Skills measurement and economic analysis: 
an introduction

1. The imperative of measurement

The importance of skill in modern economics and in economic policy discourse is widely acknowledged. Changing skills occupy a key role in proposed explanations of both economic growth (especially those informed by endogenous growth models) and the changing distribution of wages observed in many industrialised countries in recent decades. Technological and organisational changes in the workplace are argued to be generating increased demands for higher level skills and for particular skills in the areas of IT, problem solving, and communication. Raising the skills of national workforces through education and training has thus become a primary objective of economic policies aimed at developing national competitiveness.

However, in relation to this far-reaching theoretical and practical importance, economic science is hampered by the fact that procedures for the empirical measurement of skills are comparatively under-developed. The unit of measurement most commonly called upon is some indicator of educational attainment. Human capital models then search for the relationship between this indicator and economic performance, but for several reasons, this link is far from automatic. First, equal investments in education can lead to different quantities of skills or to skills that differ in their market value. Second, due to mismatch the labour market does not always fully utilise the available skill. Third, education might be used by the labour market as a signal of ability rather than as a source of skills supply. Fourth, the acquisition—but also the depreciation—of skills continues after school. Learning at work, and not just through formal training, is widely recognised as important both for the acquisition of less easily codified skills and for keeping up with technical and organisational change. All these aspects complicate the relationship between education and economic performance. To grasp the relevance of skill for productivity and economic growth, measuring it just with education indicators will not be sufficient. Add to this the serious problems of internationally comparable measures of education attainment and it becomes apparent why there remain substantial gaps in our knowledge of the empirical relationships between skills and economic performance.

If we are to improve our insights in this area, further development of skills measures seems to be a conditio sine qua non. In the belief that accurate measurement, properly informed by theory, is the key to better understanding in any science, in March 2000 an international conference was held in the University
of Kent at Canterbury to discuss these issues. The prime aim of the conference was to evaluate and illustrate emerging methodologies of skill measurement for purposes of economic analysis. We looked beyond the borders of economics, in the expectation that other social sciences would add interesting dimensions to the debate about the measurement of skills and about the relationship between skills and productivity. This special issue of *Oxford Economic Papers* publishes revised versions of some of the papers presented at the conference.

In organising the conference we hoped to make advances on several related fronts. We wished to consider what we mean by ‘skill’ and how well the meaning is matched by methods of measurement. A significant change in the meaning of skills has been a tendency to widen the use of the term even to include personal attributes, which once would not have been thought of in this manner (Payne, 2000). A generation ago the ‘unskilled’ manual worker might have needed to possess strength, stamina, and fortitude. These attributes were not described as skills. Today the junior salesperson or call centre employee needs a different set of attributes—for example those necessary to communicate effectively with customers and to work well in a team. These are now described as skills and are embedded in many governments’ definitions of ‘core’ skills. What is in a word? Nomenclature matters little if everyone agrees what is meant. But this particular development is capable of causing serious confusion, not least because it implies that the rhetoric of policy (the high skills vision, the knowledge economy) could turn out to mean very different things to different people.

### 2. Problems in measuring skills

The widening of the term makes measurement simultaneously more important and more difficult, because of the requirement for more disaggregated measures by type or category of skill. Once we go beyond indicators of educational experience, the under-developed state of skills research becomes apparent in the variety of ad hoc measures that are used in empirical studies. The choice of measure is in practice often made on grounds of data availability rather than theoretical relevance and research design. Thus, workers’ skills are measured variously by qualifications held, by education, training and work experience, through uniform tests, by occupational title, through case studies using sociological or ethnographic methods, through job analyses and ‘expert systems’ such as ONET or by wages (Ashton and Green, 1996). Studies which utilise more than one method of measuring skills do not always find that the conclusions are robust to different measurement methods, and some studies have indicated that measurement error
can lead to strikingly different conclusions regarding key empirical issues (e.g. Leuven et al., 1998; Krueger and Lindahl, 1998). Equally worrying is the perception that many of these methods carry serious conceptual limitations. Consider, here, just these few.

Using qualifications achieved as a measure of required workforce skills is limited by potential mismatch of qualifications with jobs (especially 'over-education') and the strong possibility of credentialism, whereby qualifications demanded by employers become imperfect indicators of job skill requirements (Robinson and Manacorda, 1997, Borghans and De Grip, 2000a,b). Moreover, international comparisons are often hampered by doubts over the comparability of qualification standards. Using work experience as a measure of human capital is also conventional, but time served is an even more noisy indicator of skills acquired because there is a vast variation in the quality of work experience. Occupational category offers some possibilities as an indicator of skill; yet even here changes in occupational structures do not capture transformations of jobs within existing definitions (Green et al., 2001).

