Education: tests of whether it enhances productivity or merely conveys information on individual productivity in the labour market.

Christopher Anthony Ryan

Submitted in partial fulfilment of the requirements of the degree of Doctor of Philosophy (with coursework component)

April 2001

Department of Economics

The University of Melbourne
Abstract

Human capital and screening theories of the role of education in the labour market have similar predictions about individual behaviour and labour market outcomes. This makes it difficult to test between the theories. Nevertheless, the task of doing so is important since the social return to education is likely to be small unless education adds to productivity as human capital theory, but not screening theory, assumes. Education may only convey information about likely individual productivity under screening. In fact, there is very little evidence from existing tests of the theories that education does not add to productivity. However, few of the tests that have been undertaken between the theories are convincing. The three empirical Chapters of this thesis contain tests of some aspects of the theories. The first test looks for the existence of the kind of strategic behaviour implied by screening theory. It involves the analysis of whether a policy-induced change in the schooling level obtained by the earliest school leavers in South Australia influenced the schooling obtained by others. The conclusion is that it did. The second test is one of education’s productivity-augmenting effect. This test is based on the argument that individuals are likely to convert education into productive skills differently. Therefore, education should add a source of variation in productivity and in (log) wages, if productivity is observed. The conclusion is that the variance increases with education, supporting education’s productivity-augmenting effect. The final test analyses whether recent graduates of tertiary institutions who ‘used’ the skills developed during their courses were paid more than those who did not. If they were paid more, this would suggest they were more productive. The conclusion is that the skills use effect is positive, once differences in the preferences of individuals in the two groups are taken into account, along with employer selection of individuals. There is little reliable evidence that education does not increase productivity, so human capital theory receives considerable support from the empirical work undertaken here and the review of other papers that conduct tests between the theories. However, there is conflicting evidence about screening. It seems unlikely that individuals would behave in the strategic way described under the first test undertaken in this thesis if productivity was observable, as implied by the results of the second one. It seems likely that employers learn about individual productivity over time and the process is slow enough to allow a role for education to have a screening effect. Nevertheless, the conclusion of this thesis is that the major effect of education in the labour market is its productivity-augmenting one.
Declaration

This is the certify that

i. The thesis comprises only my original work except where indicated in the preface,

ii. Due acknowledgment has been made in the text to all other material used,

iii. The thesis is less than 100,000 words in length, exclusive of tables, maps, bibliographies and appendices.
Preface

The key data used in the three empirical Chapters of this thesis are drawn from:

- Data collected and published by the Australian Bureau of Statistics;
- The *Youth in Transition* Survey collected by the Australian Council for Education Research; and
- The Skills Utilisation Survey conducted by the Educational Outcomes Research Unit of the Faculty of Education at the University of Melbourne.

Supplementary use was also made of data collected by the National Centre for Vocational Education Research and the Department of Education, Training and Youth Affairs and data published by the Ministerial Council on Education, Employment, Training and Youth Affairs.

Chapter 2 makes extensive use of a model developed by Spence (1979). This model is used to provide a framework to describe why testing between human capital and screening theories is difficult and for assessing existing tests of the theories. While the remaining Chapters build on the work of others, the extensions and developments comprise original work. None of the content of this thesis was developed in collaboration with others nor has it been used in obtaining any other qualification. All of the work embodied in this thesis was carried out during my PhD candidature.
Acknowledgments

I am very grateful to my supervisors, Dr Lisa Cameron and Associate Professor Jeff Borland for their assistance, advice and guidance over the course of this enterprise. Their detailed comments have improved substantially all of the Chapters of the thesis. For the last two years of my candidature I lived in Canberra, which no doubt added to the difficulty of their task.

Dr Chris Worswick, my initial supervisor, was very encouraging early in my candidature and provided helpful comments on early drafts of Chapter 5 of this thesis. Other staff of the Department of Economics were also encouraging and helpful, especially Professor Peter Bardsley and Dr Katerina Sherstyuk.

