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Schooling, Literacy, Numeracy and Labor Market Success

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ABSTRACT

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This paper uses data from the 1996 Australian *Survey of Aspects of Literacy* to examine the effects on labour market outcomes of literacy, numeracy and educational attainment. The survey includes a range of literacy and numeracy variables that are highly inter-correlated. A "general to specific" approach identifies the most relevant literacy and numeracy variables. Including the others adds little explanatory power. Among males and females separately about half of the total effect of education on labour force participation and on unemployment can be attributed to literacy and numeracy (the indirect effect) and about half to the direct effect of education. There is apparently no indirect effect of labour market experience through literacy and numeracy on participation or unemployment. The direct and total effects of experience are the same. The findings suggest that education is a value added process in which skills, including literacy and numeracy, are improved and that these skills enhance labour market outcomes.

JEL Classification: J31, I21

Keywords: Human capital, schooling, literacy, numeracy, earnings screening, Australia

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I. Introduction

One of the strongest empirical regularities in the labour market is that those with higher levels of schooling or educational qualifications have more favourable labour market outcomes, whether measured by higher earnings, higher employment or lower unemployment. In Australia, for example, each extra year of schooling is associated with about eight percent higher earnings among both men and women (Preston 1997). Those with a university degree earn about 50 percent more than those who have only completed high school and they also have lower unemployment rates (Preston 1997, Le and Miller 2000).

The reasons those with more schooling have better labour market outcomes in Australia have been the subject of much study (see, for example, Miller and Volker 1984 and McNabb and Richardson 1989). Despite pursuing alternative approaches, these studies have not provided definitive answers. This paper seeks to contribute to the literature on the effects of schooling on labour market outcomes by examining the links among schooling, skills (in particular, literacy and numeracy) and labour market outcome measures in Australia. The outcome measures used are labour force participation and unemployment. This is done through the analysis of a unique sample that includes data on a variety of measures of literacy and numeracy skills.[1] This is the 1996 Australian Bureau of Statistics' *Survey of Aspects of Literacy*. The survey information relates to "functional literacy and numeracy skills" and may therefore be more appropriate for an analysis of labour market performance than measures of IQ, school test scores or other standard academic measures. If they are more appropriate measures of the skills workers bring to the labour market, they would be subject to less random measurement error with respect to the true but unknown skills that the labour market rewards. Then their effects on labour market outcomes should be subject to less bias toward zero than more poorly measured variables.

Section II presents a brief review of some theoretical issues. In section III the relevant features of the *Survey of Aspects of Literacy* are presented as well as some descriptive statistics for the measures of literacy and numeracy. Section IV presents and discusses the multivariate statistical analyses for ascertaining the relative

[1] These data are unique not just for Australia but also for developed economies in general as information on the degree of literacy or numeracy in surveys that include other relevant information is extremely rare.

contributions of educational attainment/qualifications and literacy and numeracy to the determinants of labour market success. This paper closes (section V) with a summary and conclusion.

II. THE MODELS

There are several hypotheses as to why those with more education have more favourable labour market outcomes than those with less education.

In sorting or signaling models firms use educational attainment as a proxy for unmeasured dimensions of characteristics (*e.g.*, ability, family connections, affective traits) that enhance a worker's value to the firm (see, for example, Spence 1974). In this framework, schooling per se does not enhance the skills in workers that employers reward, but it serves as a marker for identifying which workers are more likely to possess the desired characteristics or skills.[2]

A serious problem with the screening argument for the relations among ability, schooling and labour market outcomes is the cost of schooling (Chiswick 1973). Even if tuition, fees and other typical out-of-pocket expenses for schooling are fully subsidized by the government so that the individual experiences no out-of-pocket expenditures, foregone earnings remain and can be substantial. For schooling to be used as a screen, the cost of alternative methods of evaluating ability (or whatever characteristic the employer values) would need to be greater than the cost of the schooling to the student. Yet, alternative evaluating methods would include, among other mechanisms, employer administered tests, references, and trial or probationary periods of employment, even if they go by some other label. If ability is unknown to the employer at hiring, but is known to the applicant, rather than going to school to reveal their ability, high ability workers would have an incentive to take (initially) low paying jobs as if they were low ability workers so that their high ability would be revealed on the job.

Another link between education and ability may arise from those with more ability getting a larger return from schooling. This would generate a positive relation

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[2] For analysis for Australia, see for example, Miller and Volker (1984) and McNabb and Richardson (1989). In a critique of Miller and Volker (1984), Lang and Kroop (1986) report that rather than using a university degree as a screen employers are rewarding the general, as distinct from occupation specific, skills acquired in the university.

between ability and schooling and between schooling and labour market outcomes (Weiss 1983). This does not necessarily support the screening hypothesis. Various types of human capital are complementary to each other; more of one type increases the productivity of other forms of human capital. Then, those with greater ability would tend to invest more in schooling, migration, health and other types of human capital.[3]

The more conventional explanation for the better labour market performance of those with more schooling is that schooling is a transforming process (Becker 1964, Schultz 1975). That is, school increases an unmeasured aspect of people referred to as "human capital" – productive capacities embodied in the person that are created at a sacrifice. Thus human capital may make them better at performing tasks ("worker efficiency") or it may make them better decision makers ("allocative efficiency") (Schultz 1975).

Thus, whereas in the "screening" and "complementarity" models higher ability results in more schooling, and hence higher earnings, in the "human capital" model higher levels of schooling result in greater ability and hence higher earnings. In analyses that attempt to sort out these hypotheses it is important to determine when the level of ability is measured – before or after the completion of the level of schooling under study. In the ideal situation, which apparently does not exist, a study of the relations among ability, schooling and labour market outcomes would have measures of the relevant dimensions of ability taken prior to and after the level of schooling is completed. It is also important that the ability variable is a close approximation to the dimensions of ability relevant for the labour market in which the individual will be working.[4] High school test scores (as used by Altonji 1995 and Kang and Bishop 1986) may be poor measures of the dimensions of ability that most employers value.

This discussion suggests that the link between the "skills" learned in school and labour market success may be weak because the "wrong" skills are used or are poorly measured. Analysis of the data available in the *Survey of Aspects of Literacy* may offer insights into this issue. In their 1997 report, Miller and Chiswick analysed

[3] For studies of the complementarity of schooling with other forms of human capital, see, for example, Chiswick (1999) on migration, Chiswick and Miller (forthcoming) on language capital, and Grossman (1972) on health capital.

cross-tabulations from this data set on the links between various measures of literacy and numeracy skills on the one hand and, on the other hand, labour force status, occupational distributions and levels of socioeconomic status.[5] They report that labour force participation rates increase with higher levels of literacy or numeracy. The magnitude of this increase varies by gender and nativity – it is greater for women than for men and for immigrants than for those born in Australia. They also find that unemployment propensities decrease with higher levels of literacy and numeracy. These simple cross-tabulations are suggestive that literacy and numeracy affect labour force status, in particular labour force participation and unemployment in Australia. The analysis in this paper will determine the effects of literacy and numeracy on these labour market outcomes when other variables, in particular, schooling and labour market experience, are held constant. It will also estimate the total, direct and indirect (through increasing literacy and numeracy) effects of schooling and labour market experience on these outcome measures.

III. THE SURVEY OF ASPECTS OF LITERACY

The *Survey of Aspects of Literacy* was a national survey designed to assess directly the literacy and numeracy skills of Australia's adult population (Australian Bureau of Statistics 1997). The survey was conducted between May and July 1996, and consisted of personal interviews administered to a representative sample of 10,700 people (aged 15 to 74) across Australia.

Data were collected on the demographic characteristics, labour force status, educational attainment and languages spoken by the individual, among other socioeconomic variables. The demographic variables include sex, age, state or territory of usual residence, birthplace, year of arrival in Australia, age on arrival in Australia, and whether English was the respondent's first language. There are three broad categories of labour force status: "employed", "unemployed", and "not in the labour force".[6]

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[4] It is obvious that the ability to play the piano may be relevant in some labour markets, but not in others. Similarly, test-taking ability or digital dexterity are relevant in some sectors but not in others.

[5] Other studies using these data include Norton (1997) and Cumming (1997).

[6] Although the survey also contains information on earnings, these data are available only in deciles. The cut-off points for the deciles are known, and hence the data can be thought of as having been made available in 10 categories. However, attempts to use these data did not generate findings consistent with the Australian literature that has had access to superior measures of earnings. The results from study of the labour force status data are, however, consistent with findings for conventional models reported in the literature.

All respondents were asked to provide their perceptions of their English reading and writing skills, along with similar perceptions on their mathematical skills. In addition, three types of literacy are assessed in an objective manner in the *Survey of Aspects of Literacy*, namely prose literacy, document literacy and quantitative literacy. Prose literacy is defined as the knowledge and skills required to understand and use information from texts, including texts from newspapers, magazines and brochures. Document literacy refers to the knowledge and skills needed to process information in materials such as tables, schedules, charts, graphs and maps. Document literacy depends on the individual's abilities in locating, integrating, generating and transferring information. Quantitative literacy (numeracy) involves the ability to perform arithmetic operations using numbers embedded in printed texts or documents. A quantitatively literate (or numerate) person must be able to locate and extract numbers from different types of documents that contain similar but irrelevant information, and also be able to perform the appropriate arithmetical operations when the operations to be used must be inferred from printed directions. The scores for prose literacy, document literacy and numeracy (quantitative literacy) available in the Survey have been classified by the Australian Bureau of Statistics into five levels, Level 1 (lowest) to Level 5 (highest). Appendix A, available upon request, contains additional details on the literacy and numeracy data.

In the survey there tends to be a strong positive relationship between the level of educational attainment and the rate of participation in the labour force, and a strong inverse relationship between the level of educational attainment and the rate of unemployment among labour force participants.[7] Hence, the participation rate among males and females (combined) aged 15 to 74 years ranges from 57 percent among individuals who did not complete secondary school, to 93 percent for individuals with a Higher Degree (PhD, Masters, etc.). The unemployment rate ranges from a low of only 2.2 percent among those with a Higher Degree to 11.2 percent for individuals who did not complete secondary school.

