution of matched graduates with that of the mismatched graduates using nonparametric kernel methods to handle a mix of continuous, unordered, and ordered factor data types. The obtained results show a negative effect of the education-job mismatch on wages in most of the countries.

Keywords: Higher education, education-job mismatch, wage penalty, REFLEX

1. Introduction

Education – job mismatches issues represent one of the major debate themes for researchers investigating the relation between education and labor market outcomes. Most studies investigate the effect of mismatch on wages. In the case of higher education graduates, education – job mismatch refers mostly to over-education meaning that individuals work in jobs for which a lower level of education than their own is required. The job assignment theory stipulates that the match between workers and jobs influences returns to education. Thus, higher education determines higher productivity, but productivity is shaped by job adequacy. Working in a job requiring a lower level of education means that the worker doesn’t use his or her skills entirely, resulting in lower productivity and subsequently in lower wages. On the other hand, job search theory argues that the mismatches are the result of imperfect information of both job seekers and employers and that is why the incidence of mismatch is higher among school leavers.

Few studies compared the effect of over-education and over-skilling on wages and other labor market outcomes. Results of McGuiness and Sloane (2011) studying careers of school leavers from UK show that over-skilling is...
associated with a lower wage penalty as against over-education. On the other hand, skill mismatch has a smaller effect on job satisfaction than the education mismatch has. Our paper aims to explore cross-country differences with regard to the effect of education-job mismatch on higher education graduates earnings.

2. Methodology

Our findings are based on a comparison between matched and mismatched higher education graduates earnings distributions. We used a nonparametric approach, which does not require any assumptions about the distributions of the observed data. In order to compare the earning distributions of higher education graduates a nonparametric test based on kernel methods was used. Therefore the kernel estimator of the density functions plays the most important role in our analysis. This estimator replaces the weight function from na"ive estimators by a kernel function K, being defined by the following (Silverman, 1998):

$$f(x) = \frac{1}{nh} \sum_{i=1}^{n} K \left( \frac{x-X_i}{h} \right).$$  

(1)

Where \( n \) is the sample size and \( h \) is the smoothing parameter or bandwidth.

We used a function included in R np package (Hayfield and Racine, 2008) which implements the nonparametric entropy test for univariate density equality (Maasoumi and Racine, 2002). The null hypothesis of this test stipulates the equality of two univariate density functions denoted by \( f_1 \) and \( f_2 \). Given that in practice these functions are unknown, nonparametric kernel estimators estimate them and the following statistic is computed (Granger et al., 2004):

$$S_p = \frac{1}{2} \int \left( f_1^{1/2} - f_2^{1/2} f \right)^2 dx.$$  

(2)

Bootstrap is conducted in order to make the computation, a number of 399 bootstrap replications being generated. The method implemented for the bandwidth selection follows the method of Sheather& Jones (1991).

3. Results

The analysis presented in this paper uses the dataset of the REFLEX project (The Flexible Professional in the Knowledge Society), which is a joint collaborative project of 16 institutes from Austria, Belgium, Czech Republic, Estonia, Finland, France, Germany, Italy, Japan, Netherlands, Norway, Portugal, Spain, Switzerland, and United Kingdom. Therefore the database includes information on early career outcomes of school leavers graduating ISCED 5 in 1999/2000 for each of these countries. The data are the result of a survey, which was carried out in 2005 among higher education graduates. We select for our investigation only 11 countries for which we had a considerable amount of data.

The respondents are grouped into two categories: matched and mismatched using the respondent’s self-assessment regarding the appropriate level of education for the current job. For this question the graduates had to choose one of the following answers: higher level, same level, lower level of tertiary education, below tertiary level. We considered that the matched graduates are those reporting that the level of education requested in their current job is the same as theirs and in the mismatched group are included the others. In Table 1 we reported the share of these two groups in total employed respondents for each country. The incidence of mismatching varies greatly among countries (see Frequency in Table 1). France and Spain register the highest percentages of mismatched graduates; meanwhile the lowest shares characterize Finland and Netherlands.

