



## Economic and Social Council

Distr.: General  
21 April 2011

English only

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### Economic Commission for Europe

#### Conference of European Statisticians

##### Fifty-ninth plenary session

Geneva, 14-16 June 2011

Item 5 of the provisional agenda

##### Measuring human capital

### **Monetary measures of human capital for comparative analysis: the experience of the Organisation for Economic Co-operation and Development**

#### **Note by the Organisation for Economic Co-operation and Development**

##### *Summary*

The paper summarises the outcomes of the first phase of the human capital project of the Organisation for Economic Co-operation and Development, and identifies possible directions for future research. It also shows the feasibility of measuring human capital by applying lifetime income approach and by using data already available within the statistical system of the Organisation for Economic Co-operation and Development. In addition, it highlights the types of policy implications that can be drawn from analysis based on estimated human capital values.

## I. Introduction

1. Human capital, defined as “the knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being”<sup>1</sup>, is essential to understand issues related to economic growth, quality of life, social progress and sustainable development.

2. Informed statistics on human capital, including its level and distribution, and on how it evolves over time, are indispensable for policy makers to design and implement more effective interventions. Nevertheless, there is no agreement as regards how to measure human capital in practice. The lack of a common measurement framework for human capital implies that drawing policy implications based on comparisons of country performances could be misleading.

3. The Organisation for Economic Co-operation and Development (OECD) has a long tradition both in collecting and disseminating large sets of educational indicators (Education at a Glance) and in developing methodologies for measuring the volume of education output within the System of National Accounts (SNA) (Schreyer, 2010). What has been lacking is a common framework suitable for measuring human capital in its own right. Furthermore, even if such a framework were to be in place, work would be needed to identify the corresponding data requirements and the simplified assumptions required for making this accounting framework operational.

4. To initiate efforts along these lines, the OECD and the Fondazione Giovanni Agnelli organized a workshop on human capital measurement in Turin in 2008; at that meeting, a consensus was reached that measuring human capital through the lifetime income approach was the best practical option. As a follow-up to this workshop, a proposal to launch an “OECD human capital project” was endorsed by the OECD Committee on Statistics (CSTAT) in June 2009. This project took the form of an international consortium, with countries participating on a voluntary basis, aiming to agree on common methodologies and standards for measuring human capital for comparative analysis, both across countries and over time, and to implement these methodologies and standards by means of existing and constantly updated OECD data.

5. This paper summarises the outcomes from the first phase of the project and identifies possible directions for future research. It also shows the feasibility of measuring human capital by applying lifetime income approach and by using data already available within the OECD statistical system. In addition, it highlights the types of policy implications that can be drawn from analysis based on estimated human capital values.

## II. Measuring methodology

6. Economic measures of human capital can be based on either the value of the inputs that enter the production of human capital (cost-based approach) or the value of the output that stems from investment (income-based approach). Following discussion at the 2009 meeting of CSTAT and conclusions drawn from literature surveys (e.g. Liu and Greaker, 2009; Fraumeni, 2008, 2009), the (income-based) lifetime income approach was chosen as the preferred methodology for building monetary estimates of the stock of human capital in this project.

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<sup>1</sup> OECD (2001), *The Well-being of Nations*, OECD, Paris.

7. The lifetime income approach, advocated by Jorgenson and Fraumeni (1989, 1992a, 1992b), measures the human capital embodied in individuals as the total discounted present value of the future incomes that could be generated over the lifetime of individuals. This approach can be applied to construct a human capital account that could be used alongside the conventional physical capital account in the SNA. Within this account, the stock of human capital could be measured as the lifetime income both directly observed from market activities (i.e. the work sold on the labour market) and indirectly imputed from non-market activities (e.g. household production and leisure time); further, the change in the stock of human capital during each accounting period can be decomposed into investment, depreciation and revaluation.

8. The choice of lifetime income approach in the OECD project does not imply that this approach is immune from any criticisms and drawbacks (see below). But it reflects a shared consensus among many researchers in this field that it provides the only practical and feasible way to derive a monetary measure of human capital that is consistent with both economic theory and accounting standards (e.g. Abraham, 2010).

