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Human capital theory and education policy in Australia

John Quiggin

Australian Research Council Senior Fellow

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Abstract

The human capital model is the basis of neoclassical analysis of labour markets, education and economic growth. However, education policy in Australia has been influenced by models based on screening theory and public choice theory which yield the policy implication that reductions in education spending are generally desirable. In this paper, the competing models, and the evidence supporting them, are surveyed. It is concluded that the human capital model is strongly supported by the available evidence. The predictions of screening models are generally not supported by empirical tests, except where they coincide with those of the human capital model. The main evidence supporting the public choice model, derived from the literature on educational production functions is shown to be deficient. The principal policy conclusion of the paper is that the negative effects of recent cuts in education spending will outweigh any benefits achieved through reductions in public debt.

Two-line summary

In the 'human capital' model, education is an investment that produces benefits in the future. Recent cuts in education spending will therefore reduce future national income.

Human capital theory and education policy in Australia

The human capital model is the basis of neoclassical analysis of labour markets, education and economic growth. It has also had an important influence on other social sciences such as sociology and demography. In recent years, however, the human capital model has fallen from favour in Australia and New Zealand, particularly in relation to education policy. Criticisms of the human capital model have been made by advocates of screening models (Maglen 1990, 1993) and by public choice theorists (Institute of Public Affairs 1990).

The reason for the appeal of these alternatives to the human capital model is not hard to find. For the past twenty years, governments in Australia and New Zealand have sought to reduce government spending as a proportion of GDP. Screening and public choice models imply that cuts in education spending will be socially beneficial. On the other hand, estimates of the social return to education and of the contribution of education to economic growth, based on the human capital model, yield the politically unpalatable implication that education spending should be expanded up to the point where the rate of return to additional spending is equal to the general rate of return on capital.

The object of the present paper is to review the human capital model and its critics. It is concluded that the human capital model remains the appropriate basis for analysis of educational policy in Australia.

1. Economic models of education

1.1 The human capital model

The human capital model (Mincer 1958; Schultz 1961) is an elaboration of the commonsense notion that the function of schools is to teach students, that is, to provide them with information and skills that will be valuable in later life. As with other investments, a sacrifice of current income (the goods and services that teachers and students could produce if they were not engaged in education) is accepted in order to generate monetary and non-monetary returns in the future.

In narrow versions of the human capital model, knowledge and skills are valued instrumentally, insofar as they contribute to increased productivity and hence, other things being equal, to higher earnings. However, the human capital model may be interpreted more broadly, to encompass learning that does not contribute to higher market earnings. A knowledge of, and capacity to appreciate, literature, for example, provides a future consumption stream not reflected in market earnings. However, because monetary returns are easier to measure, most empirical studies have focused on monetary returns rather than on broader definitions of the benefits of education.

1.2 The human capital model -- empirical evidence

Preston (1997) reviews a large literature on private and social rates of return to education, based on the estimation of earnings functions. The private rate of return is derived by comparing the costs actually borne by the student (earnings foregone and tuition fees) with the benefits received (the increase in after-tax income). The social

rate of return takes account of both private and social costs and benefits, including the costs of publicly-provided education and the increased tax payments of more highly educated individuals.

Ideally estimates of the social rate of return should take account of external benefits arising when higher productivity is not fully reflected in higher wages. These external benefits represent one of the main reasons for public subsidies to education. However, because external benefits are hard to capture econometrically, the existence of a net subsidy to education implies that the measured social rate of return is lower than the measured private rate of return for any given data set.

Studies of the private and social rates of return to education, summarised by Psacharopoulos (1973, 1981), indicate that incomes increase with the level of education and that the implied private and social rates of return to education are high. Chia (1990) estimates that the investment in a bachelor's degree in Australia yields a private rate of return of 9.6 per cent for males and 12.6 per cent for females. Estimates of social rates of return as high as 15 per cent have been reported (Miller 1982). Maani (1996) provides similar estimates for New Zealand.

Some difficulties arise with the rate-of-return approach, however. It is likely that students who are more intellectually able will undertake more education and that these students would have had above-average earnings even in the absence of education. Hence it is difficult to determine what proportion of the higher incomes of educated people is due to education and what proportion to native ability. This 'selection bias' problem is independent of the screening hypothesis, discussed in Section 1.4, since it would apply even if ability was fully observable.

