Expenditure and Income Inequality in Australia 1975-76 to 1998-99

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This paper is draws from the approach, model and results, from my PhD thesis; *Inequality, Welfare, Household Composition and Prices: A Comparative Study on Australian and Canadian Data,* currently under submission.

Abstract

This paper examines and compares the nature, magnitude and movement in the inequality of income and expenditure of Australian households from 1975-76 to 1998-99. It specifies a demographically extended complete demand system and uses household survey and price data to obtain estimates of its parameters to construct and compare alternate equivalence scales and price indices. The paper finds that the real adult equivalent disposable income inequality of households has been rising in consistently from 1975-76 to 1998-99, while real adult equivalent expenditure inequality recorded a fall over the period as a whole. The decline in the inequality of accommodation expenditure has been significant in offsetting the rise in inequality of expenditure on food and alcohol and tobacco. The rise in wage inequality and to a lesser extent investment income inequality, have largely accounted for the rise in gross income inequality. Insight into the effect of prices, household size and composition on inequality is gained by contrasting the non-scaled per household based measures of inequality, with the inequality based on real equivalence scaled measures of welfare. The inequality estimates are quite sensitive to the equivalence scale used as the household size deflator but not to the cost of living index used as the price deflator. Excluding observations from the original sample can have extreme consequences on the reported magnitude and trend in inequality.

Keywords: Inequality, Equivalence Scales, Cost of Living Index.

JEL Classification: D1, D6, I3

1 Introduction

The inequality of welfare impacts on an individual's feelings of belonging and participation and the level of social division within a society. Significant increases in inequality may have such tangible effects as increased crime, political unrest and support for extremist groups. Saunders, Stott and Hobbes (1991) noted that Australia has a rather high level of income inequality, similar to the U.S., while considerably higher than Sweden.

Most Australian studies have found that income inequality in Australia rose through the mid seventies to the early nineties – see, for example, Meagher and Dixon (1986), Saunders (1993), Borland and Wilkins (1996), and Harding (1997). The timing and severity of the inequality increases differed slightly according to the data, unit of analysis and the equivalence scale used to take note of differences in household size and composition. Until recently the Australian literature has been paid to expenditure inequality in Australia, or to comparisons between income and expenditure measures of inequality. Barrett, Crossley and Worswick (1999) found for Australia that consumption inequality was rising but at a slower rate than income inequality from 1975-76 to 1993-94, while Blacklow and Ray (2000) found that expenditure inequality was falling over the period. This raises the question of what has been happening to the inequality of welfare in Australia since then?

While it is common to use inequality indices or other statistical measures to characterise the dispersion of welfare, the explicit or implicit assumptions of their properties have significant effects upon the measurement of inequality. The choice of the variable to represent welfare also raises the question, what variable best measures welfare and what does the resulting index of inequality measure? Household level data is usually the only source of comprehensive data containing indicators of welfare for inequality studies, which raises the issue of how to use equivalence scales to facilitate welfare comparisons across households of

different size and composition. Households also frequently face different prices and price movements due to geographical dispersion and may be affected differently by prices, depending upon their demographics and level of welfare. This raises the issue of how to measure the general level of prices through price and cost of living indices?

Sen (1970) and Roberts (1980c) demonstrated that welfare comparisons and social welfare functions were possible and valid, by relaxing non-comparability and allowing the social analyst to weigh individuals' welfare gains and losses. Kolm (1969) and Atkinson (1970) considered the practical implications of the aggregation of individual welfare into social welfare functions and considered the link between such functions and their ethical bias.

In the Kolm-Atkinson framework, the social welfare function is defined on the distribution of 'income' rather than the distribution of individual utility or welfare. Muellbauer (1974a,b) extends the approach to define the social welfare function on the distribution of money metric individual welfare such that the measure of welfare is adjusted with a price index and an equivalence scale based on demographics in a utility consistent measure. The analysis of Muellbauer (1974a,b) and Roberts (1980a,b), suggests that an equivalence scale and cost of living index should be used to deflate nominal household measures of welfare to provide real equivalent or money metric measures of welfare to provide an accurate picture of inequality in light of the variation in household size and composition and prices and their effect on household behaviour.

