THE AUSTRALIAN NATIONAL UNIVERSITY
Centre for Economic Policy Research

DISCUSSION PAPERS

INTERACTION BETWEEN GOVERNMENT AND PRIVATE OUTLAYS: EDUCATION IN AUSTRALIA, 1949-50 TO 1981-82

Ross A. Williams
Discussion Paper No. 79
November 1983

P.O. Box 4, Canberra 2600, Australia
INTERACTION BETWEEN GOVERNMENT AND PRIVATE OUTLAYS:
EDUCATION IN AUSTRALIA, 1949-50 TO 1981-82

Ross A. Williams
Department of Economics
ESSS, ANU, Canberra
November 1983

DISCUSSION PAPER NO. 79

ISBN: 0849638 80 2
ISBN: 0725-430X
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Abstract</td>
<td>1</td>
</tr>
<tr>
<td>1. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>2. GOVERNMENT AND PRIVATE DECISION MAKING</td>
<td>5</td>
</tr>
<tr>
<td>2.1 Government Expenditure on Education</td>
<td>5</td>
</tr>
<tr>
<td>2.2 Price of Education</td>
<td>7</td>
</tr>
<tr>
<td>2.3 Private Expenditure on Education</td>
<td>8</td>
</tr>
<tr>
<td>3. EMPIRICAL FINDINGS</td>
<td>10</td>
</tr>
<tr>
<td>3.1 Government Expenditure</td>
<td>10</td>
</tr>
<tr>
<td>3.2 Price of Education</td>
<td>12</td>
</tr>
<tr>
<td>3.3 Private Expenditure</td>
<td>13</td>
</tr>
<tr>
<td>4. OVERVIEW</td>
<td>15</td>
</tr>
<tr>
<td>Notation for Data</td>
<td>17</td>
</tr>
<tr>
<td>Data Sources</td>
<td>18</td>
</tr>
<tr>
<td>Footnotes</td>
<td>19</td>
</tr>
<tr>
<td>References</td>
<td>21</td>
</tr>
</tbody>
</table>
ABSTRACT

In the last thirty years marked shifts have occurred in the composition of educational funding in Australia. In 1930-31, 20 percent of final expenditure on education was private. By 1981-82 the private share had fallen to 5 percent. Government expenditure on private schools, however, has risen rapidly from token levels in the mid-1960's so that by 1981-82 it was 40 percent greater than total private expenditure on education.

This paper seeks to explain the movements in the composition of educational funding. Attention is paid both to the usual factors thought to influence expenditure on education, such as the level of GDP, cost and demographic factors, and to the interrelationships between public and private sectors. The analysis departs from the conventional "arithmetic of education" by recognising that participation rates in education depend, in part, upon the variable to be explained, that is, on the level of service provided as measured by real expenditure on education.

The main findings may be summarised as follows:

- Growth in government expenditure on education can largely be explained by increases in GDP and demographic factors, although there was a once-for-all upward shift in the period 1973-74.
- Government expenditure is shown to be negatively related to private expenditure.
- There appears to have been some substitution of government for private expenditure in non-government schools but the effect is not large. The point estimate implies that a dollar increase in government transfers results in a net increase of around 80 cents in total real expenditure on private education. There is external evidence, however, that substitution is much greater for current expenditure than for capital expenditure.
- Governments tend to target total final expenditure on education rather than its components (consumption expenditure and investment).
- Increases in government provision of educational services exert upward pressure on the costs of providing education (mainly salaries).
INTERACTIONS BETWEEN GOVERNMENT AND PRIVATE OUTLAYS:
EDUCATION IN AUSTRALIA, 1949-50 TO 1981-82

1. INTRODUCTION

The interface between public economics and consumer demand analysis is a relatively neglected area of empirical research. Studies of household demand behaviour typically ignore government provision of goods and services. Similarly, attempts to explain government outlays over time frequently pay little attention to private expenditures.

