Methodology and practice in measuring the labor market outcomes of education

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Abstract

This paper examines the availability and significance of internationally comparable statistics (classifications and indicators) in studying labor market outcomes of education. he studies employs mixed-methods approach, building on time-series data for twenty years long period (2002-2022). The study presents functional interpretation of the modern structure and reciprocity of standardized labor market information; adds to the methodology of collecting and analyzing labor market data; and identifies some missing data needed to inform economic policy and enhance job security. Selective review of education-work literature delineates five orthodox theories of relationship with foremost respect to information that were further compared and analyzed with respect to data conformity and ability to support economic choices. Though much has been done, the present study finds considerable support in further methodological development in raising the scale and convergence of the statistical coverage for help increasing transparency and effectiveness of both labor markets and school systems. This research employs only sound orthodox labor market theory and uses internationally comparable aggregate statistics from OECD, ILO, UNESCO, and UN. Due to the changing structure of the labor markets any further follow-up studies will be a must.

Key words: human capital, economic methodology, labor market information.

Introduction

The study of the education-work relationship has a long history. It is with the generation of the theory of human capital and the following several decades that the link has been given substantial, though not sufficient, quantitative measurements. Two major economic disciplines examine education-work overlapping functions: economics of education and labor economics. There are no considerable theoretical problems in formulating hypotheses and models of the relationship. Rather, the difficulties arise from the lack of sound methodology and reliable data to test the former. For proper analysis of their functional match, a crucial role is to be given to the regularly and purposefully collected information, in internationally comparative and clear manner, so that the advantages of comparison and broader perspective could be realized. Moreover, making use of such information for both policy and individual purposes requires its classification and organization in composite indicators with clear structure and brief contents.

Therefore, I examine the relation between education and work in aggregate terms, focusing on theory and statistics for educational outputs and labor market outcomes. In sharing the goal of evaluation of educational improvements leading to respective status in the labor market, this article might be somehow biased in favor of quantitative (not qualitative) school-job match. It is organized as follows: section 2 gives latest terminology and provides conceptual model on the mutual relationship; section 3 presents five theories of the relationship, ending with comparison and summary of identified information needs; and section 4 offers comprehensive outline of the respective classified, internationally comparable statistics, with respective methodological insights and going into details, where deemed necessary.

Results

1. Education and work: definitions, concept and significance

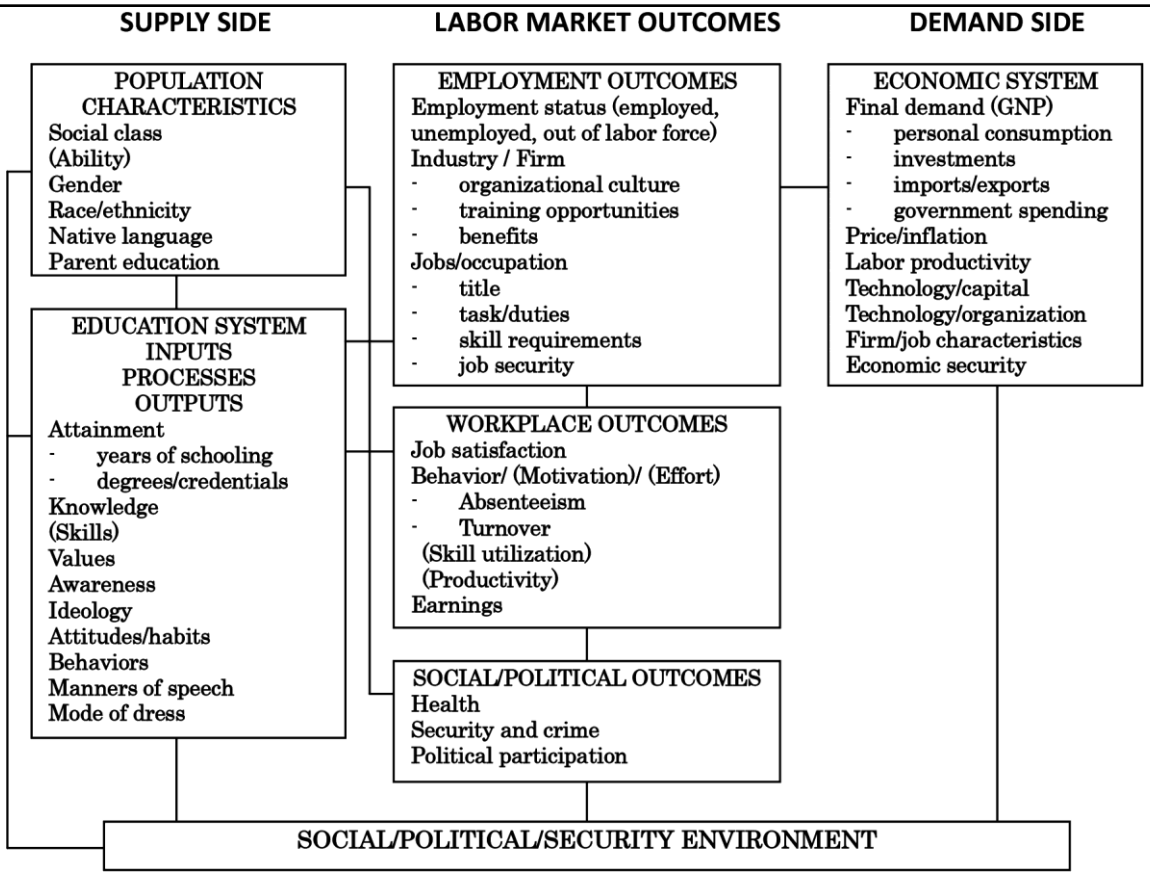
Education is understood to involve organized and sustained communication designed to bring about learning (UNESCO 1997: ISCED). Sustained here means that the learning experience has the elements of duration and continuity; while communication stands for the relationship between two or more persons involving the transfer of information. The wide implications of the roles and functions of education as social institution have often brought its analyses outside the neoclassical investment theory. Education is not necessarily economic process, though it is the main component of human capital.

Human capital is the productive wealth embodied in labor, skills and knowledge (OECD, 2004). Its epistemology will be further discussed in section 3.1.

Labor market can be represented as ranking (firms, jobs and employment statuses) and sorting (distribution of workers among these ranks and especially among jobs), (see Tilly and Tilly, 1994). *Employment* is a primary input to GDP and the core source of income to the households. On the other hand, *unemployment* shows strong inverse relationship to education, that has its limits though. The matching of people with jobs occurs through a bargaining process in which employers likely search for the cheapest worker who possesses the human capital required for entry into a given job, while workers search for the most highly rewarded job, they can get with the human capital they possess. However, ascriptive categories of people are not spread uniformly across the landscape of work, suggesting existing 'mismatches' between skills and characteristics of work. Allotment of workers to jobs above or below their abilities has been called 'wasteful of ability, or destructive of unit efficiency' (Young 1965 [1958]: 112). In fact, such distribution is both part and result of a complex socioeconomic system in which education plays major role (discussed in section 3).

