ABILITY AND AGE-INCOME PROFILES

BY JOOP HARTOG

Institute for Economic Research, Erasmus University, Rotterdam

This paper is devoted to the personal distribution of income. The focus is on the relation between individual age and income and on the observed regularities in these age–income profiles. Empirically, age–income profiles show marked differences by occupation and by education. In general, with increasing levels of education both the level and the slope of the age–income profile increase; there is also a tendency of the variance of income to increase with age. Explanations of these facts are discussed. The human capital model is found defective in two ways: direct measurement of capital formation that occurs through on-the-job training is not feasible and the demand side of the labor market is ignored. Lydall's approach stressing the role of ability development is considered promising, yet lacking a theoretic integration of the relevant factors. The relation between education and ability is also reviewed. It is concluded that IQ is an important variable associated with educational attainment, but that its explanatory power with respect to earnings in addition to length of schooling is almost negligible. Moreover, its development over age cannot be held responsible for the age–income profile, since its peak is far too early. Ability as a multidimensional concept appears attractive, though empirical problems are manifold. Finally, interesting direct empirical evidence on productivity development with experience is found in the literature on the learning curve. In certain jobs, where productivity can be measured directly, increasing experience on the job produces an asymptotic productivity profile.

In the final section the conclusions are reviewed and used to briefly indicate a new theory. According to this theory, capabilities are the key variables in the labor market. Individual preferences regarding employment of these capabilities guide decisions about job choice. The labor market rewards capabilities and capability development over age explains the age–income profile.

1. THE FACTS

An age–income profile specifies the relation between an individual's age and his labor income. Empirical evidence on this relation is derived primarily from cross-sectional income measurements of the labor force rather than from individual income history, and is available for many countries and for many years. Analyses of the material point to notable regularities in the data with respect to level, slope and variance of the profiles. Level and slope differ markedly between occupations. Moreover, this variation of level and slope appears to be correlated: low levels coincide with small slopes, high levels occur jointly with steep slopes. There is also correlation with the educational level of the individual. In general, it appears that the higher the level of education, the higher the level and slope of the age–income profile. In all educational groups there is a tendency of the variance of income to increase with age; this effect is most noteworthy at the higher levels of education. Typical examples are given in Figure 1, where median earnings and interquartile ranges are presented for a number of educational levels (Netherlands, 1965).

This paper is devoted to explanation of the observed facts. A brief review of the literature will be given, as well as an overview of empirical enquiries into the role of individual capabilities. Finally, a new approach will be presented. This approach is based on a dynamic generalization of the interaction of capabilities and job choice.

median and interquartile range by education.

