Theses of doctoral (PhD) dissertation

THE THEORY OF EDUCATIONAL SORTING AND THE PROBLEMS OF ITS EMPIRICAL TESTING

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1. Preliminaries and Motivation of the Dissertation[1]

The mainstream in the economics of education looks at the investment in education as a way of human capital accumulation. By the ortodox human captial theory the return of this investment is taken to come in the form of the enhanced productivity of those who have received the education. With this assumption they conclude that educational investment is profitable for both for the individual and the society. In the first case the increased level of productivity leads the greater lifetime earnings, whilst in the second case society profits from the enhanced productivity of the whole economy and hence from the increased economic growth. In the macro level the education also has positive external effects.

The birth of the human capital theory, in the form we know, is usually connected the an article of *Theodor W. Schultz [1961]* called *Invetsment in Human Capital*, and a book of *Gary S. Becker [1964]* called *Human Capital*.

A decade later an alternative approach of the economic role of education was published by *Michael Spence [1973]* in his work *Job Market Signaling*. This was the first signaling model. This approach focuses on that function of the education system, that it provides information of the workers' inherent productivity (signals it) to the employers without giving enhancing it. Naturally education can increase productivity, but it is not necessary to its operation.

According to *John G. Riley ([2001] 432-433.o.*) three crucial work have led to signaling. The first was the foundation of auction theory and the examination of the effects of private informations on incentives *(William Vickrey [1961])*. The second was the analysis of the trade-off between efficiency and redistribution in optimal income taxation (*James Mirrlees [1971]*). The third was the first model of a market with asymmetric and imperfect informations (*George Akerlof [1970]*). *Andrew Clark [2000]* also mentioned *George Stigler [1962]*, who has examined the role of information and searching on the labour market.

Spence's pioneer work was closely followed by Kenneth J. Arrow (*Arrow [1979]*), Richard Layard és George Psacharopoulos (*Layard – Psacharopoulos [1974]*), Peter Wiles (*Wiles [1974]*), Joseph E. Stiglitz (*Stiglitz [1975]*), John G. Riley (*Riley [1975]*) and others. Those works have developed the theory that handles the educations purely informational

[1] This paper is the summary of the PhD dissertation for public dicsussion, which was written considering the useful advices of the two opponents (Dr. Péter Galasi, Dr. Péter Földvári) of the formal version of the dissertation.

aspects on the labour market. The signaling games, where the employees make the first step and invest in signals (education), where followed by screening, where employers force out by incentive schemes (for example wage schedules) the signaling investment of the workers. The two types of models are jointly called sorting.

The educational sorting hypothesis has the following core assumptions (*Polónyi [2002]*):

- education does not increase productivity;
- education provides information of the workers pre-educational productivity;
- employers has no information about the workers individual productivity, but they know its distribution in the whole population;
- those workers who has higher productivity has comparative advantage in education.

A large part of literature handles the sorting as a rival of (ortodox) human capital theory. Only a few papers are looking for a synthesis between them. The recent dissertation is one of them, and its aim is to use the sorting theory as a tool to comprehend the education's contribution to the processes of the economy.

To reach his goal, this dissertation uses the examination of one function of the education (sorting) and studies its relationship to other functions, mainly the productivity enhancing one. According to some economists (like *Blaug [1993]*), differences between human capital and sorting explanations of education has economic policy implications. If we compare the educational investments if there is pure sorting effect (only informational role, with no gain in productivity) and if there is pure human capital effect (education improves productivity) we find, that most equilibrium in the sorting situation decrease social welfare (the education's private return is higher than its social return), while the human capital case increases it (the education's private return is lower than its social return). This difference even greater if we compared sorting with endogenous growth models (*Romer [1986]; Lucas [1988]*). This is why so many testing attempts for so long time: to find out if educational investment harm or if it is good for societies. So the educational-sorting hypothesis has heavy consequences for development policy and educational policy, and empirical testing of its relevance seems to be important.