While most inequality studies adopt the use of price indices and equivalence scales, income is still the most commonly used indicator of welfare. McGregor and Borooah (1992), Kakwani (1993), Slesnick (1994), Johnson and Shipp (1997), among others, argue that consumption expenditure is a more appropriate indicator of well being, since utility is derived from the consumption of goods and services. An argument often expressed in favour of use

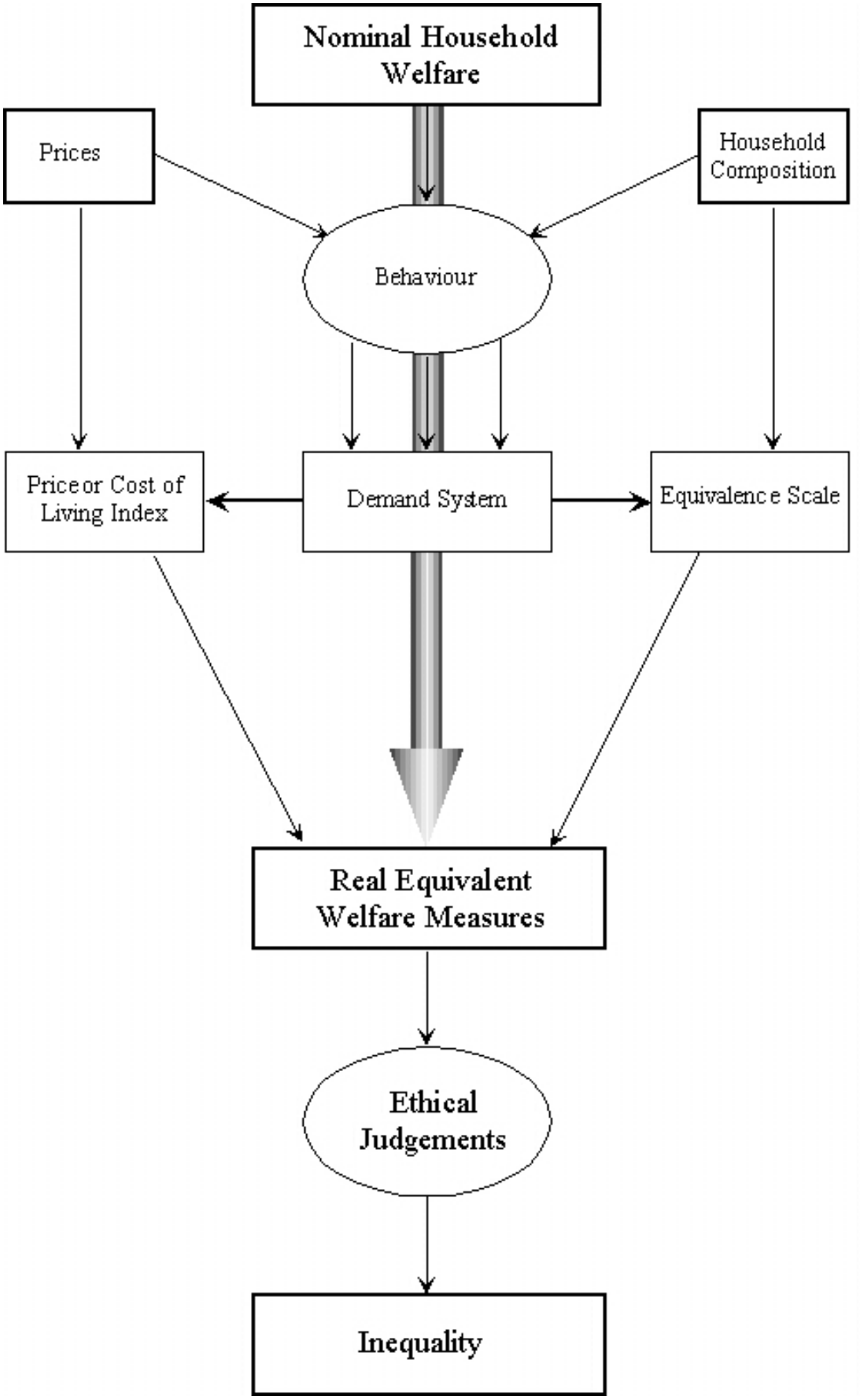
of expenditure in inequality comparisons is based on the fact that expenditure is less subject, than income, to short term fluctuations since households can smooth away the former by adjusting savings – see, for example, Blundell and Preston (1998). Moreover, given the reality of income concealment to escape taxation, income data is notoriously unreliable for use as a measure of welfare and welfare comparisons.

