Sensitivity of Australian income distributions to choice of equivalence scale: Exploring some parameters of Indigenous incomes

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Acknowledgments

Abbreviations and acronyms

ABS	Australian Bureau of Statistics
AGPS	Australian Government Publishing Service
ANU	The Australian National University
CAEPR	Centre for Aboriginal Economic Policy Research
ME	marginal effects
NHS	National Health Survey
OECD	Organisation for Economic Cooperation and Development
OLS	Ordinary Least Squares
SLA	Statistical Local Area

Abstract

Indigenous families experience substantial and multiple forms of economic burden arising from the size and structure of their families and households. Indigenous households are more likely to have more than one family in residence than other Australian households and are more likely to be multi-generational with older Indigenous people living with younger people in extended family households. Given that equivalence scales attempt to control for family size and composition and the relative costs of maintaining various families, such differences are likely to be reflected in their income distributions—hence, it is important to consider whether these distributions are affected by using alternative scales. This paper seeks to characterise the economies of household size in Indigenous and other Australian households using equivalence scales that cover the range of feasible values and 1995 National Health Survey data. Furthermore, the extent of re-ranking in income distribution when using the various scales provides an intuitive benchmark for the sensitivity of the respective distributions. The analysis will be conducted for both households and income units to illustrate potential sensitivities of the results to the inclusion of extended kin networks in the definition of households.

Background

Poverty and inequality studies almost always use an equivalence scale to adjust raw income to account for the cost of maintaining households and families. These costs are said to vary with household size and composition, and sometimes the number of employed in the household and other household characteristics. Unfortunately, variations in the assumptions about the relevant costs, and the relative complexity of the transformations involved, mean that measures of equivalent income are difficult to compare directly. For example, different groups will be classified as poor depending on which equivalent income is used. The purpose of this paper is to understand better the calculation of equivalent income and to identify whether a particular group, Indigenous persons, are being re-ranked by several widely used measures. The paper also examines to what extent Indigenous people move along the overall distribution of Australian income when different measures of equivalent income are applied.

One of the most widely cited international studies of poverty claims that 'equivalence scales have in general no great effect on the rank order of measured inequality across countries as long as average family size is not extremely large' (Buhman et al. 1988). Since the rationale for choosing a specific scale is rather vague, the importance of testing the sensitivity of income inequality estimates to the choice of equivalence scale has long been acknowledged—especially where there are substantial differences in family size and composition (Aaberge & Melby 1998; Coulter, Cowell & Jenkins 1992; De Vos & Zaidi 1997; Lancaster & Ray 1998; Schiepers 1992). The qualification about family size by Buhman et al. is clearly not valid in the context of Indigenous people who live in family groupings which tend to be very different from those of other citizens.

Daly and Smith (1995) suggest that Indigenous families are experiencing substantial and multiple forms of economic burden in comparison with other Australian families. Indigenous people live in larger households than do other Australians and have smaller incomes which, once corrected for household size, are much smaller incomes. Indigenous households are more likely to be comprised of more than one family compared with other Australian households. They are also more likely to be multi-generational, with older Indigenous people living with younger people in extended family households. Adult mortality is another important factor driving family formation (and dissolution) among the Indigenous households with many children forced to live with other relatives or friends (Gray 1990). The complexity of extended family formations is matched by equally complex definitions of parenting and related child-care arrangements.

These household characteristics have economic implications—for example, suggesting that older generations are not having to survive independently but remain ensconced within an extended family network (Smith & Daly 1996). This can have benefits for a household, especially as aged adults are often in receipt of reliable sources of pension income and provide child-care and stability to household membership. However, there may also be economic disadvantages to these social arrangements with many Indigenous households being overly dependent on kin with low welfare-based incomes. These welfare recipients may, in turn, be under substantial economic pressure from other adults and children who are dependent upon their incomes (Finlayson 1991; Rowse 1988). Such dependents may not qualify as dependents under Centerlink criteria and may be particularly at risk in these economically vulnerable households.

Since extended family formations are the norm in many Indigenous communities, it is necessary to consider the level at which income analysis should be conducted. The household and family are notoriously difficult to define, especially in a cross-cultural context. The Australian Bureau of Statistics (ABS) (1991: 60) defines a 'household' in the national population census as:

> [A] group of people who reside and eat together (in a single dwelling) ... as a single unit in the sense that they have common housekeeping arrangements—i.e. they have some common provision for food and other essentials of living.

Persons living in the same dwelling, but with separate catering arrangements, can therefore be classified as separate households. However, the identification of such households can be particularly problematic where people are living in improvised dwellings, share domestic resources across dwellings, are highly mobile, or have large flows of visitors (Daly & Smith 1995; Finlayson 1991; Martin & Taylor 1996; Smith 1992; Smith & Daly 1996). One innovative attempt

to capture the dynamic complexities of Indigenous households is being implemented in surveys of two remote communities, Kuranda and Yuendumu (Smith 2000).[1] Notwithstanding future developments in data collection, this paper is necessarily confined to existing ABS data sources. The focus on the non-remote Indigenous population in this paper may somewhat reduce the impact of these factors on our results.

Income and poverty studies often use 'income units', which are defined by the ABS as:

> One person, or a group of related persons within a household whose command over income is assumed to be shared. Income sharing is considered to take place between partners in a couple relationship, and between parents and their dependents (ABS 1995: 95).

Given the ethnographic evidence about resource sharing in (and even across) large Indigenous households, the assumption of a nuclear or coupled family is inappropriate. The nature of the definitions of income units and families means that it is better to study Indigenous economic activity at the household level.

The distinct nature of Indigenous families and households has led Smith and Daly (1996: 6) to claim:

> [T]he census indicator of household income is a more reliable measure of Indigenous income and status than family income, given that the census concept of household at least has the potential to capture extended kin formations via the multi-family household type, than does the discrete 'family' concept.

While we endorse this judgment, we also examine the other family grouping that is widely-used in poverty analysis, income units. However, given our preference for the household concept in the Indigenous context, the analysis will predominantly focus on the broader grouping of people.

The style of analysis in this paper is deliberately rudimentary, with its focus on the extent of re-ranking along Australia's income distribution, in order to understand better equivalent income calculations. However, before any empirical analysis is possible, it is necessary to introduce some basic theory underlying equivalent income calculations.

A brief introduction to equivalence scales

To compare economic well being one needs to adjust for the income needs of households with different characteristics. As indicated above, this can be achieved by applying equivalence scales to adjust raw household income. Buhmann et al. (1988) describes four types of equivalence scales: scales developed for statistical purposes only (e.g. count people relative to a given standard of living); program-based scales; those based on analysis of consumption surveys (indirectly measuring utility through consumer revealed preference); and subjective scales which attempt to directly measure utility associated with different income levels or family characteristics. While each type of scale has different strengths and weaknesses, and a distinct theoretical basis, they can all be represented in a parametric form to facilitate comparisons between scales.

Equivalence scales are usually applied to raw household income in order to derive equivalent (or equivalised) household income as follows:

$$I_E = \frac{I_H}{S_i} \qquad\qquad (1)$$

where I_E is equivalent income, I_H raw household income and S_i the equivalence scale. When S_i is set equal to one, the scale does not vary with households size or composition and equivalent income I_E equals raw household income I_H. When S_i equals the number of persons in the household, I_E is per capita income. Equivalence scales typically result in measures of equivalent income that lie between raw household income and per capita income. A very useful parametric form of S_i is that proposed by Buhmann et al. (1988):

$$S_i = H^{\theta} \qquad\qquad (2)$$

where H is household size and θ a parameter representing 'the elasticity of scale with respect to household size'.[2] Variations in θ between 0 and 1 result in equivalent income measures that lie between raw household income and per capita income. For example, Buhmann et al. (1988: 120) estimated the scale predominantly used in Australian poverty studies (i.e. the Henderson equivalence scale) had a θ of 0.55.

Whilst this functional form is a very convenient way of capturing a range of equivalence scales with different inherent economies of size, it does not capture variation in the composition of households. One simple extension of equation 2 that captures differences between adults and children is:

$$S_i = (A + \eta K)^{\theta} \tag{3}$$

where A is the number of adults in the household and K the number of children. The parameter η can be thought of as a relative weight for a child. Variations in θ between 0 and 1 again capture differences in economies of size. The differential weighting for children, as opposed to adults, permit the analyst to capture differences in household composition as well as household size.

Of course, other functional forms can also be used that capture both composition effects and economies of size. A linear alternative to equation 3 is:

$$S_O = 1 + \alpha(A - 1) + \beta K \tag{4}$$

where A and K are defined as above and α and β represent the cost of additional adults and children. Variation in α and β between 0 and 1 will produce measures of equivalent income that lie between raw household income and per capita income.

In this paper, equation 4 is used to represent particular equivalence scales and to generalise the results across a range of possible scales. The two equivalence scales used in this paper are the Henderson and Organisation for Economic Cooperation and Development (OECD) scales.