Self-reported English reading skills are classified into four levels, "Excellent", "Good", "Moderate" and "Poor". There is a very strong, positive relationship between labour force participation rates and the level of reading skills, with the participation

[7] For further details regarding the descriptive statistics in this and the next two paragraphs, see Miller and Chiswick (1997).

rate among males and females combined with "Excellent" skills, at 78 percent, almost 2.5 times that of those with "Poor" reading skills (33 percent). The unemployment rate of these groups differs by a factor of almost four, 5.5 percent for individuals with "Excellent" reading skills and 20 percent for those with "Poor" reading skills.[8]

Prose skills are reported in five levels, with Level 1 being the lowest and Level 5 the highest. Labour force participation rates rise with prose skill level, with the rate being 48 percent at the lowest level of skill, and 92 percent at the highest level of skill. Conversely, unemployment rates fall with level of prose skill, from 16 percent at the lowest level of skill and only 2 percent at the highest level of skill.

It is readily apparent from these data that level of educational attainment, literacy and numeracy are closely linked to the various labour market outcomes considered. The difficulty for understanding these links is that level of educational attainment and skills (such as, literacy and numeracy) are, in turn, related. There is a positive association between schooling level and both literacy and numeracy. Attempts to assess the economic benefits from education that do not take account of literacy and numeracy may be misleading. Analysis of the determinants of labour market outcomes that takes account of literacy and numeracy skills, as well as educational attainment, may permit improved insights into the reasons why the better educated have economic outcomes superior to those of the less-well educated.

Unfortunately, it is not possible to sort out the "causal" relationships between schooling and literacy/numeracy with these data. All three are measured at the time of the interview which is also when labour force status is measured. While schooling was completed some time earlier, with data only on skills measured after schooling is completed it is not possible to determine whether schooling caused or was caused by the literacy/numeracy skills. Moreover, the data are not sufficiently rich to develop an instrumental variables or simultaneous equations system to resolve the dilemma. In spite of these limitations, the results can be instructive.

Under the screening hypothesis, once schooling is held constant, variations in levels of literacy and numeracy would have no effect on earnings. This suggests that adding literacy and numeracy to an earnings equation with schooling on the right hand side would not lower the returns to schooling, but would result in statistically

[8] Information on labour market outcomes by self-reported writing and mathematical skills and by document and quantitative literacy is available from the authors.

insignificant and economically meaningless coefficients on literacy and numeracy. The human capital story would be that schooling enhances literacy and numeracy, as well as other forms of human capital. Since literacy and numeracy do not encompass all of the forms of ability, including them in the equation would lower the coefficient of schooling (but not drive it to zero) while at the same time showing literacy and numeracy as a significant determinant of earnings.

IV. ECONOMETRIC ANALYSES

Studies of the determinants of labour market outcomes have generally employed probability models where the participation decision is examined separately from the employment/unemployment outcome, conditional on being in the labour force. This is generally done for expositional purposes. Few additional insights have been gained from the studies that have adopted a more general multinomial specification of the probability model where the allocation of workers across the employment, unemployment and not-in-the-labour force states is considered simultaneously (see, for example, Wooden 1991, Brooks and Volker 1985). Single equation logit models of participation and of unemployment among labour force participants will be estimated in this study.

The decision to enter the labour force is a major one for many individuals. It will be affected by a large range of factors. Research into these has largely concentrated on the labour supply decisions of females because of the nearly universal participation of non-aged adult males who are not disabled or enrolled in school. Chiswick and Miller (1994) and Kenyon and Wooden (1996) provide overviews of the Australian literature. Consistent with findings for other countries, Kenyon and Wooden (1996, p.20) report that cross-sectional studies show that female labour force participation increases with wages and with educational attainment, and decreases with the number of children at home.

The study that is probably of most relevance to the current research is by Chiswick and Miller (1994). They model female labour supply using a standard reduced form specification in which the participation decision is related to the respondent's age, educational attainment, location of current residence, marital status, presence and age structure of children, husband's income, country of birth, and, among immigrants, duration of residence in Australia, citizenship and English language skills. They show that among their sample of 25-64 year old females, labour

force participation rates decline with age, particularly from age 40 onwards. The degree of participation in the labour force increases with educational attainment, tends to be lower in non-metropolitan areas than in metropolitan areas, and is lower if children less than 15 years of age are present in the household, with the children's effect being more pronounced if they are less than age two.

Chiswick and Miller (1994) also include a dichotomous variable for English language proficiency in some of their specifications. This is set to one for individuals who speak only English at home, or if a language other than or in addition to English is spoken in the home, they speak English "very well". The variable was set to zero where a language other than English is spoken in the home and the respondent speaks English "well", "not well" or "not at all". It was shown that immigrants possessing English language fluency had participation rates about 4 percentage points higher than other groups. This effect was the equivalent of that of about 1.5 years of schooling.

This study also models labour supply within a reduced form context.[9] Thus the person's tendency to join the labour force is expressed as

$$PR_i^* = X_i\beta + \varepsilon_i \qquad (1)$$

where PR_i^* is a latent index that captures the propensity of individual i to join the labour force, X is a vector of observed factors (*e.g.*, educational attainment, potential labour market experience, birthplace, etc.) that are held to influence labour supply decisions, β is a vector of coefficients to be estimated, and ε is a stochastic error term that captures the net influences on labour supply decisions of all unobserved factors and also the influence of purely chance events. The explanatory variables in this model will be restricted to those used in the typical study, as the primary aim is to ascertain the extent to which the effects of schooling on labour supply decisions can be linked to literacy and numeracy.

Two outcomes are derived from PR^* with reference to an arbitrary threshold of zero. Thus, the individual is held to be a labour force participant (PR = 1) where PR^* exceeds zero, and is outside the labour force (PR = 0) otherwise. With the logit model to be employed here, the natural logarithm of the odds ratio of the probability of labour force participation (PR) to the probability of non-participation (1 – PR) in the

[9] The study of unemployment is conducted here within a similar framework. Le and Miller (2000) provide a review of modelling issues and provide comparison results.

labour force is expressed as $\log\left[\frac{PR_i}{1-PR_i}\right] = X_i\beta$. The parameter estimates in the logit model therefore record the impact on the logarithm of the odds ratio of a small change in the explanatory variables.

The model specifications adopted here are constrained by the way the data from the *Survey of Aspects of Literacy* are made available to the research community. While information is available on educational attainment, potential labour market experience, birthplace, duration of residence, gender, disability and location in Australia, there are no data on marital status or family details such as the presence of children and the income of the spouse. In addition, there is a lack of detail on labour market history that might facilitate an approach along the lines of that used by Le and Miller (1999). Participation rates and unemployment rates are therefore both related only to the contemporaneously measured personal characteristics of educational attainment, potential labour market experience, birthplace, duration of residence, disability, location and, where appropriate, literacy and numeracy. Separate equations are estimated for males and for females to allow for the effects of the full set of explanatory variables to vary by gender. The analysis is limited to those aged 15 to 64 years. Means and standard deviations for all variables are presented in Appendix B. This Appendix, available upon request from the authors, also contains a brief description of the variables.

Results from conventional models (which do not contain information on literacy and numeracy) of labour force participation and of unemployment are presented in Table 1.[10] The estimates of the determinants of male participation rates are presented in the first column, and of male unemployment rates in the second column of the table. There is a positive relationship between labour force participation and educational attainment. Evaluated at the mean of the variables, an extra year of schooling increases the male participation rate by 0.53 percentage points.[11] Potential labour market experience also has a strong effect on labour force

[10] The information on location was made available in three categories: (a) capital city for the States of New South Wales, Victoria, Queensland, Western Australia, the Northern Territory and the Australian Capital Territory, (b) the balance of the state for these areas, and (c) the whole of South Australia and Tasmania.

[11] The partial effects are calculated as $\beta(1-\overline{PR})\overline{PR}$, where $\overline{PR}$ is the mean participation rate and β is the coefficient of interest.

participation rates, with participation rates rising with this measure of experience for the first 17 years of potential labour market activity. Beyond this threshold participation rates decline with potential labour market experience. These patterns of labour market attachment are typical in the literature (see, for example, Miller and Neo 2001).

Both birthplace and duration of residence matter when labour market attachment is being considered. Labour force participation rates are lower among the overseas born than among the native born, with the differentials being much greater among immigrants from non-English speaking countries. The participation rate differences between the foreign born from English-speaking countries and the native born are quickly reduced with duration in Australia, with the participation rates of male immigrants from English speaking countries exceeding those of the native born after about 7 years of residence. The participation rates of male immigrants from non-English speaking countries, however, never gain parity with those of the native born.

It is not surprising that participation rates are also relatively low for those who report a disability. Location in Australia, however, does not appear to have an impact on labour force participation rates once other differences in the sample are taken into account.

Estimates of the unemployment model for males are listed in the second column of Table 1. Evaluated at the mean of the variables, an extra year of education lowers the unemployment rate by 1.7 percentage points. The estimated coefficients on the experience variables reveal a pronounced U-shaped relationship between potential labour market experience and unemployment status. However, as the turning point in this relationship occurs at 48 years, for almost all of the sample[12] unemployment rates decrease with potential labour market experience.[13] Unemployment rates are higher among the overseas born than among the native born, and particularly so among the overseas born from non-English speaking countries. The unemployment rates of the foreign born decrease with duration of residence in Australia for the first 21 years of residence. As a result, the unemployment rates of the foreign born from English-speaking countries gain parity with those of the

[12] Slightly less than one percent of the sample has more than 48 years of potential labour market experience.

[13] In Miller and Neo's (2001) study based on the 1991 Australian Census of Population and Housing, there is also a U-shaped relationship between age and unemployment rates, though the lowest unemployment rates are experienced by those aged around 45.

Australia born after 15 years of residence in Australia. However, despite the pronounced reduction in unemployment rates with duration of residence, the unemployment rates of the foreign born from non-English speaking countries do not catch up with those of the native born.[14]

Results for the models of labour force participation and unemployment for females are presented in the final two columns of Table 1. Labour force participation rates increase strongly with level of education (by 4.0 percentage points per year of education, evaluated at the means), and unemployment rates are much lower among better educated females than among their less-well educated counterparts (by 1.4 percentage points per year of education). Of some note is the apparent greater strength of the effect of education on the participation rate among females compared to males.

What happens when account is taken of the differences in literacy and numeracy across the levels of educational attainment? To examine this issue, the specification contained in Table 1 can be augmented with variables for literacy and numeracy. There is a wealth of information in the survey on literacy and numeracy. Indeed, as will be shown, the large number of highly inter-correlated literacy and numeracy variables creates multicollinearity problems if all are included in the analysis. While multicollinearity does not bias the logit coefficients, it results in large standard errors. Multicollinearity is not a problem if the sole purpose of the analysis is prediction, but it can be a problem for hypothesis testing. These considerations shape the procedures that are followed.