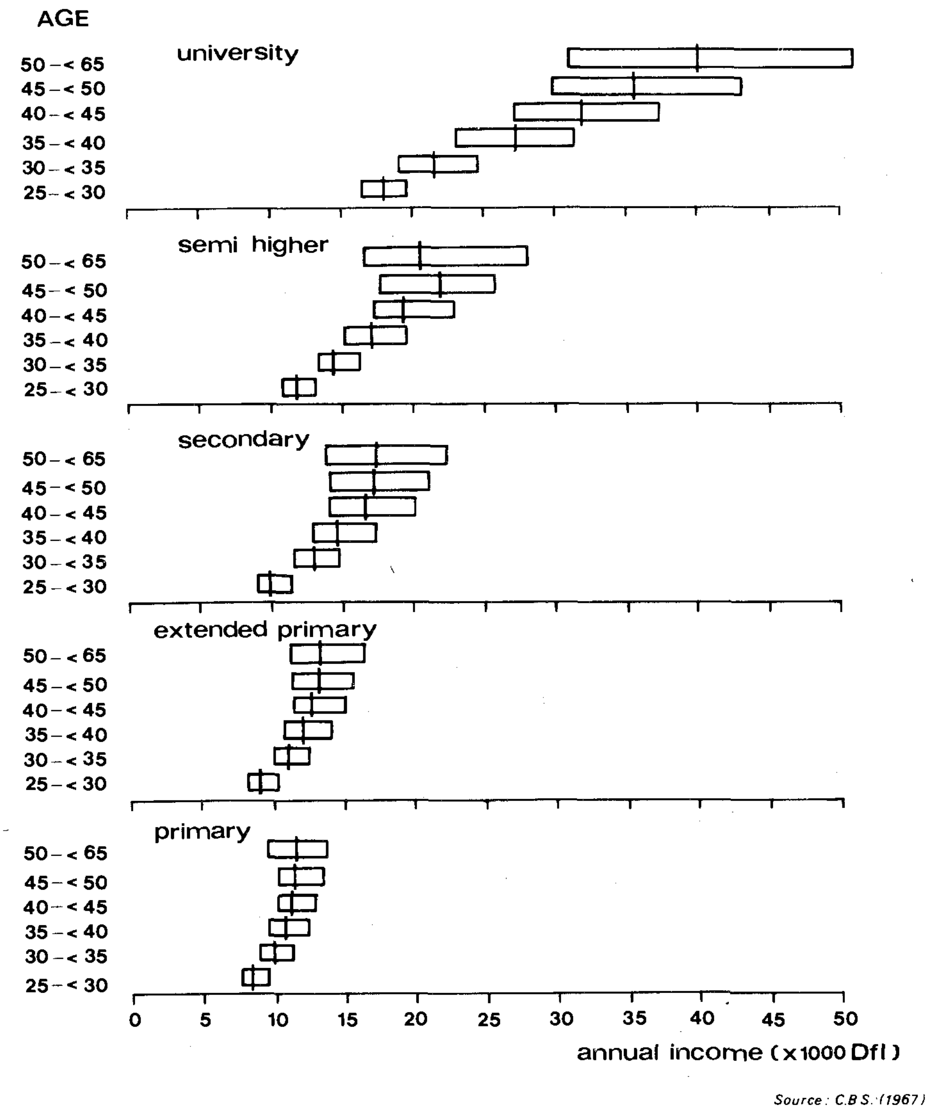


Figure 1. Earnings of Male Employees, 1965.

2. The Human Capital View

One approach to the observed facts is originally due to Becker (1964), but later extended and applied by many others. It is known as the human capital explanation and will be discussed below.

The human capital explanation consists of applying capital theory to the supply side of the labor market. An individual that has to prepare for an occupation by taking an education incurs costs and foregoes income for which he wants to be compensated in the salary he will earn after education. Hence, this theory predicts higher salaries for occupations that demand longer educations, with salary differentials related to the cost of borrowing (Mincer, 1970). Human capital theory therefore provides an explanation for the correlation between the length of education an occupation requires and its earnings. Repeated testing has demonstrated the usefulness and validity of this approach.

However, this part of the theory only predicts differences in levels of earnings, not a positive relation with age. To this end, the theory has been extended by Mincer (1962) who assumes that formal education at school is followed by on-the-job training. Continued training, continued investment in oneself, leads to an upward sloping age–income profile, as the investments pay off. Steepening of the profile is also due to the fact that observed income may be reduced during the investment period as the individual is forced to pay (part of) his investment. The framework appears appropriate for making calculations about rates of return and suitable hypotheses on individual behavior and individual constraints are capable of producing age–income profiles of a shape conforming to that observed in reality. Differences in individual rates of investment explain differences in the income profiles as well as the increasing variance of income over age.

The validity of the approach is less evident than in the case of formal schooling. Testing has now become very difficult because of the problems encountered in direct measurement of human investment. The only direct evidence of continued investment consists of formal training programs that entrants in a company may undergo. But these programs never last more than a few years, while explanation of income profiles requires investment to continue up to ages 40 to 45 or higher (as long as the slope of the profiles is positive).

The theory also fails to account adequately for the link between level and slope of the age–income profile. An explanation requires a link between investment in schooling and on-the-job training, but more than the hypothesis that it would obviously be profitable for individuals to invest heavily in on-the-job training if it were profitable to invest heavily in formal schooling has not been accomplished (Mincer, 1962). In fact, the individual determinants of investment have barely been analyzed (Becker, 1967).

Finally, it has been argued that increasing productivity with age is not necessarily the result of deliberate investment processes, but may be an unavoidable by-product of engaging in productive activities: learning by doing (Eckaus, 1963).

This paper will attempt to go further than the human capital analysis by paying attention to the particular contents of the investment process: the improvement of skills. Once the role of skills in generating income has been analyzed the investment in skill development will become part of a more general theory. The proposed theory will include the demand side of the labor market, thereby correcting for an important omission in the human capital theory.

3. Lydall's Approach

Lydall explicitly considers the changes in individual income that occur over age after entering the work force. Upon entering, the individual is capable of earning a particular income, depending on his general level of ability, education and vocational qualifications. Lydall himself has summarized his views on the age–income profile (Lydall, 1968, p. 113):

"But as time passes, several changes take place. First, there are changes in effective abilities, resulting from biological changes and the effects of experience. Secondly, there are changes in health and strength, and in personality characteristics, such as ambition, which again are the result of biological and environmental influences. And, thirdly, there are changes of status, resulting from promotion or other shifts in position within the hierarchy of employees within organizations. We should also add a fourth category, of miscellaneous factors as yet unidentified, which go under the heading of 'chance'."