Figure 1 illustrates the link between the various concepts and information that allows the analysis of inequality based on explicit assumptions about household behaviour and judgments about inequality.

This paper examines inequality, using indices with different sensitivities to inequality so as to examine the effects of ethical judgements on inequality measurement. An inequality index may be said to be more sensitive to inequality if it gives weight to welfare gains and losses at the lower end of welfare distribution than the upper end[1]. It considers both disposable income and expenditure adjusted for variations in household size and prices with a range of equivalence scales and price indices, as measures of welfare. More specifically the study seeks to; a) compare and contrast the use of income and expenditure as measures of welfare in evaluating inequality; b) examine the effect of equivalence scales choice on inequality; c) study the sensitivity of inequality to the choice of price indices and d) to investigate the effect of sample selections on inequality.

[1] See Shorrocks and Foster (1987) for more explanation of "Transfer-Sensitive" inequality measures.

Figure 1 Flow Chart Of Concepts



2 Theoretical Framework

This section discusses the theoretical framework used to estimate equivalence scales and a cost if living index (CLI) to construct real adult equivalent measures of household income and expenditure. Section 2.1 briefly describes the constant utility cost function for the reference household, a single adult household. Section 2.2 briefly discusses the method of demographically scaling the reference household cost function to provide a QAIDS equivalence scale. The QAIDS CLI is presented in section 2.3, before inequality indices discussed in section 2.4.

2.1 QAIDS Cost Function

The demand system specified in this study for the estimation of equivalence scales and true cost of living indices is QAIDS, a non-linear rank-3 model of Banks, Blundell and Lewbel (1997). QAIDS allows for unique Engel curves that are quadratic in log of household expenditure and thus allow for goods to change from necessities to luxuries across the expenditure distribution. The QAIDS cost function is given in non-demographic form

$$x_R = c_R(u, \boldsymbol{p}) = e^{\left[a(\boldsymbol{p}) + \frac{ub(\boldsymbol{p})}{1 - uc(\boldsymbol{p})}\right]} \tag{1}$$

where u is utility, $\boldsymbol{p}$ denotes the vector of prices p_i, and

$$a(\boldsymbol{p}) = \alpha_0 + \sum_i \alpha_i \log p_i + \tfrac{1}{2} \sum_i \sum_j \gamma_{ij} \log p_i \log p_j \tag{1a}$$

$$b(\boldsymbol{p}) = \prod_i p_i^{\beta_i} \tag{1b}$$

$$\lambda(\boldsymbol{p}) = \prod_i p_i^{\lambda_i} \ , \tag{1c}$$

with the adding up restrictions $\sum \alpha_i = 1$, $\sum \beta_i = \sum \delta_i = \sum \lambda_i = \sum_i \gamma_{ij} = 0$, the homogeneity restriction $\sum_j \gamma_{ij} = 0$, and the symmetry restriction $\gamma_{ij} = \gamma_{ji}$ for all i, j.

2.2 Equivalence Scale Specification

Price scaling (PS), see Ray (1983), the QAIDS cost function (1) with an equivalence scale dependent on prices and household demographics, results in PS-QAIDS cost or expenditure function is given by:

$$x_h = c_h(u, \boldsymbol{p}, z) = c_R(u, \boldsymbol{p}) m_{PS}(\boldsymbol{p}, z) \qquad (2)$$

where $c_R(u, \boldsymbol{p})$ is the QAIDS cost function of Banks, Blundell and Lewbel (1997) and $m_{PS}(\boldsymbol{p}, z)$ is the equivalence scale. The majority of household equivalence scales are based on household size and composition of its members. This study follows this tradition specifying the price scaling equivalence scale as,

$$m_{\mathrm{HH}}(\boldsymbol{p}, \boldsymbol{z_{HH}}) = m_{GEN}(\boldsymbol{z_{HH}}) m_{REL}(\boldsymbol{p}, \boldsymbol{z_{HH}}) \qquad (3)$$

where $\boldsymbol{p} = \lfloor p_1 \ \ldots \ p_{n_g} \rfloor$ is price vector of the n_g goods, $\boldsymbol{z_{HH}} = [n_a \ n_{k1} \ n_{k2} \ n_{k3}]$ a demographic vector containing n_a, n_{k1}, n_{k2}, n_{k3} which denote, respectively, the number of adults, children under five years old, dependents aged between 5 and under 15 years old, and dependents aged between 15 and 25 years old, living in the household.