Three areas where the interaction between government and private activity is particularly important are education, health and housing. This paper is concerned with outlays on education, but much of the methodology is extendable to the other areas. The general issues are: (i) to what extent does government expenditure affect private expenditure? (ii) how do governments treat private outlays when framing their expenditure budgets? (iii) what are the effects of government activity on the prices of inputs and outputs?

Governments, state and federal, may be thought of as collectively deciding upon a desired level of national resources to be devoted to education. In Australia the level is set after interaction between governments, the Schools Commission, the Commonwealth Tertiary Education Commission and the general community. In this paper the level of government spending on education is postulated to take account of private expenditure on education. Government spending in turn may be devoted to "government" educational institutions or to private institutions. This division is clearest for primary and secondary schools. Post secondary institutions will be treated as government institutions.
Private expenditure on education is taken to be a function of the usual determinants of demand (such as income and relative price) and government outlay on education. The two types of government expenditure (on government versus private institutions) may be expected to have differential effects on private outlays.

Growth in final expenditure on education over the past three decades has been exceptionally fast, rising from under 2 percent of GDP in 1950-51 to a peak of 6.3 percent in 1977-78 and then falling slightly. Its composition has also changed markedly. For our purposes the key division of final expenditure is the threefold one between (1981-82 shares are given in parentheses): (i) government expenditure on government educational institutions (87 percent), (ii) government expenditure on privately run educational institutions (8 percent), and (iii) private expenditure (5 percent). In 1950-51, by contrast, 20 percent of educational expenditure was private. Category (ii) comprises current and capital grants by governments to non-government schools. These grants have grown rapidly from token levels in the mid-1960's and from 1976-77 have exceeded private expenditure on all forms of education. The three time series are plotted in Figure 1.

The plan of the paper is as follows. Section 2 examines in some detail the nature of the interrelationships between government and private decision making in education. A simultaneous system of equations is developed. The first equation is concerned with government expenditure on education, the second models the effect of changes in government activity on the price of education and the third examines private expenditure on education. Empirical estimates of the model are presented and discussed in section 3. A final section contains an overview of the findings.
Figure 1.
Government and Private Final Expenditure on Education,
Australia, Real per Capita, 1979-80 Prices, (logarithmic scale)
2. GOVERNMENT AND PRIVATE DECISION MAKING

This section deals with the nature of the interdependencies between government and private decisions on education expenditure over the period 1949-50 to 1981-82. Data limitations mean that only broad aggregates can be used in empirical work. Whilst it is not possible to disaggregate all expenditure by level of education (school, university, colleges, etc.), institutional changes affecting outlays, such as the abolition of tertiary fees in January 1974, must be recognised, even though precise quantification is not possible.

The distinction between current and capital expenditure is less important in education than in most other forms of economic activity. Education is often thought of as a hybrid investment-consumption good (as, for example, in Peltzman's (1973) study of higher education in the USA). Total government expenditure on education or its share of government outlays or GDP appear to be the political targets of government and educationists. Similarly, households paying for private education are concerned more with their cash outlays than with how the funds are distributed between current and capital expenditures.

Only limited attention will be paid to the components of final expenditure. Factors determining current expenditure on education will in the main also be the determinants of the capital stock. The number of teachers and the number of classrooms are functions of much the same variables. It follows that investment expenditure will depend largely on changes in determining variables.

2.1 Government Expenditure on Education

In fixing the level of resources to be devoted to education, governments are making economic decisions about the relationship between future and current aggregate consumption and non-economic judgments about the social value of education. The short-run opportunity costs of delaying entry into the work force by extending years of education has fallen in recent years with the rise in unemployment. In the fifties and sixties delayed entry into the work force was to some extent offset by immigration.
The neoclassical approach to education expenditure would be to assume that governments attempt to maximise, subject to a national budget or resources constraint, a social welfare function with knowledge or expenditure on education as an argument.\(^5\) The difficulty with this approach is that expenditure by governments on education in Australia is budgeted for in real terms. Educational institutions have, in the main, been fully compensated for increases in input prices such as salaries of teachers and academics and equipment and buildings costs.