He has considered each of these factors in greater detail. With respect to ability, he draws on results regarding "problem-solving ability." In cross-sections, this sort of ability rises rapidly up to ages around 14 and after a period of approximate stability, slowly declines after about the age of 25. However, he also notes that some longitudinal studies have not found a consistent decline with age. Obviously, a variable that peaks so early cannot suffice to explain earnings profiles which sometimes peak at ages beyond 40–45. Lydall attempts to solve this by pointing to the value of experience. Experience in his view, may exhibit a pattern such as that displayed by a vocabulary test, in this case the Mill Hill Vocabulary Scale, "a test of the general fund of information a person has acquired as a result of intellectual activity in the past" (Lydall, *op. cit.*, p. 116). The typical pattern for scores on this test shows an increase up to ages of 25 to 30, relative stability for the next 25 years and some decline thereafter. But even this does not tell the full story; the development of biological variables such as health and strength and of motivational factors still has to be added. And there is also the apparently separate effect of promotion within the managerial hierarchy, which "partly operates independently of ability" (Lydall, *op. cit.*, p. 117).

The concentration on the effect of changing abilities and aptitudes is certainly valuable and in fact the course that will be taken in the remainder of the paper. But some objections may be raised. First, the theory is rather speculative and does not attempt to relate the test scores to meaningful economic variables (for example, why would a variable like a vocabulary test score be significant?). Second, and more importantly, what is lacking is an integration of the explanatory components. The interdependencies are ignored and this does not seem warranted. This applies specifically to the identification of hierarchical promotions as a separate factor. Rather, one would expect that such promotions are the result of the development of certain capabilities and are thus an integrated part of the theory.

In the model that will be proposed in this paper, such an explanation will be included.

4. Education and Ability

There is no doubt that educational attainment has a considerable and positive effect on an individual's earnings. However, it is not known why this is so. Clearly, individuals undertaking education want to be compensated for the postponement of earnings; human capital analyses have convincingly shown that this is a valid approach. But problems are many if one wonders why employers are prepared to pay higher salaries to the better educated. In what respect does the better educated individual differ from the less educated? Or, which aspects of the educational process are relevant for occupational performance?

To analyze this problem, it seems reasonable to look at the cognitive content of education: schools improve intellectual abilities. Following Gintis (1971), cognitive characteristics may be defined as the individual capacities to logically combine, analyze, interpret and apply informational symbols. The hypothesis may then be advanced that schooling enhances cognitive abilities and thereby enables the individual to perform tasks with a higher social value.[1] The hypothesis may be narrowed down to the prediction that for individuals with the same level of education, earnings and cognitive ability are positively related. A common measurement of cognitive achievement is the IQ-test score (Gintis, 1971; Taubman and Wales, 1972.) Thus, according to this argument, the explanation of earnings should improve if IQ-test score is added to a regression that already includes years of schooling among its independent variables. Usually, this does *not* happen (Ashenfelter and Mooney, 1968; Griliches and Mason, 1972; De Wolff and Van Slijpe, 1973; Bowles and Nelson, 1972; Gintis, 1971; the last concludes that in nine studies he found in the literature, the increase in explained variance never exceeds 5 percent). However, this conclusion is not completely unchallenged. For one thing, the predominance of years-of-schooling over IQ appears related to age. Bowles and Nelson (1974) find that adding years-of-schooling to the regression affects the childhood-IQ regression coefficient least at the youngest age group (25–34 years). Also, Kiker and Liles (1974), taking a stand in the debate about racial (earnings) discrimination, conclude that differences in years of schooling have only a minor impact on differences in the earnings index for blacks and for whites. Adding differences in IQ score reduces the earnings differential substantially. Only further study can solve this conflicting evidence.

The abovementioned body of evidence on the irrelevance of IQ scores leads Gintis (1971) to dismiss the cognitive model altogether, and to promote the view that affective characteristics are of prime interest. By affective characteristics he means "propensities, codified in the individual's personality structure, to respond in stable emotional and motivational patterns, to demands made upon him in concrete social situations." Hence, rather than through improving an individual's

[1] Thus, the hypothesis that tasks with higher social value require a higher level of cognitive abilities is included.

skills and knowledge, the school is important as a system that conditions individuals to efficient functioning in the labor force. Gintis supports his views by pointing to the result that years of education in regressions explaining earnings apparently does not serve as a proxy for achievement characteristics (as measured by IQ). Otherwise, adding IQ-scores as an explanatory variable should reduce the years-of-schooling coefficient to zero; usually, the reduction is quite modest (from 4 to 35 percent in the studies Gintis has considered). He also produces evidence that teacher ratings (i.e., success at school) are determined by affective variables rather than cognitive ones.