The first term $m_{GEN}(\boldsymbol{z_{HH}})$ captures the effect of household size and composition in scaling total or aggregate household expenditure. It incorporates the costs of children of different ages and the economies of scale enjoyed by large households. It is specified to have a base of a single adult living alone in the base price period such that the scale measures the number of adult 'equivalent persons' living alone, *EP*. It is defined as

$$m_{GEN} = EP = \left(n_a + \kappa_1 n_{k1} + \kappa_2 n_{k2} + \kappa_3 n_{k3}\right)^{(1-\theta)} \qquad (4)$$

where the κ's represent their corresponding constant utility cost, as a proportion of an adult and θ reflects the economies of scale in household size

The second term $m_{REL}(\boldsymbol{p}, \boldsymbol{z_{HH}})$ captures the effect that household size and composition have in altering the relative demand for goods or "relative effect". It is specified to capture the relative effects of children and is specified as

$$m_{REL}(\boldsymbol{p}, \boldsymbol{z_{HH}}) = \left(\prod_{g=1}^{n_g} p_g^{\nu_g} \right)^{n_k} \tag{5}$$

where p_g is the price of each good $g = 1$ to n_g,

n_g is the total number of goods in this study nine,

n_k is the total number of dependents, $n_k = n_{k1} + n_{k2} + n_{k3}$ and

ν_g are the price elasticities of the equivalence scale with $\sum_g \nu_g = 0$.

An application of Shephard's Lemma, shows that the ν_g have the effect of shifting the budget share demands for good g by ν_g for every dependent present. Note that in the reference period when all prices are unity $m_{REL}(\boldsymbol{p}, \boldsymbol{z_{HH}}) = 1$ and prices do not affect the household equivalence scale.

The product of the two equations (4) and (5) provides the household equivalence scale used in this study to take account of the number of adults and the number and age of dependents of the household, given by

$$m_{\mathrm{HH}}(\boldsymbol{p}, \boldsymbol{z_{HH}}) = \left(n_a + \kappa_1 n_{k1} + \kappa_2 n_{k2} + \kappa_3 n_{k3}\right)^{(1-\theta)} \left(\prod_{g=1}^{n_g} p_g^{\nu_g} \right)^{n_k}. \tag{6}$$

The above specification in the reference period when all prices are unity, also neatly nests many other commonly used equivalence scales for household expenditure and income in studies of inequality.

This study examines seven alternative scales, and the results presented later provide evidence on the sensitivity of the inequality magnitudes and trends to the scale employed. The alternative scales are as follows.

i) PS-QAIDS Estimated Scales

The $\kappa_1, \kappa_2, \kappa_3$ and θ and η_g (for all g = 1 to n_g.) may be estimated along with the standard QAIDS parameters within the budget shares of PS-QAIDS,

$$s_i = \nu_i n_k + \alpha_i + \sum_g \gamma_{ig} \log p_g + \beta_i \log(\tilde{x}) + \lambda_i \prod_g p_g^{\lambda g - \beta g} [\log(\tilde{x})]^2 \quad (7)$$

where,

$$\log \tilde{x} = \log x - a(\boldsymbol{p}) - \log m_{\mathrm{HH}}(\boldsymbol{p}, \boldsymbol{z_{HH}}) \quad (7a)$$

$$m_{\mathrm{HH}}(\boldsymbol{p}, \boldsymbol{z_{HH}}) = (n_a + \kappa_1 n_{k1} + \kappa_2 n_{k2} + \kappa_3 n_{k3})^{(1-\theta)} \left(\prod_{g=1}^{n_g} p_g^{\nu_g} \right)^{n_k} \quad (7b)$$

ii) Generalised Barten-QAIDS Estimated Scales

An alternate method of estimating the parameters of equivalence scales in demand systems is the Barten method, where the equivalence scale multiplies prices in a demand system $p_i^{h*} = p_i m_i^h$. This study estimates "generalised" Barten scales, where $m_i^h = m_{BAR}^h$ for all i = 1 to 9 broad expenditure groups, using the QAIDS demand system where $p_g^* = p_g (n_a + \kappa_1 n_{k1} + \kappa_2 n_{k2} + \kappa_3 n_{k3})^{(1-\theta)}$.