The Henderson scale arose out of Professor Henderson's (1975) report, *Poverty in Australia,* and has been used in a wide array of circumstances. The scale applied in this paper is a modified version of the original scale and ignores adjustments for housing costs. This modified version of the scale was used by the ABS in publishing estimates from the ABS 1995 National Health Survey (NHS). The Henderson equivalence scale was designed in such a way as to be applicable to income units which, by definition, comprise at most two adults plus children.

The modified Henderson scale can be represented as follows:

$$S_H = 0.76 + .24(A - 1) + .2K - 0.14 W_{NotWorking} \tag{6}$$

where $W_{NotWorking}$ is a dummy variable that equals 1 if no adults in the income unit are working and 0 otherwise. This version of the Henderson scale is normalised (i.e. the scale equals 1) for income units where there are two adults, no children, and at least one adult is working.

The OECD equivalence scale used in this paper is a version of equation 4 where α and β equal 0.5 and 0.3 respectively (i.e. the 'modified' OECD scale used in De Vos & Zaidi 1997: 321). One advantage of the modified OECD (hereafter OECD) scale is that, unlike the Henderson scale, it can easily be applied to various levels of analysis.

In this paper, we are interested in examining Indigenous and non-Indigenous populations using both income units and households. As noted, the Henderson scale was designed to apply primarily to income units. However, it is possible to represent the relative weight for children (compared to adults) and the underlying economies of size assumptions embodied in the Henderson scale using the various parametric forms. For example, if one removes the Henderson scale working adjustment and re-normalises the scale so that single adult income units have a scale value of 1, then it is possible to derive a linear representation (equation 4) of the Henderson scale. We undertook this estimation for the (normalised) Henderson scale using Ordinary Least

Squares (OLS) and obtained parameters values for α and β of 0.316 and 0.263 respectively. These estimates are useful to consider particularly when examining re-ranking across Henderson and OECD equivalent income.

Though it was not designed to do so, the Henderson equivalence scale can be applied to households. In this case, we have to decide how to account for the working adjustment that the Henderson scale applies to income units. If we use the same assumption (i.e. if no adults in the household are working, then reduce the scale by 0.14), then few households, as opposed to income units, would meet this condition. Consequently, an incremental working adjustment was deemed appropriate for households whereby the scale is reduced by 0.07 for each adult that was not working in the household.

Sensitivity testing of a variety of equivalence scales is a common practice in research (Burniaux et al. 1998). For example, Atkinson, Rainwater and Smeeding (1995) considered income inequality using raw family/household income (that is, no adjustment for family size—a θ in equation 2 of 0) and per capita income (θ of 1). They found that the level of income inequality was higher with these assumptions than when income was equivalised using the square root of the number of people in the family (θ of 0.5).

Sensitivity analysis is usually conducted because of uncertainty about the implicit assumptions about economies of size and composition embedded in the equivalence scales. However, there are additional source(s) of uncertainty when measuring Indigenous income—arising from the appropriate level of analysis and heterogeneity in the Indigenous population. The question of the level of the analysis is partially addressed by conducting the analysis at both the household and income unit level. The issue of heterogeneity arises because of cultural differences within the Indigenous population. For example, some Indigenous people, especially those in cities, may live in income units, but others may live in households with resource commitments to their extended families living elsewhere. Consequently, the search for a single best measure of equivalent income for Indigenous Australians is probably a flawed exercise. Notwithstanding, it is useful to highlight the likely biases involved in the current measures of equivalent income.

Data

The 1995 NHS was conducted over the period February 1995 to January 1996. Households were randomly selected using a stratified multi-stage area sample.[3] The survey obtained information from over 54,000 Australian residents of private and non-private dwellings. The overall response rate for households was 91.5 per cent.

In addition to the main NHS sample, a supplementary sample of 1,034 Indigenous persons was obtained. This resulted in a total sample of 2,099 Indigenous persons. There were 52,763 non-Indigenous persons in the sample.

In this study, we have excluded households where a response to income questions was not obtained for all persons in the household and/or information about the composition of the household was incomplete. Visitors to the household and households in remote areas were excluded because of questions about data availability and quality.[4] Remote areas were defined as Statistical Local Areas (SLAs) where the dwelling density was less than 57 dwellings per 100 square kilometre.[5] After applying these exclusions to income unit data, there were 44,890 non-Indigenous and 1,541 Indigenous persons in the sample (Table 1). Applying the exclusions to household data further reduced the sample sizes to 44,562 and 1,451 respectively.

At the time of the 1996 Census, about 76,200 Indigenous people lived in remote areas defined using a similar criteria to that above (authors' calculations based on Hunter 1998). While the remainder of the excluded Indigenous observations in the NHS arose largely from the lack of adequate income data within income units, the population represented by the sample is still a substantial fraction of the total population. For example, the Indigenous population represented by the NHS sample was about 73 per cent of the overall 1996 Census counts.

Table 1. NHS samples sizes (after exclusions), 1995

	Indigenous	Non-Indigenous
	Persons in income units	
Non-Indigenous		44,890
Indigenous (original)	859	
Indigenous (supplement)	682	
Weighted	265,600	14,833,200
	Persons in households	
Non-Indigenous		44,562
Indigenous (original)	778	
Indigenous (supplement)	673	
Weighted	260,600	14,807,200

The measure of income on the 1995 NHS was gross personal income from all sources. The estimates of family or household income are based on two standard ABS definitions. The broader definition of households outlined above includes all persons who are usual residents of the particular dwelling. Under the ABS definition of income units, dependents are defined as

> All persons under 15 years, and persons aged 15-24 years who are full-time students, live with a parent, guardian or other relative and do not have a spouse or offspring of their own living with them (ABS 1997: 51).

For the purposes of this study, we define children in a manner that is consistent with the definition of dependants in income units. That is, any full-time student aged between 15 and 24 years is classified as a dependant. This assumption, which is an attempt to facilitate comparisons between income measures, can be contrasted to the OECD scale where only those aged 14 years or less are treated as dependent children.

The household sample contains fewer people than the income unit sample because the exclusion restrictions remove people living in households where someone did not complete the income question, even when some income units in the household provided all the required information. Problems arising from the income question within households were negligible among the non-Indigenous sample and only reduced the Indigenous population represented in the NHS by 1.9 per cent. The higher non-response of the Indigenous population is probably driven by their larger and more complex household structures which increase the probability that at least one person failed to provide all the information required.

Describing Indigenous and non-Indigenous households in the context of income measurement issues

The distinct nature of Australian Indigenous households and families is well known. Despite an extensive literature on household composition, there is little discussion of how the different structures of Indigenous and non-Indigenous households can be related to income measurement issues. One essential precursor to such a discussion is a summary of the joint distribution of adults and dependents in the respective household types using the most recent census data. Surprisingly, this has not yet been done in published studies, which instead focus on overall household size or ethnographic case studies. Table 2 redresses this gap in the literature.

While non-Indigenous households are twice as likely as Indigenous households to have one adult and no dependents (10.6% and 5.2% respectively), they are actually less likely to live in households with only one adult. The difference arises, of course, because single adult Indigenous households are substantially more likely to have dependents than other households with only one adult in them. This observation is particularly pronounced among single adult households with four or more dependents (2.9% and 0.5% respectively).

The second salient point to arise from Table 2 is that Indigenous households are much less likely than other households to only have two adults in them (45.6% and 66.9% respectively). This

confirms that Indigenous people do not conform to the dominant paradigm of a nuclear family 'model' where there is a couple living in a single dwelling.

The only two adult household where Indigenous people are more likely to live than other Australians are those with four or more dependents. This is consistent with the third stylised fact of Indigenous households that they are more likely to have large numbers of dependents. The only households with dependents where Indigenous households were less likely to be concentrated than non-Indigenous households were those with only two adults in them (i.e. those with between 1 and 3 dependents). Indeed, Indigenous households were only less likely to have two dependents than non-Indigenous households (20.7% and 20.4% respectively), but this minor difference is driven solely by the concentration of non-Indigenous dependents in two adult families.

Indigenous people are disproportionately concentrated in households with three or more adults. More than one-third of Indigenous people live in such households (35.9%). In contrast, less than one-sixth of the non-Indigenous population live in these 'atypical' households (16.5%). The substantial part of this difference arises from particularly large households where there are more than three adults taking care of four or more dependents—6.9 per cent and 0.2 per cent respectively.

To recapitulate, Indigenous people are more likely to live in larger households where there are three or more adults and large numbers of children. One important exception to this observation is that Indigenous people are substantially more likely to live in single parent households.