The analysis was undertaken as follows. First, the focus was on only six of the measures available in the survey, the three objective measures and the three subjective measures noted in the earlier discussion. Second, dichotomous variables were created for each of the possible categories within each of these measures. The "Excellent" category was selected as the benchmark group in the case of the self perceptions measures, and the highest level of skill (skill level five) was selected as the benchmark group in the case of the test-based measures. Third, variables for each

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[14] Miller and Neo (2001) report a similar result on the basis of their study of data from the 1991 Australian Census of Population and Housing. These findings are in contrast to the pattern in the United States where, other measured variables the same, immigrants reach unemployment rate parity with the native born at about five years duration (see Chiswick and Hurst 1998). The difference may be due to the greater flexibility of wages within the United States.

of the measures of literacy and numeracy were simultaneously entered into the equations determining labour force status. There is a total of 21 variables; four each for prose skill, document skill and quantitative skill, and three each for the self reports on reading, writing and mathematical skills.

When all of these variables are entered into the equation, many of the variables for literacy and numeracy were statistically insignificant or incorrectly signed, especially in the models of unemployment (regression results available upon request). This outcome is not surprising because of the very high intercorrelation among these explanatory variables. Multicollinearity is created when they are all included.

To illustrate the relationships between the various measures of literacy and numeracy, a correlation matrix is presented in Table 2 for the female sample used in the analysis of participation rates.[15] These correlations are polychoric correlations that are appropriate when each of the variables under consideration is categorical.[16] From the data in Table 2 the correlation between the self perceptions of reading and writing skills is 0.882 while that between the self perceptions of reading and mathematical skills is 0.611. Two patterns are apparent here. First, the correlations among the objective measures are higher than those among the self assessments. Specifically, the correlations among the test-based measures range from 0.895 to 0.966 while those among the self-reported measures range from 0.611 to 0.882. Second, the correlations between the self assessments and the objective measures are lower than either those computed between various self assessments, or those computed between various objective measures. The mean of the correlation coefficients between the self-reported and test-based measures is 0.546. The multiple correlation when all of the variables are considered is, of course, even higher than the "pair-wise" correlations reported in Table 2.

[15] Correlation matrices for each of the other three samples used in this study are available from the authors.

[16] The usual correlations are Pearson product moment correlations, which are appropriate for variables measured on a continuous scale. The literacy and numeracy measures (denote two of these by L_1 and L_2), while being presented as categorical data, can be thought of as having underlying continuous indices (say L_1^* and L_2^*). With the assumption that L_1^* and L_2^* have a bivariate normal distribution, their correlation is referred to as a polychoric correlation coefficient (see Neale and Cardon 1992).

Given the high degree of correlation among the measures of literacy and numeracy, all the measures of literacy and numeracy cannot be entered simultaneously into a single equation for labour market outcomes without creating serious multicollinearity problems. There are alternative techniques available for addressing this issue. For example, various measures of literacy (or numeracy) can be combined into a single index. There is no unique way to combine the various measures into a single index. To do this, however, would be to lose insights into which of the highly inter-correlated measures would give the highest explanatory power when taken separately. This would result in a loss of information that may be particularly relevant for the cost effective design of future questionnaires. That is, information is lost on which of the members of the set of literacy and numeracy variables gives the best fit.

Therefore, for the purposes of this study a "general-to-specific" modelling strategy was employed. In this alternative, variables that are insignificant or have "perverse" signs are eliminated from the estimating equation in a sequential manner until the model contains only statistically significant terms with economically meaningful signs and magnitudes. Application of this general-to-specific modelling approach needs to confront the issue that there is not necessarily a unique path from the general model to the specific model. In general, however, it was found that it was only possible to include one of the sets of self-perception measures (*i.e.*, self-perception data on either reading skills, writing skills or mathematical skills) and one of the sets of test-based measures (*i.e.*, prose skill, document skill or quantitative skill) if the aim was to have significant, and economically meaningful, estimates of the literacy and numeracy parameters. Drawing upon this, nine models were estimated that included the various combinations of self-perception measures (of either reading, writing or mathematical skills) and test-based measures (*i.e.*, prose, document or quantitative skill). This procedure was followed for the models of labour force participation and unemployment for both males and females.

The likelihood functions for these nine models, for each gender and for each dependent variable, were then compared. Table 3 gives the Chi-Squared statistics for the test of overall goodness of fit for the nine models of female participation rates to illustrate the approach taken. Note that in Table 3 the highest overall Chi-square is found when self-perceptions of mathematical skills and test-based document skills are included in the estimating equation. Similar tabulations were computed for the other

three categories of gender/employment status. This comparison shows that for the models estimated for females the combination of information on self-perceptions of mathematical skills and test-based measures of document skills maximised the likelihood function. For males the combination of self-perceptions of mathematical skills and the test-based measures of quantitative skills maximised the likelihood function.[17] For uniformity, and because it makes little difference to the argument, models based on the self-perceptions of mathematical skills and the test-based measures of document skill will be discussed here. This model will be termed the "restricted model".

Estimates from the restricted models are presented in Table 4. There are two reasons for presenting these estimates. The first is to report the effects literacy and numeracy have on labour force participation and unemployment. The second is to provide an examination of the impact that inclusion of measures of literacy and numeracy have on the partial effects of educational attainment and labour market experience on labour market outcomes. It is useful to provide an outline of the way these partial effects are to be interpreted.

The conventional model of labour force status listed previously can be re-written as:

$$PR_i^* = \alpha_0 + \alpha_1 E + \ldots \qquad (2)$$

where E denotes the level of education. The coefficient α_1 in this model can be viewed as capturing the <u>total</u> effect of educational attainment on labour market outcomes. When the model is augmented with variables for literacy (L) and numeracy (N) we have

$$PR_i^* = \gamma_0 + \gamma_1 E + \gamma_2 L + \gamma_3 N + \ldots \qquad (3)$$

In equation (2), γ_1 provides a measure of the <u>direct</u> effect of education on labour market outcomes independent of its indirect effects on literacy and numeracy. The difference in coefficients $(\alpha_1 - \gamma_1)$ provides an estimate of the <u>indirect</u> effect of

[17] For males, the second highest value of the likelihood function is for the same combination of variables that maximises the likelihood function for the models estimated for females. For females, the

education on labour market outcomes that occurs via the measures of literacy and numeracy. The effect of education can be viewed as

$$\frac{\partial PR^*}{\partial E} = \gamma_1 + \gamma_2 \frac{\partial L}{\partial E} + \gamma_3 \frac{\partial N}{\partial E}. \quad (4)$$

($\gamma_2 \frac{\partial L}{\partial E} + \gamma_3 \frac{\partial N}{\partial E}$) records the impact of education on labour market success that occurs because those with higher levels of education have higher levels of literacy and numeracy, and literacy and numeracy are themselves associated with superior labour market outcomes, as shown by γ_2 and γ_3, respectively.

The results listed in Table 4 indicate that, in general, the higher the level of literacy and numeracy, the higher the labour force participation rate and the lower the unemployment rate. These effects are slightly stronger for females than for males.

The effect of literacy and numeracy skills on labour market outcomes is quite large relative to the effects of education. Consider a person with poor document skills (level one) and poor mathematical skills ("poor") compared to a person in the top categories for literacy and numeracy. The impact on male unemployment is the equivalent of 17 years of education. This is a very large effect considering that the mean level of education is 13 years, and the range in the data is 11 years of schooling.[18]

Finally, a comparison of Tables 1 and 4 shows that the inclusion of the literacy and numeracy variables lowers the estimated effects of the education variables. For males, holding constant the influences of literacy and numeracy skills, education is statistically insignificant as a determinant of labour force participation rates, while the impact of education on unemployment once account is taken of literacy and numeracy skills is about 45 percent less than the impact attributed to education when literacy and numeracy skills are not taken into account. For females, the effect of education when account is taken of literacy and numeracy skills is around 60 percent of that

models based on self-perceptions of mathematical skills and test-based measures of quantitative skills are associated with the third highest value of the likelihood function.

[18] The data set includes a few individuals who reported that they did not attend school. These are not included in the computation of the range reported in the text. Including them yields a range of 19 years. It was not clear whether those with zero years of schooling are reporting errors or reflect true values.

derived without standardisation for literacy and numeracy skills. In other words, approximately one-half of the total effect of educational attainment on labour market outcomes appears to be due to the indirect effect of education that occurs via literacy and numeracy skills, and about half persists even when these crude measures of skills are held constant.[19] This would be consistent with a human capital interpretation of the effects of schooling on earnings, but not with a screening model interpretation.

The other measure of human capital included in the analysis is potential labour market experience, measured as age minus schooling minus 5. The coefficients of the labour market experience and labour market experience squared variables reflect the combined effects of the share of potential earnings invested in on-the-job training and the rate of return from this training. Experience is apparently uncorrelated with the levels of literacy and numeracy. Additional years since leaving school do not enhance literacy or numeracy scores. The coefficients on labour market experience and labour market experience squared do not change when the literacy and numeracy variables are added to the analyses (compare Tables 1 and 4).

While the various measures of literacy and numeracy are highly correlated, they are not perfectly correlated. Each may therefore be thought of as containing elements of specific information. It would therefore be expected that, when all variables are included in the estimating equation, the coefficients on the education variables that record only the direct effects of education would be reduced even further compared to Table 4. Table 5 contains estimates that illustrate the main findings for the male unemployment rate.

The first column of Table 5 lists the estimate of the total effect of education from the model that does not incorporate any information on literacy or numeracy (see Table 1). The second column of the table lists the estimate of the direct effect of education from the restricted model that includes only variables for self-perception of mathematical skills and document skill (see Table 4). The third column of data in

[19] The marginal (percentage point) effects of an extra year of schooling on labour market outcomes are as follows. Insignificant effects have been set to zero in this presentation.

Model	Males		Females	
	LFP	Unempl.	LFP	Unempl.
Simple Model-Total Effect	0.53	-1.74	4.04	-1.43
Restricted Model-Direct Effects	0.0	-0.99	2.30	-0.96

Table 5 contains an estimate of the direct effect of the education variable from a specification that contains all the variables for literacy and numeracy being considered in this section of the study (21 in all). Reading across Table 5, it is seen that while there is a pronounced change in the effect of education on male unemployment when the first, more limited, set of literacy and numeracy variables is included in the estimating equation (a decrease from –0.24 to –0.13) there is no further change when all the information on literacy and numeracy considered in this study is utilised in the estimated model (unchanged at –0.13). This type of effect is typical of the various models estimated for the other three gender/labour market status groups because of the very high inter-correlation among the literacy and numeracy variables.