I am also grateful to Professor Bruce Chapman of the Centre for Economic Policy Research of the Australian National University, who invited me to present material from this thesis in the graduate program seminar series of the Research School of the Social Sciences of the ANU. Participants at seminars at the ANU, the University of Melbourne and the 1999 Labour Econometrics Workshop made many helpful suggestions that have improved the content and presentation of this thesis. Dr Stephan Lamb of the Faculty of Education at the University of Melbourne provided helpful comments on Chapter 3. Venessa Tripp kindly proofread this thesis and her suggestions improved it considerably.

Other people assisted me in understanding and interpreting the data used in the thesis. Specifically, Dr Roger Jones of Quantitative Evaluation and Design Pty Ltd and Dr Gary Marks of the Australian Council for Educational Research provided assistance in understanding data used in Chapters 3 and 4 respectively. Associate Professor Richard Teese of the Faculty of Education at the University of Melbourne kindly allowed me to use the data analysed in Chapter 5 and encouraged me in undertaking this work.

Finally I would like to thank my wife, Louise Watson, for her continued love, support and good humour throughout this enterprise. As a mid-career endeavour, it could not have been possible without her understanding and tolerance. My children, Eleanor, Gillian and Benjamin transmit a little joy every day and they buoyed me during the flat periods.

While I gratefully acknowledge the contribution of the above people to this thesis, the sole responsibility for its errors and omissions is mine.
Table of Contents

List of Figures x
List of Tables xi
Abbreviations xii

Chapter 1: Introduction 1

1.1 Motivation 1
1.2 Essential features of the screening and human capital theories 2
1.3 The expansion of the Australian education and training system 3
1.4 Why tests of the theories are important 6
1.5 Tests of the two theories 7

Chapter 2: Existing tests of the human capital and screening theories of the role of education in the labour market 9

2.1 Introduction 9
2.2 A model of schooling involving screening and human capital 10
   2.2.1 Description of the model 10
   2.2.2 Implications of the model 14
2.3 Tests of screening 19
   2.3.1 Tests of whether the returns to schooling or aggregate earnings differ by job type or individual characteristics 21
   2.3.2 Tests of whether the level of schooling obtained by individuals differs according to their job types 29
   2.3.3 Tests incorporating the quality of the signal provided by education 31
2.4 Assessment of the tests 37
   2.4.1 Tests of differences in rates of return to schooling or schooling levels between different jobs or sectors 37
   2.4.2 Assessment of other approaches to testing between screening and human capital 41
2.5 Conclusion 44

v
Chapter 3: Compulsory schooling legislation and the identification of education’s screening function

3.1 Introduction

3.2 Minimum schooling legislation and signalling behaviour
  3.2.1 A simple signalling model
  3.2.2 The Lang and Kropp (1986) test
  3.2.3 Minimum schooling legislation in Australia

3.3 The Early Years of School policy in South Australia
  3.3.1 Description of the policy change
  3.3.2 The policy change and the predictions of the screening model
  3.3.3 Level of attainment and years of schooling

3.4 Data used in the analysis

3.5 Preliminary evidence
  3.5.1 The ageing of the grade cohorts in South Australia
  3.5.2 Year 12 retention in South Australia and other jurisdictions
  3.5.3 School leaving both before Year 10 and in Year 11 in South Australia
  3.5.4 Other explanations for the fall in South Australian retention rates

3.6 Methodology

3.7 Results
  3.7.1 Base case results
  3.7.2 Year 12 repetition and part-time enrolments
  3.7.3 The ‘construct validity’ problem - alternative explanations of the results

3.8 Implications and conclusions
Chapter 4: A test of education’s effect on productivity that uses the variance in wages

4.1 Introduction and motivation 88
4.2 A test between human capital and screening 91
   4.2.1 Derivation of the test 91
   4.2.2 Extensions: partial observability of productivity and multiple schooling levels 96
4.3 Implementation of the test 98
   4.3.1 The test equations 98
   4.3.2 Problems with the test 100
4.4 Data and estimation 104
   4.4.1 The Youth in Transition Survey 104
   4.4.2 Attrition from the YIT survey 107
   4.4.3 Estimation and results 109
   4.4.4 Heteroskedasticity function estimates 113
4.5 Conclusion 121
Chapter 5: Use by graduates of their skills in the labour market

