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**Measuring human capital**

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#### **Note by the World Bank**

##### *Summary*

The paper gives an overview of the use of human capital in the International Comparison Program and the related problems. It is a challenge to obtain a good measure of human capital services in the many diverse countries covered by the Program. Suggestions for methods and approaches to model the role of human capital in the production of non-market services would be very useful.

## I. Human capital use in the International Comparison Program

1. Since its initial benchmark comparison in 1970 the International Comparison Program (ICP) has used measures of human capital as part of their program to compare volumes of real output for about 150 headings of expenditure on Gross Domestic Product (GDP). The benchmark ICP for 2005 included 146 economies that are very diverse, ranging from very low to high incomes. The ongoing 2011 ICP will be even larger with as many as 198 economies. The main application of human capital arises in comparing the real volume of non-priced services, most importantly education, some parts of health expenditures and general government expenditures (excluding publicly provided individual education and health services consumed by households). Because these services are not bought and sold in a market context, it is not possible to obtain the volume of services by dividing expenditures by prices, the approach used by the ICP for most of GDP.

2. Whenever possible the general approach of the ICP is to obtain direct volume estimates for non-market services by approximating output. In the context of education this might be the number of students attending per year adjusted for quality when possible. For example, the European Union (EU)-Organisation for Economic Co-operation and Development (OECD) will use the Programme for International Student Assessment (PISA) in the 2011 ICP scores as one measure of quality for comparing numbers of primary and secondary students. However, expenditures per student rise from primary to tertiary education much faster for low-income economies, so this also needs to be taken into account. In some previous ICP benchmarks an important input, number of teachers by education level was taken as proxy for output.

3. Direct volume measures for the major health expenditure heading of hospital care have also been used. However, a common measure, bed-days, varies in quality and characteristics within and even more so between economies. At this time it seems unlikely that direct volume measures will be developed in time for the 2011 ICP. The same is true for general government expenditures where measures of output are particularly difficult.

4. The above sets the context in which the ICP does use human capital concepts. Where output is not market priced, one way to derive volume comparisons is to approximate purchasing power parities (PPPs) for the inputs of labor. The indirect volume is then derived by dividing expenditures on labor by the salary PPPs, combining comparisons of compensation for different skill and occupational employment classifications based on international standard definitions. In other words these salary comparisons are taken as the equivalent of PPPs. The expenditures on compensation are then divided by the PPPs to provide indirect volume comparisons of non-market services. This approach has been used by the EU-OECD economies and other regions in the ICP 2005 benchmark and in earlier benchmarks too.

5. However, even for some of the economies recently associated with the EU-OECD as well as economies in other regions, this method can produce improbable volumes for low salary such as in Tajikistan, Yemen or Cambodia. The reason for this is in part because salaries are lower in lower-income economies because personnel are accompanied by less capital and are therefore producing less output than in higher-income economies. Lower productivity also results because there is little pressure on supervisors to use staff efficiently when their salaries are so low and the value of their output is so hard to measure, the case in government and education especially. This problem was recognized early on in ICP work when there were fewer economies but it became even more evident in the 2005 ICP when the range of salaries across the 146 economies was much larger. So the context

in which the ICP has been most concerned with human capital is how in combination with other inputs it affects the productivity of labor in producing non-market services.

6. It should be made clear that the problem for the ICP is not qualitatively different from the issues facing national accounts statisticians in producing constant price estimates of production for these same non-market expenditures. For example, what indicator should be used to estimate real volume changes in education over time? If number of students is chosen as the indicator of real education output then some assumption must be made about quality changes. If inputs like teachers are used to approximate real volume changes in education, then some assumption must be made about productivity of teachers over time.

## **II. Problems in measuring human capital in the International Comparison Program**

7. The analytic framework for use of human capital is some form of the production function. A Cobb-Douglas production function is most frequently used in the ICP because of the problems of obtaining necessary data for all participating economies. The purpose of estimating a production function for say hospital services is to adjust salary based PPPs or price level (PPP/Exchange Rate) on the productivity of those workers. For example, suppose compensation of nurses in Cambodia when converted to Euros at exchange rates is 1% of nurses in Germany. If a simple price level based on salaries is used to convert Cambodian hospital expenditures in Euros the derived quantity will most likely show much larger hospital services per capita in Cambodia than in Germany. This is the result of the assumption that the productivity of comparably classified nurses in the two economies is equal.

8. In the 2005 ICP the equal productivity assumption was not made in Africa, Western Asia or Asia and the Pacific. Rather than use compensation comparisons directly to convert expenditures to comparable volumes, an estimate was made of productivity per worker based on capital per worker. These estimates were used to substantially raise the raw compensation based PPPs for economies with lower estimated output per worker like Cambodia. For example, in the above illustration, the price level of nurses in Cambodia might be closer to 30% that of Germany, substantially reducing the estimate of hospital services per capita.

9. To make appropriate productivity adjustments one would ideally use the flow of services from human capital for various labor skill levels and the flow of services from physical capital that accompany this labor in the hospital production relationship. Further, these inputs need to be separately available for education, health and government services. Very few economies are able to supply such detail so second and third best solutions become the only feasible alternatives for the ICP. A number of economies with developed statistical systems can provide physical capital separately for hospitals, school facilities and general government. However, many economies are not able to supply such detailed information and in ICP 2005, for example, it was necessary to use estimates of physical capital per person that applied to the whole economy. Further, even data on capital per worker were not available for a number of economies in the 2005 ICP. Consequently it was necessary to make assumptions for these economies based upon economies in the same region with similar economic levels and structures. If it had been known at the data collection stage of 2005 ICP that productivity adjustments would be made, more detailed data could have been obtained from the economies.

10. Assuming that it will be possible to obtain more detailed physical capital measures for the 2011 ICP, there remains the need to obtain a good measure of human capital services to enter into the production relationship. Preliminary work has suggested that

educational stock information is too gross to produce a satisfactory estimate. However, this experiment was done at the total economy level, whereas it should be done separately for the concerned expenditure headings for non-market services. It is hoped that this session on Human Capital can offer some guidance to ICP 2011 on feasible approaches to obtaining detailed service flows of human capital.

11. It is important that the ICP obtain data for a substantial range of economies by region and by economic level and structure but it is not necessary to cover all 198 economies for 2011. The ICP for 2011 will include seven regions that make their own regional comparisons. The Global Office at the World Bank will link the comparisons and this is where making adjustments for productivity per worker are important for putting the regional results on a comparable basis. For this reason the ICP needs to have a measure of human capital by education and/or skills for hospital personnel, teaching staff at various levels, and government.

### **III. Conclusion**

12. The flow of services from human capital is used to obtain productivity estimates from a production function that also includes physical capital. The Seminar would contribute greatly to the 2011 ICP by suggesting methods that might estimate differences in labor productivity across economies and/or alternative approaches to modeling the role of human capital in the production of non-market services. The planned completion of ICP 2011 is late 2012 or early 2013 so implementation and estimation for the non-market expenditure headings will not take place until 2012. In the meantime the Global Office would greatly appreciate any comments on or suggestions for improving the methods discussed in this paper.

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