A conclusion that can be drawn from this analysis is that the education effect in the typical study of labour force participation and of unemployment is an over-estimate of the direct contribution of schooling per se after its effects on literacy and numeracy are held constant. About one-half of the effect commonly attributed to education is in fact due to the superior literacy and numeracy skills of the better educated. Moreover, only a limited set of variables on literacy and numeracy is required to standardise for the effects that these skills have on labour market outcomes.

It is also of interest to examine whether this phenomenon varies with the level of education. To examine this, the continuous years of education variable was replaced by eight dummy variables for the highest level of education completed. Selected findings are reported in Appendix C, available upon request. These estimates show that the findings discussed above carry across to each of the levels of education considered. For example, the coefficients on the Bachelor degree variable for the four sets of gender/outcome equations are between 27 and 41 percent smaller when literacy and numeracy are held constant than when the equations do not include information on literacy and numeracy. For the Higher Degree category, the impact when information on literacy and numeracy is included in the estimating equation is between 31 and 37 percent smaller than that obtained from the specification that does not take account of literacy and numeracy. In other words, when separate educational categories are considered, between one-quarter and forty percent of the total effects associated with formal education appear to be due to the indirect effect of education that occurs via literacy and numeracy skills.

The analysis was also computed when the data were split into high-education (post-school qualifications) and low education (all other) categories. Within each category there is a sharp reduction in the coefficient of education going from the simple model to the restricted model (when self-perceptions of mathematical skills and the document skills are added), but little further reduction going to the full model.[20] Yet the education coefficients remain statistically significant.

As a further test, the analysis was computed separately for three major birthplace categories: Australia, English-speaking developed countries, and other countries. Again, it is found that within each of these birthplace categories there is a sharp decline in the coefficient on education when the self-perceptions of mathematical skills and of document skills are added to the equation (restricted model), but little or no change when the other literacy and numeracy variables are added to the analysis (full model).[21] The education coefficient remains statistically significant except among the relatively small sample from English speaking developed countries.

Thus, it appears that the patterns observed for the pooled data regarding the effects on the coefficient of education from including literacy and numeracy in the participation and unemployment equations are also found when the analyses are computed separately within broad education and birthplace categories. This provides further support for the robustness of the findings.

V. CONCLUSION

Many studies of labour market outcomes have focussed on the effects of formal education and labour market experience. It is now taken more or less for granted that formal education and labour market experience are associated with more

[20] For example, for the coefficient on years of education for male unemployment:

Education	Simple Model	Restricted Model	Full Model	Sample Size
Low	-0.266	-0.156	-0.147	1,408
High	-0.159	-0.038	-0.017	1,768

Source: Appendix C

[21]

Birthplace	Simple Model	Restricted Model	Full Model	Sample Size
Australia	-0.253	-0.133	-0.151	2,376
English Speaking	-0.194	-0.103[a]	-0.027[a]	430
Non-English Speaking	-0.283	-0.217	-0.191	370

(a) Coefficient not statistically significant.
Source: Appendix C

favourable labour market outcomes, whether measured by the degree of labour force participation, the extent of unemployment, or the wage and occupational status among the employed. Why the better educated have such advantages is less clear.

It is shown in this study using data from the Australian *Survey of Aspects of Literacy* that higher levels of education are associated with greater labour market success, as measured by participation and unemployment rates. It is also shown that higher levels of numeracy/literacy, whether measured from self-reported data or from objective test data, are also associated with greater labour market success. As the better educated also have higher levels of numeracy and literacy, it is possible that part of the improvement in labour market outcomes conventionally attributed to the attainment of more education could in fact be due to achievements in literacy and numeracy.

A model of employers using schooling as a screen would imply that adding literacy and numeracy to a regression of labour market status on schooling would neither increase the explanatory power of the model nor change the partial effect of schooling, and the literacy/numeracy variables would have little effect. A human capital model in which literacy and numeracy are only part of the human capital skills acquired in school would, on the other hand, imply that adding literacy and numeracy would increase the model's explanatory power, lower the estimated effect of education, and the literacy/numeracy variables would themselves be statistically significant and numerically important. The latter is in fact what is found.

The estimation of models of labour market outcomes that include variables for both level of education and literacy and numeracy shows that perhaps as much as one-half of the total effect of education is in fact an indirect effect of education that arises due to the higher literacy and numeracy skills of the better educated. Education appears to be associated with improvements in skills (here literacy and numeracy) that are rewarded well in the labour market. Hence education affects labour market outcomes through its effects on human capital skills that are embodied in people and which are not measurable in most other studies.

On the other hand, the effects of labour market experience on the labour market outcomes considered here do not vary with the inclusion of the literacy and numeracy variables. Experience has its effects on participation and unemployment independent of literacy and numeracy, perhaps because these skills are formed prior to or concurrent with schooling, but not with labour market experience.

These findings demonstrate the importance of education. They show that part of the effect of schooling arises because of the greater literacy and numeracy skills, and presumably other unmeasured skills, of the more highly educated. Schooling represents a human capital augmenting process in which skills, including literacy and numeracy, are improved.

Table 1: Logit Model of Labour Force Participation and Unemployment, Males and Females Aged 15-64 Years, 1996 Survey of Aspects of Literacy[(a)]

Variable	Males		Females	
	Participation	***Unemployment***	***Participation***	***Unemployment***
Constant	2.150	1.019	-1.206	0.362
	(5.26)	(2.17)	(4.62)	(0.60)
Years of Education	0.049	-0.237	0.184	-0.229
	(1.89)	(7.34)	(10.81)	(5.63)
Experience	0.106	-0.065	0.026	-0.003
	(6.66)	(3.80)	(2.73)	(0.13)
Experience squared (÷100)	-0.308	0.068	-0.123	-0.108
	(9.50)	(1.73)	(6.03)	(1.84)
Birthplace (Australia)				
Overseas – English Speaking Country	-1.777	1.469	-2.268	0.942
	(4.06)	(2.91)	(7.36)	(1.42)
Overseas – non-English speaking country	-3.059	2.262	-2.615	1.425
	(7.76)	(4.76)	(8.69)	(2.13)
Period of Residence (POR)	0.305	-0.151	0.267	-0.001
	(3.86)	(1.77)	(5.26)	(0.01)
POR squared (÷100)	-0.803	0.357	-0.645	-0.184
	(3.10)	(1.30)	(4.06)	(0.59)
Disabled	-1.536	0.650	-0.498	0.712
	(12.12)	(4.31)	(6.19)	(4.13)
Location (S. Australia and Tasmania)				
Capital city in other states	-0.047	-0.259	0.219	-0.129
	(0.23)	(1.11)	(1.85)	(0.46)
Non-capital City in other States	0.023	0.169	0.104	0.374
	(0.11)	(0.71)	(0.84)	(1.32)
χ^2 (10)	536.09	130.98	612.73	96.12
Pseudo R^2	0.211	0.076	0.115	0.069
Prediction success (%)	88.65	91.97	72.53	93.30
Sample size	3621	3176	4285	2894

[(a)] 't' statistics in parentheses. Source: *Survey of Aspect of Literacy*, Australia, 1996.

Table 2: Correlations Between Measures of Literacy and Numeracy, 1996 Survey of Aspects of Literacy, Female Participation Sample[(a)]

	Self-Perceptions Data			Test-Based Data		
	Reading	***Writing***	***Mathematical***	***Prose***	***Document***	***Quantitative***
Reading	1.0					
Writing	0.882	1.0				
Mathematical	0.611	0.633	1.0			
Prose	0.637	0.593	0.460	1.0		
Document	0.575	0.549	0.483	0.926	1.0	
Quantitative	0.544	0.527	0.545	0.895	0.966	1.0

[(a)]Polychoric correlations based on 4285 observations.
Source: *Survey of Aspects of Literacy*, Australia, 1996.

Table 3: Chi-Squared Statistics of Overall Goodness-of-Fit, Female Participation Model

Self-Perception of:	Prose skill	Document skill	Quantitative skill
Reading	718.05	735.42	733.35
Writing	743.81	760.22	756.79
Mathematical	755.88	**767.38**	758.88

Source: *Survey of Aspects of Literacy*, Australia, 1996.

Table 4: Logit Model of Labour Force Participation and Unemployment Including Literacy and Numeracy Variables, Males and Females Aged 15-64 Years, 1996 Survey of Aspects of Literacy[(a)]

Variable	Males		Females	
	Participation	***Unemployment***	***Participation***	***Unemployment***
Constant	2.884	-1.016	1.353	-2.451
	(4.38)	(1.05)	(2.34)	(1.62)
Years of Education	-0.015	-0.134	0.105	-0.153
	(0.50)	(3.69)	(5.59)	(3.45)
Experience	0.111	-0.070	0.025	0.003
	(6.89)	(4.04)	(2.52)	(0.14)
Experience squared (÷100)	0.316	0.076	-0.117	-0.128
	(9.63)	(1.91)	(5.58)	(2.12)
Birthplace (Australia)				
Overseas – English speaking country	-1.788	1.210	-2.145	0.772
	(4.03)	(2.35)	(6.75)	(1.11)
Overseas – non-English speaking country	-2.920	1.660	-2.161	0.871
	(7.24)	(3.38)	(6.90)	(1.24)
Period of Residence (POR)	0.314	-0.124	0.257	0.016
	(3.94)	(1.42)	(4.90)	(0.15)
POR squared (÷100)	-0.839	0.302	-0.626	-0.215
	(3.21)	(1.08)	(3.83)	(0.66)
Disabled	-1.489	0.582	-0.374	0.536
	(11.59)	(3.79)	(4.50)	(2.97)
Location (S. Australia and Tasmania)				
Capital city in other states	-0.078	-0.304	0.192	-0.142
	(0.38)	(1.29)	(1.59)	(0.50)
Non-capital City in other states	0.022	0.135	0.113	0.382
	(0.10)	(0.56)	(0.89)	(1.33)
Self-perception of mathematical skills (excellent)				
Good	-0.514	-0.291	-0.532	0.428
	(3.38)	(1.69)	(5.86)	(2.28)
Moderate	-0.515	0.139	-0.783	0.023
	(2.62)	(0.66)	(6.98)	(0.09)