2. Structure and Methodology of the Dissertation

The first chapter of the dissertation introduces the basic research problem, the research questions, the hypotheses and the four theses. The second and the third chapters analyze the literature and present the theoretical background. In the second chapter there is an analytical summary of sorting theory from its early models to the most recent ones. The third chapter introduces those theories of the education market to which the sorting theory has to be compared (human capital theory and statistical discrimination). The second chapter concludes in the 1. thesis.

The fourth chapter summarizes and analyses the existing tests in the literature and create distinct groups of them. This chapter along with the previous two derives a list of requirements to create appropriate tests for sorting models and gives a theoretically based critique of existing test methods. The fifth chapter contains a newly developed test method (based an Albrecht – Ours [2006]) and derives conclusions form it. The second and third thesis is equally based on the analysis of the literature and the empirical research. The sixth chapter summarizes the outcomes and achievements of the dissertation and answers the research questions. It also suggests some possible future research possibilities.

The dissertation works with three research methods. The second and third chapters uses literature-analysis and comparison. The fourth chapter also uses secondary empirical research based on the results of existing test methods. The primer empirical test in the fifth chapter uses questionnaires to collect data answered by enterprises. The quantitative data was analyzed with appropriate statistical methods (primarily binary logistic regression, correlation analysis and crosstabs) which was combined with qualitative analysis of the open questions.

3. Research Questions of the Dissertation

Many attempt was made to prove or reject the empirical relevance of educational sorting. Most of the studies did not find dominant the sorting function of the education, but the results were never convincing. They could not support nor reject it. The question is still open. This is the starting point of the dissertation: How much empirical relevance the educational sorting has? Why are all the former attempts unsuccessful? Are there a real theoretical opposition between sorting and human capital, and if there is, what would be the right test method the compare their relevance? From these multiple problem the following four research questions could be derived:

Research question 1 (theoretical): Is the theoretical opposition of human capital and sorting theories sustainable? Are the two theories really alternative approaches to education?

Research question 2 (empirical): Can it be empirically proven that the formal education has a pure informational (screening) function –besides enhancing productivity – for the employers, and does it depend on

a) the revenues, the headcount and the ownership-structure of the employing firm;
b) the formal or informal organizational culture;
c) the type of the vacancy?

Research question 3 (empirical): Can the educational screening hypothesis be tested through the employers'' human resource recruitment and selection methods (Albrecht – Ours test)?

Research question 4 (theoretical): What modifications are needed to adapt the original version of the Albrecht – Ours test (and its model) to the Hungarian labour market.

4. Model and Empirical Research

The primary empirical research of the dissertation is the development and probe of a new testing method. The test is a modified version of an existing method (*Albrecht – Ours [2006]*). The dissertation criticizes the original version both theoretically and practically. The formal model of the test is the following.

There are two types of workers, one more productive (p_H) has a low education cost (c_L), while the less productive (p_L) has high (c_H). Only the workers know their own type (private information), but the ratio of the types in the population is known by every actor. There is a negative correlation between productivity and education cost, but this correlation is not perfect: $P(p_H|c_L)=q_L$ and $P(p_H|c_H)=q_H$, where $q_L > q_H$. These conditional probabilities are known by all actors (common knowledge). Education does not affect the productivity of highly productive (p_H) workers, but if a low productivity worker invests in high level of education (s_H), then with probability r, he is transformed into a high-productivity worker. It can be seen that education has simultaneously both the productivity enhancing and the sorting functions.

Separating equilibrium does exists for some parameter values. Then a fraction $1–q_H$ of c_H workers are low-productivity workers, while a fraction q_H are high-productivity ones. Among the c_H workers a fraction $(1–r)\cdot(1–q_L)$ are p_L after the decision to invest or not into education, and a fraction $q_L+r\cdot(1–q_L)$ are p_H. The fraction of high-productivity workers with high level of education is $[(1–g)\cdot q_L]/[(1–g)\cdot q_L+g\cdot g_H]$, while there are $[(g\cdot q_H)/((1–g)\cdot q_L+g\cdot q_H)]$ p_L workers with low education.

Education is thus an imperfect indicator of the workers productivity type, but there is a positive correlation between them is separating equilibrium. Furthermore there is a negative correlation between productivity and private cost of education (and of course, between cost of education and education level).