Following Levin (1995) education and work are closely connected, with vastly corresponding organizational forms, and with most jobs having educational requirements for entry and advancement. Schools 'produce' both cognitive and specific vocational skills, behaviors, habits, values and awareness of social processes among students who will predispose them to accept the conditions and social relations which predominate among work organizations. The primary result of the labor market process is to secure employment. The 'qualitative' aspects of secured employment are useful to understand the qualitative 'fit' and the amount of types of education that workers bring into their jobs. School supply takes account and legitimate the differential preparation and certification of the young people for work role according to ability, class, race and sex as these are reflected in the inequalities of the work hierarchy. Finally, reproducing the ideology of the forms of work that characterize a society as well as workplace justice, education urges student to learn that in the capitalist workplace rewards are allocated according to individual effort and productivity and that social mobility is limited by educational attainments and efforts in both school and the workplace. In such a system, the relation between education and work will be forever changing, although following predictable laws of motion. The economic outcomes associated with education, illustrated in picture 1, are only on conceptual level, relevant to how well the education system is responding to the needs of the economy.

The significance of studies on educational outcomes is apparent at definitional level: 'Changing economic and social conditions have given education an increasingly central role in the success of individuals and nations. Human capital has long been identified as a key factor in combating unemployment and low pay but there is now also robust evidence that it is an important determinant of economic growth and emerging evidence that it is associated with a wide range of non-economic benefits, including improvements in health and a greater sense of well-being' (OECD 2004: 11).



Picture 1 – Conceptual model linking educational outputs to labor market outcomes and security
Note: Attributes enclosed in brackets are not readily observed or frequently measured.
Accustomed from Rumberger, in OECD [CERI] 1994: 227.

2. Five orthodox theories of the education-work relationship

The direction in which education starts a man will determine his future life. (Plato)

2.1. Human capital theory

The human capital theory generally states that investment in education leads to higher productivity and hence higher earnings. It assumes there is link between the marginal productivity of labor and investment in education and training. Education is portrayed as a 'black box' where knowledge and skills are produced, and those can be later used at work. The theory hosted various approaches in explaining the role of education in the distribution of earnings, economic growth, and productivity.

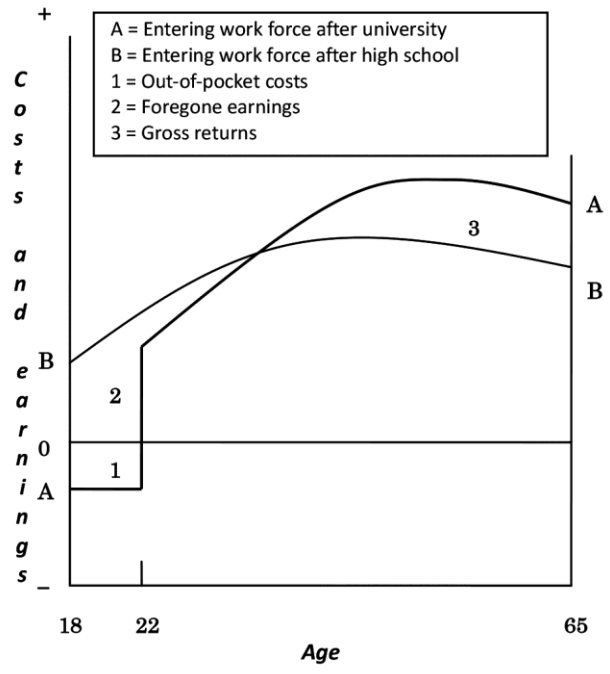
Schultz (1961) estimated the magnitude of human capital investment by expenditures (similar to cost in capital goods), and by yield (wages and salaries). He (1963: 40) also categorized several educational benefits, one of which is that '*schooling increases the capability of people to adjust to changes in job opportunities associated with economic growth*'. Denison (1962) estimated that 2% increase in the amount of education per worker (years and days of schooling) was contributing with 0.67% to the growth rate of real national income for 1929-1959 in USA, stating that '*Census that would cross-classify the data for income by education and by sex and age* (..) *with a large number of other variables - geographical location, industry, occupation, perhaps place of birth, as a minimum* [would improve understanding of] *the extent to which many of the income differentials we commonly observe when people are classified by residence, industry, etc., are merely reflections of differentials in education*'.

Mincer (1958: 292) studied the personal income distribution as function of the amount of formal training, measuring the latter by occupational status '*despite the shortcomings of the*

educational classification and the difficulties in occupational ranking'. Later (1984) he argued that '*the screening or sorting function of education is no less productive than the search for any other scarce natural resource';* that '*human capital is both augmented by learning and by selection*'*;* and that '*the interaction of the two is efficient: the more able student learns more at the same cost'*. Becker (1964: 89) stated that '*the effect of education itself could be isolated only if the amount of other human capital as well as ability were held constant*'. In studying returns to education, he justified liberal education since most of the benefits would be received when the economic environment will be different from that at the time of study or entering the labor force. Weisbrod (1962: 108) studied the non-monetary benefits from education he called '*opportunity options*' which include broadened individual employment choices and '*hedging against the vicissitudes of technological change*'. Sixty years later one could not agree more on that implication.

In a major effort Psacharopoulos (1973, 1985, 1994, and 2004) has measured returns to investment in education (the last dataset comprising estimates of the raw returns for 98 countries) and found that the average rate of return to another year of schooling is 10%. As a result of these and other studies, and their large policy implications, the returns to education became key indicator in OECD's Education at a Glance since 2001.

The sometimes overestimated role of education in the mass output of human capital literature resulted in a similar amount of critics, from the relevance of the link between education and productivity (pointed out as major defect by many) to ideology: Bowles and Gintis [1975] blamed the absence of social class element in human capital theory accusing it of 'defending the status quo'. Reliance and explanation of earnings and productivity by human capital theory has been called *cross-sectional illusion* (Thurow 1975; Collins 1979). A provocative book by Berg (1970) named 'Education and jobs: the great training robbery' added to the critique the primarily licensing function of education, that has been followed by a series of studies from which the segmentation, screening, job matching and job competition theories appeared. Despite persisting skepticism today, large part of which is due to the *very same problem of measurement of educational benefits*, human capital theory is considered "a modern synthesis of labor studies" for addressing such central issues (see Picture 2 – for review).