Poor	-1.230	0.591	-1.336	1.287
	(4.18)	(1.73)	(6.69)	(3.34)
Document Skill Level (five=maximum)				
Four	0.271	0.521	-0.974	1.575
	(0.61)	(0.66)	(1.94)	(1.16)
Three	0.584	0.611	-1.050	1.452
	(1.35)	(0.78)	(2.12)	(1.08)
Two	0.360	1.117	-1.248	1.682
	(0.81)	(1.42)	(2.51)	(1.25)
One	0.102	1.745	-1.659	2.480
(minimum)	(0.22)	(2.19)	(3.29)	(1.82)
χ^2 (17)	572.53	178.10	767.38	135.57
Pseudo R^2	0.225	0.103	0.144	0.097
Prediction success (%)	88.84	92.00	74.10	93.30
Tests of Incremental Explanatory Power				
Self-perception of mathematical skill				
χ^2 (3)	20.94	10.23	74.83	14.60
Self-perception of document skill				
χ^2 (4)	8.69	32.09	34.39	18.74
Sample size	3621	3176	4285	2894

[(a)] 't' statistics in parentheses.
Source: *Survey of Aspect of Literacy*, Australia, 1996

Table 5: Selected Coefficient from Logit Models of Unemployment, Males Aged 19-64 Years, 1996 Survey of Aspects of Literacy[a]

	Simple Model[b]	Restricted Model[c]	Full Model[d]
Years of Education	-0.237 (7.34)	-0.134 (3.69)	-0.135 (3.59)
χ^2 [e]	130.98	178.10	193.83
Pseudo R^2	0.076	0.103	0.112
Prediction success (%)	91.97	92.00	92.03
Sample size	3176	3176	3176

[a] 't' statistics in parentheses.
[b] The Simple model does not include any literacy or numeracy variables. The coefficient is from Table 1.
[c] The Restricted model includes three variables for self-perceptions of mathematical skills and four variables for document skills. The coefficient is from Table 4.
[d] The Full model includes variables for self-perceptions of reading skill, writing and mathematical skills, and for prose, document and quantitative skills. Twenty one variables are used for these influences.
[e] The degrees of freedom for the χ^2 tests are 10 for the Simple model, 17 for the Restricted model and 31 for the Full model.
Source: *Survey of Aspects of Literacy*, Australia, 1996.

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APPENDIX A

THE SURVEY OF ASPECTS OF LITERACY

The *Survey of Aspects of Literacy* was designed to examine "functional literacy and numeracy skills", defined as "the information processing skills necessary to use printed material commonly encountered at work, at home and in the community". The aims of the survey included identifying "at risk" groups of individuals with low literacy and numeracy skills, evaluating literacy and numeracy assistance programs, identifying barriers to individuals achieving skill levels sufficient for daily life and work, and providing statistical support for both planning and decision making.

As noted in the text, three types of literacy are assessed in an objective manner in the *Survey of Aspects of Literacy*, namely prose literacy, document literacy and quantitative literacy.

Prose literacy is defined as the knowledge and skills required to understand and use information from texts, including texts from newspapers, magazines and brochures. The material presented to respondents to assess their prose literacy varied in length, density, content and use of organisational aids such as headings, bullets and special type faces. Each prose selection was accompanied by questions or directives requiring specific tasks to be performed by the reader. These tasks represent three major aspects of information-processing: locating, integrating and generating. Locating tasks ask readers to find information in the text based on the specification of the question or directive. In the integrating tasks, readers must gather two or more pieces of information in the text. The information may be found in a single paragraph or in different paragraphs or sections. Generating tasks require readers to process information from the text or to make text-based inferences.

The tests for prose literacy included various tasks with different levels of difficulty. The degree of difficulty increases with the length and density of the information that readers must process, and the number of "distractors" (*i.e.*, information contained in the text that shares some of the features with the information being asked and which seems plausible but does not fully answer the question).[22]

[22] The objective measures of literacy and numeracy were obtained using methodology developed for the International Adult Literacy Survey by Statistics Canada and the Educational Testing Service in the United States of America. The methodology was extensively pilot-tested in Australia to ensure that it was suitable for the Australian context. The tasks were ranked in order of their difficulty on a scale of 0 to 500. Respondents were then assigned scores (also on a scale of 0 to 500) according to their performance on the tasks they were given. These scores were then categorised into five levels. People with Level 1 literacy or numeracy skills have very poor skills, and they could be expected to experience considerable difficulties in using many of the printed materials that may be encountered in daily life. Level 2 people could be expected to experience some difficulties in using many of the printed materials encountered in daily life. At Level 3 people would be expected to have the ability to cope with a varied range of materials found in daily life and at work. People at Level 4 have good literacy skills, while people who possess Level 5 skills have very good literacy skills, and can make use of their skills for very demanding tasks.

Document literacy refers to the knowledge and skills needed to process information in materials such as tables, schedules, charts, graphs and maps. Document literacy depends on the individual's abilities in locating, integrating, generating and transferring information. To assess their document skills respondents were presented with a variety of tasks, including tasks where they were required to match one or more features of information asked in a question to either identical or synonymous information given in the document (*i.e.*, to locate information in a document), tasks where they had to integrate information by comparing and contrasting information from different parts of the document, tasks where they had to generate information by processing information found in the document and by making text-based inferences, and tasks where they had to transfer information from one source to another (*e.g.,* when completing order forms).

As with the prose tasks, different levels of document tasks were set. The difficulty associated with document tasks is affected by the structure and content of the document, the number of categories or features of information in the question that the reader must process or match, and the extent to which the information asked for in the question is related to the information stated in the document.

Quantitative literacy involves the ability to perform arithmetic operations using numbers embedded in printed texts or documents. A quantitatively literate person must be able to locate and extract numbers from different types of documents that contain similar but irrelevant information, and also be able to perform arithmetic operations when the operations to be used must be inferred from printed directions. Each type of question associated with a quantitative task extends over a range of difficulty. Again a range of tasks was used in the assessment procedure, with the difficulty of the tasks depending on the particular operation required to perform a specific task, the number of arithmetic operations needed, the extent to which the numbers are contained in printed materials, and the extent to which an inference must be made to identify the type of operation to be performed.

APPENDIX B

The variables used in the statistical analyses available in the *Survey of Aspects of Literacy* for Australia are defined as follows.

Educational Attainment: The continuous "Years of Education" variable was created by assigning years of full-time equivalent education to each of the levels of education listed below. In the specification where dichotomous variables are used, the following levels of education are distinguished, with each dichotomous variable being set equal to unity if this is the individual's highest level of education, and being set equal to zero for individuals who do not have this as their highest level of education: (i) Higher degree (PhD, Masters); (ii) Postgraduate diploma; (iii) Bachelor degree; (iv) Undergraduate diploma; (v) Skilled vocational qualification; (vi) Basic vocational qualification; (vii) Completed the highest level of secondary school; (viii) Has not completed the highest level of secondary school. The final education category is used as the benchmark group.

Age: This is a continuous variable that measures the individual's age. It is formed from the mid-points of the 5-year age brackets used in the presentation of the sample information in the Confidentialised Unit Record File. The multivariate analyses are based on individuals aged 15-64 years.

Labour Market Experience: This is a measure of potential labour market experience computed as *Age-Years of Education-5*.

Birthplace: Three birthplace regions are distinguished in the analysis, and dichotomous variables are used to represent membership of these. They are: (i) Born abroad in main English-speaking country; (ii) Born abroad in other country; (iii) Born in Australia. The final category is used as the benchmark group in the analysis.

Disability (Nature of Handicap): This is a dichotomous variable and is set to unity if the individual reports any form of a disability. The variable is set to zero for individuals without a disability. As with some other recent surveys, see for example the *Survey of Employment and Unemployment Patterns* analysed by Le and Miller (1999), the high mean for this variable suggests that respondents may take a very wide view of the meaning of disability.

Region of Residence: Three regions of residence are distinguished, and dichotomous variables used to represent membership of these. They are: (i) Capital city for New South Wales, Victoria, Queensland, Western Australia, the Northern Territoy and the Australian Capital Territory; (ii) Other location in the above states; (iii) South Australia and Tasmania, which are States for which categories (i) and (ii) are not available. The final category is used as the benchmark group in the statistical analyses.

Period of residence: This is a continuous variable that measures the years individuals born outside Australia have resided in Australia. It is computed from the year of arrival in Australia. If the year of arrival is greater than zero then period of residence

is equal to 96.5 minus the year of arrival. It is assigned a value of zero for the native born.

Participation index: This variable is set equal to unity if the individual is in the labour force (employed or unemployed) at the time of the survey. Individuals who are not in the labour force are assigned a value of zero.

Unemployment index: This variable is set equal to unity if the individual who is in the labour force is actually unemployed at the time of the survey. Individuals who are in the labour force who are employed (*i.e.*, not unemployed) are assigned a value of zero.

Table B-1: Means and Standard Deviations of Variables, Males ad Females Aged 15-64 Years, 1996 Survey of Aspects of Literacy[(a)]

Variable	Males		Females	
	Participation	***Unemployment***	***Participation***	***Unemployment***
Level of Education				
Years of Education	12.857 (2.42)	12.994 (2.40)	12.553 (2.45)	12.981 (2.38)
Higher degree	0.027 (0.16)	0.030 (0.17)	0.012 (0.11)	0.016 (0.13)
Postgraduate diploma	0.024 (0.15)	0.025 (0.16)	0.031 (0.17)	0.038 (0.19)
Bachelor degree	0.087 (0.28)	0.096 (0.29)	0.094 (0.29)	0.117 (0.32)
Undergraduate diploma	0.025 (0.16)	0.025 (0.16)	0.036 (0.19)	0.040 (0.20)
Associate diploma	0.092 (0.29)	0.094 (0.29)	0.053 (0.22)	0.062 (0.24)
Skilled vocational qualification	0.239 (0.43)	0.245 (0.43)	0.107 (0.31)	0.106 (0.31)
Basic vocational qualification	0.031 (0.17)	0.031 (0.17)	0.094 (0.29)	0.110 (0.31)
Completed secondary school	0.170 (0.38)	0.167 (0.37)	0.179 (0.38)	0.185 (0.39)
Did not complete secondary school	0.306 (0.46)	0.288 (0.45)	0.395 (0.49)	0.325 (0.47)
Age	38.166 (12.87)	37.180 (12.19)	38.071 (12.84)	36.193 (11.80)

Experience	20.345 (13.19)	19.222 (12.39)	20.559 (13.44)	18.260 (12.18)
Birthplace				
Australia	0.740 (0.44)	0.750 (0.43)	0.737 (0.44)	0.753 (0.43)
Overseas – English speaking country	0.113 (0.32)	0.118 (0.32)	0.109 (0.31)	0.112 (0.32)
Overseas – non-English speaking country	0.147 (0.35)	0.132 (0.34)	0.155 (0.36)	0.135 (0.34)
Period of Residence (POR)	5.103 (9.75)	4.918 (9.59)	5.072 (9.67)	4.905 (9.55)
Disabled	0.300 (0.46)	0.258 (0.44)	0.254 (0.44)	0.202 (0.40)
Location				
Balance of State	0.105 (0.31)	0.106 (0.31)	0.105 (0.31)	0.101 (0.30)
City	0.576 (0.49)	0.578 (0.49)	0.580 (0.49)	0.593 (0.49)
Non-city	0.318 (0.47)	0.316 (0.46)	0.315 (0.46)	0.306 (0.46)
Sample size	3621	3176	4285	2894

[(a)]Figures in parentheses are standard deviations.
Source: *Survey of Aspects of Literacy*, Australia, 1996.