Yet, empirical studies on the role of IQ in generating earnings have produced some regularities that are worth repeating. First, it may be pointed out that it appears largely irrelevant for the conclusions at what age the IQ-test is taken; some studies use childhood-IQ, some use IQ tests applied during or just prior to military services, but scores at different ages are well correlated (Bowles and Nelson, 1974).

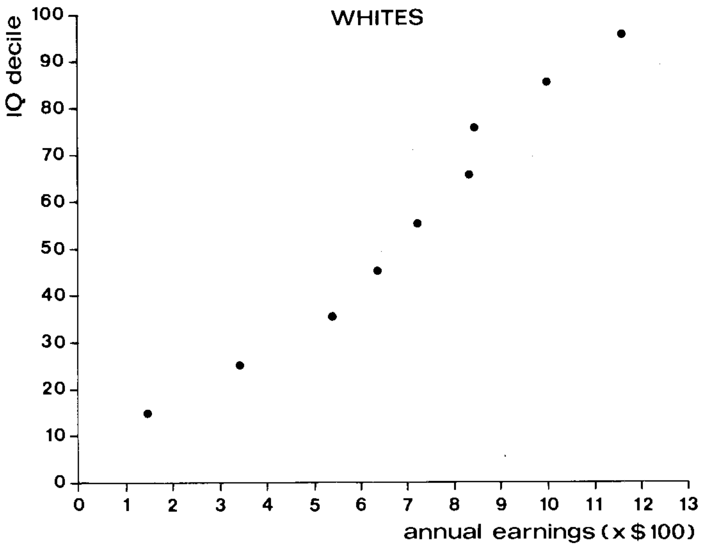
With respect to the impact of IQ on earnings by age, Hause (1972) finds the effect on log-earnings to increase with age, particularly so for the higher educational levels. Bowles and Nelson (1974) find the normalized regression coefficient of earnings on IQ to be fairly stable over age groups, though highest at the lowest and the highest ages. Stability of normalized coefficients is compatible with Hause's increasing coefficient through the empirical fact of increasing variance of (log-) earnings with age.

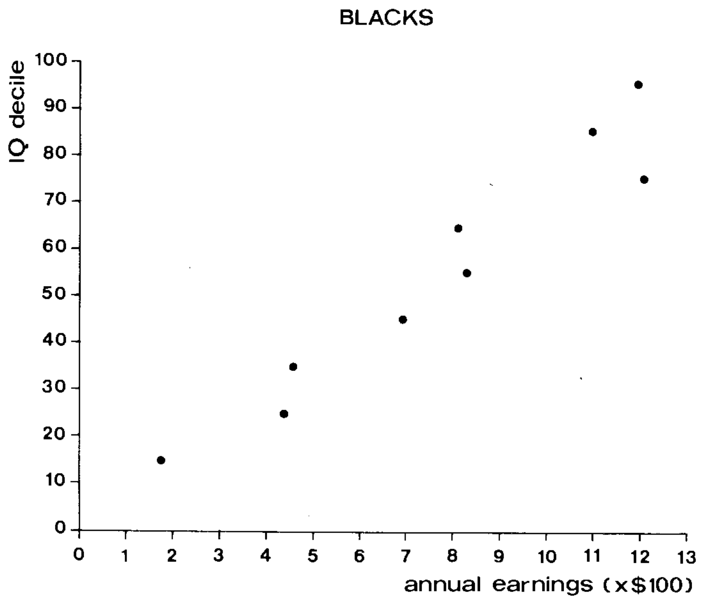
A very appealing finding concerns the role of IQ as a variable that interacts with other values, rather than having an independent additive effect on earnings. De Wolff and Van Slijpe (1973) find interaction with social-economic background and Hause (1972) finds interaction with years of schooling. Both results are compatible, of course, through the association between background and schooling. Bowles and Nelson (1974) have developed the most complete model in this respect. They present a recursive system, in which genotypic IQ and social-economic background produce childhood-IQ (measured in the lower classes of elementary school), childhood-IQ plus background produce years of schooling, while schooling, background and childhood-IQ explain earnings and occupational status. Estimates of their equations[2] lead to the conclusion that childhood-IQ has a substantial direct impact upon years of schooling but not on income or occupational status. What effect there is of IQ on income works through the effect on years of schooling.

Another piece of evidence on the role of IQ is furnished by Kiker and Liles (1974). As mentioned, they are interested in the earnings differential between blacks and whites in the U.S.A. In their analysis, they use dummy regressions of earnings on IQ test scores (by decile) and on educational attainment. The result for loadings on the IQ-dummies are presented in Figure 2. Positions on the IQ-scale appear to be translated (almost) linearly into positions on an income scale. It should be pointed out that their data consist of observations on first-term

[2]The first equation, explaining childhood-IQ, was not estimated; instead, hypotheses on the correlation between the variables were made.