Attempts to correct for native ability have found the effects of selection bias to be small. Techniques include the use of path analysis to take account of interaction effects (Blau and Duncan 1967). More recently, techniques using data on identical twins, who are assumed to have equal native ability, have been employed in the United States (Ashenfelter and Krueger 1994) and Australia (Miller, Mulvey and Martin 1995). As Miller, Mulvey and Martin (1995, p. 597) conclude, both their work and that of Ashenfelter and Krueger show that 'there is little evidence of upward bias in the typical OLS estimate of returns to education'.

Another difficulty is that the rate of return can only be accurately assessed at the end of an individual's lifetime, or at least after a substantial period of participation in the labour force. These latter problems make it very difficult to use the rate-of-return approach to assess the output of the school system except by using long-term census data from countries such as the United States where different jurisdictions provide very different standards of education.

The most extensive and sophisticated study of this kind is that of Card and Krueger (1992). Card and Krueger use a 5 per cent sample of the US Census made available for public use and examine white men educated in US public schools between 1920 and 1949, divided into three ten-year cohorts. This is combined with extensive state-level data on the quality of education, measured by length of the school year, teacher-student ratios and the wages of teachers relative to those of workers in general. Card

and Krueger (1992) find that each of their quality measures is strongly, and statistically significantly, correlated with returns to education.

There is some evidence on the non-monetary benefits of education. More educated individuals have better health knowledge and better health status, even after controlling for such variables as family income (Grossman 1976; Kenkel 1990). Other cited benefits include transmission of cultural values (McMahon 1987), more intelligent voting behavior (Brennan 1988) and reduced predisposition to criminal behavior (Webb 1977).

Evidence on the benefits of education is reinforced by a large literature on comparisons of international economic performance. A number of studies, notably including Barro (1991) and Mankiw, Romer and Weil (1992) conclude that growth in human capital is a centrally important contributor to economic growth. Mankiw, Romer and Weil (1992) used the fraction of the working-age population attending secondary school as a measure of human capital investment at any point in time. Whereas a model using only physical investment variables performed poorly in explaining economic growth, the same models performed well when human capital was included. Human capital has been emphasised particularly in explanations of the strong long-term economic growth experienced in East Asian nations (Jung 1992; Woo 1991).

1.3 The screening model

In the screening model of education (Arrow 1973; Stiglitz 1975; Wiles 1974), it is assumed that education has no inherent social value. Rather, the education system provides a method of sorting students and placing the most able individuals in the most difficult, and best remunerated, jobs. Under the screening model, the output of the education system is a ranking. The quality of the ranking is determined by its correlation with the capacity to perform high-status jobs.

Many advocates of the screening model, such as Weiss (1995), assume that, even if the human capital model has some validity, some combination of the two models will be applicable. Weiss therefore expresses surprise at the hostility with which supporters of human capital theory, and of education, have responded to the screening model. In fact, the standard predictions of the screening model depend critically on the assumption that education has no inherent value. Otherwise, consideration of problems of signalling simply reinforces the conclusion that market institutions lead to underinvestment in human capital.

Consider, for example, the case of a student who sits an entrance examination to begin a course and a final examination on completion of the course. Under the standard screening model, in which education has no inherent value, both examinations serve the same function, that is, to provide a signal about native ability. In the absence of any learning, the course and final examination are a socially costly way of refining the signal generated by the entrance examination. Relative to the case of full information there is over-investment in education.

This argument collapses once it is recognised that students actually learn something in the process of education. The final examination now serves primarily as a signal about

how much was learned during the course. If the signal about learning is imperfect, then, ceteris paribus, students will under-invest in education, since they are unable to provide a fully informative signal to employers. The fact that most assessment is ostensibly concerned with assessing students grasp of course material rather than their native ability suggests that this is indeed the dominant purpose of assessment. If so, a correctly specified signalling model will predict under-investment in human education.

In this paper, therefore, the term 'screening model' will be used to refer to the hypothesis that the education system exists solely, or primarily, to provide a ranking of native ability, and that, as a result, there is a tendency to over-invest in education relative to the case of perfect information. The problem of the nature and extent of under-investment in education in a correctly specified human capital model with imperfect information remains to be explored.