Table 2. Percentage of population living in households by composition of adults and dependents, 1996 Census

| Number of adults | Number of dependents | | | | | TOTAL |
	0	1	2	3	4 or more	
	Non-Indigenous					
1	10.6	2.1	2.3	1.1	0.5	16.7
2	27.4	10.5	16.3	8.9	3.8	66.9
3	4.3	1.5	1.5	0.8	0.3	8.5
4 or more	6.0	0.8	0.7	0.2	0.2	8.0
TOTAL	48.4	15.0	20.9	11.0	4.7	100.0
	Indigenous					
1	5.2	3.3	4.1	3.0	2.9	18.5
2	10.0	7.7	10.7	8.8	8.4	45.6
3	3.3	2.5	2.9	2.5	2.3	13.5
4 or more	8.2	2.5	2.7	2.1	6.9	22.4
TOTAL	26.7	16.0	20.4	16.4	20.5	100.0

Note.   At the time of the 1996 Census there were 17,536,300 non-Indigenous people and 352,800 Indigenous people counted. These counts are adjusted for non-response and other factors in deriving final estimates of the resident population.

Table 3 presents analogous data for the NHS in order to gauge how representative the sample was, at least in terms of household composition. Household characteristics in the NHS reveal that it tends to slightly under-sample the large households with three or more adults and over-sample single adult households (Table 3). For example, the percentage of the Indigenous population living in NHS households with three or more adults was 32.1 per cent compared to 35.9 per cent in the 1996 Census. The converse of this is that the NHS was more likely than the census to have Indigenous households with only one adult (23.2% and 18.5% respectively).

Table 3. Household composition of NHS, 1995

Number of adults	Number of dependents					
	0	1	2	3	4 or more	Total
	Percentage of non-Indigenous households (after exclusions)					
1	10.6	1.8	2.6	1.0	0.4	16.5
2	25.0	9.5	15.8	9.3	3.8	63.5
3 or more	11.2	4.3	3.0	1.1	0.6	20.1
Total	46.8	15.6	21.4	11.4	4.8	100.0
	Percentage of Indigenous households (after exclusions)					
1	5.3	4.7	7.2	4.1	4.1	25.5
2	10.4	9.7	12.8	9.1	6.4	48.4
3 or more	7.0	4.9	1.6	7.7	4.9	26.2
Total	22.7	19.3	21.7	20.9	15.4	100.0
	Percentage of Indigenous households (before exclusions)					
1	4.9	4.6	6.8	3.4	3.5	23.2
2	9.3	9.0	12.0	7.6	6.9	44.7
3 or more	7.4	5.6	2.9	7.1	9.1	32.1
Total	21.6	19.2	21.7	18.0	19.5	100.0

Notes. The weighted populations represented in the 3 panels are 14,810,000; 260,600; and 345,000 respectively. The third panel relates to households where exclusions were not enforced. Households with three or more adults are aggregated because of the small cell sizes in NHS.

While the overall differences between the census and NHS data are relatively minor, the differentials become exaggerated when the necessary data exclusions are imposed. That is, focusing on the households for which there is valid income data and who do not live in remote areas further reduces the percentage of Indigenous households where there are three or more adults from 32.1 per cent to 26.2 per cent. Presumably, this is because it is harder to collect income information from all adults in large households and because remote areas have larger households. There are few differences between the distribution of non-Indigenous households in the 1996 Census and the NHS, either with or without exclusions.

Taken as a whole the NHS sample is broadly-speaking representative of the Indigenous population. Unfortunately, the exclusions necessary to conduct an analysis of income lead to a particular sample of Indigenous people, which is not necessarily representative of the Indigenous population. As a consequence, the role of larger Indigenous households will be understated by the NHS data. Conversely, the role of single adult households may be overplayed and this should be taken into account in the analysis of income re-ranking observed in the NHS.

Other features of the NHS indicate that it is representative of the Indigenous population, irrespective of whether the exclusions are applied. The Indigenous age distributions in the NHS and the 1996 Census are virtually identical, with 40 per cent being less than 15 years of age. At the other end of the distribution, the census and NHS indicate 3.0 per cent and 2.4 per cent respectively are aged over 65 years. The non-Indigenous age distribution in the census is virtually identical with that in the NHS.

While the census does not include any information on income units, but rather on families, it is worth reinforcing the above story by examining the differential in composition of Indigenous and non-Indigenous income units. Table 4 illustrates that the differences between income units replicated the basic differentials identified above between households. However, while the differences are still substantial they tend to be compressed for income units, by definition, given that income units are forced to have a maximum of two adults in them. That is, Indigenous income units are closer to non-Indigenous income units because the non-Indigenous are more likely to live in two adult households while the Indigenous are disproportionately concentrated in households with three or more adults. Consequently, the act of breaking up larger Indigenous households into smaller income units creates more of both single adult and dual adult income units—thus distorting both. The increase in the number of single adult units with dependents,

relative to the household distributions is a distinct feature of the Indigenous sample. This is consistent with ethnographic evidence that indicates Indigenous sole parent families tend to live in multi-adult households with their extended families.

Table 4. Composition of income units in NHS, 1995

	Number of dependents					
Number of adults	0	1	2	3	4 or more	Total
	Non-Indigenous income units					
1	25.6	2.8	2.9	1.2	0.4	33.0
2	24.9	11.1	17.2	9.8	4.1	67.0
Total	50.5	13.9	20.1	11.0	4.5	100.0
	Indigenous income units					
1	19.7	8.9	8.1	5.3	5.2	47.3
2	10.4	9.5	11.8	13.6	7.4	52.7
Total	30.1	18.4	19.9	19.0	12.6	100.0

Table 5. Percentage of population by number of people working in the households, 1995 NHS

Number of people working in household	Indigenous	Non-Indigenous
0	27.1	18.7
1	41.7	29.2
2	23.9	39.2
3	5.8	9.4
4	1.5	3.6
Total	100.0	100.0
Population	260,600	14,807,200

Another dimension of some equivalence scales is that they attempt to correct for costs associated with employment. Table 5 provides useful background by describing the proportion of the population living in households categorised by the number of people working in them. Indigenous people are much more likely to be living in households where either no one works or only one person is employed. That is, in spite of the fact that Indigenous people are more likely to live in multi-adult households, they are less likely to live with more than one employed person. This follows, more or less directly, from the disproportionate level of joblessness in the Indigenous community and has important implications for the extent of re-ranking from Henderson equivalent income.[6]

Overview of Indigenous income distributions

The relatively low-income status of Indigenous Australians is widely documented (Altman 2000; Altman & Hunter 1997; Hunter 2001). This section presents similar evidence using the 1995 NHS to set up the analysis of income deciles in the rest of the paper. Indigenous people are clearly concentrated in the bottom half of the Australian income distribution for both households and income units, with the largest cluster tending to be in the bottom two deciles (Figures 1 and 2). The dominance of the non-Indigenous population in the overall Australian income distribution mean that their distribution is basically a flat line at the 10 per cent mark.[7]

Figure 1. Distribution of Indigenous household equivalent income, 1995
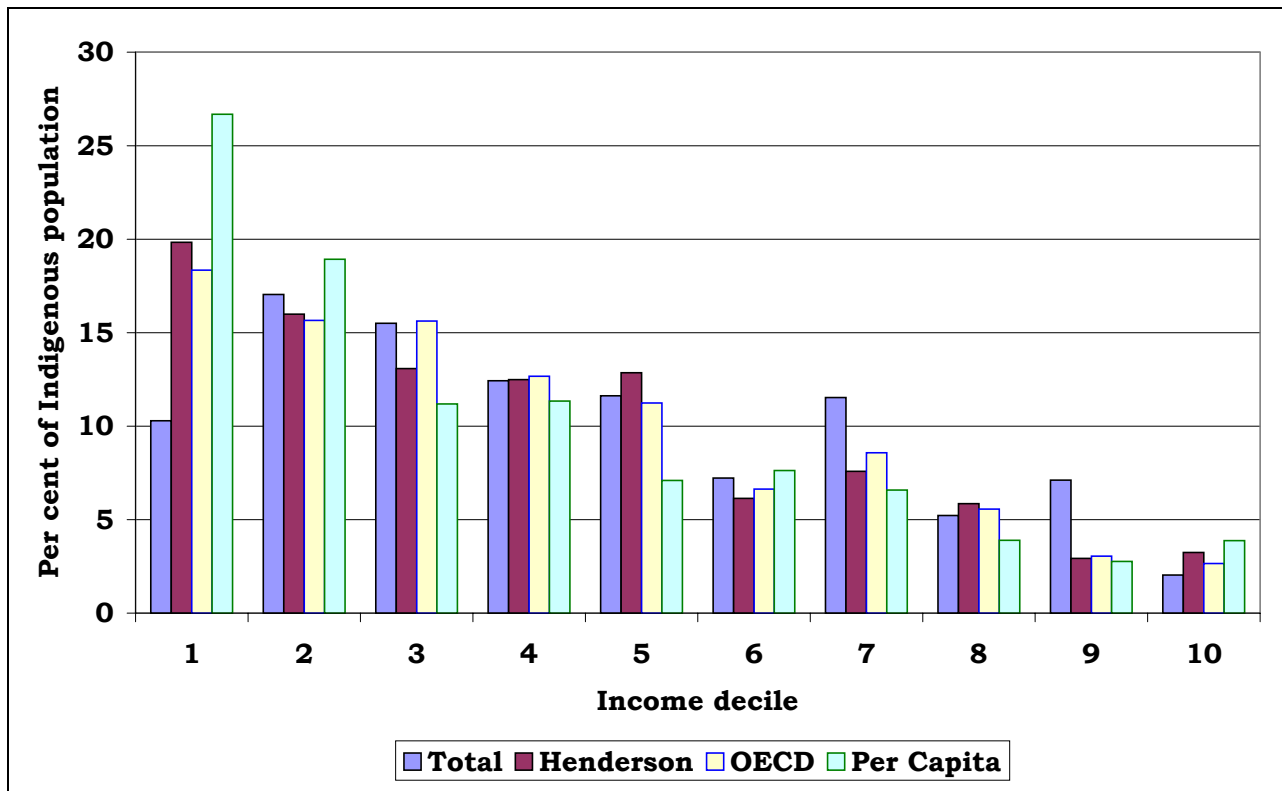
Source: 1995 NHS.

