

**Income fluctuations over the lifecycle:
a cohort analysis of indigenous and
non-indigenous Australians, 1986–96**

B.H. Hunter and M.C. Gray

No. 183/1999

ISSN 1036-1774
ISBN 0 7315 2618

Dr Boyd Hunter is a Research Fellow and Mr Matthew Gray is a Post-doctoral Fellow at the Centre for Aboriginal Economic Policy Research, The Australian National University. Dr Hunter is also a Ronald Henderson Research Fellow.

Series Note

The Centre for Aboriginal Economic Policy Research (CAEPR) was established in March 1990 under an agreement between The Australian National University (ANU) and the Aboriginal and Torres Strait Islander Commission (ATSIC). Since 1 January 1999, CAEPR operates as university centre and is funded by ATSIC, the Commonwealth Department of Family and Community Services and ANU. CAEPR's principal objective is to undertake high quality independent research that will assist in furthering the social and economic development and empowerment of Aboriginal and Torres Strait Islander people.

CAEPR's mission is to be a world-class centre undertaking research on indigenous economic development issues that combine academic excellence with policy relevance and realism. In Australia, CAEPR is currently the only dedicated research centre focusing on indigenous economic policy issues from a national perspective: its publications, which include the CAEPR Discussion Paper series, aim to broadly evaluate government policy, influence policy formulation and inform rational debate.

The Director of the Centre is responsible to the Vice-Chancellor of ANU and receives assistance in formulating the Centre's research priorities from an Advisory Committee consisting of senior academics nominated by the Vice-Chancellor and representatives nominated by ATSIC, the Department of Employment, Workplace Relations and Small Business and the Department of Family and Community Services.

CAEPR Discussion Papers are intended as one forum for the rapid dissemination of refereed papers on research that falls within the CAEPR ambit. These papers are produced for discussion and comment within the research community and indigenous affairs public policy arena. Many are subsequently published in academic journals. Publications can be purchased from:

Centre for Aboriginal Economic Policy Research
2nd Floor, J.G. Crawford Building
The Australian National University
Canberra ACT 0200
Telephone 02-6279 8211
Facsimile 02-6249 2789

Abstracts or Summaries of all CAEPR Discussion Papers can be found at the following World Wide Web address: <http://online.edu.au/caepr/>

As with all CAEPR publications, the views expressed in this Discussion Paper are those of the author(s) and do not reflect an official CAEPR position.

Professor Jon Altman
Director, CAEPR
The Australian National University
June 1999

Table of Contents

Summary.....	v
Introduction.....	1
The income gap between indigenous and non-indigenous Australians, 1996	2
Trends in relative income deprivation, 1986–96	4
A cohort analysis of income distribution, 1986 and 1996	7
Longitudinal analysis of income, 1986, 1991 and 1996 Censuses.....	18
Policy discussion	19
Appendix A. Tables for the cohort analysis, 1986–96.....	21
Appendix B. Longitudinal analysis of income, 1986, 1991 and 1996.....	25
Notes	32
Appendix notes	33
References.....	34

Tables

Table 1.	Trends in indigenous and non-indigenous poverty: persons aged over 15 years, 1986 and 1996	5
Table A1.	Income distributions for indigenous males, 1986–96.....	21
Table A2.	Income distributions for indigenous females, 1986–96	22
Table A3.	Income distributions for non-indigenous males, 1986–96.....	23
Table A4.	Income distributions for non-indigenous females, 1986–96	24
Table B1.	Descriptive statistics for regressions.....	29
Table B2.	FE and OLS regressions of log male income, 1986–96 Censuses	30
Table B3.	FE and OLS regressions of log female income, 1986–96 Censuses	31

Figures

Figure 1.	Income distribution: males aged 15 years and over, 1996.....	3
Figure 2.	Income distribution: females aged 15 years and over, 1996.....	4
Figure 3.	Income distribution: indigenous males, cohort aged 15 to 24 years in 1986	9

Figure 4.	Income distribution: non-indigenous males, cohort aged 15 to 24 years, 1986–96	9
Figure 5.	Income distribution: indigenous females, cohort aged 15 to 24 years, 1986–96	10
Figure 6.	Income distribution: non-indigenous females, cohort aged 15 to 24 years in 1986	10
Figure 7.	Income distribution: indigenous males, cohort aged 25 to 34 years in 1986	11
Figure 8.	Income distribution: non-indigenous males, cohort aged 25 to 34 years in 1986	11
Figure 9.	Income distribution: indigenous females, cohort aged 25 to 34 years in 1986	12
Figure 10.	Income distribution: non-indigenous females, cohort aged 25 to 34 years in 1986	12
Figure 11.	Income distribution: indigenous males, cohort aged 35 to 44 years in 1986	13
Figure 12.	Income distribution: non-indigenous males, cohort aged 35 to 44 years in 1986	13
Figure 13.	Income distribution: indigenous females, cohort aged 35 to 44 years in 1986	14
Figure 14.	Income distribution: non-indigenous females, cohort aged 35 to 44 years in 1986	14
Figure 15.	Income distribution: indigenous males, cohort aged 45 to 54 years in 1986	15
Figure 16.	Income distribution: non-indigenous males, cohort aged 45 to 54 years in 1986	16
Figure 17.	Income distribution: indigenous females, cohort aged 45 to 54 years in 1986	17
Figure 18.	Income distribution: non-indigenous females, cohort aged 45 to 54 years in 1986	17

Summary

The myth of equality in Australian society is clearly exposed by the large income gap between indigenous and other Australians. Data from the 1986, 1991 and 1996 Censuses is used to conduct a cohort analysis of the income distributions for indigenous and non-indigenous males and females. Single-year age cohorts are used in the first longitudinal regression analysis of indigenous income. Trends in relative income deprivation are identified.

The income gap between indigenous and non-indigenous Australians, 1996

- In 1996, the overall average income for indigenous adults was \$14,200 (1996 dollars) which was 30 per cent less than the average of \$21,100 for the total population. Indigenous people are over-represented in almost all income categories below \$20,800 and under-represented in almost all income categories above this income. Around one-fifth of indigenous people would have to shift their income bracket in order to achieve an equivalent income distribution to that of non-indigenous people.
- Breaking the income distributions down by sex shows that the differences between the indigenous and non-indigenous populations are largely driven by the distinct nature of the non-indigenous male income and in particular the high rates of full-time and well-paid employment.

Trends in relative income deprivation, 1986–96

- An analysis of changes in relative income deprivation for indigenous and non-indigenous males and females between 1986 and 1996 is presented. Relative income deprivation is defined as the proportion of the population with an income less than 40, 50 or 60 per cent of the median income. There has been a large fall in poverty among individual Australians between the 1986 and 1996 Censuses with the proportion of the Australian population receiving less than 50 per cent of the median Australian income falling from 27.6 per cent in 1986 to 24.4 per cent in 1996.
- It is demonstrated that the major reason for the decline has been the recent trend towards ‘individualisation’ of welfare payments. The process of individualisation may mean that welfare payments are now more likely to be paid to both married partners rather than one partner (usually the male).

A cohort analysis of income distribution, 1986 and 1996

- A large proportion of the indigenous male cohort aged between 15 and 24 years in 1986 moved from having no income to having a small income (in the range associated with part-time employment or welfare payments) between

1986 and 1996. The change for the analogous female cohorts was less pronounced.

- The process of individualisation of welfare payments is particularly evident for females aged between 25 and 34 years in 1986.
- Indigenous and non-indigenous male and female cohorts aged between 35 and 44 years in 1986 tended to be moving out of the workforce by 1996 and consequently, experienced a decline in income between 1986 and 1996.
- The individualisation of the welfare system has a consistent impact on female cohorts aged over 35 years in 1986.
- For the cohorts aged between 45 and 55 years in 1986 the vast majority of those in employment moved out of the workforce between 1986 and 1996. One feature of this transition was that the non-indigenous male cohort appear to have left relatively large numbers of lower-paid positions in this period.

Longitudinal analysis of income: 1986, 1991 and 1996 Censuses

The cohort nature of the data allows the first longitudinal regression analysis of the determinants of personal income for indigenous and non-indigenous Australians. The advantage of this approach is that statistical techniques can be used to control for unobservable differences between the indigenous and non-indigenous populations, such as ability and schooling quality, as well as assimilation, discrimination and other attitudes. The results demonstrate that the failure to control for unobserved differences in existing studies of indigenous income will induce a significant bias in both empirical and policy analysis.

Policy discussion

The deliberate policy shift in the early 1990s to paying welfare to individuals ('individualisation') has resulted in an increase in financial independence among many females. The intra-family redistribution inherent in individualisation is a positive force promoting equality within the home, if not between households.

The other insight from the analysis is that the generosity of welfare payments or improved targeting of benefits has materially advantaged extremely poor indigenous people. While this is a positive outcome in its own right, it is important to bear in mind the interaction between tax, welfare, productivity and incentives to work. As long as all these policy instruments are effective, it is entirely appropriate that welfare be targeted to those in immediate need, while tax and productivity enhancing policies focus on the incentive to work.

Acknowledgments

We are indebted to Professor Jon Altman, Dr Tom Crossley, Ms Yi-Ping Tseng, Dr Will Sanders and Dr John Taylor for comments on an earlier draft. Editorial assistance was provided by Linda Roach and Hilary Bek, with layout by Jennifer Braid.

Introduction

The myth of equality in Australian society is clearly exposed by the large income gap between indigenous and other Australians. Taylor and Hunter (1998) estimate that, in aggregate terms, indigenous people's incomes would have to increase by \$1.6 billion (1996 dollars) per annum to achieve income equality. This number is remarkable given that indigenous people only constitute about 2 per cent of Australia's population. This paper describes this income gap in detail and teases out the major reasons for the low levels of income experienced by many indigenous Australians.

1996 Census data on income permit an update of how indigenous people fare relative to other Australians. However, rather than mechanically update previous income data, this paper attempts to shed new light on the income deprivation of indigenous Australians by tracing changes in income over the lifecycle for indigenous and non-indigenous males and females. The unit of analysis used is a 'cohort' of individuals who can be uniquely identified in successive censuses by their sex, age and indigenous status.

The census data on income indicate pre-tax income from all sources rather than separately identifying sources of income. Census income therefore reflects a complex interaction between age, the social security/transfer payment system, labour income, assets and other private income. It is not possible to interpret the results in terms of conventional economic studies of labour income unless attention is restricted to a select sample of individuals in each census (Daly 1995; Preston 1997). However, the necessary restrictions are incompatible with the cohort approach that requires that the information on all individuals in a particular demographic group be used. Consequently, our analysis must be interpreted in terms of gross income and cannot be compared directly to wage studies.

This cohort analysis provides the first 'longitudinal' data on indigenous income. Whilst there is no pretence in this paper at following the same individuals across time, Deaton (1985), Verbeek and Nijman (1992) and Hunter and Gray (1998) describe how carefully constructed cohorts permit a 'pseudo panel' or 'longitudinal' analysis. The advantage of the cohort approach is that it facilitates a more subtle analysis of the determinants of income that controls for the unobservable characteristics of both indigenous and non-indigenous Australians. Given that it is usually not possible to observe characteristics such as ability, schooling quality, assimilation, discrimination and other attitudes, the failure to control for such characteristics can induce a significant bias in the empirical results. Therefore, notwithstanding the limitations of aggregate census data, our analysis provides one of the most accurate estimates of the factors underlying indigenous income to date.

The paper is divided into five sections. First, the income gap is examined using the overall income distributions for indigenous and other Australians in the 1996 Census. Second, changes between the 1986 and 1996 Censuses in the

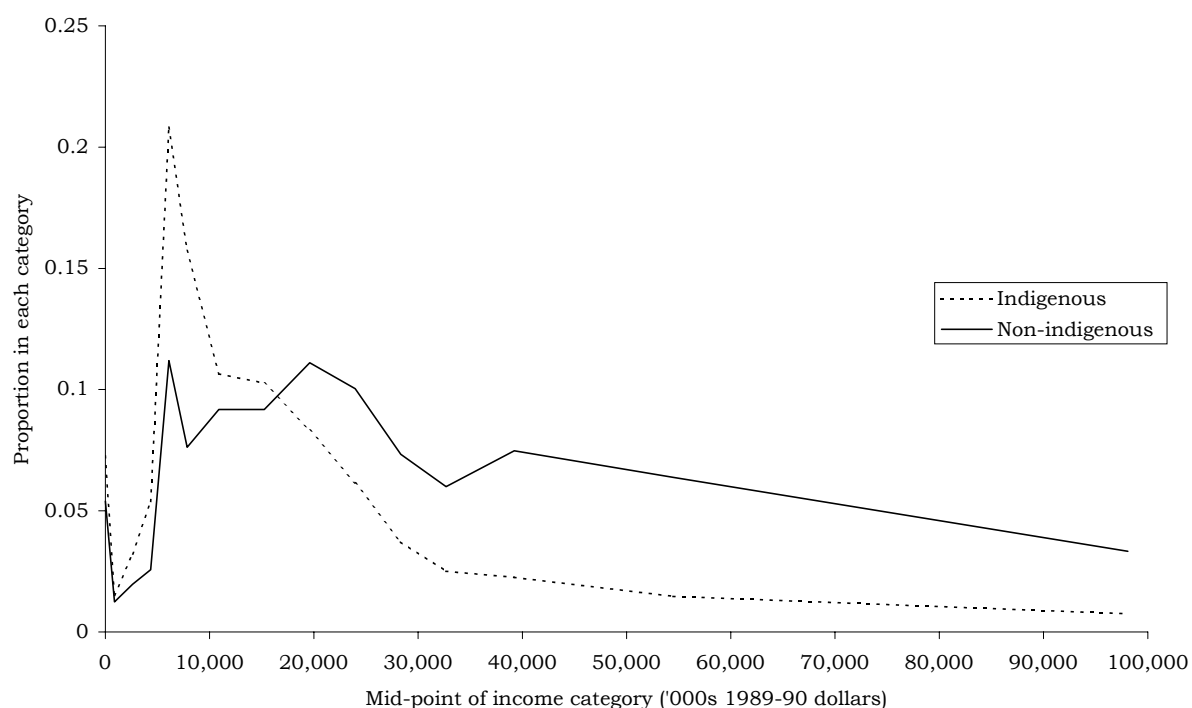
relative income deprivation of indigenous Australians, are described. Third, the changes in the income gap for this period are analysed by tracing what happens to ten-year age groups of indigenous and other Australians. Fourth, a panel of single-year age cohorts for the last three censuses is constructed with a view to conducting the first formal 'longitudinal' analysis of indigenous Australians. This panel data facilitates the identification of the factors affecting indigenous and non-indigenous income. The final section reflects on the implications of this study for policy.

The income gap between indigenous and non-indigenous Australians, 1996

In 1996, the overall average income for indigenous adults was \$14,200 that was 30 per cent less than the average of \$21,100 for the total population. While this is partly due to relatively low indigenous employment and the greater dependence of indigenous people on welfare payments, it also reflects their overall lower occupational status and educational attainment. For example, the average income for indigenous people in full-time non-Community Development Employment Projects scheme employment estimated from the National Aboriginal and Torres Strait Islander Survey (NATSIS) was \$27,300, 13 per cent below the average income for all full-time employed people. If the income of all employed indigenous people is considered, then average income falls to \$21,142, which is still 24 per cent lower than the average income of all non-indigenous employees. This reflects the much greater reliance on low-status and part-time work by indigenous workers (Taylor and Hunter 1998).

Indigenous people are over-represented in almost all income categories below \$20,800 (1996 dollars) per annum and under-represented in all categories above this income. The index of dissimilarity of 19.7 between these distributions indicates that around one-fifth of indigenous people would have to shift their income bracket in order to achieve an equivalent income distribution to that of non-indigenous people.¹ If the distribution of indigenous incomes was the same as for non-indigenous incomes then the resultant estimated total income of indigenous people would rise from \$3.3 billion to \$4.9 billion, an increase (or relative shortfall compared to non-indigenous Australians) of \$1.6 billion (Taylor and Hunter 1998).