While input prices matter in the medium term, they seem to have been unimportant in short-term decision making by governments. Furthermore, since governments are the dominant employers of teachers and academics, salary levels cannot be assumed to be independent of the volume of resources devoted to education.

Previous Australian studies by Karmel (1966), Blandy et al. (1979), Williams (1979) and Burke (1983) have analysed expenditure on education in terms of student numbers multiplied by the average cost of education. The models are of the form:

\[(1) \text{Expenditure} = \text{population} \times N \times \text{student participation rate} \times \text{resources per student} \times \text{price (cost) of a unit of resources}\]

where \(N\) is the proportion of the population in the main education age groups. Staff-student ratios enter through the term representing resources per student. Equation (1) may be rewritten as:

\[(2) y = N \times \text{student participation rate} \times \text{resources per student}\]

where \(y\) is real national expenditure on education per head of population. Equation (2) allocates the growth in educational expenditure between its different components. In this paper we attempt to go one stage back and express \(y\) in terms of \(N\) and the determinants of student participation rates and resources per student. It is postulated that the main determinant of participation rates and resources per student is the level of GDP per head. However, student participation rates will also in part depend on resources devoted to education, i.e. on the dependent variable. Thus when in the reduced form \(y\) is expressed as a function of GDP and \(N\), \(N\) will have an exponent which exceeds unity.
Measures of social attitudes are not included directly for they are difficult to quantify. They depend on factors such as perceived rates of return to education and observations about relative levels of expenditure on education in other OECD countries. To some extent these influences will be picked up by the GDP term. Some comfort can be found from Miller's (1982) study using cross-section data from the 1976 Australian census. He found that income was "by far the most important determinant of school participation rates" (p.47).

Nevertheless, it is clear that the gradual movement in social attitudes culminated in the adoption of the Karmel Report (see Schools in Australia (1973)) by the Whitlam government. A dummy variable, DUK, is introduced to capture this once-for-all increase in Commonwealth government assistance to schools (and tertiary institutions).

Returning to the issue of public/private mix, y is to be regarded as the level of national educational expenditure desired by governments. Actual expenditure may be partitioned between government expenditure for government institutions \((y_1)\) and private institutions \((y_2)\), and private expenditure \((y_3)\). To allow for the possibility of governments valuing private expenditure differently from their own, the expenditure equation is written as:

\[
(3) \quad (y_1 + y_2 + a_3y_3) = f_3(DUK, \text{GDP}, N)
\]

The preceding arguments suggest that a multiplicative functional form is appropriate. The equation for government expenditure is thus:

\[
(4) \quad (y_1 + y_2) = (a_1 + a_2DUG) \text{GDP}^{-n} \quad a_3y_3
\]

where \(a_2\) is \((1 - n)^{-1}\) and \(n\) is the elasticity of the participation rate with respect to expenditure on education. No attempt will be made to model the allocation of government expenditure between \(y_1\) and \(y_2\).
The hypothesis that government targets relate to total outlays, rather than to consumption and investment outlays separately, will be investigated by estimating an equation for consumption expenditure with capital expenditure as an explanatory variable. The expected coefficient on the latter is minus one.

2.2 Price of Education

The main determinant of the price of education is salaries paid to teachers and academics. Salary payments dominate final consumption expenditure on education. Consumption expenditure in turn is much larger than investment expenditure. In 1981-82 gross fixed investment in education was 9 percent of total final expenditure; the ratio has never exceeded 25 percent.

It is postulated that government expansion in the volume of resources devoted to education exerts an upward pressure on labour costs. This may occur for two reasons. Firstly, the supply of teachers is unlikely to be infinitely elastic at the current wage, at least in the short run. Secondly, governments favourably disposed to education may increase both the volume of resources devoted to education and the remuneration of teachers. Rapid expansion of school and tertiary institutions may also be expected to exert upward pressure on the prices of capital goods. However these resources are less specialised than labour and the price effect consequently smaller.