There is no fully developed account of the screening model in which the behaviour of firms, individuals and political decision-makers is explicitly modelled. However, it is useful to look at the implications of the screening model when all individuals and firms act rationally. First, the large amount spent on educational services that, according to the screening hypothesis, are valuable only as ranking mechanisms, implies that other methods of ranking must be difficult and costly.

If ability could be ranked easily, for example, by observation of school performance prior to minimum school leaving age, by IQ testing, or by observing workforce performance over a period of several years, firms and students could mutually benefit from hiring at the minimum school leaving age. Direct workforce experience combined with, say, a Year 10 assessment and a set of standardised tests, would replace university degrees as a method of allowing employers to rank the underlying ability levels of employees. Firms that took this approach would outperform their competitors and students who left school to work for these firms would gain increased lifetime earnings.

Most presentations of the screening model appear to require either irrational behavior on the part of firms or individuals, or some game-theoretic structure in which firms and individuals are trapped in a Pareto-inferior equilibrium involving high schooling levels. The latter approach is implausible in view of the ubiquity of high education levels in modern societies, despite radically different economic systems and labour market structures. On the other hand, the irrationality hypothesis creates difficulties for empirical testing, since many tests are based on an assumption of rational behaviour.

The most influential advocate of screening models in education has been Blaug (1976; 1985). Blaug's views appears to spring more from his methodological position, based on Lakatos' theory of scientific research programs, than from consideration of empirical evidence. In the Lakatosian approach, competition between scientific research programs is essential for scientific progress, and Blaug therefore supports any competitor for human capital theory. However, Blaug (1976, pp. 848-9) states:

The point of a testable theory is to define states of the world that cannot occur if the theory is true. It is sometimes difficult to see what states of the world are excluded by credentialism...

Despite this negative judgement, Blaug (1985) asserts that the 'naive' human capital model has been supplanted by a model based largely on screening. Yet this is not the result of any accumulation of evidence. As Blaug observes, strong versions of the screening hypothesis are firmly refuted by the evidence while weak versions are empirically indistinguishable from the human capital model. From a Lakatosian viewpoint, the screening hypothesis presents an ideal example of a degenerating research program. It has survived repeated falsifications of central predictions without leading to the discovery of a single new and unexpected fact.

1.4 The screening model -- empirical evidence

Compared with the human capital model, the empirical literature on the screening model is very limited and inconclusive. Moreover, much of it is focused on minor anomalies such as 'sheepskin effects'. Such anomalies may indicate that it is difficult to signal educational achievement, but do not support strong forms of the screening model.

The strongest prediction of the screening hypothesis is that the earnings differential associated with higher levels of education should decline over time as employers acquire direct knowledge of their employees' ability. This prediction is refuted by extensive evidence showing that the earnings differential associated with higher levels of education rises with the number of years of experience (Psacharopoulos 1974).

Wiles (1974) proposed testing the screening hypothesis by comparing wages for graduates working in their field of specialisation and those working in other fields. The human capital model would predict a greater return for graduates working within their fields. Miller and Volker (1984) applied this test to a sample of science and economics graduates, finding a statistically significant difference only for male science graduates. Arabsheibani (1989) applied the Wiles test, and found significant differences in the direction predicted by human capital theory.

Since low funding of education is associated with low average educational attainment, the achievement of a given level of education in a relatively poorly-funded system implies a higher level of native ability. A student from a 'bad' or poorly resourced system should, therefore, be offered a higher wage than a student from a 'good' system with the same measured level of performance, since the implied ability level of the first student is higher. In fact, the opposite is true (Sexton and Nickel 1992; Card and Krueger 1992).

Angrist and Krueger (1991) observe that in some US states, minimum school-leaving ages result in small but systematic differences in average school attainments for students born at different times of the year. On the screening hypothesis, these differences should not affect wages. In fact, however, the extra compulsory education imposed on the basis of the time of year of birth appears to increase earnings in a small, but statistically significant way.

Another implication of the screening hypothesis is that students who plan to operate small businesses should not undertake education beyond the compulsory level, or, if both human capital and screening effects are present, should have lower average education levels than comparable students seeking wage employment. This prediction is not borne out in reality (Wolpin 1977).