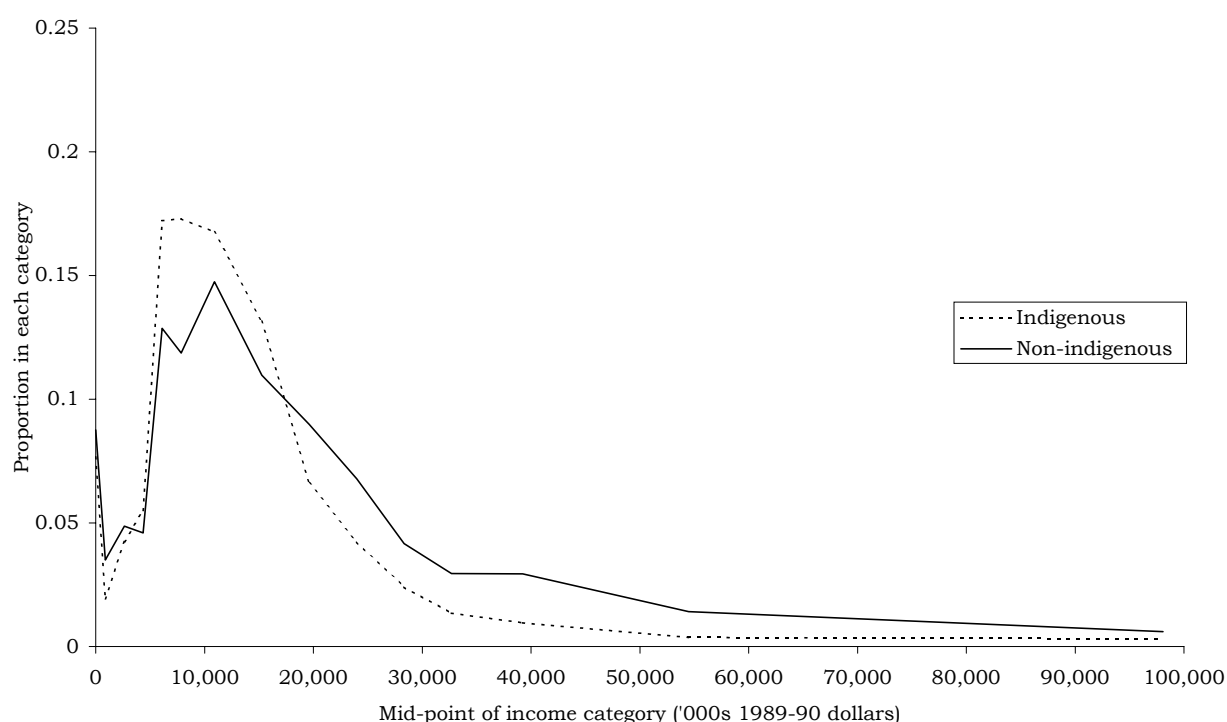
The income distributions presented in Figure 1 and Figure 2 are derived from the 1996 Census for both the male and female populations aged 15 years and over. The annual income categories are the same as those in the census but were converted to 1989/90 dollars using a weighted average of the consumer price index (CPI) for Australia's eight capital cities.² This conversion is necessary to facilitate the analysis of changes in real income between 1986 and 1996.³ All reported incomes in the remainder of this paper are expressed in 1989/90 dollars.

Figure 1. Income distribution: males aged 15 years and over, 1996

Source: Unpublished 1996 Census cross-tabulations.

Indigenous males and females are over-represented in all low-income categories. Breaking the distributions down by sex illustrates that the differences between indigenous and non-indigenous populations are largely driven by the distinct nature of the non-indigenous male income. The 'tri-modal' nature of non-indigenous male incomes is indicated in the three 'bumps' in Figure 1. The first bump corresponds to those who are outside the labour force and the unemployed (including welfare recipients). The second and third bumps correspond to those in part-time and full-time work respectively. The second and third bumps, or modes, in the distributions are more distinct than in the distributions for other groups because of the higher proportions of non-indigenous males in employment, especially full-time employment and the higher wages when in employment (Hunter and Gray 1998). The fact that there are a second and third bumps, and not just a second bump, may reflect the 'disappearing middle' identified in Gregory (1993). The 'disappearing middle' hypothesis suggests a growth of both low-paid and high-paid jobs since the early 1980s, with a relative decline in the number of jobs in the middle of the distribution. Indigenous males have no second or third bumps indicating that they have little full-time and well-paid work.

Figure 2. Income distribution: females aged 15 years and over, 1996



Source: Unpublished 1996 Census cross-tabulations.

Indigenous and non-indigenous females have no significant second and third bumps in their distributions. Therefore, female employment is much less likely to be full-time and well-paid relative to non-indigenous males. While non-indigenous females are more likely to have incomes above \$20,000, there is a broad similarity with income distributions for the indigenous population. That is, notwithstanding the fact that non-indigenous females have higher wages and better access to employment than their indigenous counterparts, many are either outside the labour force or receiving social security payments.

Trends in relative income deprivation, 1986–96

Large changes in the composition of indigenous households since 1986 mean that it is difficult, if not impossible, to construct consistent, inter-temporal comparisons of household and family income between indigenous and non-indigenous Australians.⁴ While poverty and individual welfare are determined by the resources available to the immediate family and household, changes in the relative income deprivation of individuals provides a rough guide to recent trends in poverty. It is important to remember that poverty trends will be fundamentally

affected by the distinct composition, or clustering, of indigenous households and the particular sharing arrangements within them (Altman and Hunter 1998).

There is no agreed-upon 'best approach' to setting a poverty line. The comparison of indigenous and non-indigenous poverty is fraught with difficulties from several perspectives (Altman and Hunter 1998). Rather than directly measuring poverty it is usually much simpler to measure deprivation relative to the lowest level of income, consumption or expenditure enjoyed by the most well endowed half of the population (that is, the median). The 'median approach' defines someone as poor if they earn, consume or spend less than a certain fraction of the median.

In a comparative context, Mitchell (1991) suggests that approaches that rely on consumption and expenditure patterns present greater difficulties in application than income approaches. For this reason the median income approach suggested by Fuchs (1965) and used by Mitchell (1991) is adopted here. The relative simplicity of Fuchs's (1965) approach to income poverty facilitates sensitivity tests of the results. Sensitivity analysis both tests the robustness of the results and provides insights into the depth of poverty and the clustering of the poor due to the social security system.

Table 1. Trends in indigenous and non-indigenous income poverty: persons aged over 15 years, 1986 and 1996

	1986 Census Per cent of median personal income			1996 Census Per cent of median personal income		
	<40%	<50%	<60%	<40%	<50%	<60%
Male						
Indigenous	18.6	29.1	41.0	16.9	30.7	44.0
Non-indigenous	10.4	15.9	22.4	11.0	18.4	25.2
Female						
Indigenous	30.9	40.2	50.7	18.9	30.4	43.0
Non-indigenous	30.5	38.9	48.6	21.3	30.0	39.0
Persons						
Indigenous	24.9	34.8	46.0	17.9	30.6	43.5
Non-indigenous	20.4	27.5	35.5	16.2	24.3	32.2
Total	20.5	27.6	35.7	16.2	24.4	32.5

Note: Head count measures of poverty indicate the proportion of the population below various percentages of the median personal income for all Australians at the respective censuses. Personal income is used because the changes in household composition add an extra degree of variation in the results. Large increases in identification of particular types of indigenous households (for example, sole parent households) make it difficult to ensure that the same households are being compared across time.

Following Mitchell (1991), indigenous and non-indigenous poverty is measured relative to 40, 50 and 60 per cent of the Australian median income for the period in question. For example, if 50 per cent of the Australian population received more than \$20,000 in 1996, then the poverty line would be set at 40, 50

and 60 per cent of this income (that is, \$8,000, \$10,000 and \$12,000, respectively) in that year. Table 1 traces changes in poverty measured for indigenous and non-indigenous individuals over 15 years old.

There has been a large fall in poverty among individual Australians between the 1986 and 1996 Censuses. The percentage of Australians with incomes less than 50 per cent of the median Australian income fell from 27.6 per cent to 24.4 per cent between 1986 and 1996. This overall decline in individual poverty, or more precisely relative income deprivation, was not sensitive to using the alternative 'poverty lines' of either 40 or 60 per cent of the median Australian income. Indeed, the proportion of adults with very low incomes (that is, less than 40 per cent of the median) fell by one percentage point more than that measured by the other poverty lines.

A major reason for the decline has been the recent trend towards 'individualisation' of welfare payments typified by the changes embodied in the *Social Security Act 1991*. The policy change resulted from a prolonged debate about the efficiency and equity of paying the bulk of welfare payments to one partner in a coupled income unit (Edwards 1983). One of the major changes in the Act was the separation of the Parenting Payment Partnered Allowance from the Newstart allowance. The process of individualisation may mean that welfare payments are now more likely to be paid to both married partners rather than one partner (usually the male).

Table clearly reflects this policy change with significant differences between males and females. Females experienced large falls in poverty, especially among the very poor sector. The fact that indigenous females generally experienced substantially larger falls in poverty than their non-indigenous counterparts, especially among those with less than 40 per cent of the median income, indicates that individualisation has had more effect on the section of the community most likely to rely on welfare payments.

The converse effect of the individualisation of social security payments is that there has been a slight rise in most measures of male poverty. However, the overall effect of individualisation appears to have been a reduction of poverty and an increase in the financial independence of a substantial section of the Australian community. While individualisation of welfare is a major factor it is not the only factor, with a substantial fall in the number of indigenous males with less than 40 per cent of the median income. It is likely that improvements in the targeting of social security payments in the last 15 years may have had a positive impact on indigenous males who were particularly deprived (see Mitchell, Harding and Gruen (1994) for discussion of increased targeting of welfare in Australia in this period).

One alternative explanation of the declines in poverty is the increasing labour market participation rate of females and a contemporaneous decline in male participation. However, given that such factors are likely to affect all measures of poverty equally and that indigenous employment has not kept up

with non-indigenous employment (Hunter and Gray 1998), this cannot be the whole story.

A cohort analysis of income distribution, 1986 and 1996

The income distributions for all of the age groups presented above do not allow easy comparisons in the changes in the distributions because the income categories differ between the 1986 and 1996 Censuses. Since the original income categories overlap when converted into 1989/90 dollars, the categories for 1986 and 1996 are adjusted to give a consistent set of income classes. This is achieved by assuming that people are uniformly distributed across each of the income categories.⁵

The 1986 and 1996 Censuses are cross-sectional data sets that, in principle, include the entire Australian population. However, they can be treated as 'panel data' by grouping individuals into cohorts, and treating the averages within these cohorts as individual observations that vary over time. These cohorts are defined such that each individual is a member of only one cohort, which is the same for all time periods. In this paper, cohorts are defined on the basis of year of birth, sex and indigenous status. In this section, cohorts are defined by ten-year age groups starting with those aged 5 to 14 years in 1986.⁶ The detailed results are presented in Appendix Tables A1 to A4. Graphical presentations of changes in the income distributions for selected cohorts are presented in Figures 3 to 18. The figures are grouped to facilitate comparison between indigenous and non-indigenous cohorts.

Figure 3 and Figure 4 illustrate the changes in the income distributions for indigenous and non-indigenous males aged between 15 and 24 years in 1986. The indigenous cohort experiences a large change with over 20 per cent of the cohort moving from no income to a small income between 1986 and 1996. The reason is likely to be related to the fact that many will have left home and are no longer dependent upon their parents. While there is an analogous change for the equivalent non-indigenous male cohort, the major difference arises from the size of income that most of these individuals can expect in 1996. Indigenous cohorts seem to move into the range associated with welfare payments, part-time employment, or exceptionally low pay, while non-indigenous males in this cohort move into a range associated with better-paid employment and full-time jobs.

For females aged between 15 and 24 years in 1986, there is a similar story (Figures 5 and 6). In contrast to the male cohorts, there is less difference in the changes experienced by indigenous and non-indigenous females than for their male counterparts. That is, while the non-indigenous female cohort are more likely to be in higher income groups in both 1986 and 1996, there are only small changes in the distributions between these two censuses. The income gap is evident for both males and females at a young age and it is greatly exacerbated by

the better employment prospects of non-indigenous male youth as they enter the workforce en masse.

The cohorts aged between 25 and 34 years in 1986, have entered their prime labour force years by 1996. Figures 7 to 10 illustrate that the processes evident for the younger cohort continue for this group, with some notable differences. For example, there is some evidence of further movement of males in this cohort into better-paid employment, albeit rather small changes in the case of indigenous males. There are also large increases in the number with income in the range associated with welfare or part-time employment (\$2,831 to \$11,322). For indigenous males, this change appears to be associated with a loss of low-paid jobs paying between \$11,322 and \$28,306. The movement to welfare reliance among non-indigenous males is associated with the loss of slightly better-paid jobs paying between \$15,097 and \$37,741. However, the fact that non-indigenous job losses are concentrated among lower-paid employees appears to challenge Gregory's assertion that the disappearing middle is associated with the demise of middle management jobs (Gregory 1993; Belchamber 1996).

The process of individualisation of welfare payments is particularly evident for females aged between 25 and 34 in 1986. Indigenous and non-indigenous females in this age group were more likely to have no income in 1986 than their counterparts in 1996 (that is, compare Figures 9 and 10 to Figures 5 and 6). However, by 1996 there was a large fall in the number of females in this cohort with little or no income. Of itself, this observation might indicate that females experienced large increases in labour force participation. Given that the largest changes in the income distribution were concentrated in the range associated with welfare it is more likely that the changes embodied in the *Social Security Act 1991* have ensured that more females receive government payments. The advent of Parenting Payment Partnered Allowance will have a particularly strong influence on the distributions in this part of the life-course traditionally associated with raising families.

The other side of the increase in welfare payments to females must be a corresponding decline in welfare payments to males. This appears to be more important for indigenous males where there was a substantial fall in the \$11,323 to \$15,096 range potentially associated with the total welfare paid to very large families who are entitled to many allowances (Daly and Hunter 1998).

The cohorts aged between 35 and 44 in 1986 tend to have moved out of the workforce by 1996 and consequently to have experienced a decline in income (Figures 11 to 14). This trend is consistent for both males and females irrespective of their indigenous status. The only difference between the cohort groups is that the various groups left the different jobs that they held in 1986. Therefore, non-indigenous males left or lost better-paid full-time jobs whereas other cohorts appear to have lost low-paid, part-time jobs.