The dependent variable to be explained is the price of education, $P_e$, relative to the price of all final expenditure as measured by the implicit deflator for gross national expenditure, $P_g$. From 1959-60 onwards the price of education is a weighted average of implicit deflators for consumption and investment expenditure on education by governments. For earlier years it is necessary to use as proxies the implicit deflators for total government expenditure on consumption and investment.
Explanatory variables are changes in government real final expenditure on government institutions (\(dy_1\)) and \(w\), an index of average weekly earnings deflated by \(p_e\). Thus the equation is:

\[
p_e/p_g = b_0 + b_1\Delta y_1 + b_2w
\]

2.3 Private Expenditure on Education

The effects of public expenditure on private demands may be analysed using conditional demand functions (see Pollak (1969), (1971)). In this approach the consumer's utility function contains both publicly and privately supplied goods. The publicly supplied goods and services are treated as precommitted outlays and maximisation is with respect to gross income. If the utility function is separable in public and private goods then the precommitted quantities (public goods) have only an income effect.\(^7\)

The problem then reduces to the conventional private demand model where the quantities of private goods demanded are functions of the prices of private goods and net income (i.e. the cost of public goods is deducted from gross income).

Netting out is appropriate for public goods like defence, but not for goods and services such as education which are both publicly and privately provided. The separability assumption is inapplicable for jointly provided goods. Without this assumption the demand equations for private goods include the publicly provided quantities as explanatory variables.

An additional complication in the Australian context is that governments allocate a proportion of their education expenditure to private schools. The main aim of this policy, as enunciated in the Karmel Report (see Schools in Australia (1973)) and subsequent reports of the Schools Commission, is to raise resource use in non-government schools to target levels. In other words, there is an assumption that such outlay is in addition to, rather than a substitute for, private expenditure. Nevertheless, there are no institutional constraints which prevent some offsetting changes in private expenditure.
The decision that children attend private schools rather than government schools is made on the basis of a comparison of the educational services provided by the two systems, the price of private services, and the financial resources of the family. As with government expenditure, the participation rate (in private schools) is partly a function of the dependent variable and the coefficient of the demographic variable N will exceed unity in the reduced form equation.

Brennan and Pincus (1983) show that, assuming a homogeneous service, an increase in public provision of schooling will in general lead to a reduction in consumption of the private service. This reduction may be greater or less than the increase in government provision so that the net effect on aggregate consumption of education is uncertain. On the other hand, prior to 1974 private and public expenditure on tertiary education was largely complementary.

Government transfers to private schools lower the price of private education. The effect on private expenditure will depend on the price elasticity of demand. Capital transfers facilitate the opening of new private schools in areas where previously only government education was available. This encourages complementary private expenditure.

The effect of government activity on private educational expenditure is thus an empirical matter.

The equation for private expenditure has as explanatory variables government expenditures \((y_1, y_2)\), a real price index of the costs of education \((p_e/p_c)\), real personal disposable income \((Y)\) and the demographic term \((N)\). Formally:

\[
y_3 = f_y(p_e/p_c, Y, y_1, y_2)^N
\]

The major variable missing from equation (6) is religious affiliation, particularly the proportion of Catholics in the population. Such a variable is certainly necessary to explain differences in private expenditure on education across states. At the national level, however, the variable is relatively slow moving. Definitional problems also exist.
Prior to 1974 the dependent variable includes tuition fees paid to tertiary institutions. However, a significant proportion of these fees were paid for out of government transfers in the form of scholarships. These transfers should in principle be subtracted from private expenditures ($\gamma_p$) and added to government expenditures ($\gamma_g$). The only data available on a time series basis relate to university fees financed by the Federal government through its Commonwealth Scholarships scheme, S. It is assumed that total tertiary fees financed by governments, $P$, are proportional to the value of Commonwealth Scholarships, i.e. $P = kS$, where $k$ becomes a parameter of the model to be estimated.