Figure 2. Distribution of Indigenous income unit equivalent income, 1995
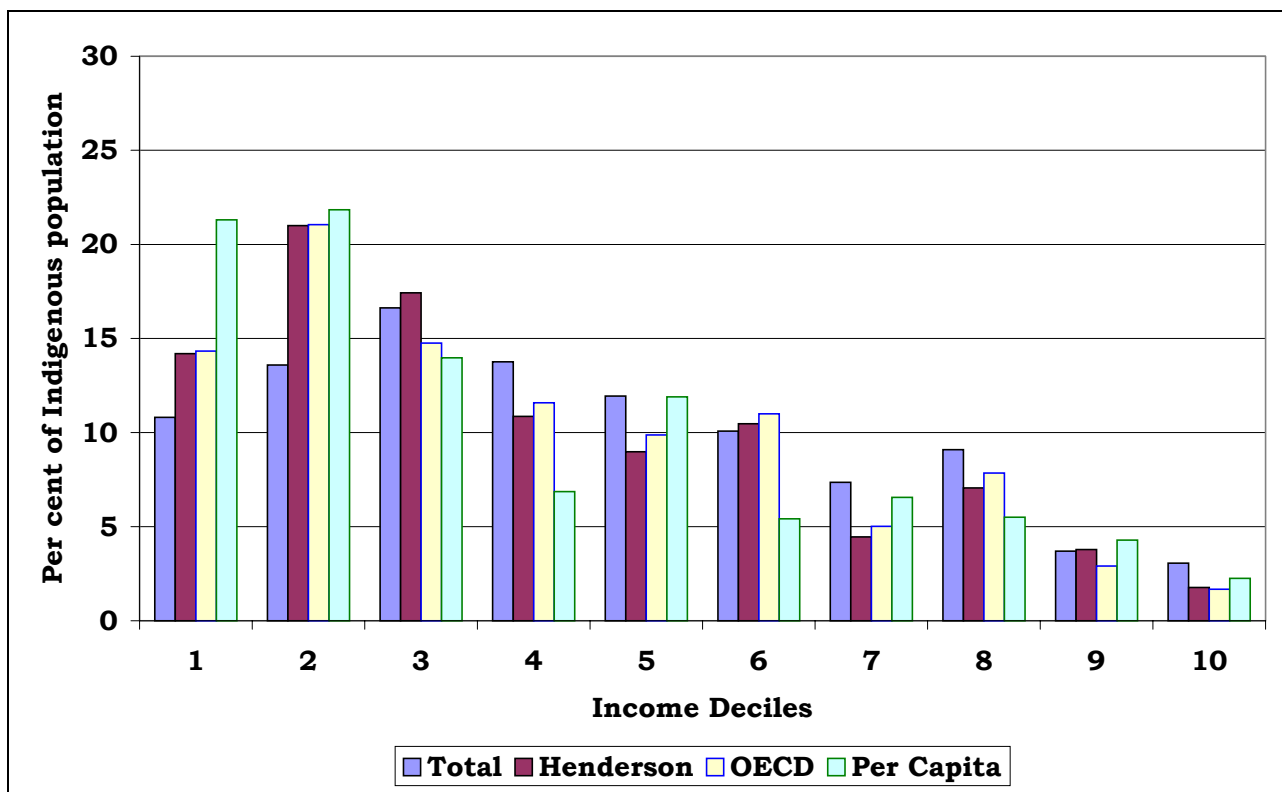
Source: 1995 NHS.

Overall, the distributions are similar, but per capita income tends to classify more Indigenous people in the bottom decile. This is consistent with the fact that this scale assumes that larger households have higher costs than other scales and hence such households are more likely to fall into a lower decile. The differences between the distributions of raw and per capita income tend to be the most pronounced with the Henderson and OECD distributions tracking each other reasonably closely.

The distribution of Indigenous income for income units is more variable. This is consistent with the artificial nature of many income units in the Indigenous context. That is, re-ranking among the deciles is more pronounced for income units than households, thus providing prima facie evidence that Indigenous income will be more sensitive to the assumptions about the economies of size and composition of the relevant social grouping. Consequently, the failure to get these assumptions right is likely to lead to higher measurement error in Indigenous income.

Another inconsistency between Figures 1 and 2 is that all measures have relatively low numbers of Indigenous income units in the bottom decile. It is particularly unusual that the per capita, OECD and Henderson measures all have fewer Indigenous in the bottom decile than the second decile. For raw income, there are actually more people in the third decile income units than in each of the bottom two deciles. This is unlikely given all existing studies of Indigenous disadvantage point to an overwhelming concentration of economic problems in the bottom two deciles (especially Altman & Hunter 1997; Hunter 2001). This suggests that equivalent income calculated for Indigenous income units does not reflect Indigenous circumstances and provides further rationale for preferring households to income units.

Notwithstanding such problems in measuring income unit income, the overall distributions are reasonably similar. However, analysing the distribution can hide important issues such as whether the people in the various deciles are the same. Indeed, the following section will show that a substantial percentage of the population move between deciles even when the net changes to the distribution are quite small.

The extent of re-ranking using several widely used measures of income need

To examine the extent of re-ranking in the NHS, we re-estimate equivalent income using the various equivalence scales. Given that we are using the same raw income, the only thing which varies between the measures of equivalent income are the equivalence scales and their assumptions about the economies of size and composition of households and income units.

Households

Table 6 illustrates the effects of assumptions about economies of size and composition within households. The first three rows take the extremes of the assumptions about equivalence scales, raw income and per capita income. By moving to per capita income and hence assuming the maximum feasible cost for each extra person, large Indigenous families are likely to be moved down the distribution into lower deciles. Indeed, over three-fifths of the Indigenous population were in households that changed to a lower rank (62.0%). In contrast, 42.2 per cent of the non-Indigenous households moved down the distribution when per capita income is calculated. This is not surprising given the disproportionate number of Indigenous people living in large households with many dependents and adults.

Many Indigenous people live in households whose rank improves after per capita income is calculated (19.2%). The reason for this is that a substantial proportion of the Indigenous population live in households where there is only one adult (although often with dependents). Non-Indigenous people are two-and-a-half times more likely than Indigenous people to live in households where there is only one adult and no dependents, and hence it is not surprising they are more likely to be re-ranked up by the per capita calculation (34.4%). This differential in the propensity to be ranked higher in per capita income is completely explained by the different distribution of Indigenous and non-Indigenous population in such households (Tables 2 and 3).

The net effect on re-ranking of these competing tendencies is that Indigenous people are slightly more likely to live in households which are re-ranked than other Australians, with only 18.8 per cent compared to 23.4 per cent remaining in the same decile in the respective distributions. Clearly, the net effect of re-ranking along the distribution hides a substantial degree of (gross) distributional change, which in turn is driven by large differences in household size and composition. This is a major finding which implies that equivalent income and derived poverty measures may hide substantial changes in the ranks of the poor. The fact that only one-fifth of people, Indigenous or otherwise, stay in the same decile when using per capita as opposed to raw income illustrates the possible extent of the problem.

These stylised facts are replicated when the analysis focuses on income units. The fact that households are often artificially broken down into smaller income units tends to generate more upward re-ranking and slightly less downward re-ranking than was seen in households. However, the overall observations about the relativities between Indigenous and non-Indigenous populations and the fact that net changes tend to hide many (gross) distributional changes remain valid.