Figure 3. Income distribution: indigenous males, cohort aged 15 to 24 years in 1986

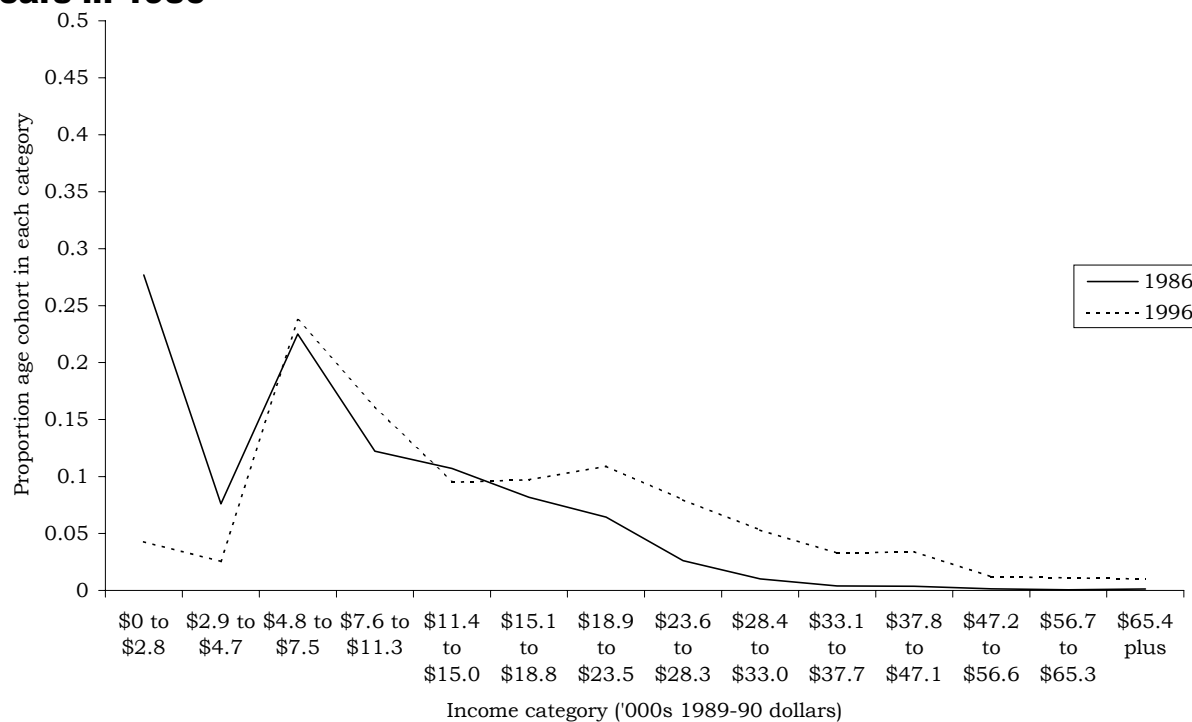


Figure 4. Income distribution: non-indigenous males, cohort aged 15 to 24 years, 1986–96

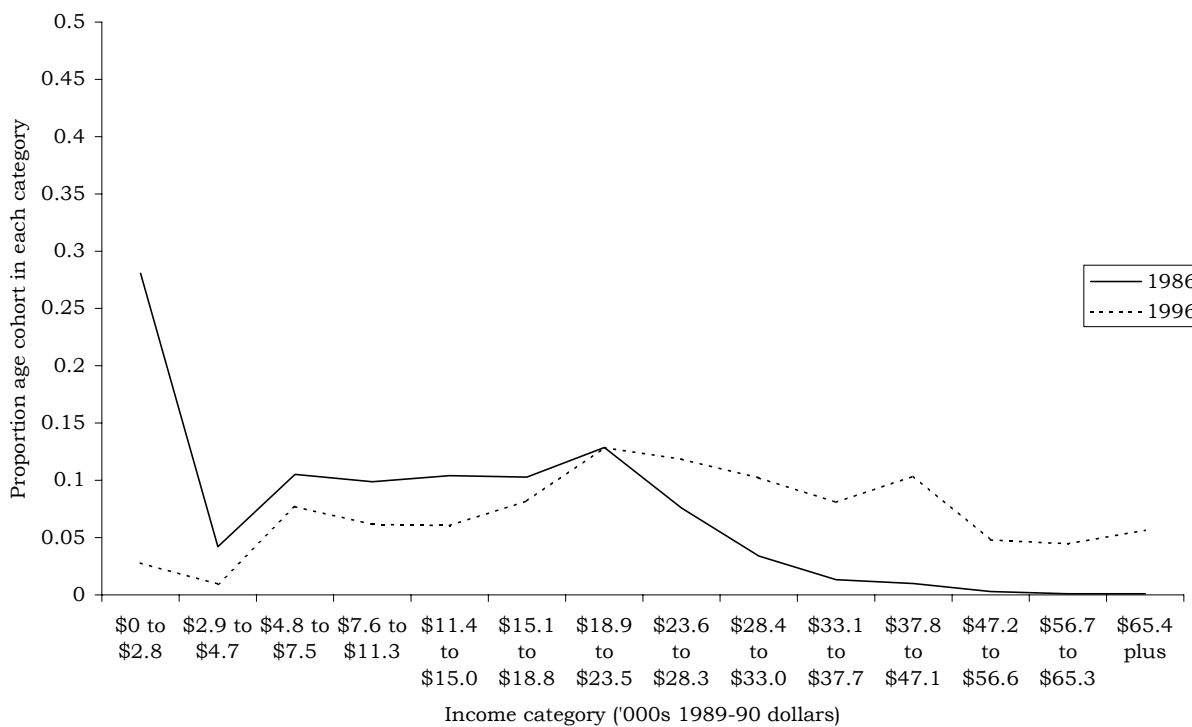


Figure 5. Income distribution: indigenous females, cohort aged 15 to 24 years, 1986–96

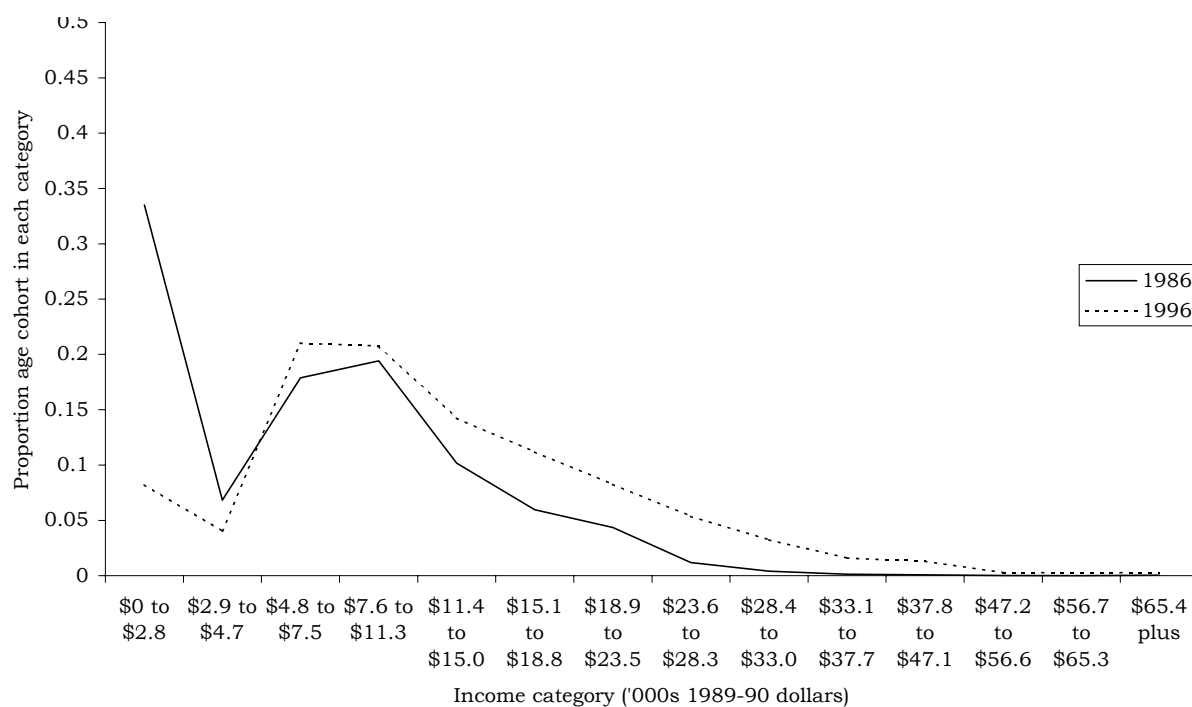


Figure 6. Income distribution: non-indigenous females, cohort aged 15 to 24 years in 1986

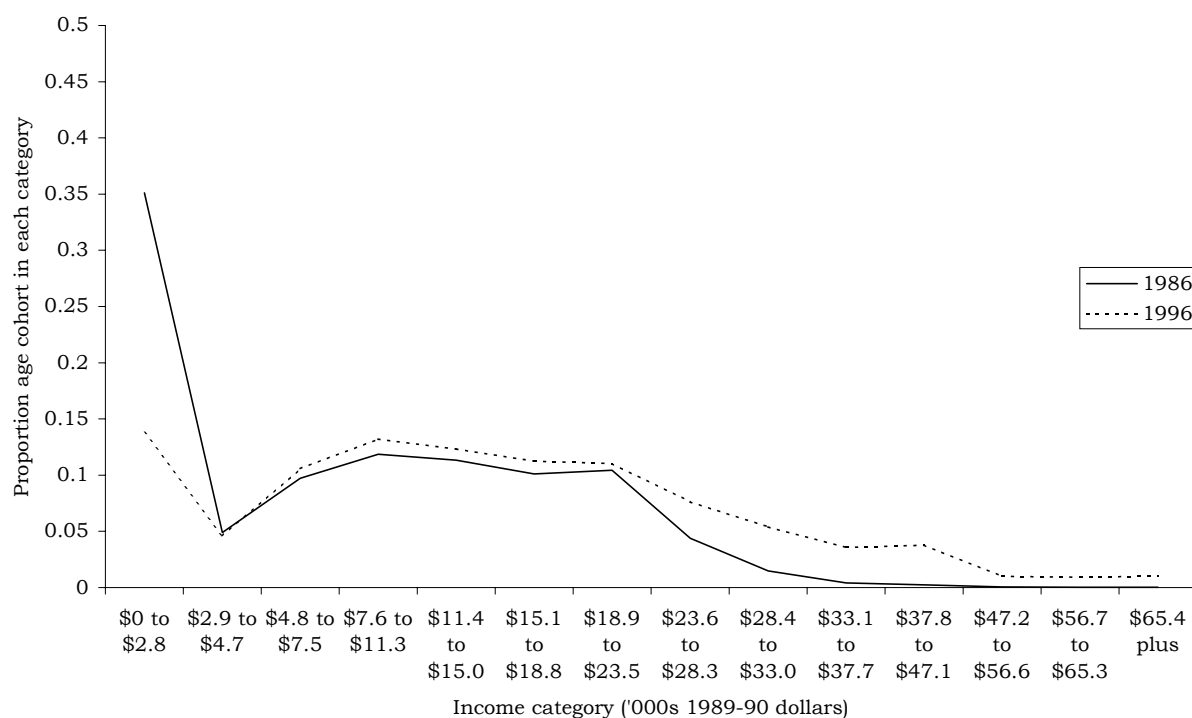


Figure 7. Income distribution: indigenous males, cohort aged 25 to 34 years in 1986

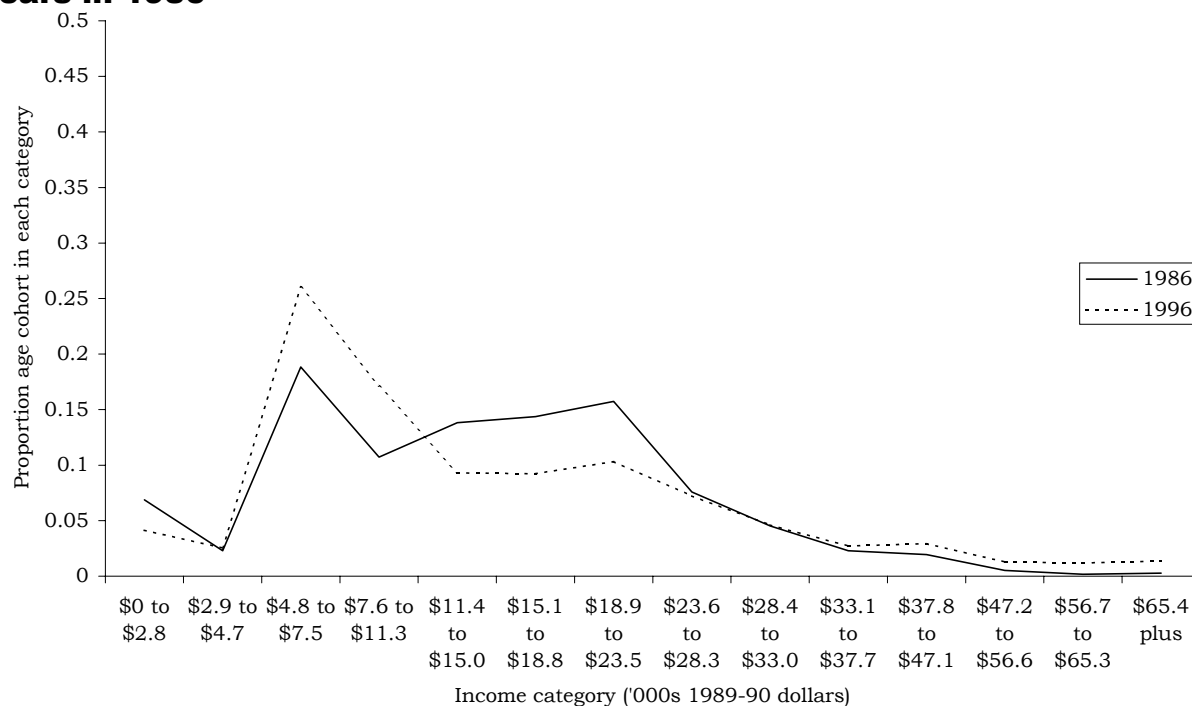


Figure 8. Income distribution: non-indigenous males, cohort aged 25 to 34 years in 1986

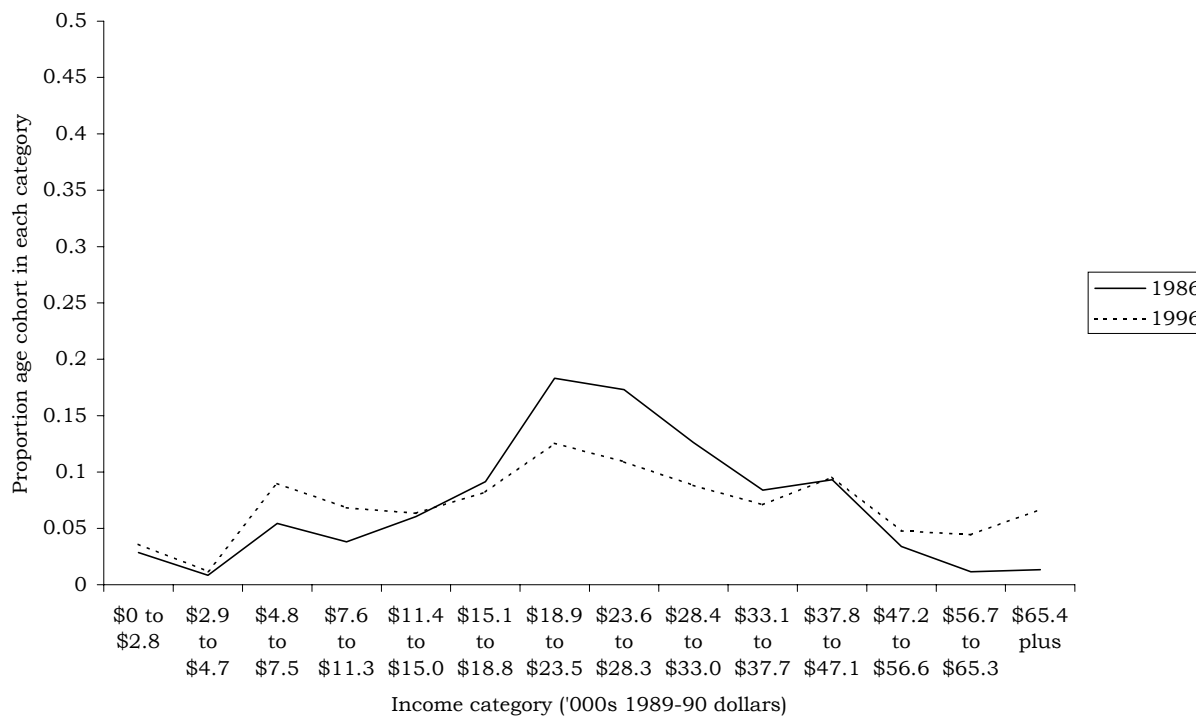


Figure 9. Income distribution: indigenous females, cohort aged 25 to 34 years in 1986

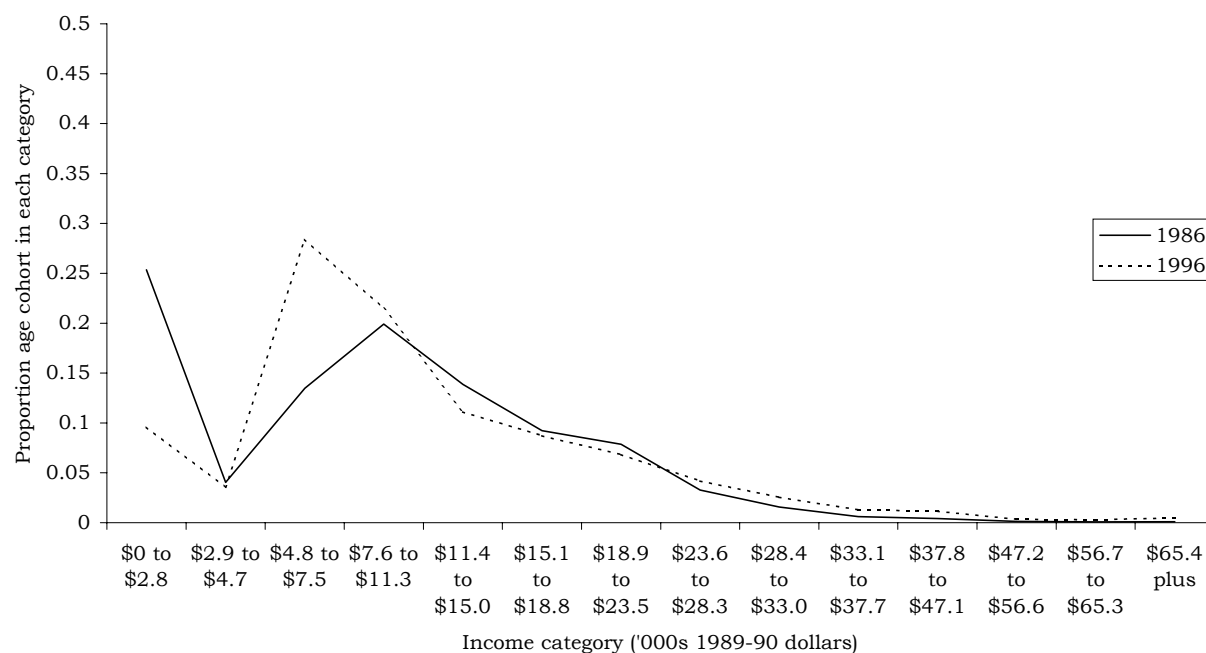


Figure 10. Income distribution: non-indigenous females, cohort aged 25 to 34 years in 1986