APPENDIX C

Table C-1: Logit Model of Labour Force Participation and Unemployment, Males and Females Aged 15-64 Years, 1996 Survey of Aspects of Literacy[(a)]

Variable	Males		Females	
	Participation	***Unemployment***	***Participation***	***Unemployment***
Constant	2.880	-1.371	0.790	-2.026
	(10.74)	(5.10)	(5.10)	(6.15)
Level of Education (Did not complete secondary school)				
Higher Degree	1.246	-2.379	2.138	-1.444
	(2.01)	(3.07)	(3.85)	(1.68)
Postgraduate Diploma	0.610	-1.146	1.114	-1.944
	(1.09)	(2.08)	(4.34)	(2.67)
Bachelor Degree	1.109	-1.608	1.226	-1.664
	(2.96)	(4.80)	(7.66)	(4.60)
Undergraduate Diploma	0.029	-1.503	1.029	-1.353
	(0.08)	(2.30)	(4.87)	(2.41)
Associate Diploma	0.239	-1.133	0.952	-1.580
	(1.04)	(3.93)	(5.14)	(3.43)
Skilled Vocational Qualification	0.154	-1.095	0.305	-0.551
	(0.94)	(5.46)	(2.58)	(2.17)
Basic Vocational Qualification	-0.176	0.198	0.805	-0.874
	(0.52)	(0.66)	(5.80)	(3.03)
Completed secondary school	-0.438	-0.919	0.281	-0.537
	(2.49)	(4.38)	(2.67)	(2.48)
Experience	0.095	-0.075	0.023	-0.003
	(5.91)	(4.25)	(2.31)	(0.12)
Experience squared (÷100)	-0.294	0.110	-0.126	-0.096
	(9.14)	(2.78)	(6.12)	(1.61)
Birthplace (Australia)				
Overseas – English Speaking Country	-1.873	1.624	-2.307	1.071
	(4.16)	(3.16)	(7.35)	(1.54)
Overseas – non-English speaking country	-3.148	2.448	-2.711	1.614
	(7.73)	(5.03)	(8.80)	(2.30)

Period of Residence (POR)	0.322 (3.97)	-0.169 (1.95)	0.277 (5.35)	-0.016 (0.15)
POR squared (÷100)	-0.855 (3.22)	0.409 (1.47)	-0.676 (4.18)	-0.147 (0.45)
Disabled	-1.539 (12.07)	0.618 (4.07)	-0.503 (6.26)	0.682 (3.92)
Location (S. Australia and Tasmania))				
Capital city in other states	-0.075 (0.37)	-0.192 (0.82)	0.218 (1.84)	-0.116 (0.41)
Non-capital City in other States	-0.016 (0.07)	0.227 (0.95)	0.112 (0.90)	0.375 (1.31)
χ^2 (17)	565.61	149.49	629.09	111.44
Pseudo R^2	0.223	0.087	0.118	0.080
Prediction success (%)	88.68	92.07	72.72	93.30
Sample size	3621	3176	4285	2894

(a) 't' statistics in parentheses.
Source: *Survey of Aspects of Literacy*, Australia, 1996.

Table C-2: Logit Model of Labour Force Participation and Unemployment Including Literacy and Numeracy Variables, Males and Females Aged 15-64 Years, 1996 Survey of Aspects of Literacy[a]

Variable	Males		Females	
	Participation	***Unemployment***	***Participation***	***Unemployment***
Constant	2.709	-2.305	2.571	-4.066
	(5.23)	(2.77)	(4.96)	(2.94)
Level of Education (Did not complete secondary school)				
Higher degree	0.863	-1.644	1.547	-0.909
	(1.35)	(2.08)	(2.68)	(1.04)
Postgraduate diploma	0.341	-0.542	0.564	-1.466
	(0.59)	(0.95)	(2.13)	(1.98)
Bachelor degree	0.793	-1.044	0.720	-1.207
	(2.01)	(2.91)	(4.25)	(3.20)
Undergraduate diploma	-0.280	-0.934	0.673	-1.030
	(0.72)	(1.41)	(3.11)	(1.81)
Associate diploma	-0.067	-0.731	0.665	-1.433
	(0.28)	(2.41)	(3.51)	(3.08)
Skilled vocational qualification	-0.039	-0.839	0.082	-0.346
	(0.23)	(4.05)	(0.67)	(1.32)
Basic vocational qualification	-0.344	0.462	0.576	-0.656
	(0.98)	(1.48)	(4.04)	(2.23)
Completed secondary school	-0.683	-0.561	-0.031	-0.250
	(3.59)	(2.49)	(0.28)	(1.09)
Experience	0.097	-0.074	0.018	0.009
	(5.93)	(4.12)	(1.79)	(0.37)
Experience squared (÷100)	-0.293	0.095	-0.110	-0.132
	(8.98)	(2.39)	(5.20)	(2.13)
Birthplace (Australia)				
Overseas – English speaking country	-1.895	1.366	-2.218	0.970
	(4.15)	(2.60)	(6.84)	(1.33)
Overseas – non-English speaking country	-3.027	1.804	-2.254	1.100
	(7.24)	(3.59)	(7.02)	(1.49)
Period of Residence (POR)	0.334	-0.140	0.272	-0.006
	(4.07)	(1.58)	(5.07)	(0.06)

POR squared (÷100)	-0.899 (3.35)	0.350 (1.24)	-0.671 (4.01)	-0.159 (0.46)
Disabled	-1.498 (11.58)	0.564 (3.63)	-0.377 (4.52)	0.510 (2.81)
Location (S. Australia and Tasmania)				
Capital city in other states	-0.103 (0.50)	-0.249 (1.05)	0.191 (1.58)	-0.126 (0.44)
Non-capital city in other states	-0.009 (0.04)	0.187 (0.77)	0.118 (0.93)	0.383 (1.33)
Self-perception of mathematical skills (excellent)				
Good	-0.452 (2.97)	-0.303 (1.74)	-0.520 (5.70)	0.393 (2.08)
Moderate	-0.473 (2.41)	0.086 (0.40)	-0.803 (7.13)	0.017 (0.06)
Poor	-1.167 (3.99)	0.621 (1.83)	-1.361 (6.78)	1.280 (3.25)
Document Skill Level (five=maximum)				
Four	0.451 (0.98)	0.489 (0.61)	-0.981 (1.94)	1.608 (1.19)
Three	0.859 (1.92)	0.586 (0.75)	-1.045 (2.10)	1.457 (1.08)
Two	0.616 (1.34)	1.066 (1.34)	-1.253 (2.51)	1.678 (1.24)
One (minimum)	0.341 (0.73)	1.706 (2.13)	-1.695 (3.34)	2.502 (1.84)
χ^2 (24)	602.58	197.66	794.59	150.15
Pseudo R^2	0.237	0.115	0.149	0.108
Prediction success (%)	88.76	92.03	74.19	93.30
Tests of Incremental Explanatory Power				
Self-perception of mathematical skill χ^2 (3)	18.29	10.39	76.51	13.34
Self-perception of mathematical skill χ^2 (4)	10.06	29.14	36.69	19.18
Sample size	3621	3176	4285	2894

[(a)] 't' statistics in parentheses.
Source: *Survey of Aspects of Literacy*, Australia, 1996.

Table C-3: Selected Coefficients from Logit Models of Unemployment, Males Aged 15-64 Years, 1996 Survey of Aspects of Literacy[a]

	Simple Model[b]	Restricted Model[c]	Full Model[d]
Level of Education (Did not complete secondary school)			
Higher degree	-2.379 (3.07)	-1.644 (2.08)	-1.615 (2.03)
Postgraduate diploma	-1.146 (2.08)	-0.542 (0.95)	-0.528 (0.91)
Bachelor degree	-1.608 (4.80)	-1.044 (2.91)	-1.021 (2.79)
Undergraduate diploma	-1.503 (2.30)	-0.934 (1.41)	-0.970 (1.45)
Associate diploma	-1.133 (3.93)	-0.731 (2.41)	-0.764 (2.46)
Skilled vocational qualification	-1.095 (5.46)	-0.839 (4.05)	-0.834 (4.00)
Basic vocational qualification	0.198 (0.66)	0.462 (1.48)	0.412 (1.30)
Completed secondary school	-0.919 (4.38)	-0.561 (2.49)	-0.566 (2.49)
χ^2 [e]	149.49	197.66	211.96
Pseudo R^2	0.087	0.115	0.123
Prediction success (%)	92.07	92.03	92.00
Sample size	3176	3176	3176

[a] 't' statistics in parentheses
[b] The Simple model does not include any literacy or numeracy variables. The coefficients are from Table 1 of Appendix C.
[c] The Restricted model includes three variables for self-perceptions of mathematical skills and four variables for document skills. The coefficients are from Table 2 of Appendix C.
[d] The Full model includes variables for self-perceptions of reading skill, writing and mathematical skills, and for prose, document and quantitative skills. Twenty one variables are used for these influences.
[e] The degrees of freedom for the χ^2 tests are 17 for the Simple model, 24 for the Restricted model and 38 for the Full model.
Source: *Survey of Aspects of Literacy*, Australia, 1996.

