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2. Measures of Mental Ability and Educational Attainment

To measure mental ability it is necessary to know what is being measured and to define a set of units to differentiate between people. Following the approach of psychologists, we conceive of mental ability in terms of the capacity to retain ideas and comprehend and solve abstract problems. While there is no perfect empirical counterpart to this theoretical definition, there are several measures on which differential performance is partly determined by the theoretical construct. The more that differences on the measure are determined by mental ability, the more appropriate is the measure as a proxy.

The two most obvious measures, which should be related to mental ability, are rank in high school class and scores on a standardized set of tests. Although both measures are related to mental ability, one may be a better proxy than the other.

Standardized tests can be divided into IQ and aptitude (achievement) tests. In principle, aptitude tests measure the amount of knowledge or skill acquired (primarily in school) in particular subjects. IQ tests are thought of as measuring general inborn ability, which does not depend upon previous schooling (or the factors noted above). However, a substantial body of evidence suggests that most IQ tests depend, among other things, on years of schooling, quality of schooling, and cultural background.[1] Thus, the difference between IQ and aptitude tests is more a matter of degree than of kind, and we will intermix information from both types of tests as long as the data can be converted to a common scale.

Consider also the differences between test scores and rank in class. One major difficulty of rank-in-class data is that they are computed on the basis of students in a given grade in a single high school, when in fact different schools in the same city often have different quality students, and differences in quality generally exist also between urban and rural schools. Therefore, unless information on the quality of the

[1] See for example Learned and Wood (1938).

students is available, it may be misleading to equate the ability of individuals who have the same rank in different schools. On the other hand, the same test may be used in all schools in a system, or, at a minimum, test scores can be standardized over a population. In either case students from various schools can be compared.

Another reason why rank in class can be a very poor proxy of mental ability is that rank may be determined much more by such things as docility in class, memorization, and grades in nonacademic courses. These factors may explain the well-known phenomenon that a disproportionately large percentage of girls are in the higher ranks in class in high school.

An individual's rank in class may, on the other hand, be more dependent on such things as drive and motivation, and these characteristics may be crucial for future academic and career success.[2] Thus some studies, such as Berdie and Hood (1963), have found rank in class slightly more important than IQ or aptitude tests in determining which students enter college. However, contrary evidence exists in Folger and Nam (1967).

Although most studies find that knowledge of both IQ and rank in class significantly improves the prediction of college attendance, we rely on test scores because of the problem of standardization. In order to facilitate a comparison of results from different samples, we converted the ability measures to the same units for all samples. This not only enables us to compare results, but also to combine small samples for estimation purposes, as discussed in detail below. The standardization method that we used was to convert the IQ measure for each sample into percentile terms, with the "norm" being the population of high school graduates. Since most of the samples involve statewide tests of graduating seniors (e.g., Minnesota, Kansas, Iowa), standardization simply consists of transforming the raw IQ measure into within-sample percentile terms. This treatment assumes that the distribution by ability of high school graduates is the same in all states. However, even if the

[2]Of course, genetic influences, pre- and postnatal diet, home and school atmosphere, personal motivation, and drive can all affect an individual's intellectual performance as measured by IQ tests or rank in class. To the extent that all the factors that affect class rank or IQ scores are also relevant in determining income, or in determining which are the talented students currently available for college training, then our mental ability index is appropriate in measuring the return to education. Our analysis, of course, is not suitable for determining such magnitudes as the loss of talent that would not have occurred if all children and expectant mothers had had adequate diets.

sample distribution for a state differs from the national norm, the effect will probably be small provided ability is used as the dependent variable.[3]

The main advantage of this conversion method is that it avoids the problem of using conversion tables to compare various raw IQ scores. Such tables contain only the major IQ measures and in many cases appear to be based on small samples. Another advantage of our method is that it permits use of results provided by other investigators in which data are presented only in percentile form. For samples that clearly are not representative of the high school graduate population, we converted the data in a more complicated way.

We assume that the different tests and testing procedures yield data that are comparable. This requires that the rankings of individuals be the same if given the same test at different times or different tests at the same time. Various studies have indicated high reliability (of most tests) for individuals. Even greater reliability should be expected when broad groupings are used; hence, there should be little difficulty in combining the samples. In order to compare and combine samples from different time periods, we make the additional assumption that the average ability level of high school graduates has remained approximately constant over time. Support for this hypothesis is contained in Berdie, et al. (1962), which traces the average ability level of high school graduates in Minnesota from 1928 to 1960, and in which there appears to be no trend in the average ability level as measured by the ACE examination. Further supporting evidence is available in Finch (1946).

We are primarily interested in analyzing post-high school educational attainment. For this purpose it is useful to distinguish two stages in the educational process: entrance into college and length of stay in college. Our analysis is concerned with the former aspect, since the necessary data are more readily available. The basic education measure that we use in analyzing the relation between college entrance and ability is the percentage of high school graduates who enter college.

In this study we do not analyze vocational education because there are virtually no data of the form we need. This suggests that the results of our analysis require careful interpretation. For example, in discussing the loss of talent that results when high-ability students do not attend college, it would be important to know how many of these attended vocational school and if the rate of return to such education was high.

[3]This follows because according to the standard results in errors-in-variable problems, if there is an additive measurement error in the dependent variable that is not correlated with the independent variable, we will obtain an unbiased estimate of the slope coefficient. Because of the conversion method used, there is no clear reason for not expecting the measurement errors to meet the above conditions.

Such considerations are particularly relevant in view of the long time period under study and the accompanying changes in emphasis on vocational training. In the 1930s, for example, there was a strong emphasis on this type of education (Anderson and Berning, 1950), although we suspect that in more recent years many equivalent programs have been given by colleges, junior colleges, and community colleges.