There are two extreme separating equilibrium in this model. The first is when employers have information only about the schooling level of the applicant (in the test the authors assumed this adequate with the formal recruitment channel). In this case the rational employer hire only the ones with high school level (s_H), and the motivation of schooling for the c_L type workers is only signal their abilities. The c_H type workers want to increase their schooling, too, but it is not only for signaling, because their ability will increase with

probability *r*. The test is therefore not appropriate for them, because the employer in this case will screen the increased productivity.

In the second separating equilibrium the employers have additional information (besides education) on the productivity type of the workers, that perfectly reveals their productivity. Therefore the employers hire only p_H type ones. In this case there is no signaling. The only reason that low-cost workers choose high level of schooling is only because it can convert them to p_H workers with probability *r*.

The educational investment of workers are similar in both of the two cases, but their motivation is different, and so is different the economic role of education. Since the more educated (s_H) workers become employed with less then probability 1, the analysis of the employers recruitment data can demonstrate if the firms count less on the schooling type of workers in the presence of the alternative, perfect (or nearly perfect) information on the workers productivity. The hypothesis is the test:

The more valuable information the employers have on the productivity of job applicants in addition to their schooling level, the less they rely on the educational data. Consequently if the recruitment and employee selection method is more informative, the level of the required education will be lowered more frequently. In the dissertation the proxy of informational level of the recruitment and employee selection method is the expected validity of the used techniques. One of the modifications on the original test of Albrecht and Ours is the proxy variable, since they used the dummy variable of the formality of the recruitment channel for it. The dissertation argues that recruitment channel is not adequate.

The data was not appropriate to test the hypothesis of the above mentioned form, that is why it was transformed into the following form:

The more valuable information the employers have on the productivity of job applicants in addition to their schooling level, the less they rely on the educational data. Consequently if the recruitment and employee selection method is more informative, the schooling level of the hired worker will be less frequently higher than the ex ante required education. The proxy of informational level of the recruitment and employee selection method is the expected validity of the used techniques.

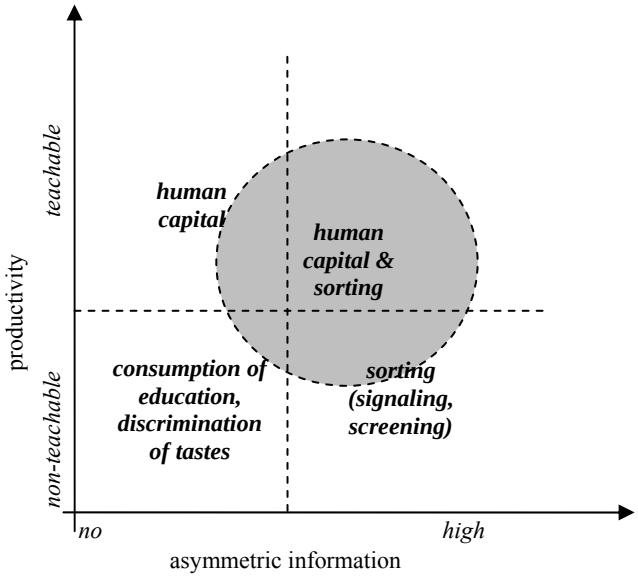
The primary method data analysis was binary logistic regression (the dependent variable was the dummy of the change in the educational requirements: 1 if it is modified upward, 0 if not). A model with 5% significance level showed, that if the validity of the selection method is over 30%, it increases the probability of the hiring an „overeducated" worker with 18%. There is also an effect on the dependent variable of the following factors: revenues of the employer, type of the job by functional area, work specifications of the job. The formalization of the corporate culture has only effect on 10% significance level.

The correspondence between the validity of selection methods and the change in the ex post schooling level was also traceable with correlation analysis and crosstabs.