In order to disaggregate the extent of re-ranking between raw and per capita income, the changes between raw and OECD income, and OECD and per capita are presented. Given that per capita assumes higher costs for additional household members than OECD income, which in turn assumes higher costs than raw income, one should expect that the tendencies identified above are replicated, although probably with smaller magnitudes. This expectation is borne out with Indigenous people more likely to move down the distribution, and less likely to move up, than non-Indigenous people. Therefore, the phenomenon of gross re-ranking along the distribution appears to be monotonic in the assumption about economies of household size and composition. Since the variation in assumptions about household costs are not as large for each of these pair-wise comparisons, it is not surprising that more people remain in the same decile of the distribution for both populations.

Given that raw and per capita incomes represent the extremes of assumptions about household costs, it is useful to examine widely used measures of equivalent income—that is, using the Henderson and OECD scales. The Henderson scale implicitly assumes higher economies of size and composition and is closer to raw income measures than per capita—with the OECD income being closer to per capita than the Henderson measures.

There is less difference between Henderson and OECD measures than was apparent between other types of equivalent income examined. The reason for this is that the underlying assumptions about the economies of size and composition are reasonably similar. Among the Indigenous population, 84.7 per cent remain in the same decile, which is actually higher than the stability indicated in the non-Indigenous population.

Another notable observation is that the OECD scale is likely to re-rank Indigenous household incomes, as opposed to other Australian incomes, higher than in the Henderson distributions (7.7% and 7.4% respectively). At face value, this result is surprising to the extent that the distribution and composition of Indigenous households would tend to reverse this relativity. However, the adjustment for the costs of working, included in the Henderson but not the OECD scale, means that the Henderson measure of equivalent income for Indigenous people will already be depressed relative to non-Indigenous incomes because of the ongoing low levels of Indigenous employment (Hunter & Taylor 2001).

It is possible to gauge the effect of the working adjustment by examining how the results change when it is excluded from the Henderson calculations. This hypothetical can also be rationalised on the grounds that the OECD scale does not have any equivalent adjustment, thus isolating the effect of the scales attributable to assumptions about household size and composition. The exclusion of the working adjustment scale appears to have no or little effect on the extent of re-ranking in the non-Indigenous population—but it has a significant effect on the Indigenous results, increasing the extent of movement up the distribution by 2.2 percentage points (with 9.1%, rather than 6.9%, of the Indigenous population being in a higher decile in the OECD distribution). Furthermore, the Henderson scales that exclude an adjustment restore the expected relativities in the distribution of household income, with Indigenous households being slightly

less likely than other Australians to be ranked higher using OECD measures (6.2% and 7.3% respectively). Overall, there is relatively little re-ranking between the Henderson and OECD income distributions with similar percentages of the populace moving up and down the distribution for both Indigenous and non-Indigenous population, irrespective of whether the adjustment for the costs of having a job is applied.

Table 6. The extent of re-ranking among the various equivalence scales

	Households		Income units	
	Indigenous	Non-Indigenous	Indigenous	Non-Indigenous
Raw same decile as per capita	18.8	23.4	17.8	21.4
Raw higher decile than per capita	62.0	42.2	57.0	40.8
Raw lower decile than per capita	19.2	34.4	25.2	37.8
Raw same decile as OECD	35.7	40.8	28.1	38.2
Raw higher decile than OECD	48.0	31.1	50.2	32.4
Raw lower decile than OECD	16.3	28.1	21.8	29.4
OECD same decile as per capita	35.3	41.6	33.3	35.5
OECD higher decile than per capita	48.9	32.3	46.5	35.0
OECD lower decile than per capita	15.8	26.1	20.2	29.5
Henderson same decile as OECD	85.4	85.3	72.9	76.5
Henderson higher decile than OECD	6.9	7.3	11.6	11.9
Henderson lower decile than OECD	7.7	7.4	15.5	11.7
Without working adjustment Henderson scale				
Henderson same decile as OECD	84.7	85.5		
Henderson higher decile than OEC	9.1	7.2		
Henderson lower decile than OECD	6.2	7.3		

Table 7 examines the extent of income re-ranking in more detail by examining where on the distribution a household is re-ranked after applying per capita income adjustment. For example, Indigenous households at the extremes of the distribution are actually more likely to stay in the same decile with 54.0 per cent staying in the first decile compared to 39.8 per cent of the non-Indigenous population in the lowest decile of raw income. At the other extreme, 87.9 per cent of the 5,000 or so Indigenous householders in the top decile of raw income remained in that decile after applying the per capita equivalence scales. It is important to note the underlying small sample sizes for Indigenous estimates in the upper deciles. The fact that Indigenous people are slightly less likely than other Australians to remain in the same decile overall is explained solely through the greater instability in the middle deciles.

Table 7. Percentage of households whose income was re-ranked between raw income and per capita scales, 1995

Raw income deciles	Decile of per capita household income										Total	Population in each decile
	1	2	3	4	5	6	7	8	9	10		
Indigenous households												
1	54.0	24.7	6.5	8.6	6.1	0.1	0.0	0.0	0.0	0.0	100.0	26,803
2	66.4	17.5	11.7	2.9	0.0	0.0	1.4	0.0	0.0	0.0	100.0	44,402
3	42.4	33.2	9.7	2.5	4.7	2.6	0.0	5.0	0.0	0.0	100.0	40,404
4	25.9	18.1	22.8	14.1	6.7	5.6	4.3	0.0	2.5	0.0	100.0	32,385
5	0.2	38.9	15.9	7.9	10.8	6.4	4.8	10.7	0.3	4.1	100.0	30,277
6	0.0	12.1	16.0	13.8	31.9	2.4	4.2	10.3	0.6	8.6	100.0	18,818
7	0.0	5.3	10.2	34.4	7.2	18.2	17.9	1.7	5.1	0.0	100.0	30,034
8	0.0	0.0	0.0	20.3	0.6	17.5	30.0	8.7	10.8	12.1	100.0	13,611
9	0.0	0.0	0.0	12.4	7.1	35.9	16.8	5.7	17.3	4.8	100.0	18,529
10	0.0	0.0	0.0	0.0	0.0	2.7	5.7	3.7	0.0	87.9	100.0	5324
Total	26.7	18.9	11.2	11.3	7.1	7.6	6.6	3.9	2.8	3.9	100.0	260,600
Non-Indigenous households												
1	39.8	11.3	12.7	24.1	9.6	2.5	0.0	0.0	0.0	0.0	100.0	1,480,101
2	23.6	23.5	36.4	9.1	0.0	2.2	5.2	0.0	0.0	0.0	100.0	1,493,214
3	24.4	20.2	11.3	11.2	17.7	4.4	0.5	8.6	1.7	0.0	100.0	1,444,090
4	8.9	23.1	12.8	15.5	6.1	15.6	8.6	0.0	9.4	0.0	100.0	1,466,009
5	0.7	16.5	15.9	17.7	13.1	8.4	13.2	7.5	1.0	6.0	100.0	1,486,799
6	0.3	4.2	8.5	10.7	26.2	14.5	8.7	21.6	0.6	4.7	100.0	1,478,998
7	0.0	0.3	2.1	9.0	16.2	27.9	15.3	4.1	22.4	2.6	100.0	1,477,487
8	0.0	0.0	0.1	1.8	9.9	15.8	25.1	21.9	19.2	6.2	100.0	1,492,320
9	0.0	0.0	0.0	0.8	2.2	8.5	21.2	26.8	19.2	21.2	100.0	1,487,077
10	0.0	0.0	0.0	0.0	0.0	0.5	2.5	10.3	27.3	59.4	100.0	1,501,114
Total	9.7	9.9	10.0	10.0	10.1	10.0	10.1	10.1	10.1	10.1	100.0	14,810,000

Table 8. Percentage of households whose income was re-ranked between OECD and Henderson scales, 1995

OECD	Decile of household income adjusted using Henderson scales										Total	Population in each decile
	1	2	3	4	5	6	7	8	9	10		
Indigenous households												
1	99.7	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	47,804
2	9.9	87.9	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	40,779
3	0.0	13.9	73.4	12.7	0.0	0.0	0.0	0.0	0.0	0.0	100.0	40,691
4	0.0	0.0	10.0	79.9	10.1	0.0	0.0	0.0	0.0	0.0	100.0	33,025
5	0.0	0.0	0.0	3.4	86.5	10.1	0.0	0.0	0.0	0.0	100.0	29,299
6	0.0	0.0	0.0	0.0	28.1	69.8	2.2	0.0	0.0	0.0	100.0	17,280
7	0.0	0.0	0.0	0.0	0.0	4.4	86.1	9.5	0.0	0.0	100.0	22,361
8	0.0	0.0	0.0	0.0	0.0	0.0	0.8	90.6	8.5	0.0	100.0	14,494
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	78.1	21.9	100.0	7946
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	97.4	100.0	6908
Total	19.8	16.0	13.1	12.5	12.9	6.1	7.6	5.9	2.9	3.3	100.0	260,600
Non-Indigenous households												
1	94.5	5.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	1,460,127
2	6.5	82.3	11.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	1,466,935
3	0.0	10.8	79.7	9.4	0.0	0.0	0.0	0.0	0.0	0.0	100.0	1,464,697
4	0.0	0.0	9.5	81.1	9.4	0.0	0.0	0.0	0.0	0.0	100.0	1,474,032
5	0.0	0.0	0.0	9.5	78.3	12.0	0.2	0.0	0.0	0.0	100.0	1,478,288
6	0.0	0.0	0.0	0.0	12.0	77.6	10.5	0.0	0.0	0.0	100.0	1,487,916
7	0.0	0.0	0.0	0.0	0.0	10.7	82.3	7.1	0.0	0.0	100.0	1,484,292
8	0.0	0.0	0.0	0.0	0.0	0.0	7.2	87.8	5.0	0.0	100.0	1,492,412
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	91.8	3.2	100.0	1,503,701
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	97.0	100.0	1,494,809
Total	10.0	9.8	9.9	10.0	10.0	10.1	10.0	10.1	10.1	10.1	100.0	14,810,000