In choosing between two investment programs (A and B) an individual who seeks to maximize the economic return on his investment will choose the program with the highest present value. An investment program might consist of entering the labor market after graduating from high school (B) or of completing four years of university instead (A). The present value formula is:

$$V = \sum_{i=18}^{65} \frac{Y_i}{(1+r)^{i-18}}$$

Where

V is the present value at age 18;

r is the rate of interest

Y is earnings or cost in a particular year

i is age

Picture 2 – Investment in schooling
Note: Accustomed from Rees (1979: 38-39)

2.2. Segmentation theory

Doeringer and Piore (1971) developed the dual labor market hypothesis, dividing the labor market into two parts – 'primary' and 'secondary' – for which different entry requirements count and different cohorts are competing. The primary consists of individuals from upper social strata who are admitted to training slots, well-paid jobs and attractive career paths, and the secondary with low level jobs, poorly paid (market-clearing wages, see Akerlof 1984: 146) and without prospects, comprising disadvantaged workers, young people, women, and members of minorities, usually (but not implicitly) with lower educational attainment. Hence the segmentation theory holds that *labor market has no uniform allocation mechanism* (e.g. non-economic barriers exist) and contrary to human capital theory the connection between education and income (respectively productivity) is not straightforward, given that it does not hold for persons admitted only to the secondary labor markets. Numerous case studies in the developing countries [where economic systems suffer considerable asymmetries and discontinuities] have found segmentation is due to demand side of the labor market (i.e. structural working conditions in the respective sector). The segmentation theory however describes only a particular process of the labor market and can hardly provide a general theory of labor market selection.

2.3. Screening hypothesis

Assuming that economic agents have highly imperfect information, Arrow (1973), Spence (1973), and Stiglitz (1975) argued a different role of education, that is a selection (or filtering) function. Employers lack information about people's abilities, while people need appropriate channel to show their abilities to employers. Education does not add to productivity, it rather certifies that the person has the skills required for the diploma. Diploma is then used by employers as selection criteria.

Spence (1973) argued: '*We have an information problem in the society and the problem of allocating the right people to the right jobs. Education, in its capacity as a signal* […], *is helping us to do this properly*'. However, he urges that if education is '*too productive relative to the costs, everyone will invest heavily in education, and education may cease to have a signaling function*'.

Stiglitz (1975) recognized the essential role of education in selection as '*the school system is the major screening institution in our society* [because] *information is a natural by-product of its principal activity of providing knowledge (skills) and guiding individuals into the right occupations*'.

Layard and Psacharopoulos (1974) state that if screening is the main function of education, '*it could probably be done more cheaply by testing and other means, and agencies would have developed to reap the very large profits that could be made by doing this*'.

In its strong version the screening hypothesis claims it is higher credentials that lead to employment and higher earnings, irrespective of actual abilities and knowledge. Here academic credentials are important for getting the job, but not necessarily for doing it. The weak version implies that employers have '*employee stereotypes*' like gender, educational credentials, age, marital status, previous experience, family background, etc., which they think are good indicators of job performance on average. As for most jobs it is cheaper to rely on group characteristics, the '*educational credentialism*' often leads to '*statistical discrimination*'. Thus '*the screening hypothesis is a label for a classic information problem in a labor market*' (Blaug 1985: 22).

There is substantial evidence that the screening hypothesis partially explains the income effects of education (Blaug 1976; Weiss 1995). In the last decades the time spent in education has increased implying possible escalating role of screening, while return to educational signals evidenced decline with work experience, referred to as '*the sheepskin effect*'. Form a social point of view this implies overinvestment in education. However, this does not mean that (initial) abilities of workers are underutilized (Borghans and De Grip 1999: 21).

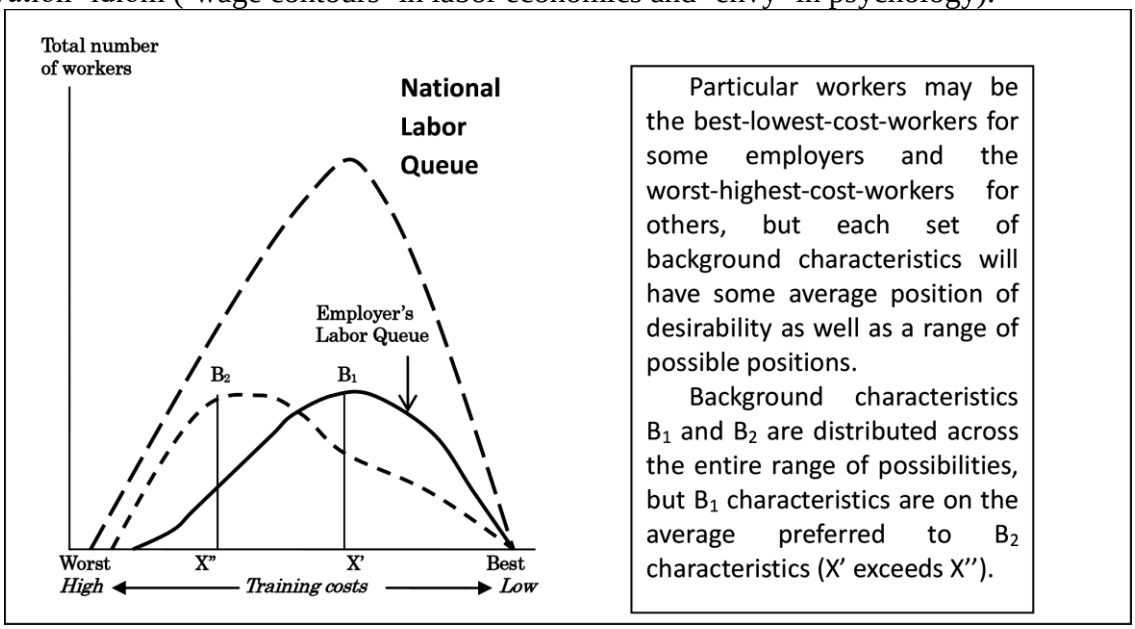
2.4. Job matching theory

Job matching theory adds to skills-rewards rationale the comparative advantage of applying skills in that segment of the labor market where those will be more productive and rewarding

(Sattinger 1975, 1978; Jovanovic 1979). Individual's productivity is determined not only by his abilities but also by the specific demands which a particular job entail. Thus, the knowledge and skills are differently waged relevant to where in the labor market those are utilized. Various cases may and actually exist: some occupations requiring higher qualification involve higher cost thus leading to segmentation; some other require special abilities that cannot be gained through education. Moreover, available labor market information about job requirements and worker skills is scarce, making it difficult for actors on both sides to reach closest match. Thus, the value of job matching theory *depends on information prerequisites*. Since workers can only check the appropriateness of their abilities once they are on the job, the process of job search involves repeated job-switching. Topel and Ward (1992) have found that over his 40 years-long career a typical worker changes 10 times his job of which 7 are in his first 10 years on the labor market. In fact, job-matching theory employs the same approach as human capital theory in explaining education-occupation relationship, namely education-earnings ratio (average earnings of each occupation are used to represent occupations quantitatively in job matching, see Tachibanaki 1995: 151).