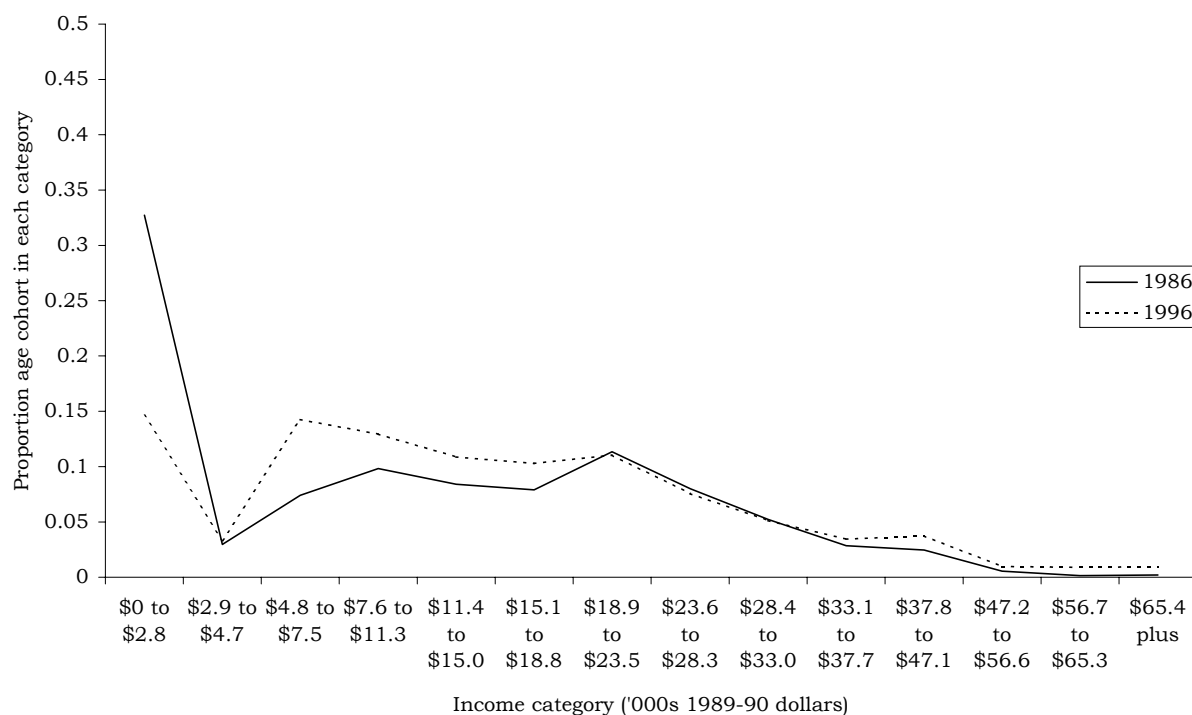


Figure 11. Income distribution: indigenous males, cohort aged 35 to 44 years in 1986

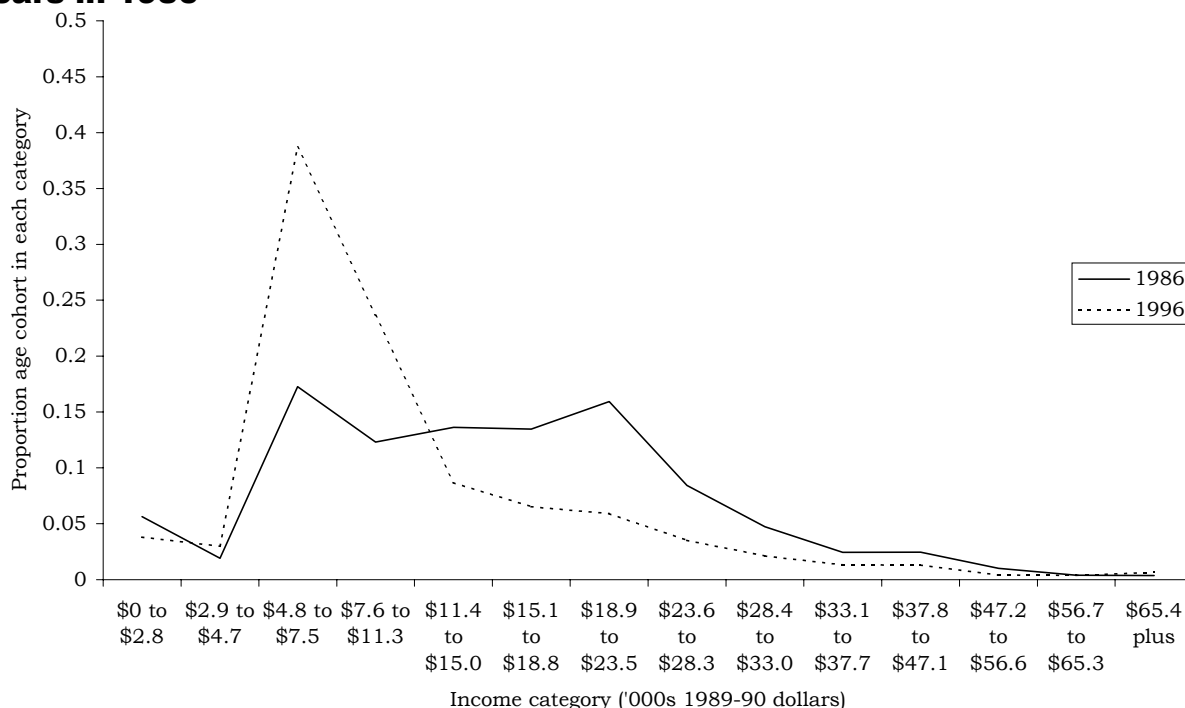


Figure 12. Income distribution: non-indigenous males, cohort aged 35 to 44 years in 1986

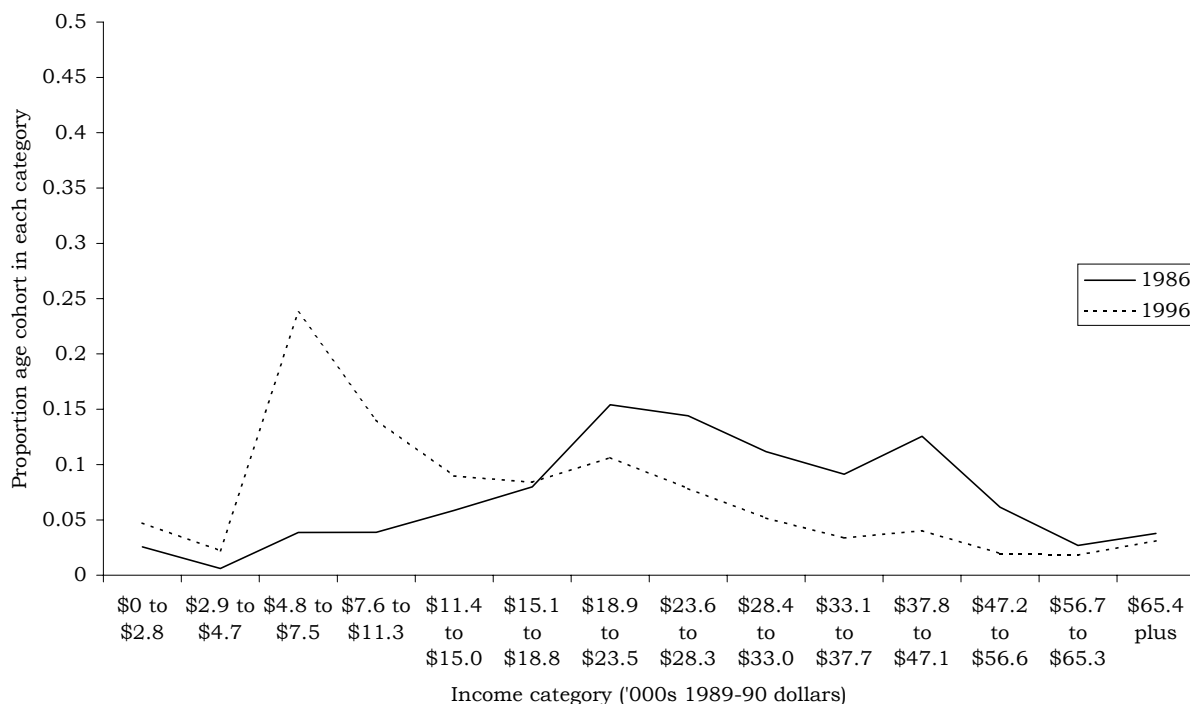


Figure 13. Income distribution: indigenous females, cohort aged 35 to 44 years in 1986

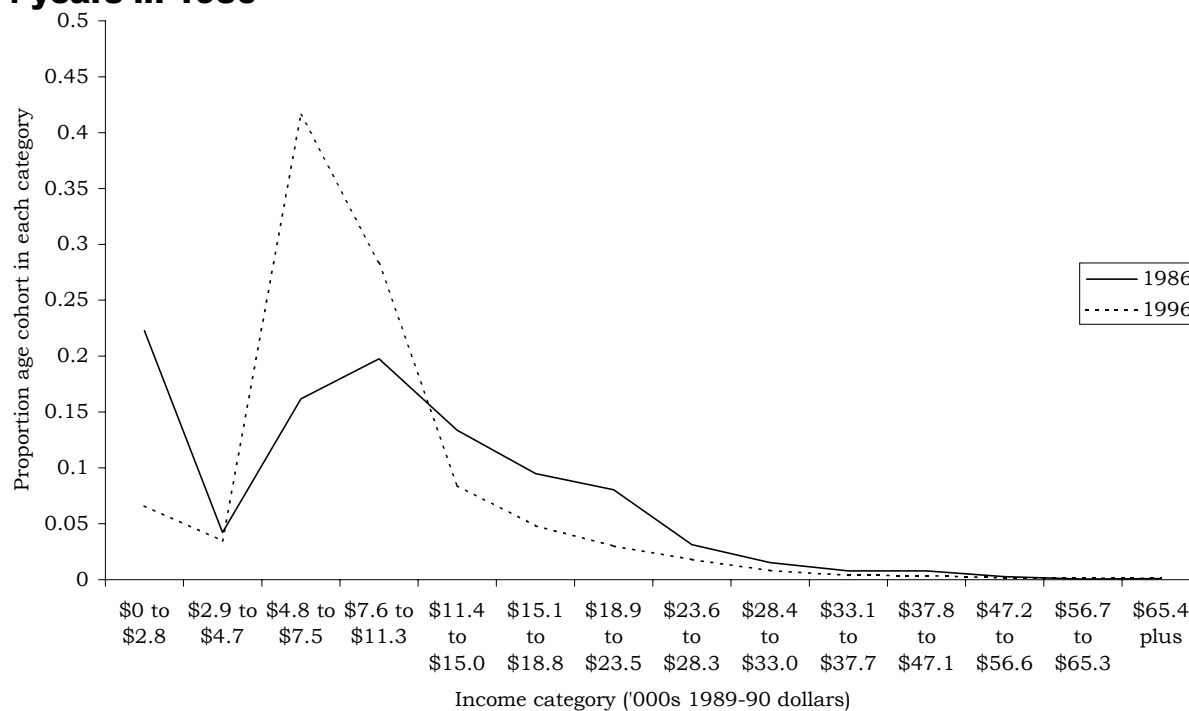


Figure 14. Income distribution: non-indigenous females, cohort aged 35 to 44 years in 1986

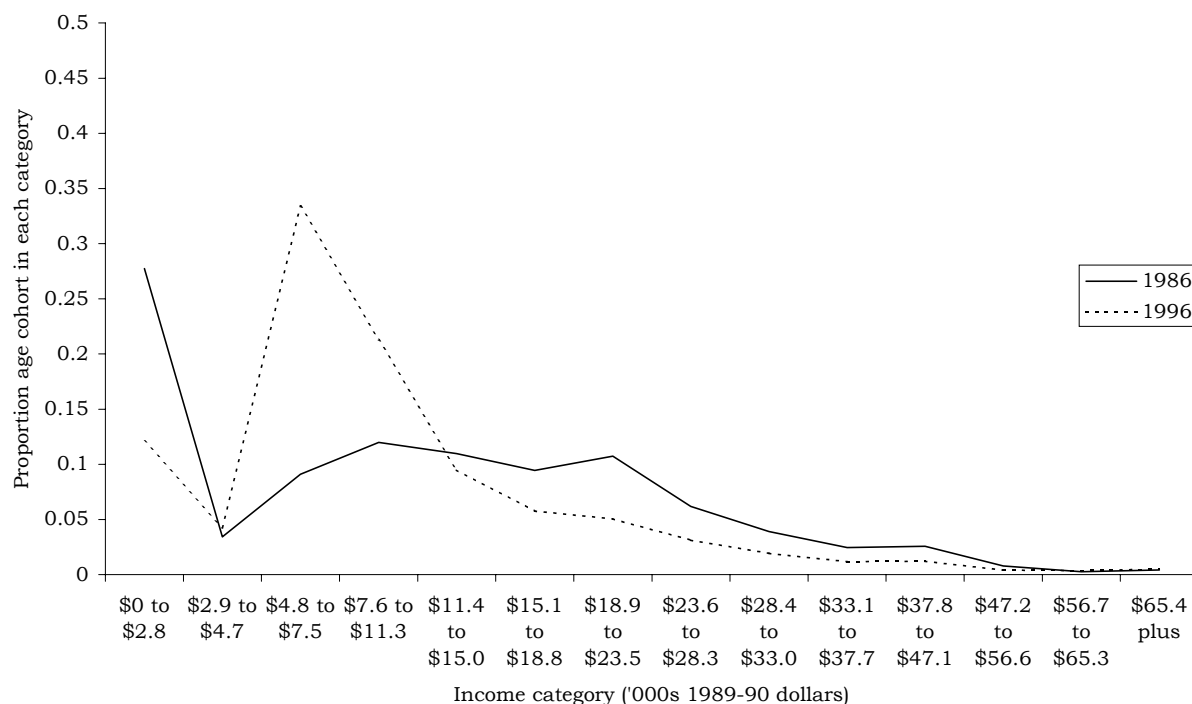


Figure 15. Income distribution: indigenous males, cohort aged 45 to 54 years in 1986