Both Indigenous and non-Indigenous Australians appear to have distinct clusters of people some way from the main diagonal in Table 7 (i.e. the entries which indicate the extent to which people remain in the same decile). Such 'clusters' can be identified by casting your eyes across the rows and identifying where the percentage figures in the row increase then fall then increase again. For example, the extent of re-ranking in the second non-Indigenous decile of raw income increases to the main diagonal (the second decile of per capita income), declines to 0.0 per cent in the fifth decile of per capita income before increasing to 5.2 per cent in the seventh decile. This 'cluster' of people who are re-ranked up four or five deciles from their original place in the distribution is likely to consist of smaller single adult households, presumably most of who are without dependents. Such households will be ranked higher in the per capita income because they do not incur the extra costs of larger households assumed in this scale. A similar phenomenon is apparent for Indigenous Australians, albeit with smaller 'clusters'. This is consistent with the substantial number of single adult Indigenous households although less than in the non-Indigenous population.

A relatively large number of Indigenous Australians are re-ranked lower in the per capita distribution. For example, a remarkable 66.4 per cent of Indigenous people in the second decile of raw income are ranked in the lowest decile of the per capita distribution. In contrast, only 23.6 per cent of non-Indigenous people in the second decile are re-ranked downwards. This, as was pointed out above, is because many Indigenous households are very different from the Australian average household. Consequently, it is not surprising that there is a large cluster of people who are re-ranked lower in the per capita distribution because large households are assumed to have higher costs than other households—there is a 'cluster' of people, especially non-Indigenous people, who are re-ranked down about four or five deciles. For example, about one-eighth (12.4%) of Indigenous householders in the ninth decile of raw income are ranked in the fourth decile of per capita income.

Relatively little re-ranking was evident when comparing Henderson and OECD income in detail (Table 8). While the re-ranking is likely to include the same groups of households re-ranked between raw and per capita income, the extent of movement along the respective income distributions is constrained by the similarity of the assumptions about household costs. As a result, re-ranking is constrained within a relatively narrow band within one decile of the original place in the distribution. Even if there are clusters similar to those identified in Table 7; the focus on deciles is too broad to identify them. Consequently, Table 6 provides an adequate summary of the changes in the distributions when using Henderson rather than OECD income.

Appendix A further breaks down the overall re-ranking among households in Table 7. For example, Tables A1 and A2 shows the percentage of each decile of OECD household income that were classified in the various deciles of raw income and per capita income.

In the first decile of OECD income almost twice as many people were originally classified in the bottom decile of per capita income (85.8% compared to 44.5%). In a sense, this decile is closer to the per capita measure than to raw income. However, with the possible exception of the top two deciles of OECD income, a substantially greater number of people originate from lower deciles of per capita income. This is because per capita income assumes lower economies of household size and composition than either the OECD or raw income. Notwithstanding, the fact that the whole distributions are recalculated mean that some household types move up the distribution between raw income and OECD income—with the top two deciles of OECD being more likely to originate from a lower decile of raw income than a lower decile of per capita income. These observations are consistent with the differences in Tables A1 and A2 for the non-Indigenous populations, although these tend to be substantially smaller than the Indigenous differentials. This confirms that the extent of re-ranking is much greater for the Indigenous population than for other Australians in every part of the distribution.

Who is being re-ranked?

The above analysis is speculative because equivalence scales embody many factors that can vary simultaneously. While the changes in the decile re-ranking provide information about where the changes in distribution are occurring, it is useful to tease out what factors are driving the changes. Consequently, an appropriate multi-variate technique is required to capture the extent

of re-ranking along the deciles of the income distribution. The ordered probit procedure is commonly used where there is a natural ordering (ranking) of a categorical variable (Greene 2000: 434–6). This regression procedure assumes there exists a latent (unobserved) variable, which determines whether the rank of a person falls, stays the same, or increases. This variable is correlated with regressors and hence changes in the values of regressors may lead to a latent variable crossing a threshold (determined empirically within the model). The value of the latent variable relative to the thresholds determines the probability that an income will be re-ranked by various equivalence scales.

The specification of the regressors is relatively easy since they are largely suggested by the formulas used to derive equivalence scales. The number of adults and children in a household should obviously be taken into account. While labour force status is used to define the Henderson scales, its omission from the OECD and other scales means that the role of employment and other labour force states in driving the sensitivity of equivalent income can be identified. Basic demographic characteristics of individuals are also included because differing sources of income may be apparent at various stages of the lifecycle and this may affect the extent of re-ranking. For example, the reliance of many elderly Australians on fixed sources of income, may mean they are more likely to be re-ranked as income thresholds change relative to some benchmark (e.g. pension rates). Finally, information on whether a person has identified as Indigenous is included in order to test whether there are residual differences between Indigenous and other Australians after other factors are taken into account (especially, the substantial differences in household structure and age profiles—see Taylor 1997)).

Table 9 reports the results of an ordered probit regression model that predicts changes in the probability, arising from the correlates of re-ranking, between the Henderson and OECD equivalence scales (see Appendix Table B1). Such changes are called marginal effects (ME), and are measured relative to a reference person defined as a non-Indigenous female aged between 25 and 64 years who is outside the labour force and lives in a household where there are two adults and no dependents. Note that the MEs for each row sums to zero because each regressor can only re-rank a household one of three ways—into a lower decile, into the same decile or into a higher decile.

The pattern of MEs confirms the earlier analysis. Living in a single adult household means that a household's Henderson decile rank is likely to be lower than it is in the OECD ranking relative to the reference person (11.7%). Similarly, such people are also more likely to be either in the same decile or in a higher decile of the OECD distribution. The probability of being in a lower decile for OECD income increases as the number of adults in the house gets larger with the MEs peaking at 21.5% in households with four or more adults. The MEs of staying in the same decile fall commensurately with few of the people who live in large households (at least large in terms of the number of adults) that shift into a higher decile.

The MEs for the number of dependents in the house are not strictly consistent with the economies of household size and composition implicit in the respective scales. More dependents in a house tend to be associated with being less likely to be in lower OECD decile ranking relative to the Henderson distribution—people in houses with three or more dependents are about 10 percentage points less likely to be in a lower decile of OECD income. The explanation for this anomaly is that there is an interaction between the number of children and the working adjustment in the Henderson equivalence scale. For example, adults in households with large numbers of dependents are generally less likely to be working than other households. That is, the effect of the adjustment for differences in working costs is swamping the fact that the OECD scale assumes that extra children cost more to maintain than does the Henderson scale.

One revealing aspect of the analysis is that demographic factors can be particularly important in affecting the extent of re-ranking. The MEs for respondents aged 65 and over being in a lower decile is only surpassed by the MEs for households with four or more adults. The likely reason for this is that the OECD decile cut-offs are close to the relevant entitlements for the age pension. Again very few in such households move into a higher decile of OECD income.

The MEs for the labour force status variables reflect the fact that the Henderson scale includes an adjustment for the cost of working. Accordingly, those employed are less likely to be ranked in a

lower decile of OECD income and more likely to either stay in the same decile or move to a higher decile.

Table 9. The predicted probability of re-ranking between Henderson and OECD measures for a reference person (marginal effect in %), Australian households, 1995

	Henderson versus OECD		
	In a lower decile	In the same decile	In a higher decile
One adult	-11.7	7.5	4.3
Three adults	11.8	-11.3	-0.6
Four or more adults	21.5	-20.8	-0.7
One dependent	-6.9	5.7	1.2
Two dependents	-8.8	6.8	1.9
Three dependents	-10.2	7.4	2.8
Four or more dependents	-9.7	7.2	2.4
Aged 24 or less	-9.4	7.1	2.3
Aged 65 or more	14.4	-13.8	-0.6
Male	2.0	-1.8	-0.2
Employed	-12.4	7.2	5.2
Unemployed	-13.5	5.6	8.0
Indigenous	2.7	-2.5	-0.2

Notes: The reference person is defined as the omitted variable in the ordered probit regression in Appendix Table B1. Omitted variables include: two adults, no dependents, aged between 25 to 64, female, not in the labour force, and non-Indigenous.