2.5. Job competition theory

Put forward by Thurow (1975) [similar arguments have been addressed in Sorokin, 1927], the job competition theory represents labor market as consisting of two rows: one containing jobs classified by level; the other containing individuals classified according to their qualifications (see Wolbers 2000). Job seekers try to get the most attractive jobs, while employers prefer to employ the highest educated. As a result of which, *the best jobs go to the higher educated*, while the lower educated (because of their less favorable position in the row) are forced to accept less attractive jobs (for labor queue illustration see Picture 3). That is how a basic cause for high unemployment often emerges, known as "*the crowding out*" (Teulings and Koopmanschap 1989). In this concept, education is referred as "positional" (Hirsch 1977), it serves as an indicator of worker's trainability implying estimate of training costs for employers. It may become a *'defensive expenditure necessary to protect one's market share'* (Thurow 1975), that is, individuals may have to invest in additional education simply to maintain their relative position in the labor queue if other workers are also obtaining additional education. Such type of behavior will result in an absolute increase in educational credentials for given available jobs (Elchanan and Geske 1990: 64). A room is left for defining 'interdependent preferences' and 'reference group norms', studied in sociology under the 'relative deprivation' idiom ('wage contours' in labor economics and 'envy' in psychology).



Picture 3 – The labor queue /ranking workers form least to most preferred/
Accustomed from Thurow (1975: 93).

2.6. Similarity and distinction of education-work theories

Comparison and estimate of how distributive labor market theories cope with each other is attempted at *Table 1*. Theories generally build on the neoclassical theory of only one labor market, except segmentation and job matching in part. The four other theories seem to upgrade over the human capital theory which remains basis for judgment in literature after all. It also appears that the Job competition theory is the most viable concept with two weak and two strong convergences with the rest of theories. It can certainly meet principles of rationality and simplicity, and host large empirical proof (for instance see Table 1). Moreover, the recent advance in educational level classification and the increasing scale of labor force survey structures provide ground for extensive studies in this direction. Rough estimate of the magnitude and significance of educational level among general factors of employment can be obtained by extrapolating attained educational level as analysis factor [the hypothesis of educational levels meant here, not the hypothesis of types of education (Arum and Shavit 1995)], and labor market outcome (employment or unemployment) as result. Presuming that links between educational level and employment entry/exit rates are not entirely linear (as predicted by Thurow's job competition model) but curvilinear, such aggregate level studies may be regarded as promising contribution to the field. Results may suggest that educational race takes place at the expense of skills, knowledge, abilities, and efficiency quest; that job competition replaces wage competition; that credentialism and opportunism replace innate functions of and change both education and work concepts. Testing Job competition theory demands some time to be allowed for time-series though.

Table 1 – General interaction of education-work hypotheses

Hypotheses	Human capital	Segmentation	Screening	Job matching	Job competition
Human capital	***	Weak divergence	Strong divergence	Weak convergence	Weak convergence
Segmentation	Se. adds fragment on non-economic barriers*; Se. contradict straightness of education-income link	***	Weak convergence	Weak convergence	Strong convergence
Screening	Sc. adds to explanation of income effects of education; Sc. contradict straightness of education-productivity link while adhering the other extreme, e.g. primarily selection function of education	Both allege screening function of education; Se. holds process is predetermined while Sc. allows equal criteria based on credentials [frequent statistical discrimination is recognized though]	***	Weak convergence	Strong convergence
Job matching	JM provides alternative explanation of wage growth to HC, i.e. because of good match not tenure; JM and HC apply similar approach	JM allows segmentation; JM implies screening based on job-skills match, while Se. on discriminative non-purely economic conjuncture	Both allow for imperfect information; JM rely on expertise and on-the-job selection as extension to Sc. [declining] educational signals as	***	Weak convergence

Hypotheses	Human capital	Segmentation	Screening	Job matching	Job competition
			statistical predictors		
Job competition	JC adds protective function of education for keeping own's market share; JC skip reliance on productivity and earnings explanation, imply role of personal characteristics	Both assume ranking, sorting, interdependent preferences and statistical discrimination: JC driven by competition while Se. by soft factors and policy	Both assume imperfect information, screening-type of selection, credentialism and overinvestment in education	Both infer skills and job requirement match; differ in explaining the way this match actually happens	***

*semantically not correct since segmentation is economically-driven

2.7. Additional data requirements

In total, each of the five theories requires different data in order to assess its appropriateness. Some data is available (standard labor force surveys and education statistics), some have to be further collected. Heijke (1996) denotes some of the latter, summarized in Table 2. Important feature of the logic behind explorative theories of the labor market with respect to education is the advance towards the quantification of either respective *probabilities of finding a job* with particular type of education or *the risk of unemployment*, which Heijke denotes as '*labor market discrepancies'*.

Table 2 – Data requirements to labor market information

Labor market theory	What additional labor market information is needed?
1. Human capital theory	Wage data for people with particular educational background (years of education count, not diploma)
2. Segmentation theory	Data on occupations divided by *business size* and *branch of industry*; labor supply differentiated by *educational level, age, sex, ethnic minority status*.
3. Screening hypothesis	Data on probability of successfully completing the course (school drop outs do not count)
4. Job matching theory	Data on job characteristics (knowledge and skills operationalized in the form of educational background); labor market information differentiated by *occupational* category and *educational* category
5. Job competition theory	Data on educational decisions of the student cohort; on the level of jobs in relation to the educational level of the people holding these jobs, and on the changes in these levels over time

3. The role of information

Information not used in production may merely convey a competitive advantage. (Hirshleifer 1971)

Country-specific information comes from national labor force surveys, censuses, and education statistics. Information on international level derives from country-specific information. It usually originates either from uniform questionnaires which are sent to countries from the international organization which is gathering data with no or minimum adjustments, or comes 'raw' and is additionally accustomed to the standard with much work by both country and international organization statisticians. The purpose of collecting information internationally lies in its comparability, access and global monitoring. It is first classified, and indicators are later derived, followed or concurrently with the analyses. The institutions active in this process are the International Labor Organization (ISCO, ICSE, ISIC (UN) classifications; KILM Indicators and Yearbook of Labor Statistics Database), OECD (Education at a Glance Indicators and Employment Outlooks being

the organization's flagship publications for providing comprehensive database and analyses) and UNESCO (ISCED classification and UNESCO Institute of Statistics Databases with an extensive coverage of education systems). In adding to the general recognition of the role of information for analysis and policy, I am rather interested in following what the state of such information is at present. Given the current condition of the literature, I assume a shift towards more appropriate statistical coverage in internationally valid and efficient manner would greatly contribute to the study of the phenomena. Hence it will inherently comprise classifications and indicators on both education and the labor market, which present form and evolution I briefly introduce below.