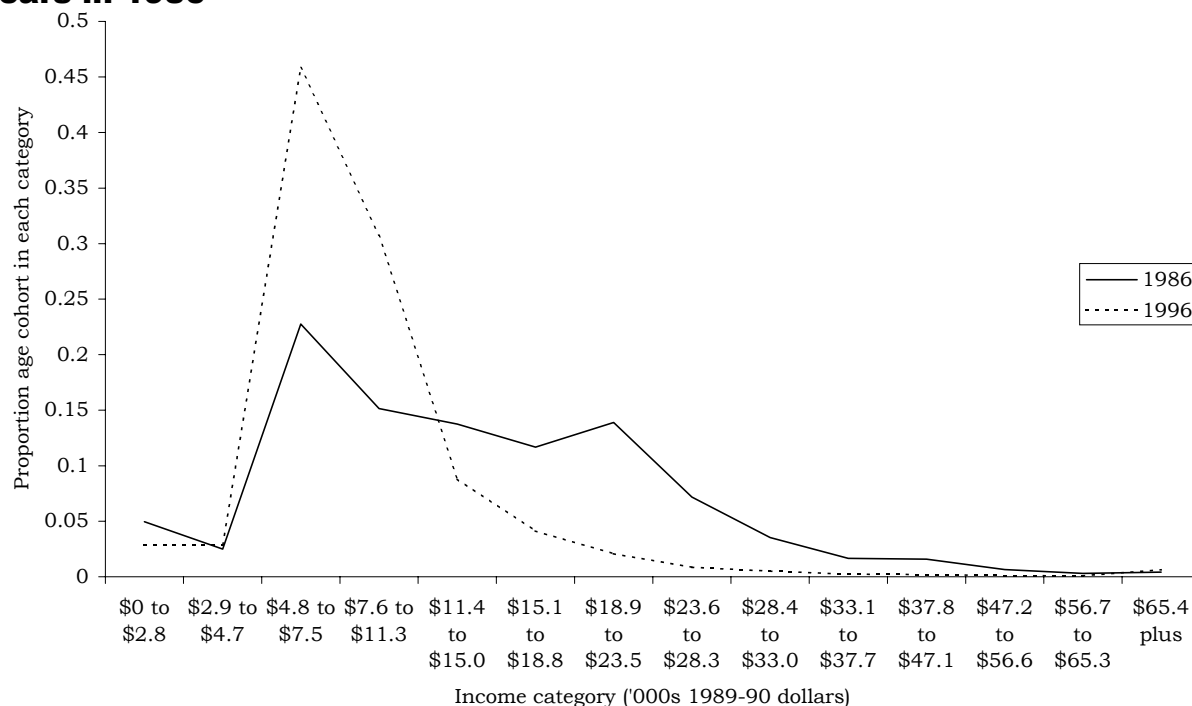


Figure 16. Income distribution: non-indigenous males, cohort aged 45 to 54 years in 1986

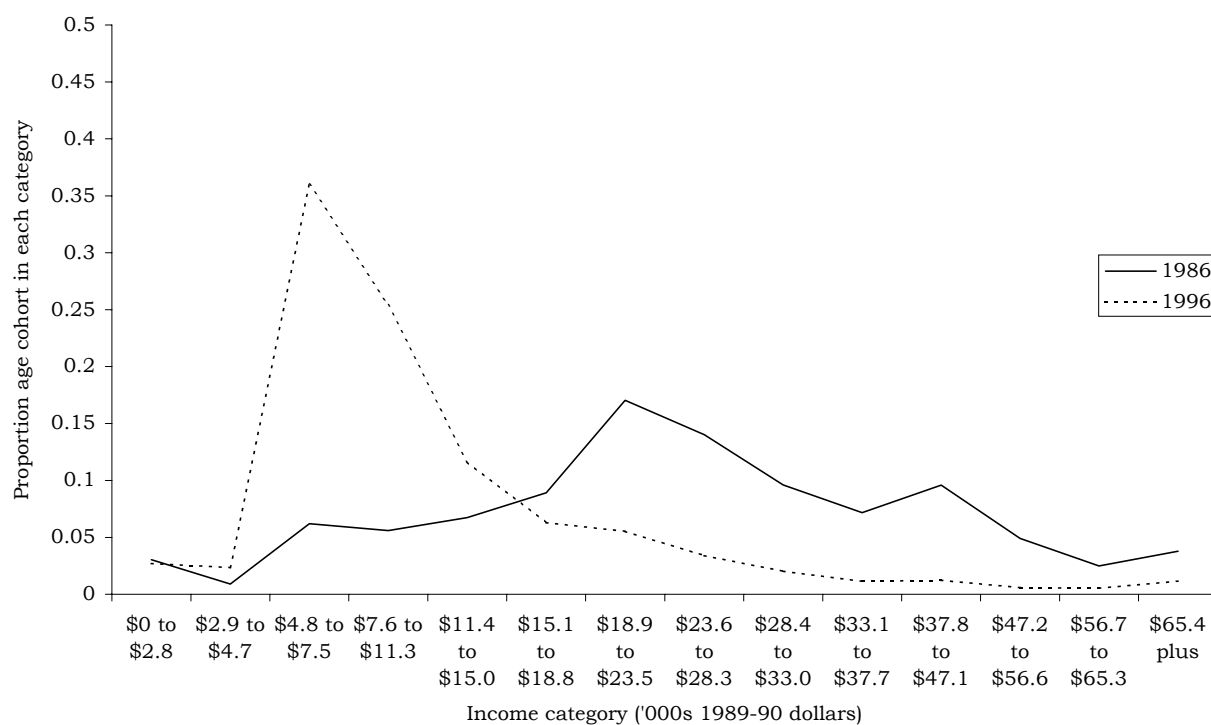


Figure 17. Income distribution: indigenous females, cohort aged 45 to 54 years in 1986

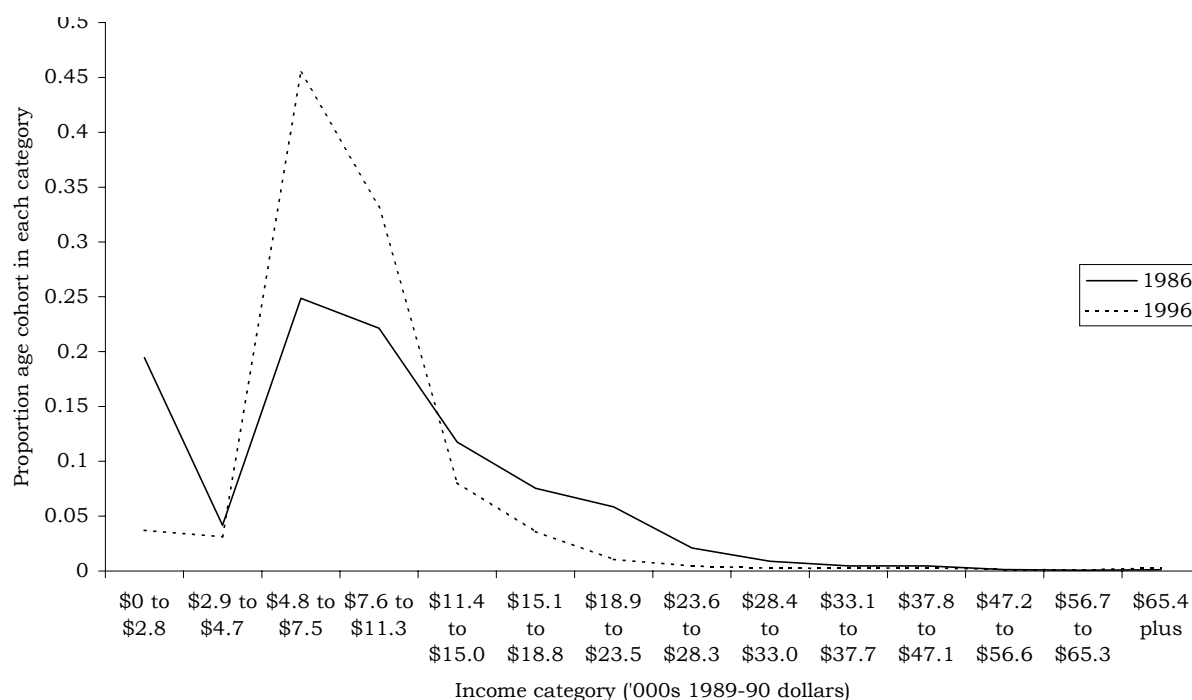
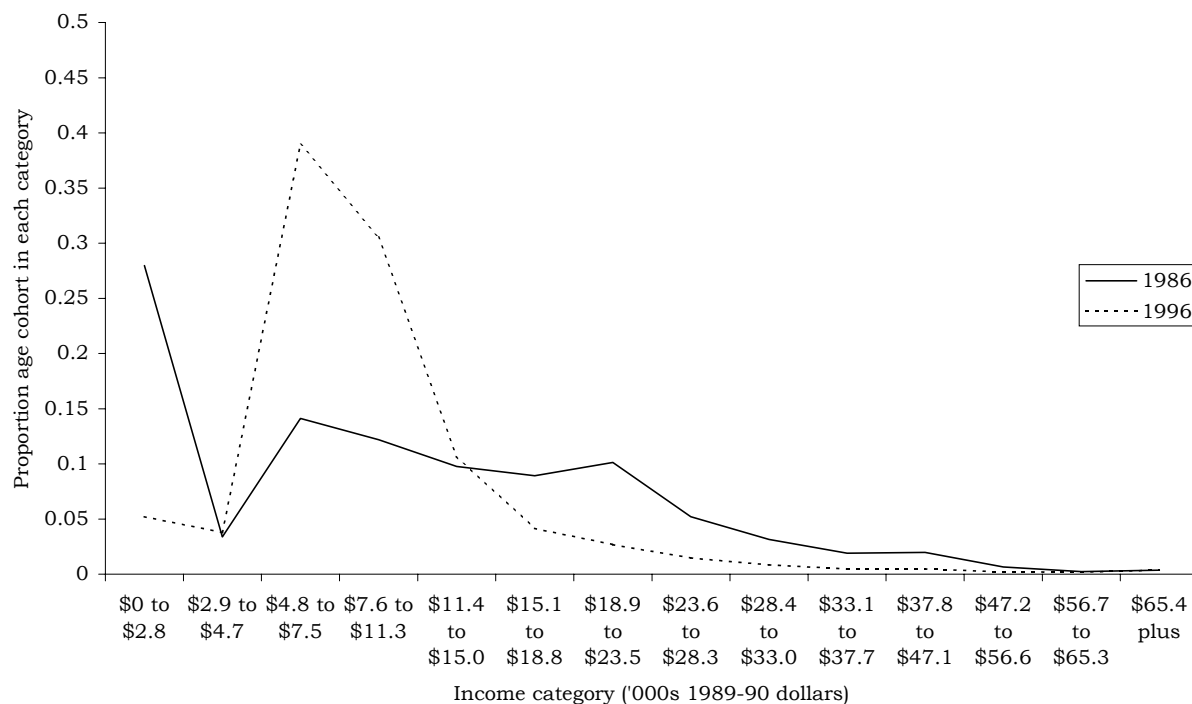


Figure 18. Income distribution: non-indigenous females, cohort aged 45 to 54 years in 1986



The individualisation of the welfare system has a consistent impact on female cohorts aged over 35 years in 1986. That is, between 1986 and 1996 there were substantial falls in the number of women who have little or no income of their own in almost all cohort groups.

The results for the cohorts aged between 45 and 54 in 1986 are reported in Figures 15 to 18. The trend noted earlier accelerated with the vast majority of those in employment moving out of the workforce between 1986 and 1996 (see Hunter and Gray 1998). While it is not surprising that the indigenous male and female cohort left low-paid and part-time employment in this period, the non-indigenous male cohort appear to have left relatively large numbers of lower paid positions. While there were still substantial numbers of well-paid 45 to 54 year-old non-indigenous males in 1986, there were more receiving less than the average weekly earnings (that is, between \$11,323 and \$28,305). One explanation is that career paths for older non-indigenous males are interrupted more by structural change or choice than is conventional wisdom among economists. This finding is reminiscent of Gregory and Hunter's (1996) finding that there was a substantial loss of manufacturing jobs in low-income neighbourhoods that were not replaced by jobs in the growth sectors of the economy.

The stylised facts established in these older cohorts are replicated for those aged 55 and over in 1986 (see Appendix A). That is, workers continue to leave the workforce but the relativities between indigenous and non-indigenous and male and female cohorts were maintained. There is evidence that individualisation of welfare payments also increased the financial independence of older females, particularly non-indigenous females. Not only did older females have an income in the range associated with welfare, but also there appeared to be substantial increase in the amount of money received from the government. Therefore, poverty, or relative deprivation, among older female cohorts was reduced by the dual impact of greater incorporation within the welfare system through individualisation and an increasing generosity of welfare payments in the late 1980s and early 1990s (Mitchell, Harding and Gruen 1994).

Longitudinal analysis of income, 1986, 1991 and 1996 Censuses

In this section we present a formal statistical analysis of the determinants of personal income for indigenous and non-indigenous Australians. For the purpose of this analysis the ten-year cohorts analysed above are broken down into single-year cohorts. The finer cohorts used in this section permit the first longitudinal regression analysis of the determinants of personal income for indigenous and non-indigenous Australians. The advantage of this approach is that statistical techniques can be used to control for unobservable differences between the indigenous and non-indigenous populations. In principle, this provides a more

accurate assessment of the effect of education on income than is possible in cross-sectional estimates.

The statistical technique usually used in income-based regression studies is Ordinary Least Squares (OLS). Previous cross-sectional studies provide potentially biased estimates of the effect of education because of the failure to account for unobserved differences between individuals such as ability or motivation (for a detailed discussion of the so-called 'ability bias', see Griliches 1977; Ashenfelter and Kruger 1994; Daly and Liu 1997). If there are systematic unobserved differences between individuals which are correlated with the explanatory variables as well as income, then the OLS estimates of the effects of such factors on income will be biased and inconsistent. Unfortunately, the highly grouped nature of the cohort data on income from all sources means that our estimates are limited in their ability to provide detailed information about the underlying behaviour at an individual level. The main purpose of this section is to get an idea of the potential biases involved, especially in terms of education.

The fact that in this study wage income is not separately examined from non-wage income adds an extra element of complexity. The following analysis should be viewed in conjunction with a companion study of labour force status and employment using the same data as is used here (Gray and Hunter 1999).

OLS estimates do not allow for unobserved differences between individuals or cohorts to be controlled. In this study we compare OLS estimates to the results obtained using the appropriate statistical technique, the fixed effect (FE) model. This provides insights into the potential biases introduced by the failure to control for unobserved characteristics.

Details of the comparison of the OLS and FE estimates are presented in Appendix B. It is sufficient to note here that the analysis demonstrates that there are significant differences between the estimates. Hence, it is clear that the failure to control for unobserved differences in existing studies of indigenous income will induce a significant bias in both the empirical results and the policy analysis. The grouped nature of the data used in this study mean that estimates in Appendix B cannot be used as the sole basis for policy prescription.

The techniques used in this section are best suited to an analysis of individual level data.⁷ Unfortunately, there are no publicly available survey data on individuals that permit an adequate analysis of the role of unobservable characteristics on indigenous income. Until such data are available it will not be possible to accurately gauge the adequacy of indigenous education policy as a means of addressing ongoing poverty in the indigenous community.

Policy discussion

The relationship between income and an individual's wellbeing can be very tenuous, especially among the indigenous population. Hunter (1999) illustrates

that problems in health, housing, arrest and victimisation are apparent even among relatively well-off indigenous families. Hunter concludes that income deprivation is not the whole story and policy needs to recognise the behavioural interdependencies between these problems. One important underlying factor is the marginal attachment of many indigenous people to the labour force and, therefore, to Australian society at large.

In terms of target groups within the indigenous population, just over 80 per cent of adults can be said to currently depend on some form of government support to prop up their presence in the labour force or to sustain them outside of it (Taylor and Hunter 1998). Evidence from NATSIS points to a number of structural reasons for people requiring welfare support including poor health, high arrest rates, family responsibilities, discouraged worker effects due to lack of local job opportunities and lack of qualifications and skills (ABS/CAEPR 1996). Reducing these effects requires change over the long term, in some instances inter-generationally.

In view of the large numbers of indigenous people whose expected wages are lower than their social security entitlements, the productivity of the indigenous labour force needs to be addressed (Hunter and Daly 1998). The substantial returns to education, especially degree qualifications, identified in this paper mean that improving educational outcomes remains the most successful way of significantly augmenting individual productivity. One alternative is for indigenous incentives to work to be addressed through the tax system. For example, a negative income tax, or analogous tax proposals, could be used to boost the expected wages of indigenous people so that effective marginal tax rates are reduced. The tax credit proposal by the so-called 'five economists' could provide one basis for appropriate reform (Dawkins 1999).⁸

While the financial incentive to work needs to be addressed for indigenous income and employment to converge towards the national average, there is no question that, collectively, indigenous people want to work as much as other Australians. If all the people who want to work as revealed by the NATSIS are included in the workforce, then the indigenous participation rate would be 67.2 per cent, about 15 per cent more than are currently looking for work. This statistic is substantially higher than the record high in Australia's overall participation rate in 1995 of 63.8 per cent. Almost one-sixth of the indigenous population have been discouraged from seeking employment. It is imperative that policy attempts to address all the employment needs of the current, potential and future indigenous labour force.