Table 4A: Logit Model of Labour Force Participation and Unemployment Including Literacy and Numeracy Variables, Males and Females Aged 15-64 Years, 1996 Survey of Aspects of Literacy, Better-Educated Sample[(a)]

Variable	Males		Females	
	Participation	***Unemployment***	***Participation***	***Unemployment***
Constant	1.574	1.974	1.769	-3.064
	(1.14)	(1.23)	(1.74)	(1.48)
Years of Education	0.079	-0.038	0.103	-0.152
	(1.06)	(0.47)	(2.56)	(1.63)
Experience	0.153	-0.124	0.042	0.148
	(5.11)	(3.71)	(2.29)	(2.53)
Experience squared (÷100)	0.448	0.249	-0.198	-0.418
	(7.31)	(3.24)	(4.79)	(2.71)
Birthplace (Australia)				
Overseas – English speaking country	-2.415	1.690	-2.027	1.978
	(3.92)	(2.37)	(4.86)	(2.39)
Overseas – non-English speaking country	-2.885	1.788	-2.081	2.301
	(4.90)	(2.45)	(5.13)	(2.75)
Period of Residence (POR)	0.409	-0.269	0.285	-0.189
	(3.39)	(1.95)	(4.17)	(1.45)
POR squared (÷100)	-1.132	0.766	-0.729	0.487
	(2.82)	(1.67)	(3.32)	(1.19)
Disabled	-1.047	0.827	-0.414	1.052
	(5.21)	(3.41)	(2.90)	(3.62)
Location (S. Australia and Tasmania)				
Capital city in other states	-0.150	-0.279	0.030	-0.661
	(0.44)	(0.71)	(0.15)	(1.41)
Non-capital city in other states	0.038	0.079	0.237	0.159
	(0.11)	(0.20)	(1.06)	(0.34)
Self-perception of mathematical skills (excellent)				
Good	-0.319	-0.422	-0.558	0.484
	(1.42)	(1.57)	(3.91)	(1.63)
Moderate	-0.440	0.348	-0.719	-0.722
	(1.38)	(1.00)	(3.77)	(1.24)

Poor	-1.086	0.121	-0.910	1.744
	(1.86)	(0.16)	(2.36)	(2.68)
Document Skill Level (five=maximum)				
Four	0.716	-0.219	-1.113	0.330
	(1.13)	(0.26)	(1.49)	(0.24)
Three	0.273	0.473	-1.240	0.653
	(0.46)	(0.59)	(1.67)	(0.49)
Two	0.105	1.033	-1.455	1.185
	(0.17)	(1.26)	(1.94)	(0.88)
One	-0.130	1.356	-1.749	0.824
(minimum)	(0.20)	(1.57)	(2.26)	(0.58)
χ^2 (17)	236.09	63.61	254.56	69.10
Pseudo R^2	0.225	0.090	0.129	0.131
Prediction success (%)	91.73	94.63	81.52	95.51
Tests of Incremental Explanatory Power[(b)]				
Self-perception of mathematical skill				
χ^2 (3)	4.67	5.88	22.01*	12.16*
Self-perception of document skill				
χ^2 (4)	4.56	12.86*	11.1*	4.79
Sample size	1935	1768	1905	1493

[(a)]'t' statistics in parentheses.
[(b)]* = test significant at 5% level.
Source: *Survey of Aspects of Literacy*, Australia, 1996.

Table 4B: Logit Model of Labour Force Participation and Unemployment Including Literacy and Numeracy Variables, Males and Females Aged 15-64 Years, 1996 Survey of Aspects of Literacy, Less Well Educated Sample[(a)]

Variable	Males		Females	
	Participation	***Unemployment***	***Participation***	***Unemployment***
Constant	4.006 (3.99)	-10.672 (0.06)	1.772 (2.15)	-12.484 (0.08)
Years of Education	-0.165 (3.18)	-0.156 (2.65)	0.039 (1.10)	-0.035 (0.40)
Experience	0.089 (4.58)	-0.050 (2.37)	0.015 (1.20)	-0.026 (0.95)
Experience squared (÷100)	-0.269 (6.82)	0.006 (0.13)	-0.087 (3.54)	-0.061 (0.87)
Birthplace (Australia)				
Overseas – English speaking country	-1.418 (2.04)	0.880 (1.12)	-2.469 (4.50)	-1.300 (0.82)
Overseas – non-English speaking country	-3.298 (5.45)	1.688 (2.33)	-2.509 (4.56)	-1.316 (0.81)
Period of Residence (POR)	0.295 (2.53)	-0.039 (0.32)	0.259 (2.86)	0.365 (1.54)
POR squared (÷100)	-0.759 (2.02)	0.024 (0.06)	-0.597 (2.16)	-1.327 (1.91)
Disabled	-1.817 (10.35)	0.450 (2.20)	-0.365 (3.51)	0.195 (0.79)
Location (S. Australia and Tasmania)				
Capital city in other states	0.043 (0.16)	-0.296 (0.98)	0.288 (1.90)	0.145 (0.39)
Non-capital city in other states	0.036 (0.13)	0.225 (0.73)	0.052 (0.33)	0.505 (1.34)
Self-perception of mathematical skills (excellent)				
Good	-0.595 (2.75)	-0.207 (0.89)	-0.510 (4.28)	0.473 (1.87)
Moderate	-0.583 (2.23)	0.058 (0.21)	-0.808 (5.64)	0.294 (0.90)

Poor	-1.405	0.696	-1.455	1.333
	(3.84)	(1.68)	(5.93)	(2.62)
Document Skill Level (five=maximum)				
Four	0.382	10.757	-0.786	10.816
	(0.53)	(0.06)	(1.13)	(0.07)
Three	1.558	10.378	-0.757	10.236
	(2.18)	(0.06)	(1.11)	(0.06)
Two	1.211	10.917	-0.943	10.334
	(1.69)	(0.06)	(1.38)	(0.06)
One	0.879	11.606	-1.414	11.557
(minimum)	(1.21)	(0.06)	(2.05)	(0.07)
χ^2 (17)	360.38	105.63	393.92	97.57
Pseudo R^2	0.252	0.109	0.124	0.118
Prediction success (%)	85.53	88.56	69.24	91.01
Tests of Incremental Explanatory Power[(b)]				
Self-perception of mathematical skill				
χ^2 (3)	16.13*	5.53	50.97*	7.89#
Self-perception of document skill				
χ^2 (4)	21.19*	22.63*	22.86*	24.12*
Sample size	1686	1408	2380	1401

[(a)]'t' statistics in parentheses.
[(b)]* = test significant at 5% level.
= test significant at 10% level.
Source: *Survey of Aspects of Literacy*, Australia, 1996.

Table 4C: Logit Model of Labour Force Participation and Unemployment Including Literacy and Numeracy Variables, Males and Females Aged 15-64 Years, 1996 Survey of Aspects of Literacy, Immigrants from English-Speaking Countries[a]

Variable	Males		Females	
	Participation	***Unemployment***	***Participation***	***Unemployment***
Constant	4.865	1.787	9.362	-12.798
	(2.00)	(0.76)	(0.07)	(0.06)
Years of Education	-0.159	-0.103	0.079	-0.008
	(1.52)	(0.90)	(1.31)	(0.06)
Experience	0.240	-0.126	0.148	0.002
	(3.36)	(1.83)	(4.10)	(0.03)
Experience squared (÷100)	-0.594	0.249	-0.378	-0.068
	(4.16)	(1.78)	(5.07)	(0.33)
Period of Residence (POR)	-0.123	-0.179	0.090	0.101
	(0.59)	(0.93)	(1.02)	(0.55)
POR squared (÷100)	0.387	0.594	-0.178	-0.377
	(0.62)	(0.97)	(0.65)	(0.69)
Disabled	-1.649	0.788	-0.275	0.180
	(3.43)	(1.71)	(1.04)	(0.30)
Location (S. Australia and Tasmania)				
Capital city in other states	0.651	-0.579	0.446	-0.703
	(1.02)	(0.90)	(1.21)	(0.82)
Non-capital city in other states	0.459	0.972	0.389	0.103
	(0.66)	(1.34)	(0.95)	(0.12)
Self-perception of mathematical skills (excellent)				
Good	-0.705	-0.213	-0.604	0.645
	(1.31)	(0.41)	(2.18)	(1.17)
Moderate	-0.381	-0.019	-1.315	-0.172
	(0.55)	(0.03)	(3.83)	(0.20)
Poor	-3.140	2.057	-1.483	1.274
	(2.36)	(1.64)	(2.13)	(0.87)
Document Skill Level (five=maximum)				
Four	-0.073	-1.565	-10.379	10.095
	(0.07)	(1.47)	(0.08)	(0.05)
Three	0.777	-1.334	-11.069	9.645
	(0.75)	(1.48)	(0.08)	(0.05)

Two	-0.120 (0.11)	-0.957 (1.01)	-11.174 (0.08)	10.802 (0.05)
One (minimum)	-0.057 (0.05)	0.256 (0.27)	-10.544 (0.08)	9.512 (0.05)
χ^2 (17)	63.87	25.75	110.74	14.51
Pseudo R^2	0.266	0.130	0.184	0.095
Prediction success (%)	92.18	93.02	76.41	94.20
Tests of Incremental Explanatory Power[(b)]				
Self-perception of mathematical skill				
χ^2 (3)	6.11	3.29	16.57*	2.31
Self-perception of document skill				
χ^2 (4)	3.62	8.53#	11.39*	6.06
Sample size	473	430	496	345

[(a)]'t' statistics in parentheses.
[(b)]* = test significant at 5% level.
\# = test significant at 10% level.
Source: *Survey of Aspects of Literacy*, Australia, 1996.