3.1. Classifications

Each classification has its conceptual basis, methodology, definitions and terminology, data collection and international reporting rules, criteria on defining groups, etc. Usually it changes in time following the descriptive and analytical needs which led to its foundation.

3.1.1. ***UNESCO's International Standard Classification of Education (ISCED)*** has been designed to serve as 'an instrument suitable for assembling, compiling and presenting statistics of education both within individual countries and internationally'. ISCED is a multi-purpose system, planned for education policy analysis and decision making, with universally valid basic concept and definitions invariant to the particular circumstances of a national educational system or stage of economic development of a country. Its 1997 version (*ISCED 1997*) covered primarily two cross-classification variables: levels and fields of education, while its current 2011 version presents a revision of the ISCED 1997 levels of education classification, and introduces a related classification of educational attainment levels based on recognised educational qualifications. For level description and fuller picture of 1997 ISCED's 6 levels and 25 fields of education see Table 3.

Table 3 – Brief description of ISCED 1997 framework

Levels of education	Level description	Fields of education
Pre-primary - O	Initial stage of organized instruction, designed primarily to introduce very young children to a school-type environment	There are 25 fields of education, modified to eliminate overlapping, and increased to include new fields: Basic programs; Literacy and innumeracy; Personal development; Teacher training and education science; Arts; Humanities; Social and behavioral science; Journalism and information; Business and administration; Law; Life sciences; Physical sciences; Mathematics and statistics; Computing; Engineering and engineering trades; Manufacturing and processing; Architecture and building; Agriculture, forestry and fishery; Veterinary; Health; Social services; Personal services; Transport services; Environmental protection; Security services.
Primary - 1	Normally designed to give students a sound basic education in reading, writing and mathematics	
Lower secondary - 2	Generally continues the basic programs of the primary level, although teaching is typically more subject-focused	
Upper secondary - 3	Instruction is often more organized along subject-matter lines than at ISCED-2 level.	
Post-secondary non-tertiary - 4	The programs at this level set the boundary between upper secondary and post-secondary education form international point of view, even though they might clearly be considered as upper secondary or post-secondary programs in a national context; programs serve to further broaden the knowledge of participants who have already completed a program at level 3; have typical duration of 6-24 months.	
First stage of tertiary - 5	More advanced programs than those offered in levels 3 and 4, but not leading directly to advanced research qualification); divided in 2 parts: 5A with largely theoretical base intended to provide sufficient qualifications for gaining entry into advanced research programs and professions with high skills requirements, and 5B programs that are generally more practical/technical/occupationally specific than ISCED 5A programs.	
Second stage of tertiary - 6	This level is reserved for tertiary programs that lead to the award of an advanced qualification. The programs are devoted to advanced study and original research.	

Accustomed from OECD 2000; and UNESCO 1997.

Since 2012 UNESCO uses the ISCED 2011. Table 4 reveals the correspondence (or concordance) between ISCED levels in the 2011 and 1997 versions. The basic unit of classification in ISCED remains the *educational program*, defined on the basis of its educational content as *an array of sequence of educational activities which are organized to accomplish a pre-determined objective or a specified set of educational tasks*.

Table 4 – Correspondence between ISCED 2011 and ISCED 1997 levels

ISCED 2011	ISCED 1997
ISCED 01	-
ISCED 02	ISCED 0
ISCED level 1	ISCED level 1
ISCED level 2	ISCED level 2
ISCED level 3*	ISCED level 3
ISCED level 4*	ISCED level 4
ISCED level 5	ISCED level 5
ISCED level 6	
ISCED level 7	
ISCED level 8	ISCED level 6
* Content of category has been modified slightly.	

Source: UNECO 2012: 63.

ISCED 2011 has four levels of tertiary education compared to two levels in ISCED 1997: levels 5, 6 and 7 in ISCED 2011 together correspond to level 5 in ISCED 1997, while level 8 in ISCED 2011 corresponds to level 6 in ISCED 1997. ISCED 2011 simplifies the complementary dimensions at the tertiary ISCED levels compared to 1997. It will also be possible to distinguish between academic and professional orientations within ISCED 2011 levels 6 to 8 once internationally-agreed definitions have been developed.

Classification of socioeconomic activity has often been criticized for various reasons. Meyer et all (2004) exemplified how a decision by UNESCO statisticians in 1950's to compile comparable educational enrolment for a six-year primary level and three-year junior and secondary levels brought out that in ensuing decades 'many countries structured their mass schooling systems around this six-year/three-year/three-year model generally without investigating whether it would best meet any of the presumed purposes of schooling' (Meyer et al. 2004: 88). He accused copying world models or conventions leading to 'simple mimesis that has more to do with knowing how to fill in forms than with managing substantive problems' (Ibid). However, one cannot deny that intentionally ISCED is designed to serve as a framework to classify educational activities as defined in programmes and the resulting qualifications into internationally agreed categories, hence the basic concepts and definitions of ISCED are therefore intended to be internationally valid and comprehensive to the full range of education systems (UNESCO 2012: 6).

Adding to holism and comparability of labor market data, ISCED contributes to all theories summarized in *Table 2*, especially to Segmentation, Screening and Job competition theories.

3.1.2. ILO's *International Standard Classification of Occupations* *1988 (ISCO-88)* classified persons by their actual and potential relation with jobs. Jobs were classified with respect to the type of work performed or to be performed. The basic criteria used to define the system of major, sub-major, minor, and unit groups are the 'skill level' and 'skill specialization' required to carry out the tasks and duties of the occupations (the decisive factor is the nature of skills, not the way these skills are acquired). In collecting and processing statistics classified by occupation (e.g. for use in fields such as labor market analysis, education planning, manpower planning, wages analysis, etc.) each country should ensure the possibility of conversion into the ISCO-88 system to facilitate international use of occupational information. For ISCO-88 four levels of aggregation see Table 5.