iii) Engel-Quadratic Estimated Scales

Engel scales are estimated such that two households with the same scaled equivalent expenditure have identical budget shares of food. The Engel model is not normally formally specified in utility framework, since the households cost function is only defined over food expenditure and does not easily allow the estimation of a full demand system. The following specification of a single budget share demand for food, as a quadratic function of real scaled total expenditure,

$$s_f = \nu_f n_k + \alpha_i + \sum_g \gamma_{fg} \log(p_g) + \beta_f \log(\tilde{x}^E) + \lambda_f [\log(\tilde{x}^E)]^2 \qquad (8)$$

where,

$$\log \tilde{x}_{ENG} = \log x - \log P_{Stone} - \log(n_a + \kappa_1 n_{k1} + \kappa_2 n_{k2} + \kappa_3 n_{k3})^{(1-\theta)} - n_k \nu_f \log(p_f) \qquad (8a)$$

allows $\kappa_1, \kappa_2, \kappa_3$, θ, and ν_f to be estimated. Stone's price index for each household *h*, is given in logarithmic form by the $\log P_{Stone} = \sum_g s_g \log p_g$ where s_g are the budget shares observed for each household from the data. Solving $s_f^h = s_f^R$ for the equivalence scale gives the form of the quadratic Engel scale.

iv) "Common" Scale

Another form of the equivalence scale commonly imposed in inequality studies[2] has been to specify the scale as the square-root of the number of adults plus 0.5 for each child, thus $\kappa_1 = \kappa_2 = \kappa_3 = 0.5$ and $\theta = 0.5$.

v) OECD Scale

The OECD scale is used in many of the Luxembourg Income Studies (LIS) studies is specified as $\kappa_1 = \kappa_2 = \kappa_3 = 0.5$, with each additional adult counting as 0.7 of the first, thus θ, the measure of economies is not applicable for this scale.

vi) Per Capita

Specifying $\kappa_1 = \kappa_2 = \kappa_3 = 1,\ \theta = 0$ results in a scale where all individuals in the household have identical weighting and thus scaling the measure of household welfare by this scale results in a per capita measure per household.

[2] For example Barrett Crosslet and Worswick (2000)

vii) Per Household (no equivalence scale) 1

If $\theta = 1$ then $m_{\mathrm{HH}}(1, \boldsymbol{z_{HH}}) = 1$ scaling household income or expenditure by the scale results in household income or expenditure as the measure of welfare.

2.3 Price and Cost of Living Indices

Nominal variables need to be divided by a price index for comparisons under different price levels. The CPI series constructed by the Australian Bureau of Statistics (ABS) are fixed weighted averages of goods and services where the weights are the budget shares for a working family household, typically one full-time earner, spouse and two children. Using fixed weights, does not explicitly consider consumer preferences, through the substitution effects of price changes and price-demographic effects. A suitably specified cost of living index allows for such effects.

A cost of living index (CLI), is measured by the ratio of the cost of obtaining a base period level of utility, u_0 at future prices, $\boldsymbol{p_1}$, with given household demographics, $\boldsymbol{z}$, over the cost of the base period level of utility at base level prices, $\boldsymbol{p_0}$ with the given household composition.

$$CLI = \frac{c(u_0, \boldsymbol{p_1}, \boldsymbol{z})}{c(u_0, \boldsymbol{p_0}, \boldsymbol{z})} \tag{9}$$

The QAIDS CLI may be written as

$$\mathrm{CLI} = \exp\left[\mathrm{a}(\boldsymbol{p_1}) - \mathrm{a}(\boldsymbol{p_0}) + \frac{\mathrm{u_0 b}(\boldsymbol{p_1})}{1 - \mathrm{u_0 c}(\boldsymbol{p_1})} - \frac{\mathrm{u_0 b}(\boldsymbol{p_0})}{1 - \mathrm{u_0 c}(\boldsymbol{p_0})} \right] \times \prod_{\mathrm{g}} \left(\frac{\mathrm{p_1}}{\mathrm{p_0}} \right)_{\mathrm{g}}^{\delta_{\mathrm{g}}\, \mathrm{n_k}} \tag{10}$$