Coefficents of IQ-test score in linear regression of earnings on IQ-scores (dummies by decile) and educational attainment.





Source: KIKER and LILES (1974)

Figure 2. Earnings and IQ.

separatees from the U.S. army; the income data were collected within a year after separation from the army. Thus, their findings are in line with the result found by Bowles and Nelson (1974), that the IQ regression coefficient held out best against schooling at the lowest age group (25–34).

Before concluding this section, a warning may be voiced. Although IQ-test scores have been used extensively, it is hard to define what they really measure. Herrnstein (1971) points out that IQ is entirely a measure of relative standing with respect to mental ability in a given group. Repeated improvement of the test has effectively extended this group to the entire population of Western society. It is hard to say what this mental ability really is, but it manifests itself as a good predictor of educational success.

The conclusion from this section basically follows Bowles and Nelson (1974): IQ has its effect on income primarily through its effect on educational attainment. Its explanatory power in addition to length of schooling is almost negligible. And what effect there is is most noteworthy at the lowest age groups, i.e. at the bottom of the experience scale.

5. Ability as a Multidimensional Concept

The previous section dealt with the impact of IQ on income. Employing IQ-test scores implies a one-dimensional view of ability: a general mental ability. The success of these studies in explaining income variance was quite modest indeed. However, one may doubt whether a one-dimensional ability concept is capable of catching the wide variety of occupational and educational activities. A number of authors have promoted the simultaneous use of more than one "capability" (e.g. Mandelbrot, 1962; Tinbergen, 1956). The multidimensional view of ability is also at the heart of the psycho-testing practice of occupational counselling and employers' selection procedures prior to hiring personnel.

An important empirical study in this respect is Thorndike and Hagen (1959). They conducted a follow-up study on more than 10,000 men who were tested in the U.S. Air Force on their suitability for specific tasks (as pilots, navigators or bombardiers). These men had first had to pass a general army classification test and also had to meet the standards for admission to the Air Force training program (for which they volunteered). They had to be single, between the ages of 18 and 26, be in good health and pass an aptitude test. This test was primarily a scholastic aptitude test; the qualifying score was set at a level that could be reached by at least half the high school graduates, the country over. The mental ability level of those in the sample was thus above average. Thorndike and Hagen collected additional data on occupation and occupational success some 12 years after the tests were taken. The test battery yielded scores on 20 testing instruments, which could be grouped into five main categories:

general intellectual ability, or scholastic aptitude
numerical fluency
speed and accuracy of visual perception
mechanical knowledge and experience
psychomotor coordination.

Test scores were analyzed by occupation. On the basis of the five composite test scores the following conclusions were obtained.

1. Some occupations call for distinctive ability patterns, whereas a number of others have no decisive ability requirements. For example, architects score distinctively high on visual perception, while clergymen are about average on all test composites.

2. The general level of performance differs markedly by occupation. For example, engineers and physicians score above average on all test composites, while painters and production assemblers score below average.

3. The intellectual composite shows greater variation among occupations than any other, i.e. discriminates most; the range is smallest for the psychomotor composite.

The authors also applied a discriminant analysis to the scores on the 20 tests. This analysis was limited to 22 selected occupations, largely those in the business and professional levels. One reason to concentrate on those higher levels of occupations was the feeling that the results for the lower occupations would not be representative due to the Air Force preselection of the sample. The selected occupations were supposed about to match the capacity level of the average Air Force cadet. As a result of the discriminant analysis it was found that two factors significantly discriminate among occupations, although the variance within occupations is still very large relative to that among occupations. Also, the identification of the factors was not so simple.

"The psychological nature of the two score composites that provide this maximum discrimination among occupations is not entirely clear. The first composite appears to define some kind of a quantitative intellectual dimension, differentiating those jobs with a higher demand in quantitative and mathematical knowledge from those with a lower demand in this dimension. The second seems to be a dimension that differentiates the mechanical from the verbal types of jobs." (Thorndike and Hagen, 1959, p. 36). The results are illustrated in Figure 3.*

It would seem that the preselection, first, of the individuals through the Air Force screening, and second, through the limitation to the higher occupational groups, all at about the same hierarchic level, has taken away part of the discriminating power of the analysis. Yet, the results lend support to the hypothesis that extending the coverage of the analysis will bring out marked ability differences between individuals over the full scale of all occupations.

Finally, the authors attempted to explain success within an occupation by the test scores, either on the single items or on the composites. As a measure of success they used income. It appeared that income variance *within* an occupation cannot be adequately accounted for by the variance in the test scores. What they did not attempt and what would have been interesting is a correlation of income on test scores *across* all occupations, thus investigating the possible existence of an ability-income scale that explains income differences between occupations.