5.1 Introduction and motivation
5.2 The Miller and Volker test
5.3 Graduate earnings and their jobs
   5.3.1 Hourly earnings
   5.3.2 Differences in the tasks performed by individuals working in and out of their field
   5.3.3 Course background information and descriptions of individuals’ work environments
5.4 Estimation problems: endogeneity and unobserved ability
   5.4.1 Endogeneity of the job “choice”
   5.4.2 Unobserved ability and productivity
5.5 Heterogeneous preferences and job choice
   5.5.1 The model
   5.5.2 Estimation issues
5.6 The data
   5.6.1 Data summary
5.7 Regression results
   5.7.1 Determinants of whether individuals worked in their field
   5.7.2 Hourly wages equation
   5.7.3 Implications of the results
5.8 Conclusion

Chapter 6: Conclusion

6.1 Introduction
6.2 How to test between human capital and screening theories
6.3 Tests between human capital and screening theories in this thesis
6.4 The results of tests between human capital and screening theories
Bibliography

Appendices

Appendix 1: List of figures and tables in the Appendices 183
Appendix 2: A screening model with productive education 185
Appendix 3.1: A discrete schooling choice model 193
Appendix 3.2: Compulsory schooling legislation in Australia since Federation 199
Appendix 3.3: South Australian school entrance and progression policy 201
Appendix 3.4: Data definitions and sources for Chapter 3 203
Appendix 3.5: Econometric estimation of Year 12 retention rate equations 205
Appendix 4.1: Attrition and educational attainment 216
Appendix 4.2: Instrumental Variable estimation and results 223
Appendix 4.3: Heteroskedasticity tests 230
Appendix 4.4: Supplementary tables for Chapter 4 232
Appendix 4.5: Factor analysis of 1994 job descriptions 237
Appendix 5.1: Data summary for Chapter 5 239
Appendix 5.2: Factor analyses: job sentiments and tasks, workplace characteristics, course assessments and reasons for undertaking particular courses 241
Appendix 5.3: Bivariate probit estimation of the choices of individuals to work in their field and employer selection of individuals 257
Appendix 5.4: Alternative approaches to estimation: IV, semi-parametric and switching regression results 261
List of Figures

Figure 2.1: (a) Same sector: with and without screening 16
Figure 2.1: (b) Different sectors: screening in one sector; common $\alpha$ 16
Figure 2.2: (a) Different sectors: screening in one sector 39
Figure 2.2: (b) Different sectors: screening in both sectors but $\alpha = 0$ in one 39
Figure 3.1: Pre- and post-reform outcomes of the introduction of lower school leaving requirements 49
Figure 3.2: Changed junior primary school arrangements from the implementation of the Early Years of School policy 55
Figure 3.3: Proportion of South Australian Year 8 cohort aged 12 years: 1985 – 1999 63
Figure 3.4: Year 12 retention rate in South Australia and proportion of the cohort who were aged 12 in Year 8: 1991 – 1999 63
Figure 3.5: Proportion of the cohorts who were aged 12 in Year 8 in selected jurisdictions: 1991 – 1999 64
Figure 3.6: Year 12 retention rates in selected jurisdictions: 1991 – 1999 65
Figure 3.7: Cohort school attainment outcomes: South Australia 1991 – 1999 67
Figure 3.8: Alternative estimates of Year 12 retention in South Australia: 1991 – 1999 80
Figure 4.1: Education, productivity and the variance in (log) wages 89
Figure 5.1 (a) Market determination of in field and out of field wages 137
Figure 5.1 (b) Individual choice of working in or out of field, with the market-determined wages 137
List of Tables