The screening model does not predict that income growth will be associated with any trend in the average number of years of education undertaken by students. The only factors leading to expanding education in the screening models are those that generate an increased demand for sorting. For example, the private incentive to seek additional education and thereby improve one's chances of access to higher-status jobs will tend to rise if income inequality rises. The optimal level of education will rise over time if the costs of inaccurate sorting increase or if the efficiency of the sorting mechanism declines. There does not seem to be any reason to suppose that any of these trends has prevailed consistently. In fact, income inequality declined over the period 1945-70, a period of steadily increasing educational attainment. Further, the rise of standardised tests of ability, such as IQ tests, should have provided a low-cost substitute for the screening function of traditional education, implying that average education levels should have declined over time. Obviously this prediction is invalid.

Finally, the screening model may be tested directly by examining whether school and university performance can be predicted on the basis of measures observable at earlier ages. There is a strong correlation between IQ scores and subsequent academic performance, and between performance in university entrance examinations and university performance. Indeed, these correlations are higher than correlations between education levels and earnings (Heath 1981). It therefore seems implausible that the value of the additional screening information provided by attendance beyond school-leaving age, relative to that which would be provided by direct observation of productivity in the workplace, is comparable to the earnings foregone.

1.5 The public choice model

In the public choice model, it is normally assumed that the managers of public institutions, such as educational institutions, will seek to maximise their own utility and will promote the stated ends of those institutions only to the extent that it is personally beneficial to them. Niskanen (1968) argues that bureaucrats will benefit from expansion of their institutions beyond the socially optimal level. Although Niskanen's model implies that the returns to members of the bureaucracy will be above the socially optimal level, he assumes that production is technically efficient.

A variant of the public choice model (referred to in this paper as the 'IPA public choice model') has influenced recent economic assessments of education in Australia. Australian supporters of this model have followed Hanushek (1981) in claiming that 'throwing money at schools' will not produce improvements in educational outcomes. Hanushek claims that additional resources in education will have no impact on outcomes because of the absence of appropriate incentives, but does not develop this argument in any detail. Similarly, the Institute for Public Affairs (IPA) (1990, p. 2) states:

Drawing on public choice theory, we have started from the presumption that, unless there is evidence to the contrary, high staffing ratios do not provide a better quality of service.

The IPA presumption cannot be true for all possible staffing ratios. In practice, the IPA implicitly defines the cut-off ratio as the lowest staff-student ratio prevailing anywhere in Australia, and argues for 'levelling-down' to this minimum ratio. Subsequent writers such as Fitzgerald (1993), and various State and Federal Commissions of Audit have adopted the results of the IPA study without examining its underlying assumptions. Fitzgerald's widely-cited estimate that spending on health and education could be cut by $3 billion a year without adverse consequences has no basis beyond the argument-by-assumption described above.

Like the screening model, the IPA public choice model is difficult to reconcile with the assumption of rational behaviour. Assuming, as the IPA does, that any expressions of concern about educational quality are merely pretexts for the pursuit of teacher self-interest, it follows that teacher preferences for small class sizes reflect a preference for higher levels of leisure. If this is the case, it seems reasonable to assume that, while an increase in class sizes will force teachers to work harder, they will respond by reducing the amount of effort allocated to each student. The increase in total effort represents a transfer from teachers to their employers (in this case taxpayers) while the reduction in effort per student represents a transfer from students to taxpayers.

The IPA claim that the quality of education will be unaffected by increases in class sizes (or reductions in other resources) rests on an implicit assumption that the marginal product of labour (and other inputs) in education is zero. This assumption is inconsistent with the central premise of human capital theory, that education is an economic activity which can be analysed using the standard tools of economic theory.

1.6 Educational production functions

The most substantial evidence cited by supporters of the IPA public choice model is the US literature on educational production functions, or rather, Hanushek's (1979, 1981, 1986) summaries of that literature. Beginning with the Coleman Report (Coleman et al. 1966), a number of economists have attempted to estimate educational production functions. Econometrically, this implies the estimation (usually by OLS) of an output measure such as an average test score (or, preferably, the difference between the average test scores of students when they commence a course and scores when they complete the course) against input measures such as number of teachers per student, expenditure per student and measures of teacher quality.