Once the differentials in household size and composition and other variables are controlled for, there is relatively little re-ranking of Indigenous people between Henderson and OECD measures. Only 2.7 per cent of Indigenous people are re-ranked in a lower decile of OECD income with a commensurate fall in the probability of remaining in the same decile.

The truncated nature of the dependent variable at the extremes of the distribution may affect the estimated results in this section. For example, given that bottom decile households cannot be placed in a lower rank, the characteristics of such households could potentially bias the estimates. Similarly, households in the top decile cannot move into a higher decile. One way around this is to estimate the results for Table 9 excluding the top and bottom decile. A sensitivity analysis revealed that the above results were not substantively affected by excluding the extremes of the distribution.

An analysis of MEs was also conducted to determine whether the correlates of re-ranking differed for the other measures of equivalent income (Appendix Table B2). The probability of being re-ranked between raw and per capita incomes was dominated by the effect of household size and composition. Demographic variables and labour force status were only weakly correlated with re-ranking, if at all. Most importantly in the context of this paper, Indigenous status is not significantly correlated with re-ranking—that is, the difference between Indigenous and non-Indigenous populations is being explained almost entirely by household size and composition.

While the importance of household factors is replicated between raw income and OECD deciles and OECD and per capita deciles, the other factors tend to be more important. With regard to the extent of re-ranking between raw income to OECD income, older people are relatively more stable than persons aged between 25 and 64 years and less likely to be in a higher decile (MEs of 11.6% and -12.3%). However, these older people tend to be more likely to be in a lower decile of OECD, and less likely to be in the same decile, compared to the per capita distribution. That is, being aged 65 and over is associated with a shift down the distribution at each stage between raw and per capita income, but these MEs tend to balance out in the overall re-ranking between the extremes of equivalent income. This observation can be made for most of the demographic and labour force status variables.

The examination of the re-ranking of each stage of the move from raw income to per capita measures revealed one striking anomaly, the result for the Indigenous variable. Indigenous status was significantly correlated in Appendix Table B1 between per capita and OECD deciles, but not between raw income and OECD deciles. However, the MEs associated with this association were relatively small. Given that there was no correlation between the probability of re-ranking and Indigenous self-identification, this means that the influence of Indigenous variable is overwhelmed by the influence of household size and composition.

Policy implications

This paper argues that households should be used in preference to income units (or even families) as the basic unit of income analysis, especially statistical or policy analysis of Indigenous Australians. While households are slightly less stable than income units, at least in terms of measured income, they provide a better basis for an analysis that directly relates to Indigenous circumstances. In addition to being culturally inappropriate, income units frequently generate distributions of equivalent income, which do not accord with widespread consensus about Indigenous poverty. For example, Indigenous incomes appear to be overstated with more Indigenous people being in the second decile of per capita, Henderson, and OECD measures of equivalent income than there were in the bottom decile. In any case, there is little loss of information for other Australians in shifting the focus towards the household with non-Indigenous households looking relatively similar to non-Indigenous income units, at least in terms of size and composition. Few non-Indigenous households have more than two adults living in them and hence the overall income distributions will be relatively unaffected by moving towards a household level analysis.

Indigenous incomes are harder to characterise and less stable than non-Indigenous incomes, even if household data are used. This finding is robust and holds for the various types of equivalence scales. This is consistent with the greater diversity of household types being more likely to be both single adult and exceptionally large (i.e. with three or more adults and/or many dependents).

The large differences between the size and composition of Indigenous and non-Indigenous households mean that the issue of economies of scale in household production (and consumption) has important implications for the measurement of Indigenous poverty. Equivalence scales should accurately reflect the real cost of raising large households. Unfortunately, the range of equivalence scales used by poverty researchers becomes significantly wider as the number of children increases (Whiteford 1985: 13, 106–7). For example, while the values of the Henderson equivalence scales do not differ markedly from other scales, they do diverge for large households (Saunders 1994: 251). Consequently, the choice of equivalence scale is not trivial and there are no unique solutions to determining the extent of income inequality and poverty.

Given that an important source of variation in the inequality of equivalent income is from the number of 'dependents', it is useful to reflect on the extent to which the definition accords with household requirements for resources. Clearly, there is a need for consistency in the treatment of dependents when comparing equivalence scales. While this consistency was imposed in this paper, more discussion is required in the literature over which definition of dependents is appropriate. If older 'dependents' cost as much as adults, then the OECD treatment of children should be preferred to others, such as the Henderson scales, which assume that full-time students as old as 24 cost the same as children. The OECD definition of dependents appears to offer a more realistic assessment of resource requirements than the Henderson definition.

The policy importance of the 'measurement' error in income, indirectly identified in this paper, is that it questions the efficacy of income based means tests. If income cannot be accurately used to identify needy families and households, then it is impossible to guarantee that welfare is being directed to the right people. However, given that an overwhelming majority of Indigenous Australians experience multiple disadvantage across a range of indicators, there is probably no real question about overall Indigenous need. Notwithstanding, Indigenous families could miss out on welfare entitlements if their needs are understated by inappropriate definitions of income.

While this paper is based on national (or almost national) averages, the results probably hold for a diverse range of Indigenous groups (e.g. those living in urban, rural and remote areas, respectively). That is, the sorts of issues identified between Indigenous and non-Indigenous Australians are likely to be similar to those between Indigenous sub-populations. It is not necessary to assume a monolithic Indigenous culture when evaluating equivalence scales—except perhaps because there is no adequate data of sufficient quality against which particular sub-populations could be benchmarked. In the near future, this qualification will be a binding qualification on the ability to distinguish between groups of Indigenous Australians.

Future work will generalise the results in this paper. This will be achieved by using single and dual parameter models of equivalence scales, which examine the continuum of possible equivalence scales. Such models will facilitate the analysis of the implications of measurement error induced by potentially inappropriate characterisations of equivalence scales for measured Indigenous poverty, especially Indigenous poverty relative to other Australian poverty.

Appendix

Table A 1. Percentage of households whose income was re-ranked between raw income and OECD scales, 1995

OECD	Decile of household income adjusted using raw household income										Total	Population in each decile
	1	2	3	4	5	6	7	8	9	10		
Indigenous households												
1	44.5	44.9	8.0	2.7	0.0	0.0	0.0	0.0	0.0	0.0	100.0	47,804
2	10.2	43.8	36.2	9.6	0.2	0.0	0.0	0.0	0.0	0.0	100.0	40,779
3	3.4	10.9	39.1	22.4	18.6	5.6	0.0	0.0	0.0	0.0	100.0	40,691
4	0.0	0.7	10.6	37.6	28.9	11.3	10.9	0.0	0.0	0.0	100.0	33,025
5	0.0	1.4	5.1	11.9	18.4	23.6	27.3	4.5	7.9	0.0	100.0	29,299
6	0.0	0.0	5.4	8.2	17.9	10.0	41.1	9.7	7.6	0.0	100.0	17,280
7	0.0	0.0	0.0	2.2	14.4	7.6	37.7	20.6	16.8	0.6	100.0	22,361
8	0.0	0.0	0.0	2.1	9.2	5.7	17.1	19.7	44.1	2.1	100.0	14,494
9	0.0	0.0	0.0	0.0	0.0	20.5	5.3	39.7	31.9	2.5	100.0	7946
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	32.3	67.7	100.0	6908
Total	10.3	17.0	15.5	12.4	11.6	7.2	11.5	5.2	7.1	2.0	100.0	260,600
Non-Indigenous households												
1	71.2	19.8	8.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0	100.0	1,480,101
2	22.5	52.4	19.5	5.0	0.7	0.0	0.0	0.0	0.0	0.0	100.0	1,493,214
3	7.6	21.8	32.6	28.2	7.9	1.8	0.1	0.0	0.0	0.0	100.0	1,444,090
4	0.0	5.3	24.9	27.4	32.2	9.3	0.8	0.0	0.0	0.0	100.0	1,466,009
5	0.0	2.5	4.7	23.8	26.6	27.0	13.2	2.0	0.2	0.0	100.0	1,486,799
6	0.0	0.0	6.5	5.7	17.7	28.8	27.3	11.5	2.6	0.0	100.0	1,478,998
7	0.0	0.0	1.3	5.7	8.2	17.5	28.8	28.9	9.5	0.0	100.0	1,477,487
8	0.0	0.0	0.0	3.5	4.4	10.4	20.8	28.2	29.7	3.0	100.0	1,492,320
9	0.0	0.0	0.0	0.0	2.9	4.8	5.8	27.4	37.2	22.0	100.0	1,487,077
10	0.0	0.0	0.0	0.0	0.0	0.0	2.6	2.0	20.2	75.2	100.0	1,501,114
Total	10.0	10.1	9.8	9.9	10.0	10.0	10.0	10.1	10.0	10.1	100.0	14,810,000