Table 1.1: Participation rates in post-school education by age group (years): 1987 and 1997 4
Table 2.1: Summary of tests between human capital and screening 22
Table 2.2: Magnitude of the schooling elasticity under alternative education, signalling and sorting assumptions. 38
Table 3.1: Average school completion of grade cohorts at the beginning and end of the 1990s by jurisdiction 66
Table 3.2: Estimated effect of the implementation of the Early Years of School policy in South Australia 76
Table 3.3: Estimated effect of the implementation of the Early Years of School policy in South Australia on adjusted retention 81
Table 4.1: Comparison of 33 year olds from the 1994 Youth in Transition data with Australians aged 30 – 35 years in 1993. 106
Table 4.2: Least squares wage regression results – Youth in Transition data 111
Table 4.3: Heteroskedasticity function results: multiplicative heteroskedasticity – continuous and discrete schooling cases. 115
Table 4.4: Heteroskedasticity tests: alternative specifications of the heteroskedasticity function 117
Table 4.5: Impact of added variables on the heteroskedasticity function 120
Table 5.1: Wage and factor analysis outcomes: wages and job descriptions of full-time workers by whether working in field or not 129
Table 5.2: Graduate responses about the future and their expressed levels of satisfaction with their jobs by whether working in field or not 131
Table 5.3: Results of factor analyses on the reasons individuals undertook courses, their assessment of the skills they developed and aspects of their work environments 134
Table 5.4: Employed in field or not probit equation 151
Table 5.5: Hourly wage regression: employed in field effect 154
Table 5.6: Average actual and predicted wages by qualification and whether working in field of study 158
Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABS</td>
<td>Australian Bureau of Statistics</td>
</tr>
<tr>
<td>ACER</td>
<td>Australian Council for Educational Research</td>
</tr>
<tr>
<td>ANU 3</td>
<td>Australian National University 3 occupational status scale described in Jones (1989)</td>
</tr>
<tr>
<td>ASCO I</td>
<td>Australian Standard Classification of Occupations First Edition</td>
</tr>
<tr>
<td>ASSP</td>
<td>Australian Studies in School Performance</td>
</tr>
<tr>
<td>CAE</td>
<td>College of Advanced Education</td>
</tr>
<tr>
<td>DEETYA</td>
<td>Department of Employment, Education, Training and Youth Affairs</td>
</tr>
<tr>
<td>DETYA</td>
<td>Department of Education, Training and Youth Affairs</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>GLS</td>
<td>Generalised Least Squares</td>
</tr>
<tr>
<td>IV</td>
<td>Instrumental Variables</td>
</tr>
<tr>
<td>MCEETYA</td>
<td>Ministerial Council on Education, Employment, Training and Youth Affairs</td>
</tr>
<tr>
<td>ML</td>
<td>Maximum Likelihood</td>
</tr>
<tr>
<td>NCVER</td>
<td>National Centre for Vocational Education Research</td>
</tr>
<tr>
<td>NSSC</td>
<td>National Schools Statistics Collection</td>
</tr>
<tr>
<td>OLS</td>
<td>Ordinary Least Squares</td>
</tr>
<tr>
<td>SACE</td>
<td>South Australian Certificate of Education</td>
</tr>
<tr>
<td>SCRCSSP</td>
<td>Steering Committee for the Review of Commonwealth/State Service Provision</td>
</tr>
<tr>
<td>SES</td>
<td>Socio-economic status</td>
</tr>
<tr>
<td>STE</td>
<td>Survey of Training and Education</td>
</tr>
<tr>
<td>TAFE</td>
<td>Technical and Further Education</td>
</tr>
<tr>
<td>VET</td>
<td>Vocational Education and Training</td>
</tr>
<tr>
<td>YIT</td>
<td>Youth in Transition survey</td>
</tr>
</tbody>
</table>
Minerva Access is the Institutional Repository of The University of Melbourne

Author/s:
Ryan, Christopher Anthony

Title:
Education: tests of whether it enhances productivity or merely conveys information on individual productivity in the labour market

Date:
2001-04

Citation:

Publication Status:
Unpublished

Persistent Link:
http://hdl.handle.net/11343/39440

File Description:
Intro.

Terms and Conditions:
Terms and Conditions: Copyright in works deposited in Minerva Access is retained by the copyright owner. The work may not be altered without permission from the copyright owner. Readers may only download, print and save electronic copies of whole works for their own personal non-commercial use. Any use that exceeds these limits requires permission from the copyright owner. Attribution is essential when quoting or paraphrasing from these works.