In general, the results of applying the educational production function approach to US data, particularly that generated by the Coleman Report, have been negative. Although a number of explanatory variables have been tried, most are statistically insignificant most of the time. Hanushek (1981) draws the conclusion that the marginal product of additional inputs is zero because incentives in public schools are inappropriate,

Hanushek's conclusion is inconsistent with international evidence showing that increased educational expenditure has been associated with increased rates of school completion and educational attainment. In Australia, for example, both real expenditure per student and the school completion rate rose steadily from 1960 to 1990 (Williams et al 1993). Cuts in expenditure per student in the early 1990s were followed by declining completion rates (Quiggin 1994).

The disparity may be explained by the observation that both production function estimation and Hanushek's method of aggregating results by counting t-statistics are unsatisfactory and outdated. The inadequacy of the production function approach as a method of estimating the parameters of educational technology was noted by Levin (1974) and is discussed further by Färe, Grosskopf and Weber (1989). The development of econometric methods based on the concepts of duality theory, such as cost, distance and profit functions, has rendered the direct estimation of production functions obsolete for most purposes.

Grosskopf et al. (1997) undertake an analysis of the technical efficiency of Texan schools using the distance function approach, in which efficiency is measured by a distance function relating educational inputs to improvements in test scores. Although they refer favorably to Hanushek's work, Grosskopf et al. find, contrary to Hanushek's claims, that there is a positive relationship between inputs and outputs.

Moreover, the appropriate method of combining the results of multiple studies is not to count significant t-statistics as Hanushek has done, but to use the tools of meta-analysis, described by Hedges and Olkin (1980, 1985). Hedges, Laine and Greenwald (1994a,b) performed such a meta-analysis and found that, taken collectively, the studies reported by Hanushek imply the existence of a positive and statistically significant relationship between test scores and expenditure per student.

2. Australian critics of the human capital model

Maglen (1990, 1993) criticises the human capital model and argues that a form of screening model is applicable in Australia. Maglen is particularly concerned with the evidence on growth accounting, productivity and the education-earnings relationship. These issues will be addressed in turn.

2.1 Growth accounting

Attempts to explain economic growth, such as the growth accounting literature beginning with the work of Denison (1962, 1979, 1984), have laid considerable stress on the role of human capital. In Denison's early studies of US economic growth (Denison 1962), human capital investment was found to be substantially more important than physical investment. In his critique of the human capital model, Maglen (1990) stresses the fact that later estimates have been more modest.

Denison's early estimates imply a return to human capital investment several times greater than the return to physical investment. Subsequent downward revisions are less optimistic but still consistent with the view that investments in education yield returns at least as large as those of physical investment. Therefore the results of

growth accounting exercises are generally consistent with the human capital model on which they rely.

Maglen undertakes his own exercises in growth accounting, consisting of comparisons between measures of education and training effort and rates of growth of GDP. The measures of human capital investment used by Maglen are either stocks (such as the proportion of the labour force with degrees) or flows expressed in per capita terms (such as number of first degrees awarded per million of population). Neither of these measures is necessarily correlated with the rate of growth of the stock of human capital. For example, Maglen (1993, p. 33), discussing the data on educational attainment, states:

The clear leader on every count is the US, but their labour productivity growth record is even more dismal than Australia's.

The confusion between stocks and flows is evident. Although the average level of educational attainment is higher in the United States than anywhere else in the world, the educational attainment of cohorts completing school has been virtually constant for the past two decades, implying that growth in average educational attainment is approaching zero. The United States has the world's highest average levels of labour productivity and, over the past two decades, low rates of labour productivity growth, just as the human capital model would predict.

2.2 Education and productivity

A central part of Maglen's critique of the human capital model is the claim that microeconomic evidence on the link between education and productivity and between productivity and earnings is weak, although the link between education and earnings is well established. Maglen's critique rests, not on strong negative evidence, but on the paucity of the data and on the difficulty of conducting a conclusive test.