The base level of utility u_0 can be obtained as a function of prices, demographics and expenditure by using the PS-QAIDS indirect utility function. The base level of utility is given by

$$u_0 = \log \psi(x_0, \boldsymbol{p_0}) = \frac{\log x_0^{rs}}{b(\boldsymbol{p_0}) + c(\boldsymbol{p_0}) \log x_0^{rs}} \qquad (10a)$$

where the real scaled natural log of expenditure in the base period is given by,

$$\log x_0^{rs} = \log x_0 - a(p_0) - \log EP - (EP - 1) \sum_k \delta_k \log p_{0k} . \qquad (10b)$$

2.4 Welfare and Inequality Measures

Inequality measures generally try and estimate the level of inequality of the population units in an economy or society by measuring the dispersion of a variable associated with welfare. Normally some measure of income or consumption is used as an indicator of welfare. In this study, real per equivalent adult disposable income, and real per equivalent adult expenditure are used as alternative measures of the welfare of household members.

One of the most common measures of the dispersion in welfare is the Gini Coefficient[3], that ranges form G=0 for perfect equality to G=1. The Gini coefficient is implicitly based upon a welfare function that is essentially a rank-order-weighted sum of welfare shares. Consider a population of H households with a measure of welfare w_h, enjoyed by household h and let $\overline{w}$ be the mean welfare.

$$\begin{aligned} G &= \frac{1}{2H^2 \overline{w}} \sum_i \sum_j \left| w_i - w_j \right| \\ &= \frac{1}{H} \sum_h^H \left(1 + \frac{1}{H} - \frac{2}{\overline{w} H} h\, w_h \right) \end{aligned} \qquad \text{where } w_1 > w_2 > w_H \qquad (11)$$

While the Gini coefficient satisfies the Pigou-Dalton Principles of Transfers in that inequality declines when a transfer from a richer to a poorer household is made. However the sensitivity of the Gini to transfers is dependent upon the number of population units between the units involved in the transfer and not the level of welfare. The Gini is most sensitive to transfers

around the modal level of welfare and typically insensitive to transfers to low welfare households, thus violating transfer sensitivity or Principle of Diminishing Transfers.

The "Generalised Entropy" (GE) family of indices developed by Shorrocks (1980) are axiomatic inequality indices in that they are formulated by imposing a a number of desireable properties in the measurement of inequality. The GE family satisfy the Pigou-Dalton Principle of Transfers, Mean Independence, Population Invariance and Transfer Sensitivity (for $c<2$, see below) and are additively decomposable. The GE measures of inequality are given by

$$I_c = \frac{1}{H}\frac{1}{c(c-1)}\sum_h\left[\left(\frac{w_h}{\overline{w}}\right)^c - 1\right] \qquad c \neq 0,1 \qquad (12)$$

$$I_0 = \frac{1}{H}\sum_h \log\left(\frac{\overline{w}}{w_h}\right) \qquad (12a)$$

$$I_1 = \frac{1}{H}\sum_h \frac{w_h}{\overline{w}}\log\left(\frac{w_h}{\overline{w}}\right) \qquad (12b)$$

The parameter c reflects different perceptions of inequality, with lower value representing a higher degree of sensitivity to transfers. The measures used in this study, are the mean logarithmic deviation, I_0, Theil's coefficient, I_1, half the square of the coefficient of variation, I_2 and the Gini coefficient G[4]. The standard errors of these measures are estimated using their respective sample variances.

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[3] See Gini (1912).

[4] Note that the GE family are related to the Atkinson Index (A_ε)of inequality via

$$A_\varepsilon = 1 - \left[\varepsilon(\varepsilon-1)I_{1-\varepsilon} + 1\right]^{1/1-\varepsilon} \qquad \varepsilon \neq 1, \varepsilon \geq 0$$
$$A_1 = 1 - exp\left[-I_0\right] \qquad \varepsilon = 1$$

3 The Data and Estimation

This paper uses the Household Expenditure Surveys (HES) 1975-76, 1984, 1988-89, 1993-94 and 1998-99 from the Australian Bureau of Statistics (ABS) to examine the nature and movement in the inequality of welfare. These data sets contain information on household income, expenditure, demographic characteristics and other household information. Data of this nature can allow the estimation of equivalence scales and cost of living indices from demand system estimation, so that real equivalent measures of expenditure and income can be used as measures of welfare.