The issue of mismatch between worker and job also bedevils skills measures that are based solely on job descriptions. Indicators drawn from job analyses may be imperfect measures of the skills possessed by job-holders. Whether it is best to measure skills via the person or the job ought to depend on the purposes of any specific analysis, but practice has tended to be influenced mainly by tradition. Whilst human capital theory was developed by academic researchers and stressed the individual’s capabilities, typologies of skill have largely been the preserve of practitioners and have been concerned primarily with the requirements of the job. Yet the distinct implications have now entered the discourse of economics. For example, analyses of the link between computers and wages (Krueger, 1993) might be criticised not only for their possible misspecifications of the relationship (Dinardo and Pischke, 1997; Entorf and Kramarz, 1997) but also for their possibly unwarranted assumptions about the match between computer usage and computer skills (Borghans and Ter Weel, 2000).

In short, we think that the methodological issues deserve special attention. Not only is reliable and valid measurement a cornerstone of good science, the development of an informed empirical understanding of skills, suitably conceptualised, could be an immensely powerful aide to improved policy-making in this field. If, in addition, we find that the understanding of major issues, such as the origins of greater inequality in our societies, turns on the adequacy of available skills measures, the need to make progress in this field is the more evident.

3. Recent developments

The papers in this issue build on some interesting recent developments in the measurement of skills for studying economic performance. First, Andy Green and Hilary Steedman (1997) and others have been further developing methodologies for international comparisons of qualifications and through them work-
force skills. This concern with international comparisons grew out of the earlier work of the National Institute of Economic Research, focussing on skills and productivity (e.g. Prais, 1987). Their approach could usefully be applied to a wider range of countries. Second, there are some promising developments in the collection of data. The OECD and Statistics Canada (1995, 1997) made a major contribution to our understanding of the role of skills with the International Adult Literacy Survey (IALS), measuring three different literacy skills covering a broad range of skill levels. IALS data are used in several papers in this special issue. Ashton et al. (1999) have been developing job analysis methods for measuring skills by adapting the procedures of occupational psychologists and applying them in a survey context. Previous US work in this spirit has drawn on secondary analysis of existing commercial job analyses (Cappelli, 1993) and information about skills contained in the occupational description of the dictionary of occupational titles (Autor et al., 200). Third, there is increasing use by economists of standardised tests for purposes of making empirical inferences about the changing skills market and about diverging growth paths (Murnane et al, 1995). In an international context, standardised tests of both literacy and numeracy are already starting to be utilised for purposes of comparing international economic outcomes (Hanushek and Kimko, 2000). Fourth, cross-national estimates of educational attainment in the workforce have been developed and used to test propositions in the economic growth literature (Gemmell, 1996; Barro and Lee, 1996a, 1996b; Krueger and Lindahl, 1998).

4. The papers in this issue

The first paper in this issue directly addresses the widening of the meaning of skill. Cathleen Stasz compares the dominant economic perspective with a socio-cultural one. She uses a fourfold typology of skill: academic or cognitive; generic; technical; ‘work-related attitudes’ or soft skills. Academic skills are associated with specific subject areas and are usually acquired through formal education. Generic skills include things like problem solving, communication and team working. Tests of such abilities exist but are not widely used. Technical skills are ones that are used in a particular occupation or job and may include academic skills. Soft skills are hard to define and therefore least easily measured. Stasz argues that there appears to be a new intensity of demand for soft and generic skills, thus raising the question of how such skills are to be improved. In contrast to the economic perspective, the socio-cultural approach ‘shifts the focus of inquiry from individuals to interactive systems or social settings that are larger than the behaviour and cognitive processes of a single person. The social setting in which cognitive activity takes place is an integral part of that activity and not just the surrounding context for it’. Which approach is taken has a strong bearing on the degree to which skills are regarded as transferable, with the economic approach leading often to an over-presumption of transferability from school to workplace or from firm to firm. Stasz adds that ‘formal knowledge may play only a small portion of what enables workers in
many fields to successfully confront the ambiguities of practice’. It would be absurd to argue that academic skills were unimportant in the hiring decision, but the economic approach has tended to emphasise these at the expense of soft and generic skills which ‘have not yet found their way into quantitative research on labor market performance’. Not least this is because adequate measures of such skills are still in their infancy. The sociocultural approach is often able to get a much richer assessment of skill requirements at any given workplace. Unfortunately, however, it is in the nature of the ethnographic, case study approach involved in this sort of work that generalisations are at worst impossible and at best limited.