*Thanks are due to the publisher, Wiley & Sons, for kind permission to reproduce the diagram.

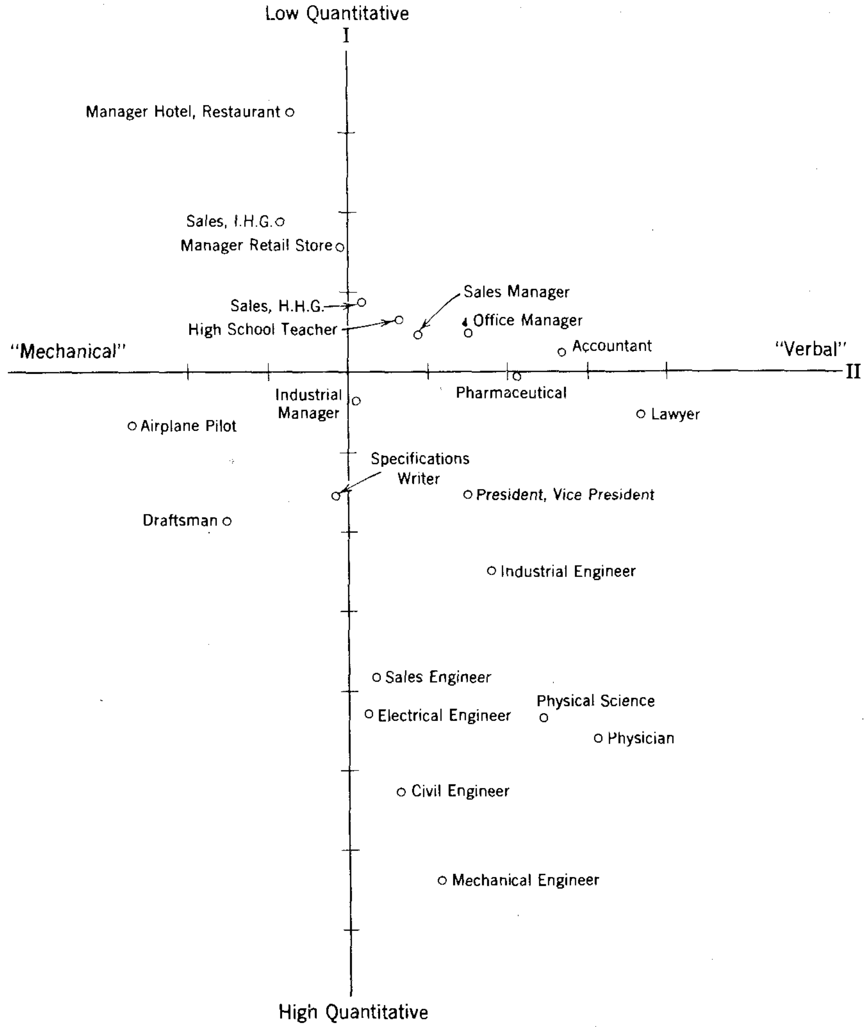


Figure 3. Location of Occupational Group Means on First Two Discriminant Axes.

6. Ability and Age

Evidence on the relation between ability and age is scanty. A few things are known, however. Lydall's evidence on the development of general intelligence with age was already cited. This evidence is affirmed by Verhage (1964). Intelligence profiles by age show a rapid increase between the ages of 12 and 20, a peak somewhere in the range 20–32 and a decline thereafter.

Studies on the effects of aging on manufacturing workers (Nipg, 1968) have shown that certain physical measures are significantly related to age (maximum effort, manual strength, etc.), but that mental measures have only a weak relation to age (ability to concentrate, perceptual speed, memory capacity). Sensory and motor abilities showed the fastest decline, although Lydall cites evidence that motor abilities hold up well until late middle age (Lydall 1968, p. 117). It is probably best to summarize this evidence by reproducing one of Lydall's quotations (Lydall, *loc. cit.*): "A gradual decline in all types of measurable ability sets in after thirty but does not become marked until well after fifty."

It should therefore be concluded that the development of these kinds of abilities with age in general cannot be held responsible for the observed pattern of age–income profiles. At best, the evidence is relevant for those occupations where physical strength determines individual output. But this concerns only a small minority of all occupations.

7. Learning Curves

Learning curves, originally developed to describe the reduction in total labor cost at increasing series length in industrial production (the relation was discovered in the airframe industry), have also been applied to individual worker progress in performing certain tasks (Boehmer, 1970; Corlett and Morcombe, 1970; Crossman, 1959).