For the estimation of the demographically scaled QAIDS the expenditure for each household was grouped into nine broad expenditure categories. Prices for the nine goods were constructed from CPI data by state/territory capital from the ABS. Appendix Table 3.1 contains the nine expenditure categories in terms of the ABS's HES and CPI categories. Appendix Table 3.2 contains the child/dependent age categories used in the specification and estimation of the demographically scaled QAIDS.

The system of equations is estimated by Full Information Maximum Likelihood (FIML) estimation using the SAS 6.12 system for windows. No observations were removed and each household measure was weighted by it's survey weight in the FIML estimation. The estimated PS-QAIDS parameters and their standard errors are presented in Appendix Table 3.3 and 3.4. Appendix Table 3.5 contains the equivalence scales used in the study and Appendix Table 3.6 provides the CPI and CLI figures and associated rates of inflation.

All reported statistics and inequality estimates are based on the full samples and have been weighted by the survey sample weights of the HES so that they adequately reflect the population of Australian households from which they are drawn.

4 Results

4.1 Magnitude and Movement in Australian Inequality

Tables 4.1 and 4.2 present the means, and inequality measured by the I_0, I_1 and I_2, General Entropy (GE) indices and Gini coefficient for real equivalent expenditure and disposable income, respectively, for Australian households in 1975-76, 1984, 1988-89, 1993-94 and 1998-99.

Table 4.1 Australian Expenditure Inequality Estimates

	Inequality Magnitude				
	1975-76	**1984**	**1988-89**	**1993-94**	**1998-99**
Mean Expenditure	$261.32 (2.4095)	$301.48 (2.7226)	$298.86 (2.1582)	$307.55 (2.0275)	$324.69 (2.3770)
I_0	0.1760 (0.0080)	0.1574 (0.0085)	0.1622 (0.0068)	0.1515 (0.0060)	0.1586 (0.0068)
I_1	0.1798 (0.0151)	0.1550 (0.0130)	0.1594 (0.0103)	0.1518 (0.0095)	0.1570 (0.0103)
I_2	0.2356 (0.0241)	0.1832 (0.0185)	0.1884 (0.0141)	0.1823 (0.0132)	0.1847 (0.0141)
Gini	0.3179 (0.0031)	0.3047 (0.0033)	0.3083 (0.0026)	0.2996 (0.0025)	0.3071 (0.0027)
	Period to Period Percentage Change				
	1975-76 to 1984	**1984 to 88-89**	**1988-89 to 1993-94**	**1993-94 to 1998-99**	**1975-76 to 1998-99**
Mean Expenditure	15.4% [11.04]	-0.9% -[0.75]	2.9% [2.93]	5.6% [5.48]	24.2% [18.72]
I_0	-10.6% [-1.61]	3.1% [0.45]	-6.6% -[1.18]	4.7% [0.78]	-9.9% -[1.66]
I_1	-13.8% -[1.24]	2.8% [0.26]	-4.7% -[0.54]	3.4% [0.37]	-12.7% -[1.25]
I_2	-22.3% -[1.73]	2.8% [0.22]	-3.2% -[0.32]	1.3% [0.12]	-21.6% -[1.82]
Gini	-4.2% -[2.91]	1.2% [0.84]	-2.8% -[2.40]	2.5% [2.07]	-3.4% -[2.66]

Notes: Figures in ( ) denote standard errors of the estimates.
Figures in [ ] denote t-ratios of the absolute change in the estimates, for the periods stated.
All estimates are based on 'real', equivalent' measures of disposable income, using the PS-QAIDS CLI, and equivalence scale.