Table 5 – Brief description of ISC0-88 framework

10 Major Groups	ISCO Skill Level	Sub-Major, Minor and Unit Groups
Legislators, senior officials and managers	-	
Professionals	4th	28 Sub-Major Groups (subdivisions of Major Groups)
Technicians and associate professions	3rd	
Clerks	2nd	
Service workers and shop and market sales	2nd	116 Minor Groups (subdivisions of Sub-Major Groups)
Skill agricultural and fishery workers	2nd	
Craft and related workers	2nd	
Plant and machine operators and assemblers	2nd	390 Unit Groups (subdivisions of Minor Groups)
Elementary occupations	1st	
Armed forces	-	

The latest version of ISCO came to effect in 2008 (ISCO-08). It does not changed the conceptual model in any fundamental way, yet there are significant differences in the treatment of occupational groups. The system of major, sub-major, minor and unit groups is retained, and the 10 major groups are still pretty much the same, but a significant number of sub-major, minor and unit groups were introduced to reflect changes in the occupational developments based on technology, IT and so forth. This is demonstrated in Table 6.

Table 6 – Comparison between ISCO-08 and ISCO-88 in numbers of groups

Major group	Sub-major group	Minor group	Unit group
1. Managers	4(3)	11(8)	31(33)
2. Professionals	6(4)	27(18)	92(55)
3. Technicians and associate professionals	5(4)	20(21)	84(73)
4. Clerical support workers	4(2)	8(7)	29(23)
5. Services and sales workers	4(2)	13(9)	40(23)
6. Skilled agricultural, forestry and fishery workers	3(2)	9(6)	18(17)
7. Craft and related trades workers	5(4)	14(16)	66(70)
8. Plant and machine operators, and assemblers	3	14(20)	40(70)
9. Elementary occupations	6(3)	11(10)	33(25)
0. Armed forces occupation	3(1)	3(1)	3(1)
Total ISCO-08 (ISCO-88)	43(28)	130(116)	436(390)

Source: ILO, 2012:22.

Based on table 6 the four level hierarchically structured classification allows all jobs in the world to be classified in 463 unit groups (the most detailed level of classification) which are in turn aggregated into 130 minor groups, 43 sub-major groups, and 10 major groups, based in their similarities in skill level and skill specialization required for the jobs. The skill levels for each group are measured in synthetic scale from 1 to 4, which in turn corresponds to a relative ISCED 2011 (levels of education) group. However, as we measure skills, it is notable that formal education is just one component of the measurement of skill level and should be seen as indicative.

All in all, ISCO-08 provides relatively detailed internationally comparable data, and in doing so, it is a helpful methodological instrument and database that adds notably to the study of Human capital, Screening and especially Job matching theories.

3.1.3. The UN's *International Standard Industrial Classification of All Economic Activities 2002 (ISIC Revision 3.1)* is a basic tool for studying economic phenomena and fostering international comparability of data, thus being more than just an 'industrial' classification. ISIC have wide use in classifying data according to the kind of economic activity in the fields of population, production, employment, GDP and other economic activities. As an international reference classification of productive activities, its main purpose is to provide a set of activity categories that can be utilized for the collection and reporting of statistics according to economic activities.

The hierarchical structure of ISIC 3.1 consists of 17 'tabulation categories', 62 'divisions', 161 'groups' and 298 'classes' (see Table 7).

Table 7 – Tabulation categories in ISIC 3.1 framework

A. Agriculture, hunting and forestry	G. Wholesale and retail trade, etc.	M. Education
B. Fishing	H. Hotels and restaurants	N. Health and social work
C. Mining and quarrying	I. Transport, storage and communications	O. Other community, social and personal service activities
D. Manufacturing	J. Financial intermediation	P. Private household with employed persons
E. Electricity, gas and water supply	K. Real estate, renting and business activities	Q. Extra-territorial organizations and bodies
F. Construction	L. Public administration and defense	

The newest revision of ISIC 4 since 2008 reflects the emergence of new technologies and the new divisions of labor tied to those activities and industries. While the overall characteristics of ISIC remained unchanged, still there are many methodological and structural changes with respect to ISIC 3.1. The detail of the classification has significantly increased, especially for service-producing activities. It has now 21 sections, 99 divisions, 260 groups and 419 classes (See Table 8 for types of sections).

Table 8 – Tabulation sections in ISIC 4 framework

A. Agriculture, forestry and fishing	G. Wholesale and retail trade, repair of motor vehicles and motorcycles	M. Professional, scientific and technical activities
B. Mining and quarrying	H. Transport and storage	N. Administrative and support service activities
C. Manufacturing	I. Accommodation and food service activities	O. Public administration and defense; compulsory social security
D. Electricity, gas, steam and air conditioning supply	J. Information and communication	P. Education
E. Water supply, sewerage, waste management and remediation activities	K. Financial and insurance activities	Q. Human health and social work activities
F. Construction	L. Real estate activities	R. Arts, entertainment and recreation
S. Other service activities	T. Activities of households as employers, undifferentiated goods- and services- producing activities of households for own use	U. Activities of extraterritorial organizations and bodies

Source: UN, 2008.

The definitions of the ISIC categories for education services have been defined in line with the changes applied in the last ISCED revision. However, it has not been harmonized with ISCO, as those two measure different aspects of the economy, yet ISCO groups are generally consistent with

the respective definition of these goods and services in ISIC. The EU's NACE (General Industrial Classification of Economic Activities within the European Communities) has been developed based on the fourth revision of ISIC, being quite identical to ISIC, and has no value of representation here.

ISIC 4 generally supports studies on all labor market theories listed in *Table 2*, with possible emphasis on Job matching theory.

3.1.4. The ILO's *International classification of status in employment* *1993 (ICSE-93)* comprises six groups: *Employees, Employers, Own-Account Workers, Members of Producer's Cooperatives, Contributing Family Workers, and Workers Not Classifiable by Status*. The basic criteria used to define groups are the type of economic risk (an element of which is the strength of the attachment between the person and the job (ICSE-18-R: Status in Employment according to type of economic risk), and the type of authority over establishments and other workers which the job incumbents have (ICSE-18-A: Status in Employment according to type of authority).

As employment status is the core element of any labor market analysis, ISCE-93 takes part in interpreting labor market outcome in all the discussed theories in Table 2.

3.2. Indicators

Indicators are subset of ordinary statistics. In the context of education and following OECD (2003:4, *passim*), indicators need to be '*as straightforward a manner as possible, but remain sufficiently complex to reflect multi-faceted educational realities'; 'as comparable as possible, they also need to be as country-specific as is necessary to allow for historical, systemic and cultural differences between countries';* and finally *'need to respond to educational issues that are high on national policy agendas, and where the international comparative perspective can offer important added value to what can be accomplished through national analysis and evaluation*'. As for labor market indicators, in short, good indicators will provide complete and useful information with minimum figures.