3. Empirical Findings

The three-equation system described in section 2 is part of a simultaneous system. It is not a complete system in itself because there are more endogenous variables ($\frac{p_a}{p_c}$, $S$, $\gamma_1$, $\gamma_2$, $\gamma_3$) than equations. The method of estimation is Nonlinear Generalised Instrumental Variables. The instruments used are the predetermined variables in the three equations and a dummy variable, $DG$, representing the introduction of government aid to non-government schools in 1964-65. The period of estimation is 1949-50 to 1981-82 unless otherwise specified. All real values are in 1979-80 prices. The age cohort used in $N$ is 5 to 19 years. Expenditure on older students is taken account of through the participation rate term.

3.1 Government Expenditure

Before presenting specific equations some general findings should be noted. Firstly, GDP acts with a lagged effect. This is to be expected given that triennial funding has often been used. Unrestricted regressions showed that it was appropriate to use a simple three-year moving average of GDP. Secondly, lagged private expenditure proved superior to the current value. This lag is consistent with institutional arrangements for funding of non-government schools. Thirdly, the value of the dummy variable $D_0$ for the transition year 1973-74 was put at its maximum likelihood value of one-third.
The preferred equation, with standard errors in parentheses, is:

\[
(7) \quad (y_1 + y_2) = \begin{cases} 
1.412 \\ 1.402 
\end{cases} \begin{bmatrix} 
0.00831 & + & 0.00151 \\
(0.00586) & & (0.00089)
\end{bmatrix} \text{DEU} \begin{bmatrix} 
GDP_3 & (0.066) \\
(0.054) & & (0.046)
\end{bmatrix} \\
- \begin{cases} 
1.494 \\ 0.495
\end{cases} y_3(-1) 
\]

\[R^2 = 0.9988, \quad d = 1.46, \quad h = 1.41, \quad s = 1.83, \quad \overline{(y_1 + y_2)} = 249\]

where \(d\) is the Durbin-Watson statistic (used here as a descriptive measure of error correlation), \(h\) is the "t-value" on the first-order autocorrelation coefficient in a model re-estimated with this error structure, and \(s\) is the standard error of estimate expressed as a percentage of the mean of the dependent variable.

The overall fit of the equation is good. Parameter values are of expected signs and of reasonable magnitudes. The \(h\)-statistic is less than 1.96 indicating no significant first-order autocorrelation in the errors (at the 5 percent level).

The coefficient on private expenditure is relatively large at -1.5 but it is only one standard error from an absolute value of unity. The implication of the point estimate is, for example, that a $1 increase in private resources devoted to non-government schools results in a $1.50 reduction in government aid. But the coefficient also reflects the abolition of tertiary fees in 1974.11

The coefficient on \(N\), the population aged 5-19 years, is significantly greater than unity. The point estimate suggests that the elasticity of the education participation rate with respect to real expenditure on education is around 0.3.

The t-value on the Karmel-Whitlam dummy (BDW) is 1.69. Using 1972-73 data levels the point estimate implies a rise in government expenditure of 21 percent. The exponent on GDP of 1.4 measures the elasticity of national expenditure on education (as perceived by government) with real GDP. Holding private expenditure constant, the elasticity of government expenditure on education with respect to GDP is 1.7 (at mean
values). These estimates understate the income effect to the extent that the dummy variable is also picking up GDP growth.