5. Theses and results of the dissertation

Thesis 1: The empirical literature of educational signaling and screening is highly inconsistent and unconvincing results. Analyzing and comparing the theoretical and empirical literature it can be shown that the main cause of the inefficiency of the testing attempts is the gap between theory and testing. The empirical research does keep up with the development of the theories, especially in the relation of human capital and sorting theories. Most of the test handle them as alternatives and try to find empirical evidence to support one and reject the other, while the theoretical literature has exceeded this exclusionary opposition from Spence [1974]. The development of both theories has made this kind of testing insupportable. Another source of the testing problems is the closedness of the sorting theories and empirics. They have been opened only towards human capital theory and in some cases towards discrimination theories. The dissertation argues that sorting should be treated as a part of human capital theory, with taking into account the aspects of the theory of (educational) discrimination. The role of discrimination is particularly important for empirics, because these phenomena arise inseparable almost in every case.

The next figure illustrates the relation of human capital and sorting theories according to the dissertation along the dimensions of the education's ability to teach productive skills and the informational asymmetry on the market.



The second thesis is derived from the primary empirical research and besides answering the hypothesis of the research, it has some methodological content, too.

Thesis 2: With the analysis of the existing tests along with the theoretical literature, a new model was created for an explorational empirical test of the educational sorting hypothesis. This model works with additional informational sources parallel with the educational signal (recruitment and selection process) and takes into account factors, that can bias the results, like firm-size, sector, corporate culture and job characteristics, vacancy duration. The data for the test vas collected by questionnaire (222 pieces). The results are:

a) The pure screening function of education cannot be supported nor rejected by this testing method.

b) The firms count more on the educational signal (schooling level) during the employee selection process if they gain more additional information of the workers expected productivity from the used selection techniques (greater the expected validity of the selection). The school level shows positive correlation with the validity of the selection process.

c) The role of the schooling level in the selection process is depend on the firms revenue, the organizational culture, the job characteristics and the functional area. It also depend on the fluctuation (hired workers in the same year).

d) The screening function of the schooling level can be notably biased by the firms not adequately conscious employee selection behaviour (the ratio of the low validity processes was high in the sample). In that case the determining of the educational requirements and the selection techniques are both expected to be ad hoc.

e) The informational (sorting) role of schooling can be largely biased by the character of the labour market, especially the over-education. This over education can hinder the Albrecht – Ours test in its original form.

f) In a market with over-education, the Albrecht – Ours test needs to be adapted, and measure not the ex post lowered schooling levels, but the workers hired with schooling level greater than the required.

The third thesis focuses on methodological issues.

Thesis 3: The existing tests of the educational sorting hypothesis are not capable to measure the empirical relevance of the theoretical sorting models. The analysis of the theoretical and empirical literature and the primary research of the dissertation have led to the conclusion of a list of prerequisites for future tests.

a) The aim of the test must be to detect the presence of sorting (sorting, screening) and not to settle the so called "sorting vs. human capital debate" by trying to prove the dominance one and reject the other. The education cannot be described by only on of the too theories.

b) Empirical tests have to be based on complex models that are more capable to describe the mixed role of education. There are many models in the theory to use (for example multidimensional signaling, counter signaling, simultaneous sorting and productivity enhancing), but the empirics rarely use them.

c) An important source of the continuous failure of sorting tests is level of examination. On the individual level there is no difference between the predictions of the two theories, so it cannot be tested this way. According to the literature the macro data would be useful for testing only if the two functions of the education would exist separately or the many relevant variables would have to be controlled. It is also a crucial but usually ignored observation that the same education can play a sorting or a productivity enhancing role depends on the job type. With other words, the education become sorting or productivity augmenting after the education process, when the worker gets a job. As a consequence, the best level for testing is the firm, or more closely the human resource management of the employer.

Besides the theses, the dissertation has some side-results, too. Although less important for the main research questions but these are new results with own scientific value.

- *Albrecht and Ours [2006]* suspected that with firm-size formality increases. The primary research proved that for the sample of firms.

- The primary research repeated the results of *Dakin and Armstrong [1989]* who have found that there are significant differences between the empirical findings in the

scientific literature and the practicing experts in the valuation of several employee selection methods.

- The primary research have produced a ranked list of recruitment and employee selection methods both by the opinion and the practice of the firms in the sample.

- The validity of the selection method has shown significant, moderately strong linear correlation relation to the yearly average headcount of the firms in the sample. With linear regression, the primary research showed relation between the ownership-structure of the firm, the formality of the organizational culture and the managerial type of jobs.

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