Notwithstanding data limitations, this analysis provides several important and positive insights. Individualisation of welfare payments has resulted in an increase in financial independence among many females. This result is likely to have been missed by studies which focus on traditional poverty analysis where the poverty line is set high enough so that fluctuations in welfare payments are not identified. The intra-family redistribution inherent in individualisation is a positive force promoting equality within the home, if not between households.

The other insight is that the generosity of welfare payments or improved targeting of benefits has materially advantaged extremely poor indigenous people. While this is a positive outcome in its own right, it is important to bear in mind the interaction between tax, welfare, productivity and incentives to work. As long as all these policy instruments are effective, it is entirely appropriate that welfare be targeted to those in immediate need, while tax and productivity-enhancing policies focus on the incentive to work.

Appendix A. Tables for the cohort analysis, 1986–96

Table A1. Income distributions: indigenous males, 1986–96

Income (1989 dollars)	Age at 1986 Census						
	5–14	15–24	25–34	35–44	45–54	55–64	65+
1986							
\$0 to \$2,830	NA	0.277	0.069	0.056	0.050	0.052	0.057
\$2,831 to \$4,717	NA	0.076	0.023	0.019	0.025	0.038	0.042
\$4,718 to \$7,548	NA	0.225	0.188	0.173	0.228	0.325	0.494
\$7,549 to \$11,322	NA	0.122	0.107	0.123	0.151	0.199	0.240
\$11,323 to \$15,096	NA	0.107	0.138	0.136	0.138	0.120	0.091
\$15,097 to \$18,870	NA	0.082	0.144	0.135	0.117	0.091	0.039
\$18,871 to \$23,587	NA	0.064	0.157	0.159	0.139	0.095	0.020
\$23,588 to \$28,305	NA	0.026	0.076	0.084	0.072	0.038	0.006
\$28,306 to \$33,022	NA	0.010	0.045	0.047	0.035	0.018	0.003
\$33,023 to \$37,740	NA	0.004	0.023	0.024	0.017	0.010	0.001
\$37,741 to \$47,175	NA	0.004	0.019	0.025	0.016	0.009	0.002
\$47,176 to \$56,610	NA	0.001	0.005	0.010	0.007	0.001	0.001
\$56,611 to \$65,380	NA	0.001	0.002	0.004	0.003	0.001	0.001
\$65,381 plus	NA	0.001	0.003	0.004	0.004	0.004	0.002
1996							
\$0 to \$2,830	0.261	0.048	0.043	0.041	0.038	0.029	0.066
\$2,831 to \$4,717	0.098	0.030	0.025	0.025	0.030	0.029	0.027
\$4,718 to \$7,548	0.267	0.268	0.237	0.260	0.387	0.458	0.414
\$7,549 to \$11,322	0.141	0.168	0.161	0.171	0.236	0.307	0.331
\$11,323 to \$15,096	0.080	0.097	0.095	0.093	0.087	0.088	0.089
\$15,097 to \$18,870	0.062	0.099	0.097	0.092	0.065	0.041	0.033
\$18,871 to \$23,587	0.045	0.104	0.109	0.103	0.059	0.021	0.014
\$23,588 to \$28,305	0.023	0.075	0.079	0.072	0.035	0.009	0.005
\$28,306 to \$33,022	0.010	0.046	0.053	0.046	0.021	0.005	0.004
\$33,023 to \$37,740	0.004	0.023	0.033	0.027	0.013	0.002	0.002
\$37,741 to \$47,175	0.003	0.020	0.034	0.029	0.013	0.002	0.002
\$47,176 to \$56,610	0.001	0.007	0.012	0.013	0.004	0.001	0.001
\$56,611 to \$65,380	0.001	0.006	0.011	0.012	0.004	0.001	0.001
\$65,381 plus	0.004	0.008	0.010	0.014	0.007	0.006	0.011

Table A2. Income distributions: indigenous females, 1986–96

Income (1989 dollars)	Age at 1986 Census						
	5–14	15–24	25–34	35–44	45–54	55–64	65+
1986							
\$0 to \$2,830	NA	0.335	0.254	0.223	0.195	0.119	0.063
\$2,831 to \$4,717	NA	0.068	0.041	0.042	0.042	0.047	0.038
\$4,718 to \$7,548	NA	0.179	0.135	0.162	0.249	0.394	0.513
\$7,549 to \$11,322	NA	0.194	0.199	0.197	0.221	0.229	0.246
\$11,323 to \$15,096	NA	0.102	0.139	0.134	0.118	0.104	0.088
\$15,097 to \$18,870	NA	0.060	0.092	0.095	0.075	0.052	0.032
\$18,871 to \$23,587	NA	0.043	0.079	0.080	0.058	0.034	0.011
\$23,588 to \$28,305	NA	0.012	0.033	0.031	0.021	0.015	0.005
\$28,306 to \$33,022	NA	0.004	0.016	0.015	0.009	0.005	0.002
\$33,023 to \$37,740	NA	0.001	0.006	0.008	0.005	0.002	0.001
\$37,741 to \$47,175	NA	0.001	0.004	0.008	0.005	0.001	0.001
\$47,176 to \$56,610	NA	0.000	0.001	0.003	0.001	0.000	0.000
\$56,611 to \$65,380	NA	0.000	0.001	0.001	0.001	0.000	0.000
\$65,381 plus	NA	0.000	0.001	0.001	0.001	0.000	0.001
1996							
\$0 to \$2,830	0.242	0.076	0.082	0.096	0.066	0.037	0.037
\$2,831 to \$4,717	0.093	0.041	0.040	0.035	0.035	0.031	0.029
\$4,718 to \$7,548	0.234	0.194	0.210	0.284	0.416	0.455	0.393
\$7,549 to \$11,322	0.185	0.216	0.208	0.215	0.283	0.333	0.385
\$11,323 to \$15,096	0.109	0.160	0.142	0.111	0.084	0.081	0.100
\$15,097 to \$18,870	0.067	0.125	0.112	0.087	0.048	0.036	0.032
\$18,871 to \$23,587	0.039	0.082	0.083	0.068	0.030	0.011	0.008
\$23,588 to \$28,305	0.018	0.051	0.054	0.042	0.018	0.005	0.003
\$28,306 to \$33,022	0.006	0.029	0.032	0.025	0.008	0.002	0.001
\$33,023 to \$37,740	0.002	0.012	0.016	0.013	0.004	0.002	0.003
\$37,741 to \$47,175	0.001	0.009	0.013	0.011	0.004	0.003	0.003
\$47,176 to \$56,610	0.000	0.002	0.003	0.003	0.002	0.001	0.000
\$56,611 to \$65,380	0.000	0.002	0.003	0.003	0.001	0.001	0.000
\$65,381 plus	0.003	0.004	0.003	0.005	0.001	0.003	0.006

Table A3. Income distributions: non-indigenous males, 1986–96

Income (1989 dollars)	Age at 1986 Census						
	5–14	15–24	25–34	35–44	45–54	55–64	65+
1986							
\$0 to \$2,830	NA	0.281	0.029	0.026	0.030	0.036	0.038
\$2,831 to \$4,717	NA	0.042	0.008	0.006	0.009	0.021	0.037
\$4,718 to \$7,548	NA	0.105	0.054	0.039	0.062	0.172	0.418
\$7,549 to \$11,322	NA	0.099	0.038	0.039	0.056	0.116	0.230
\$11,323 to \$15,096	NA	0.104	0.061	0.059	0.067	0.083	0.091
\$15,097 to \$18,870	NA	0.103	0.091	0.080	0.089	0.088	0.053
\$18,871 to \$23,587	NA	0.129	0.183	0.154	0.170	0.150	0.047
\$23,588 to \$28,305	NA	0.076	0.173	0.144	0.140	0.110	0.028
\$28,306 to \$33,022	NA	0.034	0.126	0.112	0.096	0.067	0.017
\$33,023 to \$37,740	NA	0.013	0.084	0.091	0.072	0.043	0.011
\$37,741 to \$47,175	NA	0.010	0.093	0.126	0.096	0.053	0.013
\$47,176 to \$56,610	NA	0.003	0.034	0.062	0.049	0.026	0.006
\$56,611 to \$65,380	NA	0.001	0.012	0.027	0.025	0.013	0.003
\$65,381 plus	NA	0.001	0.013	0.038	0.038	0.022	0.007
1996							
\$0 to \$2,830	0.302	0.029	0.028	0.036	0.047	0.027	0.023
\$2,831 to \$4,717	0.079	0.010	0.009	0.012	0.022	0.023	0.020
\$4,718 to \$7,548	0.130	0.086	0.077	0.090	0.238	0.360	0.354
\$7,549 to \$11,322	0.102	0.063	0.061	0.068	0.140	0.254	0.295
\$11,323 to \$15,096	0.093	0.067	0.060	0.063	0.090	0.116	0.123
\$15,097 to \$18,870	0.093	0.100	0.082	0.082	0.084	0.063	0.056
\$18,871 to \$23,587	0.092	0.159	0.128	0.125	0.106	0.055	0.046
\$23,588 to \$28,305	0.055	0.144	0.118	0.109	0.078	0.034	0.028
\$28,306 to \$33,022	0.027	0.110	0.102	0.088	0.052	0.020	0.017
\$33,023 to \$37,740	0.011	0.070	0.081	0.071	0.034	0.011	0.010
\$37,741 to \$47,175	0.009	0.076	0.104	0.096	0.040	0.012	0.011
\$47,176 to \$56,610	0.002	0.031	0.048	0.048	0.020	0.006	0.005
\$56,611 to \$65,380	0.002	0.029	0.045	0.044	0.018	0.005	0.004
\$65,381 plus	0.002	0.025	0.056	0.067	0.031	0.012	0.008

Table A4. Income distributions: non-indigenous females, 1986–96

Income (1989 dollars)	Age at 1986 Census						
	5–14	15–24	25–34	35–44	45–54	55–64	65+
1986							
\$0 to \$2,830	NA	0.351	0.327	0.277	0.280	0.198	0.064
\$2,831 to \$4,717	NA	0.049	0.030	0.034	0.034	0.049	0.046
\$4,718 to \$7,548	NA	0.097	0.074	0.091	0.141	0.329	0.479
\$7,549 to \$11,322	NA	0.119	0.098	0.120	0.122	0.168	0.244
\$11,323 to \$15,096	NA	0.113	0.084	0.110	0.098	0.078	0.083
\$15,097 to \$18,870	NA	0.101	0.079	0.095	0.089	0.051	0.032
\$18,871 to \$23,587	NA	0.104	0.114	0.107	0.101	0.053	0.021
\$23,588 to \$28,305	NA	0.044	0.080	0.062	0.052	0.028	0.011
\$28,306 to \$33,022	NA	0.015	0.052	0.039	0.032	0.016	0.006
\$33,023 to \$37,740	NA	0.004	0.028	0.025	0.019	0.009	0.004
\$37,741 to \$47,175	NA	0.002	0.025	0.026	0.020	0.010	0.005
\$47,176 to \$56,610	NA	0.001	0.005	0.008	0.007	0.004	0.002
\$56,611 to \$65,380	NA	0.000	0.002	0.002	0.002	0.002	0.001
\$65,381 plus	NA	0.000	0.002	0.004	0.004	0.003	0.002
1996							
\$0 to \$2,830	0.314	0.144	0.138	0.146	0.121	0.052	0.034
\$2,831 to \$4,717	0.097	0.050	0.046	0.033	0.043	0.038	0.025
\$4,718 to \$7,548	0.140	0.101	0.106	0.142	0.334	0.389	0.331
\$7,549 to \$11,322	0.114	0.119	0.132	0.129	0.213	0.306	0.387
\$11,323 to \$15,096	0.097	0.111	0.123	0.109	0.095	0.107	0.126
\$15,097 to \$18,870	0.086	0.106	0.112	0.103	0.058	0.042	0.039
\$18,871 to \$23,587	0.083	0.120	0.110	0.110	0.050	0.027	0.023
\$23,588 to \$28,305	0.044	0.098	0.076	0.076	0.031	0.015	0.012
\$28,306 to \$33,022	0.015	0.065	0.054	0.051	0.019	0.008	0.007
\$33,023 to \$37,740	0.004	0.034	0.036	0.034	0.012	0.005	0.004
\$37,741 to \$47,175	0.003	0.030	0.038	0.037	0.012	0.005	0.004
\$47,176 to \$56,610	0.001	0.009	0.010	0.010	0.004	0.002	0.002
\$56,611 to \$65,380	0.001	0.008	0.009	0.009	0.004	0.002	0.002
\$65,381 plus	0.001	0.006	0.010	0.010	0.005	0.004	0.004

Appendix B. Longitudinal analysis of income, 1986, 1991 and 1996

As mentioned in the body of the paper, if there are systematic unobserved differences between cohorts which are correlated with the explanatory variables as well as income, then the OLS estimates of the effects of such factors on income will be biased and inconsistent. That is, the estimated effects will systematically differ from the true effect and no amount of increases in the sample size will help.

The FE model permits us to control for the unobservable characteristics of each cohort which are constant over time.⁹ Examples of such characteristics include variations in discrimination, attitudes, schooling quality, health and a number of other factors that do not vary much over time.

The FE model estimates the effect of a factor on income, using variation of this factor within a cohort over time. That is, changes in income are explained by the 'within cohort' changes over time in the various determinants of income. For example, the effect of having a degree on income is estimated by relating changes in the proportion of a cohort with a degree over time to changes in the level of income after taking into account all the other factors included in the model.

The FE model does not allow us to estimate the effects of variables that do not vary over time for each cohort to be estimated. The estimates do, however, take into account the effects of such variables by subsuming them into the cohort specific constant term.

An alternative approach to controlling for unobserved characteristics is to estimate a random effects specification (see Greene 1997). Consistency of the random effects estimator requires that the random effects are not correlated with the explanatory variables in the regression, whereas consistency of the FE estimator does not require this. The appropriateness of the random effects specification can be tested using a Hausman specification test (Hausman 1978).¹⁰ For all of the models estimated the random effects specification is comprehensively rejected and the appropriate specification is the FE specification.

The explanators of personal income are similar to those used in other studies (Daly 1995; Daly and Lui 1997; Daly and Hunter 1998). As above, all explanators are measured as the proportion of the cohorts with the relevant characteristic. In addition to measures of educational qualification,¹¹ the specification used includes several other variables: age and age squared, age left school, whether a respondent is still at school, English difficulty, place of residence (section-of-State), marital status, and an indicator for the relevant census year. The small number of non-indigenous Australians living in localities meant that it was necessary to aggregate the rural and localities categories from the Australian Bureau of Statistics definition of section-of-State into one variable,

called 'rural and remote'. Appendix Table B1 provides descriptive statistics for all variables used in the regression analysis. As indicated above, the FE estimates exclude variables that are constant within a given cohort over time. Age left school is excluded because it is, in practical terms, fixed for non-teenage cohorts and therefore subsumed into the constant term under FE estimates (Hunter 1998). In any case, the fact that there were significant changes in the census questions between 1986 and 1996, means that the variation of age left school for particular cohorts between the 1986, 1991 and 1996 Censuses is more likely to indicate measurement error than genuine fluctuations in age left school. In addition, age or experience variables are excluded from the FE regressions. This requires some justification. The reason for this is that it was not possible to separately identify the fixed cohort effect from the age effects when, at most, we had three observations for each cohort. In any case, it is not statistically valid to include age variables and an indicator for the census year in the same FE regression. The census year is included to control for all period-specific factors. It must be emphasised that the data limitations mean that our results are only an approximate guide to potential biases involved in using OLS, as opposed to a FE methodology. Indeed, given that other studies use disaggregated data, their results should not be replaced by our findings. For example, Daly's (1995) study overcomes problems with census income data by focusing on full-time workers' income. As indicated above, it was not possible to make similar adjustments to the cohort data.

Theoretically, it should be possible to make an adjustment to our regression analysis by accounting for the probability of being in employment. A two-stage procedure could be used to instrument the employment prospects of a cohort if certain statistical conditions were met. Unfortunately, the aggregate cohort data failed these criteria so the focus must be on personal income from all sources.¹² As with the vast majority of other studies, the log of personal income is used as the dependent variable. The regressions are separately estimated for indigenous and non-indigenous males and females, respectively.