Similar results were obtained when the dependent variable was limited to current government expenditure. There is also some evidence for the conjecture of section 2 that governments target total outlays rather than the components. The relevant estimated equation is:

\[
(8) \quad \text{current}(y_1 + y_2) = \begin{cases} 
0.00410 + 0.0069 \text{ DICH} \\
(0.00266) (0.0059) 
\end{cases} \text{GDP}(0.063) \quad R^2(0.119) \\
- 1.861 \text{ current } y_3(-1) = 0.570 \text{ capital}(y_1 + y_2) \\
(0.555) \quad (0.140) 
\]

\[ R^2 = 0.9986, \: d = 1.27, \: h = 1.78, \: e = 2.20, \: \text{mean dep var} = 200 \]

Three comments may be made on this equation. Firstly, while first-order autocorrelation is more severe than in equation (7) the coefficients are little affected if it is allowed for. Secondly, the 95 percent confidence interval for the coefficient on capital expenditure is -0.29 to -0.85. Thirdly, the exponent on \( N \) is now not significantly different from unity. This suggests that it is capital expenditure rather than current expenditure which leads to increased participation rates.

An example would be the establishment of Colleges of Advanced Education in country areas.

No satisfactory equation was obtained for government capital outlays on education, although government current expenditure always entered with a negative coefficient. Changes in GDP and demographic changes, which were postulated in section 2 to influence investment, were not important in the aggregate equation for outlay on education.

3.2 Price of Education

Equation (5) was first estimated for the years 1959-60 to 1981-82. For this period the price data relate specifically to education. A lagged value of real average weekly earnings, \( w \), proved to be more appropriate than the current value. The estimated equation is:
(9) \[
\frac{p_e}{p} = 0.437 + 0.585 w(-1) + 0.00102 \Delta y_1
\]
\[
(0.017) \quad (0.019) \quad (0.00021)
\]
\[R^2 = 0.9790, \quad d = 1.65, \quad h = 0.37, \quad s = 1.31, \quad \overline{p_e/p} = 0.967\]

where, since the equation is linear, \( h \) is calculated as in Godfrey (1976).

The "t-value" on change in government outlay on government education is 4.8. In unrestricted form the coefficients on \( y_1 \) and lagged \( y_1 \) were almost identical at 0.00097 and -0.00101 respectively. It thus appears that increases in resources devoted to education do exert upward pressure on the cost of education. The mean absolute value of \( \Delta y_1 \) is 12.1 (1979-80 dollars per head); an increase in \( y_1 \) of this amount is estimated to raise the cost of education by around 1.3 percent at the sample mean of \( p_e/p \).

Extending the equation to the whole sample period and adding a dummy variable, \( DP \), for the break in data at 1959-60 (\( DP = 1 \) before 1959-60; 0 from 1959-60 onwards) yields:

(10) \[
\frac{p_e}{p} = 0.433 + 0.587 w(-1) + 0.00109 \Delta y_1 - 0.0478 DP
\]
\[
(0.019) \quad (0.022) \quad (0.00025) \quad (0.00081)
\]
\[R^2 = 0.9870, \quad d = 1.89, \quad h = -1.24, \quad s = 1.60, \quad \overline{p_e/p} = 0.909\]

A comparison of equation (10) with equation (9) shows that the linking dummy variable is significant. The other coefficients show little change.

3.3 Private Expenditure

Alternative functional forms for equation (6) were estimated. The price and income elasticities were more constant over time than were the marginal responses.\(^{12}\) The preferred equation is:

(11) \[
y_3 = \left\{ \frac{2.22 (p_e/p)}{(0.489)}(0.219) - 1.28 y_1 - 8.51 y_3 \right\}^{(0.41)}
\]
\[\quad (4.13) \quad (2.14) \quad (4.78)\]
\[R^2 = 0.9809, \quad d = 1.57, \quad h = 0.76, \quad s = 3.58, \quad \overline{y_3} = 34.1, \quad k = 3.15\]
\[\quad (0.42)\]
The "t-value" on government transfers to private schools \( (y_2) \) is -1.78 which is not significantly different from zero at the 5 percent level. The point estimate implies that for each $1 increase in government transfers there is a $0.18 fall in private expenditure (evaluated at the mean value of N of 0.2734). At most, then, increases in government aid to private schools results in a small decline in private expenditure. Putting it another way, virtually all government aid appears to have been fully translated into increased resources for non-government schools.