Meanwhile economists have started to consider more seriously methods of measurement, which can encompass the broader range of skills. This is being done through more sophisticated employee and employer surveys. In the UK the Skills Survey, whose data are used by Francis Green, David Ashton, and Alan Felstead in their article in this issue, is one example of this approach. Such surveys have to tackle a number of inherent difficulties, including the need to distinguish between the skills the respondent possesses and the skills needed in the job he or she does. The questions asked of respondents need to be embedded in their work situations. The use of job analysis may help, as may the keeping of detailed logs of what people actually do. One underlying principle of the Skills Survey was to ask respondents detailed questions about what they actually do. Green et al. argue that this gives more reliable information on skills than asking the same individuals what their skills actually are, though they accept that the measures will be affected by any under-utilisation. Particularly when the utilisation of skills is strongly correlated with income or occupation, biases might result. Green et al. consider the core skills of problem solving, team working, professional communication and computing. They are especially concerned with the relative contributions of formal education and work based learning in the acquisition of such skills. They find that formal schooling, off-the-job training, on-the-job training and work experience all have roles to play. Also important is the influence of ‘some new or flexible organisation characteristics’.

Another important data source on the role of skills in the labour market is the recent survey of graduates from higher education in 11 countries in Europe and Japan—CHEERS. Jim Allen and Rolf Van der Velden use the data on Dutch graduates to disentangle the roles of formal qualifications and the actual skills workers possess for their labour market position. They take the view that it is extremely difficult to measure absolute levels of skills by self assessment, since the respondents lack a clear description of the base line in the scale. Allen and Van der Velden, therefore, propose questions in which the graduates have to compare the skills they possess with the skills that are used or could be used in their job. They find that indeed educational mismatch (representing the use of formal qualifications) might differ strongly from skills mismatch (which relates to the skills actually used). Educational mismatch has a large impact on wages.
Underutilisation of skills has only a minor influence on wages. Skill mismatch, in contrast with educational mismatch, explains differences in job satisfaction and the quit intentions of graduates.

Steven McIntosh and Anna Vignoles discuss two important basic skills—literacy and numeracy. They use information from the National Child Development Survey and the IALS to derive measures of investment in both, and in terms of labour market outcomes find a significant positive return. Both data sources provide information from objective tests taken by the respondents. Such test results provide interesting opportunities to overcome measurement problems with self-assessment and job analyses. Especially for international comparison this objectivity has major advantages. One disadvantage is that these tests are costly and time consuming. Another limitation is that the putative objectivity has required in practice a separation from the workplace. This implies that data of this kind have had to focus on academic skills like reading and mathematics and have not been able to measure competences in the workplace.2

As an alternative one could consider the use of opinions of well-informed neutral observers as a source to measure skills. The background to the article by K.C. O'Shaughnessy, David Levine, and Peter Cappelli is the increase in earnings inequality experienced in the United States in the last 20 years. They concentrate on the argument that in large part this is explained by changes in the relative demand for different types of labour, which increased the returns to skill. Their data encompass over 50,000 managerial jobs in 39 companies for each of two years—1986 and 1992. The data were collected by Hay Associates, ‘the world's largest compensation consultant’. O'Shaughnessy et al. compile an index of Hay points that 'is designed to measure the extent of job requirements that workers must perform'. It is a combination of 'three groups of capabilities'—know-how; problem solving; accountability. 'Know-how' measures 'the capabilities, knowledge and techniques needed to do the job'. The score on problem solving increases 'the less well-defined and predictable job tasks are'. Accountability relates to the autonomy or individual discretion possessed. This data set allows the authors to explore wage inequality across and within firms. Unsurprisingly their skills index is a powerful predictor of wage differences within firms. However, it is less good at explaining pay differences between firms. Virtually all of the increase in inequality within firms is explained by ‘rising returns to Hay points’. This represents a more powerful role for skill than is usually found by researchers. Virtually none of the rise in inequality between firms is accounted for by the Hay points.