The remainder of this section summarises the results presented in detail in Appendix Tables B2 and B3. In general, geographic factors are not a significant influence on indigenous income but do have some effect on non-indigenous income. However, the effect of regional factors for non-indigenous people is not necessarily consistent between the OLS and FE estimates. For example, living in a major urban area, rather than an other urban area, is significantly positive using FE for non-indigenous males and using OLS for non-indigenous females. In contrast, living in a rural/remote area, rather than an other urban area, is not a significant factor using OLS but is significant for both non-indigenous males and females when FE estimates are obtained. The rural/remote variable has a significant positive effect for non-indigenous males and a significant negative effect for non-indigenous females. This difference between the sexes may be driven by greater specialisation of gender roles in rural areas and the difficulty in obtaining welfare payments if partners are fully employed on a farm or elsewhere. The significant differences between FE and OLS estimates for the non-indigenous

population implies there may be a geographic dimension to variations in unobservable characteristics. However, the apparent inconsistency between estimates may also be due the small variations in region of residence caused by the fact that in the short-term older non-indigenous cohorts tend to be rather immobile.¹³

In general, an increase in the proportion of a cohort who has difficulty in speaking English only has a significant negative effect for non-indigenous females in the OLS estimates. In the FE regressions for indigenous males and females English difficulty only has a negative and statistically significant effect on income. Again, the difference between the OLS and FE estimators implies that unobservable characteristics are important determinants of income.

The educational variables provide the greatest insight into the use of the FE estimator. While there is no significant difference between the OLS and FE estimates of the return to having a degree for indigenous cohorts, OLS estimates significantly underestimated the return to a degree for non-indigenous males and females. This implies that for the non-indigenous population, the unobserved characteristics which are being captured by the cohort specific FE are positively correlated with having a degree and negatively correlated with having a higher income. It is worth reiterating that since the FE are also cohort effects they are not picking up the effects of unobserved differences in innate ability between individuals but, rather, pick up the effects of any variable which differs between cohorts but is fixed over time for each cohort and is not included in the regression (typically because it is unobserved).¹⁴ Stated differently, the cohort nature of the data used in this paper means that unobserved differences in innate ability are eliminated and that the unobserved cohort effects may include factors such as systematic differences between cohorts in: the quality of schooling received, attitudes, assimilation and health all of which may be related to personal income.

For non-indigenous males, and indigenous females, both the OLS and FE estimators find that an increase in the proportion of a cohort having an undergraduate diploma has no statistically significant effect upon annual income. For indigenous males, diplomas only have a significant return in terms of income when the FE regression is used.

For non-indigenous females, the OLS estimator finds that an increase in the proportion of the cohort having an undergraduate diploma has no statistically significant effect upon income. In contrast, when the FE estimator is used an increase in the proportion of a cohort having a diploma is estimated to decrease income. Gray and Hunter (1999) explore this paradox in some detail by analysing cohort models of employment and labour force participation. For example, non-indigenous females who are undertaking an undergraduate diploma may be combining study towards the undergraduate diploma with time spent out of the labour force for childbearing.

Caution needs to be exercised in imposing a strong interpretation on these results because wage and non-wage incomes are being examined for both

employed and non-employed people. The effects of a change in the proportion of a cohort with a particular educational qualification may be on income via two channels. First, it may change the probability of finding paid employment. Second, conditional upon finding employment, it may affect the weekly wages, via both the number of hours worked per week and the hourly rate of pay.

Of the two problems, the failure to account for employment has the most important implications. The confounding influence of labour force status on the income analysis means that a cohort analysis of labour force status is essential (Gray and Hunter 1999).

The still at school variables are strongly negative in all the regressions examined, with little difference between the OLS and FE estimates. The marital status variables are generally positive for all males, but there are significant differences between indigenous and non-indigenous females. Marriage among indigenous females is associated with higher income while matrimony among non-indigenous females is associated with significantly lower incomes when measured using the FE technique. The pattern for non-indigenous females concords with a common result that men's wages increase with marriage while women's fall (Hill 1979). The apparent contradiction with the results for indigenous females may be explained by the trend towards individualisation of welfare payments and the greater likelihood that their partners are unemployed.

Table B1. Descriptive statistics for regressions

	Males		Females	
	Indigenous	Non-indigenous	Indigenous	Non-indigenous
Log of personal income	9.401 (0.418)	9.871 (0.625)	9.148 (0.342)	9.344 (0.476)
Major urban	0.255 (0.040)	0.634 (0.024)	0.278 (0.035)	0.649 (0.022)
Rural or remote	0.352 (0.048)	0.149 (0.018)	0.309 (0.043)	0.132 (0.021)
English difficulty	0.062 (0.039)	0.031 (0.014)	0.068 (0.046)	0.040 (0.019)
Age left school 14 or less	0.299 (0.147)	0.191 (0.172)	0.259 (0.141)	0.182 (0.163)
Age left school 17 or more	0.133 (0.102)	0.327 (0.167)	0.140 (0.115)	0.303 (0.186)
Degree	0.022 (0.019)	0.107 (0.053)	0.032 (0.028)	0.101 (0.062)
Diploma	0.227 (0.041)	0.351 (0.077)	0.180 (0.036)	0.225 (0.045)
Still at school	0.034 (0.115)	0.045 (0.170)	0.037 (0.124)	0.047 (0.178)
Widowed/divorced/ separated	0.295 (0.247)	0.305 (0.344)	0.355 (0.221)	0.340 (0.314)
Married	0.304 (0.239)	0.400 (0.365)	0.323 (0.204)	0.425 (0.332)
Year 1991	0.333 (0.473)	0.333 (0.473)	0.333 (0.473)	0.333 (0.473)
Year 1996	0.333 (0.473)	0.333 (0.473)	0.333 (0.473)	0.333 (0.473)
Observations	168	168	168	168

Table B2. FE and OLS regressions of log male income, 1986–96 Censuses

	Indigenous males		Non-indigenous males	
	FE	OLS	FE	OLS
Major urban	0.131 (0.23)	0.257 (0.55)	9.259 (5.59)**	3.712 (1.61)
Rural or remote	0.020 (0.04)	-0.369 (1.05)	3.638 (2.39)*	-4.530 (1.00)
Difficulty speaking English	-2.300 (2.86)**	-0.890 (1.59)	-7.666 (1.57)	0.317 (0.15)
Degree	1.949 (2.76)**	2.106 (2.62)**	4.771 (3.06)**	2.659 (3.30)**
Diploma	1.261 (2.95)**	0.141 (0.26)	-0.241 (0.24)	-1.360 (1.55)
Sill at secondary school	-2.191 (8.16)**	-2.617 (6.16)**	-1.937 (4.84)**	-2.961 (3.71)**
Widowed, divorced or separated	1.363 (6.08)**	1.342 (5.82)**	1.318 (3.37)**	0.563 (2.07)*
Married	1.396 (10.46)**	1.263 (6.33)**	0.744 (4.23)**	0.539 (1.93)
Year 1991	-0.125 (4.72)**	-0.064 (1.83)	-0.156 (2.20)*	-0.104 (1.60)
Year 1996	-0.153 (1.80)	-0.048 (0.53)	-0.601 (2.30)*	-0.183 (1.05)
Age		-0.012 (0.94)		0.070 (1.72)
Age squared		0.000 (0.58)		-0.001 (2.15)*
Left school aged 14 years or less		-0.340 (1.54)		-1.890 (2.90)**
Left school aged 17 years or more		-0.181 (0.50)		-1.606 (2.30)*
Constant	8.522 (27.71)**	9.557 (24.64)**	2.926 (2.37)*	7.723 (3.86)**
Hausman test $\sim \chi^2(11)$	218.5*		26.5*	
R ²	0.982	0.955	0.991	0.978
Observations	168	168	168	168

Notes: * significant at 5 per cent level; ** significant at 1 per cent level. Heteroscedasticity robust standard errors are used. Robust t-statistics in parentheses. The Hausman test, which tests whether a random effects estimator is preferable to a FE estimator, is easily rejected at the 5 per cent level.

Table B3. FE and OLS regressions of log female income, 1986–96 Censuses

	Indigenous males		Non-indigenous males	
	FE	OLS	FE	OLS
Major urban	-0.069 (0.15)	0.136 (0.30)	2.444 (1.14)	3.468 (2.87)**
Rural or remote	0.499 (1.15)	-0.728 (1.75)	-7.481 (2.43)*	-4.873 (1.48)
Difficulty speaking English	-1.889 (3.09)**	0.054 (0.13)	5.206 (1.75)	-3.651 (2.30)*
Degree	1.681 (3.48)**	1.077 (2.05)*	6.179 (4.29)**	2.016 (4.19)**
Diploma	0.472 (1.26)	-0.201 (0.27)	-9.783 (2.49)*	-0.911 (0.63)
Sill at secondary school	-1.941 (8.27)**	-2.396 (5.48)**	-2.817 (3.61)**	-3.125 (5.96)**
Widowed, divorced or separated	1.122 (8.96)**	0.811 (2.82)**	-0.335 (1.33)	0.360 (1.73)
Married	1.156 (8.83)**	0.679 (2.82)**	-0.391 (1.88)	0.262 (1.58)
Year 1991	0.007 (0.38)	0.062 (1.19)	-0.616 (2.24)*	0.130 (0.98)
Year 1996	0.054 (1.42)	0.111 (1.23)	-0.997 (2.55)*	0.056 (0.29)
Age		-0.019 (1.28)		0.009 (0.42)
Age squared		0.000 (0.65)		0.000 (1.02)
Left school aged 14 years or less		-0.470 (1.67)		-1.651 (2.53)*
Left school aged 17 years or more		-0.231 (0.62)		-2.063 (4.12)**
Constant	8.281 (32.29)**	9.662 (28.00)**	11.094 (4.02)**	8.650 (6.71)**
Hausman test $\sim \chi^2$ (11)	63.9*		87.3*	
R ²	0.983	0.945	0.988	0.968
Observations	168	168	168	168

Note: * significant at 5 per cent level; ** significant at 1 per cent level. Heteroscedasticity robust standard errors are used. Robust t-statistics in parentheses. The Hausman test, which tests whether a random effects estimator is preferable to a FE estimator, is easily rejected at the 5 per cent level.

Notes

1. A relative measure of difference in the pattern of proportional distribution between two otherwise similar data sets is provided by the index of dissimilarity. This is calculated by summing the absolute differences between the percentages of indigenous and non-indigenous people in each income category and dividing the answer by two. The example given below uses hypothetical data showing the percentages of indigenous and non-indigenous people in three income categories.

Income category (\$)	Indigenous (Per cent)	Non-indigenous (Per cent)	Absolute difference
0–3,000	65	20	45
3,000–6,000	15	50	35
6,000–9,000	20	30	10
Total	100	100	90

In this case, the index of dissimilarity would equal $90/2 = 45$ per cent. In other words, almost half of indigenous (or non-indigenous) workers would have to change their income category in order to eliminate the difference in the statistical distributions. The index thus ranges from zero (no difference) to 100 (complete difference).

2. The income categories in the census questionnaire indicate weekly income but have been annualised by multiplying by 52. Given that this assumes that income is consistent throughout the year and indigenous income can be highly variable over time, some comment on the interpretation of the results is warranted. While an individual's income may be over- or under-estimated in the census the overall distribution should be accurate, on average, as long as unevenness of indigenous income flows is not correlated across individuals. The main effect of this uneven income for indigenous people is to increase the variability of their income relative to the rest of the population. It is also worth noting that the income gap varies enormously by State and Territory (Taylor 1993).
3. The process of constructing consistent categories may obscure interesting distributional subtleties. This is caused by the assumption that the distribution within income categories is uniform when in reality there are peaks due to the income transfer system and perhaps the structure of award rates of pay. However, in the absence of more information this assumption is the best available.
4. However, family and household are notoriously difficult concepts to define, especially in a cross-cultural context. A number of studies have explored these definitional and conceptual difficulties and have presented methodological options for facilitating greater data validity and definitional flexibility (Finlayson 1991; Daly and Smith 1996; Martin and Taylor 1996; Peterson 1996). Indigenous households are larger, more likely to be multi-generational, multi-family and contain extended

family members. The high rates of mobility within regional and local social networks mean that households are likely have substantial flows of visitors, as well as 'usual residents' who are absent (Taylor 1996a, 1996b).

5. This assumption is a rough approximation given that there is likely to be significant clustering of income within census categories generated by social security or other welfare payment regimes and minimum wages set in awards.
6. The validity of inter-censal comparison of indigenous labour force status depend, in part, upon who identified as indigenous in the 1996 Census, but did not in previous censuses. Hunter (1998) has shown that it is possible to dismiss bogus identification or 'census vandals' as a major factor underlying the large non-biological increases in the indigenous population. The apparent lack of compositional change in the indigenous population also means that census data can probably be taken at face value and that inter-censal comparisons of educational attainment and participation rates are basically valid.
7. The grouped nature of the data is actually a strength of the analysis of income distributions (see Note 2).
8. The so-called 'Five Economists' Plan' seeks to incorporate a range of theoretical approaches to the integrated development of employment and tax policy. See Professor Peter Dawkins, Professor John Freebairn, Professor Ross Garnaut, Dr Michael Keating and Mr Chris Richardson, 'Dear John: how to create more jobs', (*The Australian*, 26 October 1998, p. 13). Also see Ross Gittins, 'In the five economists' plan, the compromise is golden', (*The Age*, 7 November 1998, B3) for a discussion of the theoretical cross currents related to this.

Appendix notes

9. The FE estimator essentially involves including a dummy variable for every individual or cohort in order to control for unobserved differences between individuals that are constant over time.
10. If the unobserved heterogeneity and the explanatory variables are uncorrelated then the FE and random effects estimates of the individual time varying characteristics should not differ statistically. The Hausman test is formally a test of the equality of the coefficients estimated by the fixed effects and random effects estimators. If the coefficients differ significantly, either the model is misspecified or the assumption that the random effects are uncorrelated with the regressors is incorrect.
11. Education variables are usually included in human capital studies of wages to capture the effect of general training on productivity.
12. Employment could not be separately identified from income equations for the fixed effect regressions. Given this, there is an added incentive to conduct these cohort regressions using employment as the dependant variable because the results are directly interpretable. In contrast, the results in this paper must always be qualified

as referring to wages, salaries and other income. As a result, the analysis in this paper indicates what is happening in employment outcomes, wage and non-wage income. This analysis is presented in Gray and Hunter (1999).

13. It is difficult to estimate the effect of a variable on income when there is little variation in the explanatory variable. This problem is known as multicollinearity in the statistics literature.
14. This assumes that each cohort has a similar distribution of innate ability and, therefore, on average, there will be no differences in innate ability between cohorts.

References

- Altman, J.C. and Hunter, B. 1998. 'Indigenous poverty', in R. Fincher and J. Nieuwenhuysen (eds) *Australian Poverty: Then and Now*, Melbourne University Press, Melbourne.
- Ashenfelter, O. and Krueger, A. 1994. 'Estimates of the economic return to schooling from a new sample of twins', *American Economic Review*, 84 (5): 1157–73.
- Australian Bureau of Statistics/Centre for Aboriginal Economic Policy Research (ABS/CAEPR) 1996. *1994 National Aboriginal and Torres Strait Islander Survey: Employment Outcomes for Indigenous Peoples*, cat. no. 4199.0, ABS, Canberra.
- Belchamber, G. 1996. 'Disappearing middle or vanishing bottom? A comment on Gregory', *Economic Record*, 72 (218): 287–93.
- Daly, A.E. 1995. *Aboriginal and Torres Strait Islander People in the Australian Labour Market*, cat. no. 6253.0, Australian Bureau of Statistics, Canberra.
- Daly, A.E. and Hunter, B. 1998. 'Labour market incentives among indigenous Australians: the cost of job loss versus the gains from employment', *Discussion Paper No. 391*, Centre for Economic Policy Research, The Australian National University, Canberra.
- Daly, A.E. and Liu, J. 1997. 'Estimating the private rate of return to education for indigenous Australians' *Australian Economic Papers*, September: 100–112.
- Daly, A.E. and Smith, D.E. 1996. 'The contemporary economic status of indigenous Australian families', *Australian Journal of Social Issues* 31 (4): 354–75.
- Dawkins, P. 1999. 'A plan to cut unemployment in Australia: an elaboration of the 'five economists' letter to the Prime Minister, 28 October 1998', *Quarterly Bulletin of Economic Trends*, 1.99: 48–59.
- Deaton, A. 1985. 'Panel data form time series of cross-sections', *Journal of Econometrics*, 30: 106–26.
- Edwards, M. 1983. 'The income unit in the social security system: explanation and evaluation', *Social Security Journal*, December 1983: 1–23.
- Finlayson, J. 1991. *Don't Depend On Me: Autonomy and Independence in an Aboriginal Community in Northern Queensland*, unpublished PhD thesis, The Australian National University, Canberra.