Table 4D: Logit Model of Labour Force Participation and Unemployment Including Literacy and Numeracy Variables, Males and Females Aged 15-64 Years, 1996 Survey of Aspects of Literacy, Immigrants from non-English Speaking Countries[(a)]

Variable	Males		Females	
	Participation	***Unemployment***	***Participation***	***Unemployment***
Constant	8.363	-4.797	8.284	-8.388
	(0.05)	(0.03)	(0.05)	(0.05)
Years of Education	0.025	-0.217	0.048	-0.152
	(0.39)	(2.61)	(1.00)	(1.22)
Experience	0.121	-0.104	0.041	0.059
	(3.06)	(2.29)	(1.24)	(0.71)
Experience squared (÷100)	-0.272	0.109	-0.181	-0.311
	(3.64)	(1.17)	(2.80)	(1.34)
Period of Residence (POR)	0.421	-0.137	0.318	0.022
	(4.08)	(1.21)	(4.10)	(0.14)
POR squared (÷100)	-1.156	0.264	-0.760	-0.269
	(3.44)	(0.73)	(3.15)	(0.56)
Disabled	-2.488	0.446	-0.573	1.779
	(7.36)	(0.85)	(2.25)	(3.12)
Location (S. Australia and Tasmania)				
Capital city in other states	0.192	-1.490	0.029	-0.122
	(0.36)	(2.53)	(0.07)	(0.12)
Non-capital city in other states	1.091	-0.621	0.217	0.043
	(1.58)	(0.89)	(0.44)	(0.04)
Self-perception of mathematical skills (excellent)				
Good	-0.623	0.065	-0.587	1.386
	(1.76)	(0.15)	(1.98)	(2.36)
Moderate	-0.447	0.030	-1.143	-1.364
	(0.96)	(0.05)	(3.24)	(0.93)
Poor	-0.072	0.385	-1.307	1.382
	(0.11)	(0.48)	(2.76)	(1.14)
Document Skill Level (five=maximum)				
Four	-8.959	9.234	-9.255	8.112
	(0.05)	(0.06)	(0.05)	(0.05)
Three	-9.764	8.780	-9.428	7.738
	(0.05)	(0.05)	(0.05)	(0.05)

Two	-9.849 (0.05)	9.642 (0.06)	-9.675 (0.05)	7.223 (0.04)
One (minimum)	-9.920 (0.05)	9.849 (0.06)	-10.363 (0.06)	8.038 (0.05)
χ^2 (17)	132.05	46.78	194.94	40.84
Pseudo R^2	0.278	0.176	0.256	0.215
Prediction success (%)	82.09	88.92	73.98	90.58
Tests of Incremental Explanatory Power[(b)]				
Self-perception of mathematical skill				
χ^2 (3)	3.60	0.24	13.13*	12.17*
Self-perception of document skill				
χ^2 (4)	2.59	4.99	12.21*	2.00
Sample size	469	370	565	329

[(a)] 't' statistics in parentheses.
[(b)] * = test significant at 5% level.
Source: *Survey of Aspects of Literacy*, Australia, 1996.

Table 4E: Logit Model of Labour Force Participation and Unemployment Including Literacy and Numeracy Variables, Males and Females Aged 15-64 Years, 1996 Survey of Aspects of Literacy, Australian Born[(a)]

Variable	Males		Females	
	Participation	***Unemployment***	***Participation***	***Unemployment***
Constant	2.499	-11.705	0.930	-1.216
	(3.15)	(0.08)	(1.53)	(0.77)
Years of Education	-0.003	-0.133	0.121	-0.210
	(0.08)	(2.92)	(5.40)	(3.79)
Experience	0.108	-0.058	0.009	-0.006
	(5.60)	(2.73)	(0.83)	(0.25)
Experience squared (÷100)	-0.327	0.047	-0.077	-0.106
	(8.26)	(0.93)	(3.25)	(1.58)
Disabled	-1.228	0.613	-0.349	0.359
	(8.18)	(3.48)	(3.67)	(1.70)
Location (S. Australia and Tasmania)				
Capital city in other states	-0.167	-0.032	0.166	-0.071
	(0.67)	(0.00)	(1.24)	(0.22)
Non-capital City in other States	-0.104	0.421	0.056	0.428
	(0.41)	(1.44)	(0.41)	(1.34)
Self-perception of mathematical skills (excellent)				
Good	-0.422	-0.388	-0.518	0.245
	(2.28)	(1.88)	(5.09)	(1.12)
Moderate	-0.516	0.183	-0.644	0.069
	(2.14)	(0.74)	(5.04)	(0.24)
Poor	-1.396	0.598	-1.315	1.359
	(4.00)	(1.46)	(5.42)	(3.02)
Document Skill Level (five=maximum)				
Four	0.510	10.811	-0.740	1.215
	(1.03)	(0.07)	(1.47)	(0.90)
Three	0.952	11.003	-0.736	1.037
	(1.95)	(0.07)	(1.49)	(0.78)
Two	0.773	11.474	-0.938	1.164
	(1.53)	(0.07)	(1.88)	(0.87)
One (minimum)	0.357	12.139	-1.363	2.290
	(0.68)	(0.08)	(2.67)	(1.68)

χ^2 (17)	376.47	126.64	463.86	106.05
Pseudo R^2	0.216	0.102	0.118	0.102
Prediction success (%)	89.51	92.42	73.70	93.47
Tests of Incremental Explanatory Power[(b)]				
Self-perception of mathematical skill				
χ^2 (3)	15.93	10.95	48.29	8.98
Self-perception of document skill				
χ^2 (4)	11.31	26.85	22.97	19.91
Sample size	2679	2376	3224	2220

[(a)]'t' statistics in parentheses.
[(b)*] = All χ^2 tests are significant at the 5% level.
Source: *Survey of Aspects of Literacy*, Australia, 1996.

Table 5A: Selected Coefficient from Logit Models of Unemployment, Males, 1996 Survey of Aspects of Literacy, Better-Educated Sample [(a)]

	Simple Model[(b)]	Restricted Model[(c)]	Full Model[(d)]
Years of Education	-0.159 (2.16)	-0.038 (0.47)	-0.017 (0.20)
χ^2 [(e)]	43.26	63.61	82.34
Pseudo R^2	0.061	0.090	0.117
Prediction success (%)	94.63	94.63	94.74
Sample size	1768	1768	1768

[(a)] 't' statistics in parentheses

[(b)] The Simple model does not include any literacy or numeracy variables. The coefficient is from a model comparable to Table 1.

[(c)] The Restricted model includes three variables for self-perceptions of mathematical skills and four variables for document skills. The coefficient is from Table 4A.

[(d)] The Full model includes variables for self-perceptions of reading skill, writing and mathematical skills, and for prose, document and quantitative skills. Twenty one variables are used for these influences.

[(e)] The degrees of freedom for the χ^2 tests are 10 for the Simple model, 17 for the Restricted model and 31 for the Full model.

Source: *Survey of Aspects of Literacy*, Australia, 1996.

Table 5B: Selected Coefficient from Logit Models of Unemployment, Males, 1996 Survey of Aspects of Literacy, Less Well Educated Sample [a]

	Simple Model[b]	Restricted Model[c]	Full Model[d]
Years of Education	-0.266 (5.03)	-0.156 (2.65)	-0.147 (2.45)
χ^2 [e]	74.03	105.63	120.97
Pseudo R^2	0.076	0.109	0.125
Prediction success (%)	88.78	88.56	88.49
Sample size	1408	1408	1408

[a] 't' statistics in parentheses
[b] The Simple model does not include any literacy or numeracy variables. The coefficient is from a model comparable to Table 1.
[c] The Restricted model includes three variables for self-perceptions of mathematical skills and four variables for document skills. The coefficient is from Table 4B.
[d] The Full model includes variables for self-perceptions of reading skill, writing and mathematical skills, and for prose, document and quantitative skills. Twenty one variables are used for these influences.
[e] The degrees of freedom for the χ^2 tests are 10 for the Simple model, 17 for the Restricted model and 31 for the Full model.
Source: *Survey of Aspects of Literacy*, Australia, 1996.

Table 5C: Selected Coefficient from Logit Models of Unemployment, Males, 1996 Survey of Aspects of Literacy, Immigrants from English-Speaking Countries [(a)]

	Simple Model[(b)]	Restricted Model[(c)]	Full Model[(d)]
Years of Education	-0.194 (1.96)	-0.103 (0.90)	-0.027 (0.21)
χ^2 [(e)]	12.231	25.75	41.37
Pseudo R^2	0.062	0.130	0.209
Prediction success (%)	92.79	93.20	93.72
Sample size	430	430	430

[(a)]'t' statistics in parentheses

[(b)]The Simple model does not include any literacy or numeracy variables. The coefficient is from a model comparable to Table 1.

[(c)]The Restricted model includes three variables for self-perceptions of mathematical skills and four variables for document skills. The coefficient is from Table 4C.

[(d)]The Full model includes variables for self-perceptions of reading skill, writing and mathematical skills, and for prose, document and quantitative skills. Twenty one variables are used for these influences.

[(e)]The degrees of freedom for the χ^2 tests are 10 for the Simple model, 17 for the Restricted model and 31 for the Full model.

Source: *Survey of Aspects of Literacy*, Australia, 1996.

Table 5D: Selected Coefficient from Logit Models of Unemployment, Males, 1996 Survey of Aspects of Literacy, Immigrants from Non-English Speaking Countries [(a)]

	Simple Model[(b)]	Restricted Model[(c)]	Full Model[(d)]
Years of Education	-0.283 (3.82)	-0.217 (2.61)	-0.191 (2.16)
χ^2 [(e)]	41.01	46.78	56.31
Pseudo R^2	0.155	0.176	0.212
Prediction success (%)	88.92	88.19	88.92
Sample size	370	370	370

[(a)]'t' statistics in parentheses
[(b)]The Simple model does not include any literacy or numeracy variables. The coefficient is from a model comparable to Table 1.
[(c)]The Restricted model includes three variables for self-perceptions of mathematical skills and four variables for document skills. The coefficient is from Table 4D.
[(d)]The Full model includes variables for self-perceptions of reading skill, writing and mathematical skills, and for prose, document and quantitative skills. Twenty one variables are used for these influences.
[(e)]The degrees of freedom for the χ^2 tests are 10 for the Simple model, 17 for the Restricted model and 31 for the Full model.
Source: *Survey of Aspects of Literacy*, Australia, 1996.

Table 5E: Selected Coefficient from Logit Models of Unemployment, Males, 1996 Survey of Aspects of Literacy, Australian Born[(a)]

	Simple Model[(b)]	Restricted Model[(c)]	Full Model[(d)]
Years of Education	-0.253 (6.29)	-0.133 (2.92)	-0.151 (3.13)
χ^2 [(e)]	84.54	126.64	149.41
Pseudo R^2	0.068	0.102	0.121
Prediction success (%)	92.42	92.42	92.51
Sample size	2376	2376	2376

[(a)]'t' statistics in parentheses
[(b)]The Simple model does not include any literacy or numeracy variables. The coefficient is from a model comparable to Table 1.
[(c)]The Restricted model includes three variables for self-perceptions of mathematical skills and four variables for document skills. The coefficient is from Table 4E.
[(d)]The Full model includes variables for self-perceptions of reading skill, writing and mathematical skills, and for prose, document and quantitative skills. Twenty one variables are used for these influences.
[(e)]The degrees of freedom for the χ^2 tests are 10 for the Simple model, 17 for the Restricted model and 31 for the Full model.
Source: *Survey of Aspects of Literacy*, Australia, 1996.

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