3.2.1. OECD's *Education at a Glance,* provides indicator framework that steadily improves each year, the issue of September 2004 will be shortly presented, followed by newest issue of 2022. It consists of 29 indicators divided in 4 groups as follows: A) The output of educational institutions and the impact of learning (12 indicators); B) Financial and human resources invested in education (6); C) Access to education, participation and progression (5) and D) The learning environment and organization of schools (6). Under OECD/UNESCO *World Education Indicators Program 1997 (WEI 1997)* 19 more non-member countries are included, thus extending analyses to developing countries.

Indicators with particular interest for the study are accustomed and summarized in Table 9. By extrapolating their content and evidence (as in Table 9) to the presented theories, numerous relationships, explanations and verifications can be derived. Instead of the long task to elaborate on OECD's fine work, I further give some technical insights I find important for the interpretation of the results.

Each member country submits data to the OECD at the time of collection. Countries do submit also information about the characteristics of their surveys used. This information is used to produce the appendices to EAG. Comparability is achieved through much work in the respective OECD networks with nearly 200 statisticians engaged under the so-called 'model of shared ownership'.

Table 9 – Education-work related indicators in OECD's Education at a Glance 2004

Indicator	Definition and Content	Evidence
A1: Educational attainment of the adult population	Can be summarized by the average years of schooling; Shows a profile of the educational attainment of the adult population (25-64 years old) as a proxy for the knowledge and skills available to economies and	The average educational attainment in OECD countries corresponds to 11.8 years; Countries differ widely in the distribution of educational attainment; The proportion of young people who have attained at least a tertiary education has increased.

Indicator	Definition and Content	Evidence
	societies, e.g. the stock of 'human capital'.	
A4: Tertiary graduates by field of study	Shows the distribution of tertiary graduates across fields of study	On average 1/3 of the tertiary-type A graduates obtain degree in social sciences, business or law; followed by science-related fields; Individual preferences, admission policies and degree structures influence the prevalence of different fields of study. In addition, changing opportunities in the labor market, relative earnings in different occupations and sectors are also recognized as possible choice factors.
A10: Labor force participation by level of educational attainment	Examines the relationship between educational attainment and labor market status; The adequacy of worker's skills and the capacity of the labor market to supply jobs that match those skills are deemed important issues for policymakers.	Employment ratios rise with educational attainment in most OECD countries, with tertiary education ratio markedly higher than upper-secondary graduates ratio. Those with low educational attainment are both less likely to be labor force participants and more likely to be unemployed; Unemployment ratio falls with higher educational attainment; Lower unemployment ratios associated with higher educational attainment are not always guaranteed; The gender gap in employment decreases with increasing educational attainment.
A11: The returns to education: education and earnings	Examines the earnings of workers with differing levels of education. Examines the private rate of return to educational investment (benefits over time to costs, in percentage) Examines social internal rates of return to investment in education (generally costs and benefits to society of investment in education; three estimation scenarios presented, however definition is narrow by excluding non-economic benefits or so-called educational benefit externalities)	Education and earnings are positively linked. In all countries, graduates of tertiary level education earn substantially more than upper secondary graduates; Earning differentials are key measure of current financial incentives for an individual to invest in further education; Earning differentials between males and females with the same educational attainment remain substantial in favor of males; Social internal rates of return to education are generally lower than private rates of return, due to the significant social costs of education In many countries private and social rates of return to investments in education are above the risk-free real interest rate.
A12: The returns to education: links between human capital and economic growth	Estimates the effect of changes in growth explanatory variables, including human capital, on changes in output per capita, holding the aggregate stock of physical capital constant. Productivity differences are broken down into three components: demographic effect (ration of working age population to total population), labor utilization (employment rates combined with hours worked), and labor productivity.	The estimated long-run effect on economic output of one additional year of education generally falls between 3-6% Increases in stock of human capital raise labor productivity (accounting of at least half of GDP per capita over 1990-2000 in OECD) and also serve as a driver of technological progress Demography had significant impact only in a few countries during the 1990s; Labor utilization showed to be an important factor in accounting for differences in GDP per capita.
C4: Education and work status of the	Shows the expected years young people spend in education, employment and non-employment (unemployment and withdrawal from the labor force)	A typical 15 years old can expect to be in the education system for 6.5 years more; to hold a job for 6.4 years in the next 15 years to come; to be unemployed for 0.8 years, and to be out of the labor market for 1.3 years.

Indicator	Definition and Content	Evidence
youth population	Examines the education and employment status of young males and females	The transition from education to work occurs in different points of time in different OECD countries, depending on various educational and labor market factors. At the end of the transition period (ages 25-29), when most young people have finished studying, differences in access to employment are linked to the attained educational level. Not attaining an upper-secondary education is a serious handicap. Conversely, tertiary education offers a premium for most job-seekers.

Source: OECD, 2004.

For the data on socioeconomic outcomes of education there is minimum or no adjustment made by OECD on national data. Countries conform to the templates sent for the data collection. The data used is typically not panel data but rather labor force survey type of data, at least for most countries. This obviously entails problems for serious econometric analyses since aggregate data do not contain the 'mass' of the information, while yearly data require substantial period of observation (usually 30 years). The OECD's Education at a Glance 2004 for the first time contains some time-series (1997-2002), however going back prior to ISCED 1997 is probably impossible. The only thing possible is at a higher level of aggregation with three levels of education (below upper secondary education, upper secondary and post-secondary non-tertiary education, and tertiary education).

A point to be kept in mind is that gathering data from individual countries could put on any research the burden of the compatibility issues which are not easy to deal with (for instance individual country's labor force surveys give a level of desegregation of the educational variable which would not be sufficient to derive the appropriate ISCED 97 level). The only decision here will be the use of what the international organizations have already collected.

Now what are the changes in EAG 2022? First, tertiary education has increased significantly from 27% to 48% in OECD countries: soon it will be the most common among working-age adults in OECD. Second, between young adults (25-34), there is a significant advantage of women with tertiary education (57% with bachelor, master or doctor degree) compared to just 43% of men. The average amount of investment in tertiary education also increased. Third, workers with tertiary education receive 50% higher salaries than those with upper secondary education, and almost twice higher salaries than those without upper secondary education. There are vast regional and interstate disparities. Table 10 indicates the selected measurements related to the education-work relationship.