- Fuchs, V. 1965. *Toward a Theory of Poverty in the Concept of Poverty Task Force on Economic Growth and Opportunity*, Chamber of Commerce of the United States, Washington.
- Gray, M.C. and Hunter, B.H. 1999. 'Determinants of labour force status for indigenous and non-indigenous Australians, 1986–96', *CAEPR Working Paper No. 2*, Centre for Aboriginal Economic Policy Research, The Australian National University, Canberra (forthcoming).
- Griliches, Z. 1977. 'Estimating the returns to schooling: some econometric problems', *Econometrica*, 45 (1): 1–22.
- Greene, W.H. 1997. *Econometric Analysis*, 3rd edition, Prentice Hall, New Jersey.
- Gregory, R.G. 1993. 'Aspects of Australian and US living standards: the disappointing decades, 1970–1990', *Economic Record*, 69 (204): 61–76.
- Gregory, R.G. and Hunter, B.H. 1996. 'Increasing regional inequality and the decline of manufacturing', in P. Sheehan, B. Grewal and M. Kumnick (eds) *Dialogues on Australia's Future: In Honour of the Late Professor Ronald Henderson*, Centre for Strategic Economic Studies, Melbourne.
- Hausman, J. 1978. 'Specification tests in econometrics', *Econometrica*, 46: 1251–71.
- Hill, M. 1979. 'The wage effects of marital status and children', *Journal of Human Resources*, 14 (4): 579–94.
- Hunter, B. 1998. 'Assessing the validity of intercensal comparisons of indigenous Australians, 1986–96', *Journal of the Australian Population Association*, 15 (1): 51–67.
- Hunter, B. 1999. 'Three nations, not one: indigenous and other Australian poverty', *CAEPR Working Paper No. 1*, Centre for Aboriginal Economic Policy Research, The Australian National University, Canberra.
- Hunter, B. and Daly, A.E. 1998. 'Labour market incentives among indigenous Australians: the cost of job loss versus the gains from employment', *CAEPR Discussion Paper No. 159*, Centre for Aboriginal Economic Policy Research, The Australian National University, Canberra.
- Hunter, B. and Gray, M.C. 1998. 'Recent changes in the Australian workforce: a focus on the structure of indigenous employment', *Australian Bulletin of Labour*, 24 (3): 220–40.
- Martin, D. and Taylor, J. 1996. 'Ethnographic perspectives on the enumeration of Aboriginal people in remote Australia', *Journal of the Australian Population Association*, 13 (1): 17–32.
- Mitchell, D. 1991. *Income Transfers in Ten Welfare States*, Avebury, Sydney.
- Mitchell, D., Harding, A. and Gruen, F. 1994. 'Targeting welfare', *Economic Record*, 70 (210): 315–40.
- Peterson, N. 1996. 'Cultural issues', in J.C. Altman and J. Taylor (eds) *The 1994 National Aboriginal and Torres Strait Islander Survey: Findings and Future Prospects*, Research Monograph No. 11, Centre for Aboriginal Economic Policy Research, The Australian National University, Canberra.
- Preston, A. 1997. 'Where are we now with Human Capital Theory?', *Economic Record*, 73 (220): 51–78.

- Taylor, J. 1993. *Regional Change in the Economic Status of Indigenous Australians, 1986–91*, Research Monograph No. 6, Centre for Aboriginal Economic Policy Research, The Australian National University, Canberra.
- Taylor, J. 1996a. 'Surveying mobile populations: lost opportunity and future needs', in J.C. Altman and J. Taylor (eds) *The 1994 National Aboriginal and Torres Strait Islander Survey: Findings and Future Prospects*, Research Monograph No. 11, Centre for Aboriginal Economic Policy Research, The Australian National University, Canberra.
- Taylor, J. 1996b. 'Indigenous population mobility and service delivery', *CAEPR Discussion Paper No. 118*, Centre for Aboriginal Economic Policy Research, The Australian National University, Canberra.
- Taylor, J. and Hunter, B. 1998. *The Job Still Ahead: Economic Costs of Continuing Indigenous Employment Disparity*, Aboriginal and Torres Strait Islander Commission, Canberra.
- Verbeek, M. and Nijman, T. 1992. 'Can cohort data be treated as genuine panel data', *Empirical Economics*, 17: 9–23.

Centre for Aboriginal Economic Policy Research

For information on earlier CAEPR Discussion Papers and Research
Monographs please contact:

Publication Sales
Centre for Aboriginal Economic Policy Research
The Australian National University
Canberra ACT 0200
Telephone: 02-6279 8211
Facsimile: 02-6249 2789

Abstracts or summaries of all CAEPR Publications
can be found at the following WWW address:
<http://online.anu.edu.au/caepr/>

MONOGRAPH SERIES

1. *Aborigines in the Economy: A Select Annotated Bibliography of Policy-Relevant Research 1985-90*, L.M. Allen, J.C. Altman and E. Owen (with assistance from W.S. Arthur), 1991.
2. *Aboriginal Employment Equity by the Year 2000*, J.C. Altman (ed.), published for the Academy of the Social Sciences in Australia, 1991.
3. *A National Survey of Indigenous Australians: Options and Implications*, J.C. Altman (ed.), 1992.
4. *Indigenous Australians in the Economy: Abstracts of Research, 1991-92*, L.M. Roach and K.A. Probst, 1993.
5. *The Relative Economic Status of Indigenous Australians, 1986-91*, J. Taylor, 1993.
6. *Regional Change in the Economic Status of Indigenous Australians, 1986-91*, J. Taylor, 1993.
7. *Mabo and Native Title: Origins and Institutional Implications*, W. Sanders (ed.), 1994.
8. *The Housing Need of Indigenous Australians, 1991*, R. Jones, 1994.
9. *Indigenous Australians in the Economy: Abstracts of Research, 1993-94*, L.M. Roach and H.J. Bek, 1995.
10. *The Native Title Era: Emerging Issues for Research, Policy and Practice*, J. Finlayson and D.E. Smith (eds), 1995.
11. *The 1994 National Aboriginal and Torres Strait Islander Survey: Findings and Future Prospects*, J.C. Altman and J. Taylor (eds), 1996.
12. *Fighting Over Country: Anthropological Perspectives*, D.E. Smith and J. Finlayson (eds), 1997.
13. *Connections in Native Title: Genealogies, Kinship and Groups*, J.D. Finlayson, B. Rigsby and H.J. Bek (eds), 1999.
14. *Land Rights at Risk? Evaluations of the Reeves Report*, J.C. Altman, F. Morphy and T. Rowse (eds), 1999.

RECENT DISCUSSION PAPER SERIES

- 146/1997** *Regional agreements and localism: a case study from Cape York Peninsula*, D.F. Martin.
- 147/1997** *Towards a comprehensive regional agreement: Torres Strait*, W.S. Arthur.
- 148/1997** *The CDEP scheme in a new policy environment: options for change?* J.C. Altman.
- 149/1997** *How does (and should) DSS treat CDEP participants? (What are these allegations of racial discrimination?)*, W. Sanders.
- 150/1997** *Growth of the Aboriginal and Torres Strait Islander population, 1991–2001 and beyond*, A. Gray.
- 151/1998** *Access to government programs and services for mainland Torres Strait Islanders*, W.S. Arthur.
- 152/1998** *Native title compensation: historic and policy perspectives for an effective and fair regime*, J.C. Altman and D.P. Pollack.
- 153/1998** *The continuing disadvantage of indigenous sole parents: a preliminary analysis of 1996 Census data*, A.E. Daly and D.E. Smith.
- 154/1998** *Assessing the utility of 1996 Census data on indigenous Australians*, B. Hunter.
- 155/1998** *Estimating intercensal indigenous employment change, 1991–96*, J. Taylor and M. Bell.
- 156/1998** *The relative economic status of indigenous people in the Northern Territory, 1991–96*, J. Taylor and L. Roach.
- 157/1998** *The relative economic status of indigenous people in Western Australia, 1991 and 1996*, J. Taylor.
- 158/1998** *The relative economic status of indigenous people in Tasmania, 1991 and 1996*, J. Taylor.
- 159/1998** *Labour market incentives among indigenous Australians: the cost of job loss versus the gains from employment*, B. Hunter and A.E. Daly.
- 160/1998** *The determinants of indigenous educational outcomes*, B. Hunter and R.G. Schwab.
- 161/1998** *Educational ‘failure’ and educational ‘success’ in an Aboriginal community*, R.G. Schwab.
- 162/1998** *The supply of alcohol in remote Aboriginal communities: potential policy directions from Cape York*, D.F. Martin.
- 163/1998** *Indigenous land use agreements: the opportunities, challenges and policy implications of the amended Native Title Act*, D.E. Smith.
- 164/1998** *The relative labour force status of indigenous people 1986–96: a cohort analysis*, B. Hunter and M.C. Gray.

- 165/1998** *Homelands and resource agencies since the Blanchard Report: a review of the literature and an annotated bibliography*, R. Davis and W.S. Arthur.
- 166/1998** *Parentage and indigenous population change*, A. Gray.
- 167/1998** *New and emerging challenges for Native Title Representative Bodies*, J.D. Finlayson.
- 168/1998** *Financial aspects of Aboriginal land rights in the Northern Territory*, J.C. Altman and D.P. Pollack.
- 169/1998** *The indigenous Land Corporation: a new approach to land acquisition?* J.C. Altman and D.P. Pollack.
- 170/1998** *A critical survey of indigenous education outcomes, 1986–1996*, M. Gray, B. Hunter and R.G. Schwab.
- 171/1998** *Indigenous participation in health sciences education: recent trends in the higher education sector*, R.G. Schwab and I. Anderson.
- 172/1998** *The relative economic status of indigenous people in Queensland, 1991 and 1996*, J. Taylor.
- 173/1998** *The relative economic status of indigenous people in New South Wales, 1991 and 1996*, J. Taylor.
- 174/1998** *The relative economic status of indigenous people in Victoria, 1991 and 1996*, J. Taylor.
- 175/1999** *The relative economic status of indigenous people in the Australian Capital Territory, 1991 and 1996*, J. Taylor.
- 176/1999** *Indigenous self-employment: miracle cure or risky business?* B.H. Hunter.
- 177/1999** *What's new? The parliamentary Inquiry into Indigenous Business*, W.S. Arthur.
- 178/1999** *The Grameen Bank micro-credit model: lessons for Australian indigenous economic policy*, S. McDonnell.
- 179/1999** *Trends in indigenous participation in health sciences education: the vocational education and training sector, 1994–97*, R.G. Schwab and I. Anderson.
- 180/1999** *Northern Territory land rights: purpose and effectiveness*, J.D. Finlayson.
- 181/1999** *Indigenous household demography and socioeconomic status: the policy implications of 1996 Census data*, A.E. Daly and D.E. Smith.
- 182/1999** *Shoe or stew? Balancing wants and needs in indigenous households: a study of appropriate income support payments and policies for families*, J.D. Finlayson and A.J. Auld.
- 183/1999** *Income fluctuations over the lifecycle: a cohort analysis of indigenous and non-indigenous Australians, 1986–96*, B.H. Hunter and M.C. Gray.

Notes

1. A relative measure of difference in the pattern of proportional distribution between two otherwise similar data sets is provided by the index of dissimilarity. This is calculated by summing the absolute differences between the percentages of indigenous and non-indigenous people in each income category and dividing the answer by two. The example given below uses hypothetical data showing the percentages of indigenous and non-indigenous people in three income categories.

Income category (\$)	Indigenous (per cent)	Non-indigenous (per cent)	Absolute difference
0-3,000	65	20	45
3,000-6,000	15	50	35
6,000-9,000	20	30	10
Total	100	100	90

In this case, the index of dissimilarity would equal $90/2 = 45$ per cent. In other words, almost half of indigenous (or non-indigenous) workers would have to change their income category in order to eliminate the difference in the statistical distributions. The index thus ranges from zero (no difference) to 100 (complete difference).

2. The income categories in the census questionnaire indicate weekly income but have been annualised by multiplying by 52. Given that this assumes that income is consistent throughout the year and indigenous income can be highly variable over time, some comment on the interpretation of the results is warranted. While an individual's income may be over- or under-estimated in the census the overall distribution should be accurate, on average, as long as unevenness of indigenous income flows is not correlated across individuals. The main effect of this uneven income for indigenous people is to increase the variability of their income relative to the rest of the population. It is also worth noting that the income gap varies enormously by State and Territory (Taylor 1993).
3. The process of constructing consistent categories may obscure interesting distributional subtleties. This is caused by the assumption that the distribution within income categories is uniform when in reality there are peaks due to the income transfer system and perhaps the structure of award rates of pay. However, in the absence of more information this assumption is the best available.
4. However, family and household are notoriously difficult concepts to define, especially in a cross-cultural context. A number of studies have explored these definitional and conceptual difficulties and have presented methodological options for facilitating

greater data validity and definitional flexibility (Finlayson 1991; Daly and Smith 1996; Martin and Taylor 1996; Peterson 1996). Indigenous households are larger, more likely to be multi-generational, multi-family and contain extended family members. The high rates of mobility within regional and local social networks mean that households are likely have substantial flows of visitors, as well as 'usual residents' who are absent (Taylor 1996a, 1996b).

5. This assumption is a rough approximation given that there is likely to be significant clustering of income within census categories generated by social security or other welfare payment regimes and minimum wages set in awards.
6. The validity of inter-censal comparisons of indigenous labour force status depend, in part, upon who identified as indigenous in the 1996 Census, but did not in previous censuses. Hunter (1998) has shown that it is possible to dismiss bogus identification or 'census vandals' as a major factor underlying the large non-biological increases in the indigenous population. The apparent lack of compositional change in the indigenous population also means that census data can probably be taken at face value and that inter-censal comparisons of educational attainment and participation rates are basically valid.
7. The grouped nature of the data is actually a strength of the analysis of income distributions (see Note 2).
8. The so-called 'Five Economists' Plan' seeks to incorporate a range of theoretical approaches to the integrated development of employment and tax policy. See Professor Peter Dawkins, Professor John Freebairn, Professor Ross Garnaut, Dr Michael Keating and Mr Chris Richardson, 'Dear John: how to create more jobs', (*The Australian*, 26 October 1998, p 13). Also see Ross Gittins, 'In the five economists' plan, the compromise is golden', (*The Age*, 7 November 1998, B3) for a discussion of the theoretical cross currents.

Appendix Note

9. The FE estimator essentially involves including a dummy variable for every individual or cohort in order to control for unobserved differences between individuals which are constant over time.
10. If the unobserved heterogeneity and the explanatory variables are uncorrelated then the FE and random effects estimates of the individual time varying characteristics should not differ statistically. The Hausman test is formally a test of the equality of the coefficients estimated by the fixed effects and random effects estimators. If the coefficients differ significantly, either the model is misspecified or the assumption that the random effects are uncorrelated with the regressors is incorrect.
11. Education variables are usually included in Human Capital studies of wages to capture the effect of general training on productivity.

-
12. Employment could not be separately identified from income equations for the fixed effect regressions. Given this, there is an added incentive to conduct these cohort regressions using employment as the dependant variable because the results are directly interpretable. In contrast, the results in this paper must always be qualified as referring to wages salaries and other income. As a result the analysis in this paper indicates what is happening in employment outcomes, wage and non-wage income. This analysis is presented in Gray and Hunter (1999).
 13. It is difficult to estimate the effect of a variable on income when there is little variation in the explanatory variable. This problem is known as multicollinearity in the statistics literature.
 14. This assumes that each cohort has a similar distribution of innate ability and, therefore, on average, there will be no differences in innate ability between cohorts.