At the level of the individual worker, the learning curve concerns worker performance in repetitive, routine tasks, i.e. situations where certain simple operations are repeated over and over. Empirical applications usually study performance of a worker operating a machine, such as a typewriter, cigar-making machines, capstan-lathes, certain textile industry machinery, etc. In its original format, the learning curve may be stated as follows:

$$t_n = t_1 n^{-m}$$

where

n = number of operations performed
t_n = time required to perform the nth operation
t_1 = time required to perform the first operation.

Taking derivatives shows the nature of the curve:

$$\frac{\partial t_n}{\partial n} = -mt_1 n^{-m-1} = -\frac{m}{n} t_n < 0$$

$$\frac{\partial^2 t_n}{\partial n^2} = m(m+1)t_1 n^{-m-2} = -\frac{m+1}{n}\frac{\partial t_n}{\partial n} > 0.$$

Hence, the curve has an ever increasing negative slope:

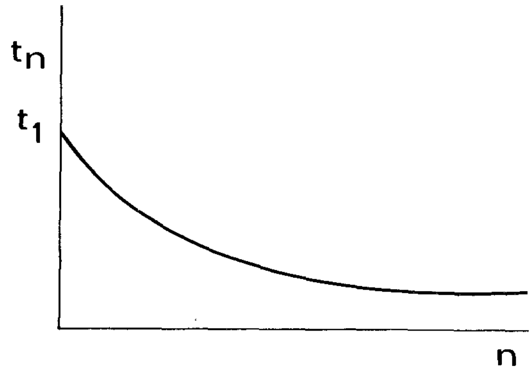


Figure 4. The Learning Curve: Operation Time.

Often, the curve is stated in terms of the reduction fraction: the reduction in operation time that occurs when the number of operations performed has doubled. This fraction, r, is a constant:

$$t_{2n} = t_1 2^{-m} n^{-m} = t_n 2^{-m} .$$

$$r = t_{2n}/t_n = 2^{-m}.$$

Corlett and Morcombe (1970) indicate that estimates thus far have produced values of r ranging from 0.70 to 0.95, roughly corresponding to values of m from zero to one half.

The curve may be reversed to show the development of individual worker productivity. The dependent variable then becomes output per unit of time rather than time per unit of output. Also, an extension first presented by De Jong (see Boehmer, 1970) may be incorporated: operation time will not, in the limit, approach zero, but some positive irreducible minimum. In inverse formulation, productivity then approaches asymptotically to some maximum level. The general format then looks like the one in Figure 5.

The conclusion from the studies on the learning curve may now be summarized. In certain well-defined routine job activities individual performance can be measured by measuring the time required to perform a (single or complex) operation. The typical shape of the development of productivity with experience appears stable over a number of applications: the growth in productivity is very fast initially, then slows down, with productivity asymptotically approaching some maximum level.

8. Proposals for an Integrated Theory

The evidence that was presented in the previous sections will now be recollected. The conclusions will be used to draw the outlines of an integrated theory that can account for the observations.

1. Income profiles show a marked similarity between families of occupations; the families appear differentiated by educational level.

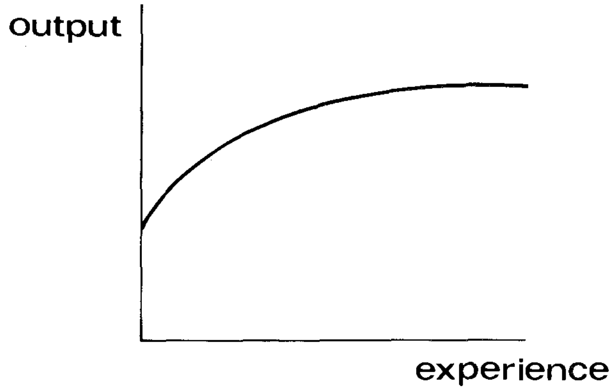


Figure 5. The Learning Curve: Worker Productivity.

2. The human capital explanation of the profiles was found unsatisfactory and at any rate incomplete due to its neglect of the demand side of the labor market.

3. Some concepts of ability that have been employed up to now in empirical studies on income distribution are static (age-independent) and thus do not even consider the impact on the income profile. Other measured ability concepts appeared unsatisfactory as immediate explanatory variables for the age–income profile.

4. If different dimensions of ability are distinguished, it appears that individuals differ markedly by occupation on their loadings of ability components: type of ability and occupation are correlated.

5. In certain jobs, where job content is well defined, it appears feasible to measure output in relation to experience; the resulting productivity profile has a stable characteristic shape.

The interesting problem now is to provide an integrated theoretical framework that accounts for the observations. A starting point for such a theory is found in conclusion 4, the correlation between ability components and occupation. These observations lend empirical support to Tinbergen's approach, in which the labor market is interpreted as a system where supply and demand of capability bundles are confronted and implicit prices for capabilities result. Jobs are described in terms of requirements of the capabilities. The individuals choose a job on the basis of their preferences for employing certain capabilities and the capability rewards.