The dependent variable, which we are aiming to explain, is given by the value (euro) of gross earnings per hour at current job. In Table 1 are reported some summary statistics regarding the distribution of this variable for the two groups. Excepting the Norway sample, the average value of the gross earnings for matched graduates exceeds the average value computed for mismatched graduates. The most significant difference is registered for UK data where the average earnings for matched respondents is about 16.5% higher than for mismatched graduates.
Table 1. Statistics regarding gross earnings at current job

| Country        | Statistics        | Matched  | Mismatched |
|----------------|-------------------|----------|------------|
| Austria        | Frequency         | 73.26    | 26.74      |
|                | Average           | 15.76    | 13.95      |
|                | Standard Deviation| 7.65     | 5.37       |
|                | 25%               | 11.98    | 10.26      |
|                | 50%               | 14.78    | 13.27      |
|                | 75%               | 18.46    | 16.73      |
| Belgium        | Frequency         | 72.00    | 28.00      |
|                | Average           | 16.70    | 14.99      |
|                | Standard Deviation| 5.70     | 4.96       |
|                | 25%               | 13.97    | 12.15      |
|                | 50%               | 16.18    | 14.36      |
|                | 75%               | 18.73    | 17.48      |
| Czech Republic | Frequency         | 76.33    | 23.67      |
|                | Average           | 5.09     | 4.60       |
|                | Standard Deviation| 3.47     | 3.60       |
|                | 25%               | 3.45     | 3.09       |
|                | 50%               | 4.34     | 3.85       |
|                | 75%               | 6.00     | 5.07       |
| Finland        | Frequency         | 84.14    | 15.86      |
|                | Average           | 16.28    | 16.19      |
|                | Standard Deviation| 5.55     | 11.85      |
|                | 25%               | 12.16    | 11.54      |
|                | 50%               | 15.77    | 15.00      |
|                | 75%               | 19.23    | 18.22      |
| France         | Frequency         | 56.47    | 43.53      |
|                | Average           | 15.98    | 14.66      |
|                | Standard Deviation| 11.06    | 12.45      |
|                | 25%               | 11.22    | 9.04       |
|                | 50%               | 14.51    | 12.50      |
|                | 75%               | 18.22    | 17.02      |
| Germany        | Frequency         | 78.63    | 21.37      |
|                | Average           | 19.57    | 18.25      |
|                | Standard Deviation| 8.14     | 6.94       |
|                | 25%               | 15.32    | 14.10      |
|                | 50%               | 19.04    | 17.88      |
|                | 75%               | 23.08    | 22.59      |

| Country        | Statistics        | Matched  | Mismatched |
|----------------|-------------------|----------|------------|
| Italy          | Frequency         | 66.82    | 33.18      |
|                | Average           | 10.67    | 10.35      |
|                | Standard Deviation| 4.88     | 5.87       |
|                | 25%               | 7.50     | 7.29       |
|                | 50%               | 9.81     | 9.23       |
|                | 75%               | 12.82    | 12.15      |
| Netherlands    | Frequency         | 84.14    | 15.86      |
|                | Average           | 15.99    | 14.81      |
|                | Standard Deviation| 5.70     | 4.37       |
|                | 25%               | 13.27    | 11.79      |
|                | 50%               | 15.38    | 14.42      |
|                | 75%               | 18.27    | 16.99      |
| Norway         | Frequency         | 72.29    | 27.71      |
|                | Average           | 22.00    | 22.67      |
|                | Standard Deviation| 10.18    | 8.63       |
|                | 25%               | 17.83    | 18.35      |
|                | 50%               | 20.55    | 21.18      |
|                | 75%               | 23.77    | 24.80      |
| Spain          | Frequency         | 64.20    | 35.80      |
|                | Average           | 10.37    | 8.43       |
|                | Standard Deviation| 5.51     | 4.55       |
|                | 25%               | 7.03     | 5.62       |
|                | 50%               | 9.23     | 7.33       |
|                | 75%               | 12.16    | 10.24      |
| UK             | Frequency         | 72.75    | 27.25      |
|                | Average           | 17.12    | 14.70      |
|                | Standard Deviation| 6.41     | 8.29       |
|                | 25%               | 12.59    | 9.44       |
|                | 50%               | 15.94    | 13.23      |
|                | 75%               | 20.60    | 17.95      |
In order to highlight the impact of education-job mismatch on wages we first compared the distributions of the variable measuring the gross earnings for the two groups of respondents: matched and mismatched. Thus we computed density estimates using a nonparametric estimator known as kernel estimator (Silverman, 1998). In the figures presented below, are represented the density plots for each country. These estimates emphasize the negative effect of the education job mismatch on earnings in all countries except Norway. To be precise, compared with the matched group, the curves estimated for the mismatched respondents are shifted to the left, meaning that the probability of finding a lower income is higher for the overeducated and undereducated graduates.