9. Standard investment theory underpins the measurement of both human and physical capital. As well known, a capital asset is one that can be used repeatedly or continuously in production over several accounting periods. The value of the productive services that the capital asset can generate during each accounting period is a flow concept, while the value of the asset itself is a stock concept.

10. Physical capital can usually be sold and bought in the market and therefore its price (stock value) can be directly observed; based on the observed stock value the corresponding service flow is derived indirectly. Conversely, human beings embodied with human capital cannot be sold and bought; as a result, the human capital stock value can hardly be observed. However, a long stream of economic theory has argued that labour compensation can be considered to be the service value of human capital, from which the human capital stock value can be derived. In other words, having a stock value and then deriving its service value (as in the case of physical capital) or having a service value and then computing its stock value (as in the case of human capital) are two sides of one coin. In principle, both accounting methods should be consistent with each other. But in practice, different assumptions made during accounting processes will definitely affect the quality of the final estimation results in different ways.

11. Due to a number of conceptual, methodological and data limitations, the current scope of the OECD human capital project has been restricted to measuring the personal economic benefits generated through market activities, where such economic benefits are measured by the market lifetime labour incomes that accrue to individuals as a result of their investment in human capital. This does not imply neglecting the wider range of benefits from human capital investment that accrue to the society at large (e.g. better parenting practices that will improve children outcomes, greater tolerance to diversity and participation in political life, which will improve the health of communities) nor other non-economic benefits that accrue to individuals (e.g. better life styles and longer life spans), but simply recognises that current valuation methodologies do not allow accounting for these other effects.

12. A further practical limitation for the measures presented here is that the estimation was limited to the population of working age (15 to 64). This implies neglecting both the human capital embodied in children below age 15 and the possibility that elderly people will extend the service life of their own skills and competences by participating longer in the paid labour market. As elderly people may continue to participate in the labour market beyond the age of 65, and will increasingly do so in the future as a result of pension reforms, this will imply that the estimates of the stock of human capital presented here are biased downwards.

13. Implementing the lifetime income approach requires three major steps. First, a database on individuals cross-classified by age/gender/education, including information on the number of people, their earnings, school enrolment rates, employment rates, and survival rates, is to be constructed. Secondly, the lifetime income for a representative individual in each classified category needs to be estimated; the fundamental assumption used here is that an individual of a given age/gender/education will have in year  $t+1$  the same labour income as that of a person who, in year  $t$ , is one year older but has otherwise the same characteristics. Thirdly, the lifetime income measures estimated are then applied to all individuals in each age/gender/education category. Summing up across all classified categories yields the estimate of the aggregate value of the human capital stock for each country.

14. The change of human capital value in a country may be driven by both the real (volume) changes of human capital and changes in price levels between two periods. Likewise, the difference of human capital value at one point in time between two countries may be due to both the real (volume) difference of human capital and the difference of the corresponding price levels in the two countries. To make more interesting comparisons either across countries or over time, we need to derive estimates of human capital volumes from the estimated human capital values.

15. To construct volume measures across countries (spatial volume index) at one point in time, the approach used here is to simply divide human capital value by the purchasing power parities (PPPs) for gross domestic product (GDP) of each country. To compute a volume index of human capital over time (temporal volume index), a Tornqvist index method was employed; in this approach, the growth rate of human capital volume is calculated as the weighted sum of the growth rates of the number of individuals across different categories of the population, using their shares of the nominal value of human capital as corresponding weights.

16. The Tornqvist method implies that the temporal human capital volume index will increase if the composition of population shifts towards people whose lifetime incomes are higher. This may occur, for example, when more people attend higher education (which is associated with higher lifetime income) or when younger people come into the working age population (because younger people have more remaining working years and so higher lifetime income). The growth rate of the volume of human capital per capita is computed as the difference between the growth rate of the human capital volume and that of the population.