The coefficient on government expenditure on government education \( (y_4) \) is small and not statistically significant. No relationship between private and public expenditure has been established, at least at the aggregate level. One might expect a positive relationship between \( y_1 \) and \( y_3 \) for tertiary education prior to the abolition of fees, and a negative relationship between \( y_1 \) and \( y_3 \) for schools. Attempts to separate out these effects using multiplicative dummy variables were unsuccessful.

The estimated elasticity \( (E_p) \) of private expenditure with respect to the index of the price of inputs is -1.0 at mean sample values. For schools considered alone, it would be possible to define an effective price, \( p^* \), as the price index for inputs multiplied by the proportion of the price paid by persons i.e. multiplied by \( y_3/(y_2 + y_3) \), where \( y_3 \) now relates only to private expenditure on schools. The price elasticity would then be given by \( \beta = \ln(y_2 + y_3)/\ln p^* \) where \( (y_2 + y_3) \) is the total quantity of education services obtained. From this may be derived an expression linking \( E_p \) and the marginal effect of \( y_2 \) on \( y_3 \), namely, \( (\partial y_3/\partial y_2) + E_p = -1.0 \). Interestingly, the estimates obtained from aggregate data approximately satisfy this relationship. An elasticity with respect to the price of inputs of around -1.0 and little or no substitution of private for public expenditure are consistent results.

It was argued in section 2 that the amount by which the exponent on N exceeds unity is a measure of the responsiveness of enrolments in private schools to the standard of education they offer. The point estimate is around 3 and is well determined. While no precise statements can be made because of the aggregate nature of the model, the results suggest that,
ceteris paribus, an increase in resource use per student in private schools produces a more than proportional increase in enrolments.

Two parameter estimates remain to be explained. Firstly, the income exponent implies an income elasticity of 0.9. Secondly, the point estimate of k implies that for the period when tertiary institutions charged fees, total fees financed by governments were about three times those financed by Commonwealth University Scholarships. Example would be teacher training awards by State governments. The point estimate is probably a little high and suggests that the variable is in part acting like a dummy variable for the abolition of tertiary fees.

4. OVERVIEW

The empirical results support the view that the key target of governments is total national expenditure on education. Private expenditures are found to exert a significant negative influence on government expenditures. Current and capital expenditures by government tend to move in compensating directions.

The effects of government spending on private spending are twofold. Government assistance to non-government schools is almost fully translated into increased resources with little offsetting change in private expenditures. Private expenditure on education appears to be little affected by increases in government expenditure on government schools. This implies that increased expenditure on government schools raises the total provision of education services in the nation.

The paper departs from the traditional "arithmetic of education" approach by explicitly recognizing that participation rates are in part dependent on education expenditures. This relationship is statistically significant so long as expenditure is defined to include capital items. Recognition of this relationship has implications for fiscal equalisation in a federal system. To the extent that observed higher participation rates in education in one state are a function of higher expenditure they should not constitute a claim for transfers from other states.
Increases in government resources devoted to education are found to exert a positive effect on the cost of education. A decision by a government to lower student-staff ratios, for example, will therefore increase consumption expenditure in the short run by the sum of (i) the extra staff required multiplied by the existing average wage rate and (ii) total staff numbers multiplied by the increase in wages occasioned by the expansion. The capital cost of the additional buildings and equipment required to accommodate the extra number of classes may be calculated in a similar manner.

The paper represents a first step in the modelling of the inter-relationships between private and government outlays. Further research can take two directions: firstly, incorporation within a systems framework where the allocation of household and government income is examined; secondly, introduction into the analysis of government revenue raising from persons.
Notation for Data

DG dummy variable for government aid to non-government schools: 0 before 1964-65, 1 from 1964-65 onwards.

DHW Karmel-Whitlam dummy variable: 0 before 1972-73, 1/3 in 1973-74, 1 thereafter.

DP dummy variable for break in price data: 1 before 1959-60, 0 from 1959-60 onwards.

GDP Gross Domestic Product per capita in 1979-80 prices.