Figure 1. Density estimates constructed from Austria observations
Figure 2. Density estimates constructed from Belgium observations
Figure 3. Density estimates constructed from Czech Republic observations
Figure 4. Density estimates constructed from Finland observations
Figure 5. Density estimates constructed from France observations
Figure 6. Density estimates constructed from Germany observations
Figure 7. Density estimates constructed from Italy observations
Figure 8. Density estimates constructed from Netherlands observations
Figure 9. Density estimates constructed from Norway observations
A density equality test was used to rigorously prove that the two density functions are different. The results of the test are shown in Table 2. According to the p-value associated to the test, the null hypothesis of equality is rejected in 9 countries, only for Italy and Norway failing to reject the null hypothesis.

Table 2. Results of The Density Equality Test for 100 bootstrap samples

| Country         | Test statistic | P-value       | Country         | Test statistic | P-value       |
|-----------------|----------------|---------------|-----------------|----------------|---------------|
| Austria         | 0.01800179     | < 2.22e-16    | Italy           | 0.004527481    | 0.22          |
| Belgium         | 0.03155312     | < 2.22e-16    | Netherlands     | 0.01740227     | < 2.22e-16    |
| Czech Republic  | 0.03176481     | < 2.22e-16    | Norway          | 0.00954735     | 0.14          |
| Finland         | 0.02140267     | < 2.22e-16    | Spain           | 0.04273227     | < 2.22e-16    |
| France          | 0.02331349     | < 2.22e-16    | UK              | 0.04517225     | < 2.22e-16    |
| Germany         | 0.009915554    | 0.01          |                 |                |               |

Conclusions

The analysis performed in this paper underlines that education-job mismatch has a negative impact on higher education graduates earnings in most of the countries included in REFLEX database. Our findings are based on the earning distributions comparison between two subsets obtained using a separation variable, which was constructed upon graduate’s self-assessment regarding the appropriateness of their education level for the current job. The most significant difference was found for the UK sample meanwhile, for the Norway and Italy samples it seems that over-education or/and under-education has no impact on labor market outcomes measured by gross earnings.

References

Allen, J. & van der Velden R. (2001). Educational mismathes versus skill mismatches: effects on wages, job satisfaction, and on-the-job search. Oxford Economic Papers, 3, 434-452
Granger, C.W., & Maasoumi, E. & Racine, J. (2004). A dependence metric for possibly nonlinear processes. Journal of Time Series Analysis, 25, 649-669
Hayfield, T., & Racine, J. (2008). Nonparametric econometrics: The np package. Journal of Statistical Software, 27, 1-32.
Maasoumi, E. & Racine, J. (2002). Entropy and predictibility of stock market returns. Journal of Econometrics, 107, 291-312
McGuiness, S. & Sloane, P.J. (2011). Labour market mismatch among UK graduates: An analysis using REFLEX data. Economics of Education Review, 30, 130-145
Sheather, S.J., Jones, M.C. (1991). A reliable data-based bandwidth selection method for kernel density estimation. Journal of Royal Statistical Society series B, 53, 683-690
Silverman, B.W. (1998). Density Estimation for statistics and data analysis. New York: Chapman & Hall/CRC, (Chapter 3).