17. To account for the contribution of different characteristics of the population (e.g. age, gender and education) to the real growth of human capital per capita, first-order partial indices for each characteristic were derived. For example, the first-order partial index corresponding to gender captures the shift in the distribution of the population between men and women alone, while ignoring other shifts among age, education within each gender category. Similarly, the first-order partial indices for age and education measure, respectively, the shift between age groups only and between educational levels only. The contribution of each characteristic to the growth of human capital per capita is defined as the difference between the growth of the first-order partial indices for each characteristic and the growth of the number of individuals in the population.

### **III. Database construction**

18. Although the lifetime income approach ideally requires information by single year of age, all data available within the OECD statistics system refer to (either 5- or 10-year) age groups. The Secretariat has relied on a number of practical assumptions and imputation

methods to generate data by single year of age. For each country, a database has been established, covering the five elements that enter the estimation of human capital based on the methodology described above, i.e. survival rates, educational attainment, employment rates, school enrolment rates and annual earnings.

#### **IV. Empirical results**

19. Due to data limitation, estimates of human capital value have been computed only for fifteen countries for the observed years for which data are available. The observed years for the majority of countries are typically from around 1997 to around 2007. For other countries, some data within this time span may be missing, or they may refer to a shorter period. For country comparisons, the year 2006 was chosen as a benchmark since estimates were available for most countries.

20. Country estimates of the stock of human capital are based on a common assumption for the discount rate (set at 4.58% per year, the value used by Jorgensen and Fraumeni in their seminal paper) and on country-specific projections of their average annual earnings growth rate (based on the national account measures of ‘wages and salaries per employee’); these projections were taken from the OECD Medium-term Baseline, which is prepared by the OECD Economics Directorate as the baseline scenario used for estimating the effects of various policy reforms within the OECD.

21. Most of the OECD estimates are in line with those reported in a number of national studies. The estimated ratios of total human capital to nominal GDP range from 8.3 in the Netherlands to 16.3 in Korea, with an average value of around 10.6. Cross-country differences are much smaller when ignoring the four countries at both ends of the distribution (the Netherlands and Italy, at the lower end; Poland and Korea, at the higher end). These estimated stocks of human capital are significantly higher than measures of conventional physical capital, i.e. between 3.6 times higher in Italy and the Netherlands, and 7.0 times higher in the United Kingdom, with a mean value of about 4.7.

22. The distribution of human capital across different groups of people within each country provides some useful information for addressing issues related to inequality, poverty and social cohesion. Although men and women account for similar shares of the population in all the countries considered, men account for more than 60% of the total human capital stock in almost all countries (with the exceptions of Romania and Poland, where men account for less than 60% but are still dominant), with this share increasing to around 70% or more in Korea, Italy and the Netherlands. The gender gap in the distribution of human capital reflects a combination of lower labour force participation, lower employment rate and lower pay for women than men in all countries. As women usually do more households’ housework than men, these gender differences would be lower if estimates were extended to incorporate non-market activities.

23. In general, the higher the educational attainment of each person is, the higher will be their earnings and probability of having a job, and thus, their measured human capital. However, because returns to higher education vary across countries, human capital distribution by education varies as well. For instance, compared with other countries, the marginal returns of pursuing higher education in Denmark and New Zealand are relatively low, while in Italy and Spain they are relatively high. In theory, higher marginal returns from taking higher education are desirable since they provide good incentives for people to augment their investments in human capital.

24. Finally, the younger the people are the more human capital they will have. The reason is that younger people have a longer remaining lifetime than their older counterparts; this effect more than offsets their lower annual income compared to seniors, leading to

larger embodied human capital. One of the policy implications from this observation is that reducing youth unemployment rates is vital to increase a country's human capital stock.

25. Estimates of real human capital per capita (in PPP terms) ranged between 79,000 United States dollars (USD) in Romania and 641,000 USD in the United States in 2006. Excluding countries at the two ends of the distribution (Romania and Poland, at the lower end, and Norway and the United States, at the higher end), differences in human capital per capita are relatively small. Broadly speaking, countries with higher GDP per capita also have higher human capital per capita, but there are exceptions. For example, despite relatively high GDP per capita in Italy and the Netherlands, their human capital per capita is low compared to other countries. On the contrary, Korea combines lower GDP per capita and higher human capital per capita than most other countries.