Table A 2. Percentage of households whose income was re-ranked between per capita income and OECD scales, 1995

OECD	Decile of household income adjusted using per capita scales										Total	Population in each decile
	1	2	3	4	5	6	7	8	9	10		
Indigenous households												
1	85.8	8.5	3.7	2.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	47,804
2	59.8	29.6	6.6	3.3	0.7	0.0	0.0	0.0	0.0	0.0	100.0	40,779
3	10.2	63.4	14.8	8.4	3.3	0.0	0.0	0.0	0.0	0.0	100.0	40,691
4	0.0	22.4	52.1	12.9	8.8	3.1	0.7	0.0	0.0	0.0	100.0	33,025
5	0.0	0.0	5.1	48.7	31.7	9.4	1.4	3.8	0.0	0.0	100.0	29,299
6	0.0	0.0	0.0	30.9	27.1	18.3	18.3	5.4	0.0	0.0	100.0	17,280
7	0.0	0.0	0.0	0.0	0.0	44.9	26.0	26.9	2.2	0.0	100.0	22,361
8	0.0	0.0	0.0	0.0	0.0	20.0	51.2	9.0	11.2	8.6	100.0	14,494
9	0.0	0.0	0.0	0.0	0.0	0.0	1.5	10.0	46.1	42.4	100.0	7946
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.8	79.2	100.0	6908
Total	26.7	18.9	11.2	11.3	7.1	7.6	6.6	3.9	2.8	3.9	100.0	260,600
Non-Indigenous households												
1	68.4	8.5	12.8	10.3	0.0	0.0	0.0	0.0	0.0	0.0	100.0	1,480,101
2	24.2	30.9	26.2	14.1	4.7	0.0	0.0	0.0	0.0	0.0	100.0	1,493,214
3	5.8	46.7	19.6	20.1	5.1	2.7	0.0	0.0	0.0	0.0	100.0	1,444,090
4	0.0	13.5	35.5	22.6	20.3	5.3	2.8	0.0	0.0	0.0	100.0	1,466,009
5	0.0	0.0	6.3	30.8	31.7	22.0	6.9	2.3	0.0	0.0	100.0	1,486,799
6	0.0	0.0	0.0	2.5	36.3	32.0	22.7	6.0	0.4	0.0	100.0	1,478,998
7	0.0	0.0	0.0	0.0	2.7	35.0	33.4	22.0	7.0	0.0	100.0	1,477,487
8	0.0	0.0	0.0	0.0	0.0	3.1	32.2	39.7	22.0	3.0	100.0	1,492,320
9	0.0	0.0	0.0	0.0	0.0	0.0	2.2	29.1	54.2	14.5	100.0	1,487,077
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	16.5	82.5	100.0	1,501,114
Total	9.7	9.9	10.0	10.0	10.1	10.0	10.1	10.1	10.1	10.1	100.0	14,810,000

Table B 1. Ordered probit regressions coefficient estimates of the extent of income re-ranking to a lower, in the same, to a higher decile

	Henderson vs OECD		Per Capita vs OECD		Total vs OECD		Total vs Per Capita	
Adults 1	0.764	(39.4)	-0.708	(-39.2)	0.837	(47.0)	1.053	(49.9)
Adults 3	-0.412	(-18.7)	0.650	(33.2)	-2.083	(-86.6)	-1.886	(-80.3)
Adults 4+	-0.683	(-22.9)	1.282	(43.3)	-3.489	(-93.1)	-3.950	(-89.1)
Kids 1	0.352	(16.2)	1.868	(75.6)	-1.004	(-52.4)	-1.726	(-80.3)
Kids 2	0.481	(22.7)	3.384	(114.7)	-2.467	(-104.7)	-4.129	(-136.7)
Kids 3	0.599	(22.7)	3.910	(113.2)	-3.849	(-122.0)	-4.574	(-119.5)
Kids 4+	0.552	(15.5)	3.872	(91.3)	-4.218	(-92.2)	-4.596	(-89.7)
Age 24	0.532	(21.8)	0.197	(9.1)	0.246	(11.3)	0.042	(1.7)
Age 65+	-0.489	(-17.7)	-0.364	(-13.4)	-0.309	(-12.2)	0.162	(5.2)
Male	-0.080	(-5.7)	-0.010	(-0.8)	-0.048	(-3.8)	-0.048	(-3.2)
Employed	0.849	(40.2)	0.278	(15.5)	0.427	(23.6)	0.079	(3.9)
Unemployed	1.047	(26.4)	-0.018	(-0.5)	-0.263	(-7.3)	-0.162	(-4.0)
Indigenous	-0.109	(-2.7)	-0.167	(-4.5)	0.002	(0.1)	-0.005	(-0.1)
Log Likelihood	-20,335		-26,504		-27,235		-19,715	
No. of 0bservations	46,013		46,013		46,013		46,013	

Notes: Omitted Variables: Adults 2, Kids 0, Age 25 to 64, not in the labour force and Not Applicable, non-Indigenous.

Table B 2. The predicted probability of re-ranking between various income measures for a reference person (ME in %)

	Probability of being re-ranked (%)		
	In a Lower Decile	In the Same Decile	In a Higher Decile
	Total versus per capita		
Adults 1	-0.2	-17.5	17.7
Adults 3	15.0	50.0	-65.0
Adults 4+	84.8	-5.7	-79.1
Kids 1	11.5	49.6	-61.1
Kids 2	88.6	-9.4	-79.1
Kids 3	95.0	-15.8	-79.2
Kids 4+	95.2	-16.0	-79.2
Age 24	0.0	-1.2	1.2
Age 65+	-0.1	-4.3	4.3
Male	0.0	1.4	-1.4
Employed	0.0	-2.2	2.2
Unemployed	0.1	4.8	-4.9
Indigenous	0.0	0.2	-0.2
	Total versus OECD		
Adults 1	-0.4	-27.6	28.0
Adults 3	30.1	22.9	-53.0
Adults 4+	81.1	-25.5	-55.6
Kids 1	5.1	31.1	-36.2
Kids 2	44.6	10.0	-54.6
Kids 3	89.1	-33.5	-55.6
Kids 4+	94.3	-38.7	-55.6
Age 24	-0.3	-9.2	9.4
Age 65+	0.6	11.6	-12.3
Male	0.1	1.8	-1.9
Employed	-0.4	-15.5	15.9
Unemployed	0.5	9.9	-10.5
Indigenous	0.0	-0.1	0.1
	Per capita versus OECD		
Adults 1	23.7	-23.6	-0.1
Adults 3	-25.4	24.6	0.7
Adults 4+	-44.2	40.4	3.9
Kids 1	-53.6	41.5	12.1
Kids 2	-58.5	-5.1	63.6
Kids 3	-58.5	-22.3	80.8
Kids 4+	-58.5	-21.2	79.8
Age 24	-7.8	7.7	0.1
Age 65+	13.4	-13.3	-0.1
Male	0.4	-0.4	0.0
Employed	-11.0	10.9	0.2
Unemployed	0.7	-0.7	0.0
Indigenous	6.4	-6.3	-0.1

Notes: Omitted Variables: Adults 2, Kids 0, Age 25 to 64, Not in the Labour Force and Not Applicable, non-Indigenous.

Notes

1. Kuranda is a small hinterland town with a population of 600 people, about half an hour's drive from the urban and tourist centre of Cairns in North Queensland. Yuendumu is a discrete, remote and predominantly Aboriginal town of 900 people located about four hours drive from Alice Springs.

    In Yuendumu, censuses were taken nightly of all persons staying overnight in households over a twelve-month period. The dynamic nature of Indigenous household composition can be illustrated in one of the four-bedroom houses surveyed. A total of 27 different adults and 15 different children slept at the house over the fortnight, totalling 42 different persons. Out of this flow of 42, a core of 11 persons (7 adults and 4 children) slept at the house for the whole two-week period (Musharbash 2000).

2. Jenkins and Cowell (1994).

3. See ABS (1995).

4. The data on visitors was frequently incomplete because the ABS did not collect data on people who were not usual residents. The data quality and comparability of data in remote areas has been questioned, especially in the context of the NHS (Altman & Hunter 1998; Gray 1997; Hunter 2001).

5. In 1995, there were 156,000 persons living in remote areas of whom 68,400 were Indigenous persons, see ABS (1999).

6. See Hunter and Gray (1998) for details of employment disadvantage of Indigenous Australians.

7. Given that Indigenous people only comprise 2 per cent of the total Australian population, the numbers of non-Indigenous in each decile is more or less 10 per cent (plus or minus 0.3).

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