For the one area that has been studied intensively, namely the effect of education on the productivity of farmers in developing countries, Maglen (1990, p. 287) concedes 'at this level and in this sector, education can have a positive effect on productivity.' There are two basic problems in conducting studies of this kind in more developed countries. First, as Maglen observes, average education levels differ greatly between occupations, so that much of the education-earnings correlation reflects the fact that highly educated people tend to hold high-paying jobs. Hence, it is hard to observe the relative productivity of individuals with different education levels in the same job. An associated difficulty, not observed by Maglen, is that people with relatively low (high) education levels in a given job are likely to be above (below) average in ability or experience for their education level. This selection effect will bias downwards the estimated effect of education on productivity in an intra-occupation regression.

There are however numerous studies showing that higher average education levels in a workplace are associated with higher productivity (Horowitz and Sherman 1980; Buxton 1977; Black and Lynch 1996). There are also a number of studies, cited by Chapman and Chia (1989) showing that higher education levels contribute to willingness and ability to adopt new technology.

2.3 Differential returns and screening

Maglen (1993, 1994) observes that the return to high school and university education, relative to the base level of compulsory education, has fallen as average education levels have risen in Australia. This result is predicted by the human capital model and not by the screening model, contrary to Maglen's claims.

The human capital model implies that education endows individuals with skills. The normal theory of supply and demand implies that, other things being equal, the more skilled individuals there are, the lower will be the skill premium. The screening model does not predict a fall in the differential return to high school education because, as the proportion of students completing high school (or university) has risen, the proportion not attaining these levels has fallen. There is no reason to suppose that the average difference in ability between the two groups, that is, the value of the degree or matriculation certificate as a signal of ability, has changed.

2.4 The IPA public choice model -- empirical evidence

The most direct test of the IPA public choice model is to compare the lifetime outcomes of students from well-funded school systems with those of students from poorly-funded systems. The IPA public choice model predicts that there should be no difference. This is precisely the test undertaken by Card and Krueger (1992). As was shown in Section 1.2, quality of education is significantly related to subsequent lifetime earnings, contrary to the predictions of the IPA public choice model.

Another prediction of the IPA public choice model is that public school systems will spend more on staff, and particularly on teaching staff, than private schools. If smaller class sizes were unproductive, we would not expect individuals who pay for their children's education themselves to be willing to pay for such things. Yet private schools spend money in almost exactly the same ratios as the public schools -- about 55 per cent on teachers' salaries and another 10 per cent on salaries for non-teaching staff (National Bureau of Employment, Education and Training 1991). This evidence does not support the view that the public system is mis-allocating resources, or that reductions in class sizes are unproductive.

Evidence from randomised trials supports the claim that increases in staff-student ratios lead to improved performance. Finn and Achilles (1990) found that increases in the staff-student ratio for elementary school students increased test scores on reading and mathematics exams. Sipe, Grossman and Milliner (1988) found that lengthening of the school term by providing extra instruction in summer led to improved test scores for disadvantaged students.

The only Australian evidence cited by the Institute of Public Affairs (1990) in support of its model is derived from a study of per capita spending on public education in the Australian states, and the proportion of students in each state attending public schools in 1979 and 1989. The IPA focuses on the decline in this proportion between 1979 and 1989, which was relatively small in the lowest-spending states, Queensland and Western Australia. As in Maglen's analysis, this analysis is based on a confusion between stocks and flows.

Moreover, as is observed by Quiggin (1993), the Institute of Public Affairs (1990) study suffers from gross deficiencies such as the failure to observe that income levels and participation rates in higher education are lower in Queensland than in other states, a fact which is presumably relevant to measures of educational output. The IPA does not even take account of the fact that students in Queensland receive only 12 years of school education compared to 13 in other states. The credence that has been given to the IPA study reflects the politically convenient nature of the conclusions rather than the quality of the analysis.

3. Implications for education policy

The central difference in the policy implications of the human capital model and the alternative models discussed here relates to the desirable level of public expenditure on education. The basic implication of the human capital model is that, in an efficient allocation of resources, public and private expenditure on education should be expanded to the point where the present value of the stream of returns to marginal investments is equal to the cost. The stream of returns includes both increased earnings and the non-pecuniary benefits of education. Under fairly weak conditions, the present value criterion is equivalent to the requirement that the marginal social rate of return to educational investments should be equal to the social rate of discount.