Table 10 – Education-work related indicators in OECD's Education at a Glance 2022

Indicator	Content
A1 To what level have adults studied?	Educational attainment of 25-64 year-olds Trends in educational attainment of 25-34 year-olds, by gender Fields of study among tertiary-educated 25-64 year-olds
A2 Transition from education to work: Where are today's youth?	Percentage of 18-24 year-olds in education/not in education, by work status Percentage of 18-24 year-olds in education/not in education, by work status and duration of unemployment Percentage of 25-29 year-olds in education/not in education, by educational attainment and work status Trends in the percentage of young adults in education/not in education, by age group and work status
A3 How does educational attainment affect participation in the labour market?	Employment rates of 25-64 year-olds, by educational attainment Trends in employment rates of 25-34 year-olds, by educational attainment and gender

Indicator	Content
	Employment rates of tertiary-educated 25-64 year-olds, by field of study Trends in unemployment and inactivity rates of 25-34 year-olds, by educational attainment Unemployment rates of 25-64 year-olds, by duration of unemployment and educational attainment
A4 What are the earnings advantages from education?	Relative earnings of workers, by educational attainment Distribution of workers by educational attainment and level of earnings relative to the median earnings Women's earnings as a percentage of men's earnings, by educational attainment and age group Relative earnings of tertiary-educated adults, by field of study

Source: OECD, 2022.

Within the economic environment, the cultural context and the labor market conditions, the educational attainment and the quality of education received have impact on the individuals' transition from education to work. While in most OECD countries traditionally education is completed before looking for work, in others education and employment are concurrent. When labour-market conditions are unfavourable, people tend to stay in education longer when job offering is low, because higher unemployment decreases the opportunity costs of education, and they see value and stimulus to further develop skills for better times. Education policy follows these conditions trying to ensure that individuals will have the skills needed for when the labor market improves. Public investment in education can be a counterbalance to unemployment and investment in economic growth (by developing those skills). Young people who are NEET are a major policy concern, as it has a negative impact on their labour-market prospects and social outcomes (See OECD 2022: 50). Education policy needs to prepare the students for the labor market of the future.

OECD's EAG statistics satisfies data needed for Human capital theory, Segmentation theory, Job matching theory and Job competition theory.

3.4.2. The ILO's *Key Indicators of the Labor Market 2002 (KILM 2002)* is an accumulation of information on the global labor market, comprising data form 1980 to 2000 for 200 countries at most (KILM Indicator 13) and 17 countries at least (KILM 17). The aggregation in indicators represents two objectives: to present a core set of labor market indicators, and to improve the availability of the indicators to monitor new employment trends. The 20 indicators of the KILM 2002 edition are shown in Table 11.

Table 11 – KILM 2001-2002

1. Labor force participation rate	6. Hours of work	11. Unemployment by educational attainment	16. Occupational wage and earning indices
2. Employment-to-population ratio	7. Informal sector employment	12. Time-related underemployment	17. Hourly compensation costs
3. Status in employment	8. Unemployment	13. Inactivity rate	18. Productivity and unit labor costs
4. Employment by sector	9. Youth unemployment	14. Educational attainment and illiteracy	19. Labor market flows
5. Part-time workers	10. Long-term unemployment	15. Manufacturing wage indices	20. Poverty and income distribution

Source: ILO, 2003.

It is notable that several indicators directly reflect the educational aspect of work, mostly emphasizing on labor market performance and national competitiveness associated with skill level of the workforce, and analytically repeating the rationale 'the higher the level of educational attainment, the lower the unemployment rates'. The use of data makes it a very convenient to create country-specific profile while giving global perspective of what labor market is. It took advantage of already collected international data, although containing some individual country supplement when possible. However, the last version of KILM represented in the table 12 shrunk the scope and eliminated important ratios.

Table 12 – KILM 2015

1. Labor force participation rate	6. Part time workers	11. Long-term unemployment	16. Labor productivity
2. Employment-to-population ratio	7. Hours of work	12. Time-related underemployment	17. Poverty, working distribution and the working poor
3. Status in employment	8. Employment in the informal economy	13. Persons outside the labor force	
4. Employment by sector	9. Unemployment	14. Educational attainment and illiteracy	
5. Employment by occupation	10. Youth unemployment	15. Wages and compensation costs	

Source: ILO, 2016.

Table 12 represent the last edition of ILO's KILM: since 2016 there is an opportunity to use data from ILOSTAT, where special attention deserves the Education and the mismatch indicators (EMI database). KILM showed overall that the labor force educational level is improving, that tertiary education generally means higher productivity and lower unemployment.

KILM is best serving the Human capital, Segmentation, Screening and Job matching theories.

3.2.3. ILO's *Yearbook of Labor Statistics* contains data on over 74 years (1935-2009) together with *Sources and Methods* series. It is divided in chapters such as: *Economically Active Population; Employment; Unemployment; Hours of Work; Wages; Labor Cost; Consumer Prices; Occupational Injuries; and Strikes and Lockouts*. It is replaced by another flagship publication – World employment and social outlook.

ILO's YLS is useful retrospective tool for studying all five labor market theories.

3.2.4. OECD *Employment Outlook* provides comprehensive analyses of the labor market situation in member countries since 1983. It employs the annual edition of OECD *Labor Force Statistics* and OECD *On-Line Labor Force Statistics* database that shows both raw data and derived statistics. It usually contains a chapter analyzing job-related human capital, such as 'upgrading workers' skills and competencies', 'Improving skills for more and better jobs' and so forth. Data showed a rightwards shift in Beveridge curve for OECD zone, suggesting a mismatch between vacancies and those looking for work. It also provides short-term forecasts.

OECD's EO is also suitable database and analysis pool for studying all five labor market theories.

Conclusions

This article brings together theory, methodology, and respective available and internationally comparable statistical coverage of education-work relationship. It provides chronological perspective for an informative comprehensive frame to the process of raising the transparency of the labor market with respect to education. The OECD once failed with constructing indicators on socioeconomic outcomes of education (1973) and use of education in manpower planning (OECD 1963), but has

steadily advanced towards sound and timely indicators. Modern analysis of educational outcome on the labor market would be almost impossible without the core contribution of data, methodology, and analytical tools of international organizations and their partner country's experts. ILO's *Labor Statistics, UNESCO and* OECD's *Education at a Glance* and *Employment Outlook* are clearly good examples of such collaboration.

Questions of effective budget allocation (public education, public employment and training services) are presumed high on policy agendas, at least normatively, thus further moves are to be expected. Facilitating those facing educational choices (individuals, employers and policy-makers) can certainly contribute to these goals. There is still discrepancy between theory and data availability, and further work in this direction will constitute a must. Since information is rather costly and time-consuming, there is reciprocal need for more theoretical unity and methodological precision, at least on basic assumptions for education's role on the labor market. The process is interdependent, such as functional cooperation can help both theory and statistics.

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