Peter Elias and Abigail McKnight discuss the use of occupation as a proxy for skill. In particular they consider the UK's SOC 90 occupational classification and the International Standard Classification of Occupations (ISOC-88). Both are based

2 At the time of writing the OECD is planning a survey of 'life skills' in which not only literacy, but also numeracy, computer skills, problem-solving skills and team-working skills will be measured by a battery of test questions.
'on two main concepts; the concept of the kind of work performed or job and the concept of skill’, where the latter is defined as the ‘the ability to carry out the tasks and duties of a job in a competent manner’. Two dimensions of skill are used: skill level—this denotes the ‘complexity of the tasks and duties to be performed’; skill specialisation—‘the field of knowledge required for competent conduct of the set of tasks’. They argue that at broad levels of aggregation, where ‘perhaps only three or four categories of skill may be defined’, the development of ISOC-88 has done much to facilitate comparisons between countries. However, at lower levels of aggregation, much greater caution needs to be exercised, in large part because of the difficulty national statistical offices have in imposing consistent coding procedures. These difficulties are starkly illustrated for the UK by the changes occurring between SOC90 and SOC2000. In the latter many managerial occupations formerly classified as high skill are demoted. Nevertheless there remains a significant discrepancy between the UK and other EU countries, with the UK apparently and implausibly possessing many more managerial skills than the rest of Europe. This serves to warn us of the need for sensitivity even when making broad comparisons of skill on the basis of occupational data.

Measurement problems are challenging enough for the analysis of any single country. How much more so when international comparisons are required, as they often are in this particular area of research. Robert Barro and Jong-Wha Lee construct probably the most extensive comparative data set to date. To achieve such breadth of coverage the unit indicator of skill which they deploy is years of educational attainment. They argue that early work on educational attainment too often used school enrolment rates or literacy rates and that such proxies ‘do not adequately measure the aggregate stock of human capital available’. Their article builds on their earlier work, extends the time period covered to 1995 and provides projections for 2000. Their calculations are based on the ‘percentage of the population who have successfully completed a given level of schooling’ adjusted by the ‘typical duration of each level of schooling within countries’. Barro and Lee present a complete data set for 107 countries from 1960 to 2000. The authors concede several shortcomings prominent among which are no allowance for ‘skills and experience’ acquired after formal schooling and no allowance for the different quality of education across countries. To the latter they might have added variations in quality across time within any country. Barro and Lee compare their data with those obtained from a variety of other sources: international test scores by students; the international adult literacy test; estimates of the market value of human capital; OECD estimates of educational attainment.

Whether international comparisons of educational attainment convey valid and reliable indications of international skill differences is addressed in a paper by Hilary Steedman and Steven McIntosh. They are concerned to find suitable comparative data on low skilled workers. The International Standard Classification of Education (ISCED) is regarded as the standard for comparison. The authors argue, however, that ISCED needs to be used with some care. The issue is explored with
reference to six EU countries. The ISCED group 0/1 was found to contain very few people in some countries. Therefore the group 0/1/2 (lower secondary education completed or lower qualifications) was found to be the most suitable measure. But the correspondence between this measure and scores from International Adult Literacy Survey was not high, whilst there are some doubts about the consistency of standards across countries at these low ISCED levels.

Richard Freeman and Ronald Schettkat start from the proposition that Germany’s wage structure is ‘more compressed’ than that of the United States. They consider whether this might explain why unemployment is higher in Germany. They argue that before this can be tested one has to adjust for the fact that there is a ‘narrower distribution of skills’ in Germany, concluding that even after such an adjustment is made the German wage distribution is still narrower than in the US. Germans who do not have jobs have ‘nearly the same skills’ as those who are employed in Germany and more than jobless Americans. Indeed the German jobless have skills close to the American average. Noting that the commonly used years of schooling are a poor variable for capturing skills differences because schooling systems differ so much across countries, they devise ‘equivalence classes between US and German schooling’, using data on years of schooling and on numeracy skills as derived from the International Adult Literacy Survey. Employing this data they cast severe doubt on the view that German employment would increase if the dispersion of pay increased. From the standpoint of skills measurement the important point is that such conclusions would be entirely missed if the conventional comparison of ‘nominal’ years of schooling were used. On this measure Germany would appear less skilled than the United States. The articles serve to demonstrate how critically sensitive results can be to the measures of skill used.

5. Conclusion

The papers in this issue show that although adequate measurement of skills faces substantial problems, there are promising developments that enable researchers to improve their understanding of the role of skills on the labour market. It is an aspiration that this publication will stimulate a dialogue across, as well as within, disciplines. We also hope to make it difficult for economists in future to use skill measures in an uncritical fashion, and to encourage awareness that skill is a problematic, if vital, concept. In principle, several of the measures described in this issue could be applied to improve data collection and analysis. More research involving thorough testing of the different ways to measure skills, and the explanation of the advantages and disadvantages of each approach, as well as the development of new skill measures, are likely to be needed to support future research.

References


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