There is a large literature on the choice of social rates of discount. Most writers argue for a rate somewhere between the real rate of interest on government bonds (normally between 3 and 5 per cent) and the average rate of return to private investments measured by the weighted average cost of capital. The latter rate is favoured by the Department of Finance (1987), and has been estimated at 8 per cent. As noted above, estimates of the social rate of return to education made in the 1980s exceeded 10 per cent, yielding the prima facie implication that levels of educational investment at that time were too low.

Furthermore the optimal level of educational expenditure, as a share of GDP, should rise over time, provided that capital and technical knowledge are substitutes for unskilled and semi-skilled labour and complements to the labour of highly educated workers. Therefore, as the capital intensity and knowledge intensity of output rises, so does the optimal human capital intensity. The ratio of public expenditure to GDP has declined in Australia over the past decade. This suggests that the gap between actual and optimal levels of expenditure has increased over time.

Australian critics of the human capital model have been primarily concerned with attacking this policy implication and calling for cuts in education spending. For example, Maglen (1990, p. 291) criticises the human capital model for false promises that 'society will reap the returns of investments of its scarce resources in education' in terms of higher productivity, and opposes expansion of higher education. It should be noted, however, that Maglen confines his application of the screening model to higher education and favours increased expenditure on primary and secondary expenditure and on employment-related training.

The screening model implies that educational expenditure is pure waste, except insofar as it contributes to the ranking of students, and therefore that it is desirable to minimise both the resources devoted to education and the time spent in the education

system. In particular, any reduction in resources or time that reduces the measured performance of all students equally is desirable, since it would reduce costs without changing the rankings. A fortiori, a reduction in resources is desirable if it reduces the measured performance of less able students relative to that of able students.

Fane (1985) and the Centre for Policy Studies (1987) make the link between screening theory and spending cuts explicit. They argue that, under screening theory, an increase in education for one student increases that student's earning capacity at the expense of a reduction in the earning capacity of others, thereby generating negative externalities. Particularly in New Zealand, Maglen's attack on the human capital model has been used to justify cuts in educational expenditure and a switch to narrowly vocational training. Blackmore (1996, p. 7) observes:

The Todd Task Force deliberation was influenced by a belief that public subsidisation of tertiary education could be reduced without major impact on participation or economic growth. ... Maglen has argued that, for society as a whole, expanding post-compulsory education has no direct effect on productivity and economic growth. ... He also argues that education became a filtering mechanism which sorts trainees according to broad behavioral traits rather than accruing specific skills.

Blackmore criticises New Zealand policymakers for their uncritical acceptance of 'Maglenesque' views, and argues that outcomes have not matched expectations in a number of areas.

3.1 Efficiency in education

The IPA public choice model is even more clearly directed towards justifying cuts in educational expenditure than the screening model. Because of the assumption that resources have zero marginal product in education, the IPA public choice model implies that expenditure should be minimised. These arguments have already been used to justify cuts in spending (Centre for Policy Studies 1987; Institute of Public Affairs 1990; National Commission of Audit 1996)□□.

The efficiency measures used by advocates of the IPA public choice model are based on input measures such as teacher-student ratios and expenditure per student. Implicitly, this approach defines the output of the system as pupil-years of school attendance. Efficiency can therefore be increased by any measure that reduces input requirements for any given number of students. 'Best practice' is represented by the lowest level of expenditure per student among the systems compared. Using this implicit measure, the increase in education spending per student that took place from the election of the Whitlam government in 1973 until 1990-1 translated, by definition, into a decline in efficiency.

As a guide to policy, the objective of maximising student-years of attendance per dollar spent is unsatisfactory. For example, this efficiency measure could be improved by trading reductions in teacher salaries for reductions in the annual number of attendance days (or contact hours per day) per student. The results of Card and Krueger (1992) and Sipe, Grossman and Milliner (1988) show that the number of days of school attendance per year is highly significant in increasing the rate of return

to education.

Alternatively, the efficiency measure could be redefined as cost per contact hour and the output measure as student-hours of attendance. This measure could be improved by scheduling low-cost activities in which a large number of students may be supervised by a single teacher. Such is a policy unlikely to yield genuine benefits -- yet conclusions of this kind follow inevitably from the assumption that teacher-student ratios are irrelevant to performance.