26. By taking as reference the value of human capital per capita in the United States, we can also construct country human capital spatial volume indices for 2006. These demonstrate that, when setting the value observed for the United States equal to 100, the index is 12.3 for Romania, 38.4 for Poland and over 60 for other countries, i.e. human capital per capita is larger in the United States than in any other participating countries.

27. Information on how human capital evolves in a country is of critical importance for policy decisions. In particular, from the perspective of sustainability, a necessary condition for a country to grow along a sustainable path is that its total capital stock in per capita terms should not decline over time.<sup>2</sup> Though the observation of declining human capital per capita does not necessarily imply that the growth path for the country in question is "unsustainable" (since the decline in human capital per capita could be offset by raising per capita stocks of other types of capital), nonetheless this trend may warrant policy attention.

28. Compared with the starting year, the total stock of human capital in real terms increased for all countries, in spite of some ups and downs for a few countries during the observation period. The rate of human capital growth, however, varied significantly across the countries. Roughly speaking, three types of patterns in the growth of human capital per capita are evident: increasing (in Italy, Poland, Spain and the United Kingdom); roughly stable (in Australia, Canada, France and New Zealand); and decreasing (in Israel, Korea, Norway and the United States).

29. To explore why human capital per capita increased in some countries while it declined in others, partial volume indices were constructed, highlighting the relative importance played by changes in the population by age, gender and education in each country. In general, the results indicate that during the period shifts in the population composition between men and women had little effect on the change of human capital per capita. Also, the contribution of educational attainment was positive while that from the age-structure was negative in all countries. The former effect reflects the rising share of the population with higher educational attainment; while the latter signals that all countries were experiencing ageing population.

30. The magnitude of these two opposite effects varied across countries. In Italy, Poland, Spain and the United Kingdom, the positive contribution from higher educational attainment exceeded the negative effect of population ageing, while the opposite was true in Israel, Korea, Norway and the United States. One obvious implication that can be drawn from this analysis is that some countries are not investing enough into higher education so as to offset the negative effect of population ageing.

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<sup>2</sup> UNECE (2009), *Measuring Sustainable Development*, Geneva.

31. The estimates of human capital value in this project are subject to a number of assumptions, in particular in terms of the choice about two key exogenous parameters, i.e., the annual growth rate for real earnings and the discount rate. Sensitivity analysis shows that estimates of the value of human capital are sensitive to the choice of these two parameters but also that, within countries, the distribution of human capital and the trend of human capital volume index are less sensitive.

## **V. Concluding remarks**

32. The OECD human capital project is one of the first attempts to measure human capital for both international and inter-temporal comparisons. While estimates are currently limited to countries that decided to participate in this project, these results show the feasibility of applying the lifetime income approach more broadly. They also highlight the feasibility of applying the methodology to the categorical data that are typically available within the OECD statistics system.

33. Human capital accounting is of crucial importance for policy making. Despite some deficiencies (such as exclusion of non-economic and social benefits of human capital investment, sensitivity to key exogenous parameters), the lifetime income approach, by bringing together the influence of a broad range of factors (demography, mortality, educational attainment and labour market aspects), allows comparing the relative importance of these factors and drawing useful policy implications from the estimates.

34. Even when restricted to market activities, these results indicate that human capital is significantly larger than traditional physical capital. Information on human capital distribution among different groups of population can also be used to address issues like inequality, social inclusion and quality of life. In addition, analysis on the evolution of human capital over time could help address issues of longer term sustainability. Finally, human capital accounting may improve the analysis of different economic aggregates in the SNA, for instance, by improving measures of the output from the education sector, by developing (non-market) accounts for household production and education, and by using measures of quality-adjusted labour inputs in productivity analysis.

35. In the future, further work could be done to enhance the quality of current estimates, to identify the links with other elements (such as physical capital account) in the SNA, and to investigate possibilities for incorporating in these monetary estimates information on the competencies of the adults population as measured through the OECD Programme for International Assessment of Adult Competencies (PIAAC).

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