GDP3 three-year moving average of GDP.

N proportion of population aged 5-19 years.

Pc implicit deflator for private final consumption expenditure (1979-80 = 1.0).

Pf implicit deflator for final expenditure on education (1979-80 = 1.0).

Pg implicit deflator for gross national expenditure (1979-80 = 1.0).

S university fees paid under Commonwealth Scholarship Scheme, real per capita (price deflator pg).

w index of average weekly earnings in real terms, 1979-80 = 1.0 (deflator is pg).

Y1 real per capita final expenditure by governments on government educational institutions. The consumption and investment series are deflated separately.

Y2 real per capita final expenditure by government on private educational institutions.

Y3 real per capita final expenditure on education by persons.

Ey real per capita national expenditure on education.

Y household disposable income per capita in 1979-80 prices (deflator is pc).
DATA SOURCES

GDP;Y:

N:
ABS, Estimated Resident Population by Sex and Age: States and Territories of Australia (3201), June 1971 to June 1981, and June 1977 to June 1982; Demographic Data Bank of IMPACT Project.

Pc,Pe,Pg:
ABS, Australian National Accounts, National Income and Expenditure (5204); unpublished working estimates made available by the Australian Bureau of Statistics.

S:

w:

Y1,Y2,Y3:
ABS, Expenditure on Education (5510); ABS, Commonwealth Government Finance (5502); unpublished working estimates made available by the Australian Bureau of Statistics and the Commonwealth Department of Education.
The paper was written while on leave from the University of Melbourne. Jenny Andersen provided excellent research assistance. G. Burke, R. Dixon and J. Pincus made useful comments on an earlier draft of the paper. I am indebted to the Commonwealth Department of Education and the Australian Bureau of Statistics for the provision of unpublished data.


2. For sources see last entry in Data Sources at end of paper. The classification differs from that of the Australian National Accounts. In the ABS, recurrent grants to non-government schools are classified as government current expenditure on education. Capital grants are regarded as a transfer and the expenditure is included as private fixed capital expenditure on education. More details of recent changes in public expenditure on education may be found in Burke (1983) and Mathews (1983).

3. Changes in Australian educational policy in the post-war period are well documented and analysed in Blandy, Hayles and Woodfield (1979), Davey (1978) and Mathews (1983). Developments from 1901 are given in Butlin, Barnard and Pincus (1982).

4. Thus, for example, Karmel (1966, p.3) states: "The simplest and most satisfactory measure of the education effort of a country is the proportion of its gross national product...which it devotes to expenditure on education. 'Expenditure' in this sense means expenditure on goods and services: on the hiring of teachers, on the purchase of materials, on the construction of buildings."


6. Powell et al (1982) acknowledge that teaching is an occupation which cannot be modelled in a neoclassical framework; both wage rates and the number of teachers are set by authorities.

7. See, for example, Phillips (1974, Chapter 3) for details. The concepts are also discussed in Deaton (1981).
8. Martin Report estimates for the early 1960's suggest that about two-thirds of all full-time university undergraduates received some form of financial assistance, predominantly from governments—see Tertiary Education in Australia (1964) p.201.

9. The program used was AUTREGALS written by Adrian Pagan at A.N.U. The method is equivalent to that described in Amemiya (1974).

10. Least squares estimates of all parameters were insensitive to whether \( y_3 \) was lagged or not. Instrumental Variable estimates using current \( y_3 \) were sensitive to functional form and convergence was a problem. For these reasons \( y_3(-1) \) is preferred and thus estimation is by nonlinear least squares.

11. The coefficient will also be picking up the tertiary scholarships (S) effect but this is small relative to the social attitudes effect. When S was added to the equation its coefficient (h) was insignificant, there was a fall in the "t-value" on the DFM coefficient, but very little change in the other coefficients.

12. Although when evaluated at mean values for the period 1949-50 to 1981-82 the elasticity estimates are not sensitive to functional form.
REFERENCES