Recent cuts in education expenditure in Australia have not been directed to the achievement of any specific efficiency goal. Rather resources have been cut on an across-the-board basis, leaving the allocation of cuts to be made in a decentralised fashion. Even if the IPA public choice model is correct, there is no reason to suppose that cuts will be made by reducing the returns to teachers rather than by reducing the quality of education.

The cost-efficiency measures that have been applied by users of the IPA public choice model of education lack any coherent rationale. They represent ratios of input costs to arbitrary and indefensible measures of output. Assessment of the effectiveness of the education system is ruled out by assumption.

One measure of effectiveness not considered by the advocates of the IPA public choice approach is the proportion of students who complete school education and go on to obtain university education. On this measure, the effectiveness of the education system improved steadily until cuts in spending per student began around 1990 in Victoria and other states. Since then, school completion rates have declined. It seems likely that cuts in higher education spending will reinforce this trend.

3.2 Distributional issues

The public choice and screening models imply that the distributional effects of education spending are random or perverse. The IPA model implies that educational spending is simply a transfer from taxpayers to teachers. Under the screening model, a general increase in education levels has no systematic effect on income distribution, since it simply replaces one ranking with another. From a starting point of equal access to educational resources, increasing expenditure on any one group benefits that group at the expense of others. Since the effect is to distort the ranking of native ability, there is a net loss of social welfare.

The distributional implications of the human capital model are more complex. A number of general observations may be made. First, in a society with an unequal distribution of nonhuman wealth, a uniform increase in endowments of human capital has an equalising effect, whether the benefits of human capital are captured in individual earnings or take the form of externalities increasing the productivity of labour in general.

Second, distributional considerations reinforce the case for an increase in the share of GDP allocated to education as income rises. Where technological progress tends to increase the demand for skilled labour and reduce the demand for unskilled labour, rising average education levels are necessary to keep returns to education stable, and

therefore to prevent the emergence of increasing income inequality. This theoretical argument is supported by the observation of rapidly increasing income inequality and increasing returns to education in the United States, where growth in educational attainment has stabilised.

Some policy conclusions may be derived from this discussion. First, equity will be improved by increases in public expenditure on education at age levels where participation is universal or nearly so. In developed countries including Australia, high school completion is now the norm and this argument therefore supports increased funding for school education. Second, equity will be improved by increases in the average level of educational attainment.

At the post-secondary level this analysis suggests that the primary focus of subsidies to education should be on ensuring that all those who can benefit from further education have access to appropriate opportunities, rather than on reducing costs incurred by those who would undertake higher education in any case. Subsidies to higher education may also be justified on the basis of externalities, capital market failure or joint provision of teaching and research.

In assessing these arguments, it is important to observe that current Australian higher education policy provides the smallest subsidies to students undertaking degrees in law and business, where the proportion of benefits accruing in the form of higher earnings is presumably greatest. Subsidies to students in the humanities are larger (because of lower HECS costs) and those to students of science, engineering and medicine larger still (because of higher expenditure per student). The implied pattern of subsidy is broadly consistent with the community attitudes observed by Round and Siegfried (1998).

4. Concluding comments

The human capital model is derived from the standard economic logic of optimisation and is supported by a large body of empirical evidence. It is not surprising, therefore, that the model is dominant in economic analysis of education throughout the world, and that it is taken as a background assumption in many other areas of economics, such as the theory of economic growth.

What is surprising is the attention paid in Australian and New Zealand, particularly in the last decade, to empirically ill-supported models such as the screening model and the IPA version of public choice theory. These models have been embraced primarily because their policy implications are convenient to governments and other groups seeking to cut public expenditure in education and other areas.

Cuts in public spending are frequently justified on the basis that current levels of expenditure constitute a burden on future generations (National Commission of Audit 1996). The reductions in education spending being imposed on the basis of screening and public choice models will have adverse effects on Australia's long-term economic growth and on the lifetime welfare of the students affected by the cuts. In view of the large body of evidence showing high private and social rates of return to educational investment, it is likely that these negative effects will more than outweigh any benefits arising from reductions in public debt levels.

Finally, the nonpecuniary benefits of education, and the corresponding costs of cuts in educational provision are substantial. In addition to reductions in the rate of economic growth, cuts in education spending will result in a culturally impoverished and less cohesive society.

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