Regarding an individual's capability stocks as subject to changes over time rather than as fixed endowments allows explanation of income changes over age. Regularities in income development should then be related to regularities in capability development. Conclusion 5, on learning curves, provides a starting point for analysis of such regularities. The results that were found there should be generalized to fit into a multicapability model. Focussing on capability development also provides a link between occupation and education.

The analytic framework for a theory as sketched above has already been developed (Hartog, 1974). The challenge that remains is to provide an operational specification for the capability variable.[3]

References

Ashenfelter, O. and Mooney, J. D., "Graduate Education, Ability and Earnings," *Review of Economics and Statistics*, vol. L, no. 1 (February 1968), pp. 78–86.

Becker, G. S., *Human Capital*, Columbia University Press for NBER, 1964.

Becker, G. S., "Human Capital and the Personal Distribution of Income," *W. S. Woitinsky Lecture no. 1*, University of Michigan, 1967.

Boehmer, G., *Lerneffekte als Kosteneinflussgrössen und ihre Berücksichtigung in der Kostenplanung unter Kostenrechnung*, dissertatie Westfälische Wilhelms-Universität, Münster, 1970.

Bowles, S. and Nelson, V. I., "The 'Inheritance of IQ' and the Intergenerational Reproduction of Economic Inequality," *Review of Economics and Statistics*, vol. LVI, no. 1 (February 1974), pp. 39–51.

Central Bureau voor de Statistiek, *Sociale Maandstatistiek*, vol. 15, no. 11, November 1967, pp. 457–462.

Corlett, E. N. and Morcombe, V. J., "Straightening Out Learning Curves," *Personnel Management*, vol. 2, no. 6 (June 1970), pp. 14–19.

Crossman, E. R. F. W., "A Theory of the Acquisition of Speed-skill," *Ergonomics*, vol. 2, no. 2 (February 1959), pp. 153–166.

Eckaus, R. G., "Investment in Human Capital: a Comment," *Journal of Political Economy*, vol. 71, no. 5 (October 1963), pp. 501–505.

Gintis, H., "Education, Technology and the Characteristics of Worker Productivity," *American Economic Review*, Papers and Proceedings, vol. LXI, no. 2 (May 1971), pp. 266–279.

Griliches, Z. and Mason, W. M., "Education, Income and Ability," *Journal of Political Economy*, vol. 80, no. 3 (May/June 1972), pp. S74–103.

Hartog, J., "Age-income Profiles and Capability Development," Discussion paper 7402, Institute for Economic Research, Erasmus University, Rotterdam, 1974.

Hause, J. C., "Earnings Profile: Ability and Schooling," *Journal of Political Economy*, vol. 80, no. 3 (May/June 1972), pp. S108–138.

Herrnstein, R., "I.Q.," *The Atlantic*, vol. 228, no. 3 (September 1971), pp. 43–64.

Kiker, B. F. and Liles, W. P., "Earnings, Employment and Racial Discrimination: Additional Evidence," *American Economic Review*, vol. 64, no. 3 (June 1974), pp. 492–501.

Lydall, H., *The Structure of Earnings*, Oxford Press, 1968.

Mandelbrot, B., "Paretian Distribution and Income Maximatization," *Quarterly Journal of Economics*, vol. 76 (February 1962), pp. 57–85.

Mincer, J., "On the Job Training; Costs, Returns and Some Implications," *Journal of Political Economy*, Supplement, October 1962.

Mincer, J., "Distribution of Labor Incomes," *Journal of Economic Literature*, vol. VIII, no. 1 (March 1970), pp. 1–26.

NIPG (Nederlands Instituut voor Praeventieve Geneeskunde—TNO) *Mens en Onderneming*, 22e jaargang, 1968, p. 265.

Taubman, P. and Wales, T., "Mental Ability and Higher Educational Attainment in the 20th Century," NBER Occasional Paper 118 (1972).

Thorndike, R. L. and Hagen, E., *Ten Thousand Careers*, Wiley & Sons, 1959.

Tinbergen, J., "On the Theory of Income Distribution," *Weltwirtschaftliches Archiv*, Band LXXVII (1956), pp. 155–175.

Verhage, F., *Intelligentie en leeftijd bij volwassenen en bejaarden*, Assen, 1964.

De Wolff, P. and van Slijpe, A. R. D., "The Relation between Income, Intelligence, Education and Social Background," *European Economic Review*, vol. 4 (1973), pp. 235–263.

[3]Support in this task is warmly solicited.