Table 4.2 Australian Disposable Income Inequality Estimates

Inequality Magnitude					
	1975-76	**1984**	**1988-89**	**1993-94**	**1998-99**
Mean Disposable Income	$286.05 (2.0029)	$306.03 (2.4083)	$300.91 (2.2869)	$302.99 (2.0292)	$331.80 (2.4367)
I_0	0.1438 (0.0081)	0.1556 (0.0094)	0.1780 (0.0081)	0.2005 (0.0086)	0.2357 (0.0106)
I_1	0.1246 (0.0092)	0.1333 (0.0093)	0.1595 (0.0133)	0.1611 (0.0099)	0.1738 (0.0095)
I_2	0.1359 (0.0126)	0.1391 (0.0105)	0.2087 (0.0261)	0.1881 (0.0158)	0.1858 (0.0118)
Gini	0.2729 (0.0034)	0.2874 (0.0035)	0.2998 (0.0028)	0.3067 (0.0025)	0.3217 (0.0028)
Period to Period Percentage Change					
	1975-76 to 1984	**1984 to 1988-89**	**1988-89 to 1993-94**	**1993-94 to 1998-99**	**1975-76 to 1998-99**
Mean Disposable Income	7.0% [6.38]	-1.7% -[1.54]	0.7% [0.68]	9.5% [9.08]	16.0% [14.51]
I_0	8.3% [0.95]	14.3% [1.80]	12.7% [1.90]	17.6% [2.57]	64.0% [6.87]
I_1	7.0% [0.67]	19.6% [1.62]	1.0% [0.09]	7.9% [0.93]	39.5% [3.73]
I_2	2.4% [0.20]	50.0% [2.47]	-9.8% -[0.67]	-1.2% -[0.12]	36.8% [2.89]
Gini	5.3% [2.95]	4.3% [2.77]	2.3% [1.83]	4.9% [3.93]	17.9% [10.93]

Notes: Figures in ( ) denote standard errors of the estimates.
Figures in [ ] denote t-ratios of the absolute change in the estimates, for the periods stated.
All estimates are based on 'real' 'equivalent' measures of disposable income, using the PS-QAIDS CLI and Equivalence scale.

The most striking feature of the results is that, over the sample period as a whole (that is 1975-76 to 1998-99), while the estimates for disposable income inequality increased substantially, expenditure inequality fell. This is consistent with Blacklow and Ray (2000) who found a similar result from 1975-76 to 1993-94 using HES data. This study illustrates that despite the overall falling expenditure inequality from 1975-76 to 1998-99, real equivalent expenditure inequality rose from 1993-94 to 1998-99. Meanwhile a significant rise in real equivalent income inequality from 1993-94 to 1998-99, (as shown by the Gini and I_0 in

Table 4.2) indicates a continuation of the rapid growth in real income inequality recorded in earlier sub-periods.

Expenditure inequality fell considerably from 1975-76 to 1984, rising slightly through to 1988-89, before falling again in 1993-94 and rising once more in 1998-99. This result differs from Barrett, Crossley and Worswick (1999) who report a small rise in non-durable consumption inequality throughout the sample periods from 1975-76 to 1993-94 and a significant rise in the Gini over the period. The difference in results is primarily due to the restricted sample of working aged population and removal of the top and bottom 3% of observations in the Barrett, Crossley and Worswick's study; see Blacklow and Ray (2000). Section 4.3.1 further examines the effect of sample restrictions on the Australian inequality estimates.

In contrast to expenditure, disposable income inequality has risen significantly over the 23-year period. Table 4.2 illustrates this with real equivalent disposable income inequality rising by almost 40% in the case of the I_1 index, with half this increase occurring from 1984 to 1988-89, during the speculative boom of the late 1980's. The reported rise in equivalent disposable income inequality through out the period is consistent with the findings of Saunders (1991), Lombard (1990) and Barrett, Crossley and Worswick (1999) amongst others. It is however in contrast to Harding (1997) who found little change in equivalent disposable income inequality from the 1982 IDS and the 1993-94 HES.

The estimates for 1975-76 in Tables 4.1 and 4.2, indicate that the level of equivalent expenditure inequality was considerably higher than that for disposable income. This is in contrast to an earlier result from Podder's (1972) analysis, based on the 1966-68 Survey of

Consumer Expenditures and Finances (SCEF)[5]. However his finding was based on per household figures unadjusted by an equivalence scale. Later in Section 4.3 this study demonstrates that per household income inequality was higher than expenditure inequality in 1975-76 in line with Podder's result for 1966-68. Barrett, Crossley and Worswick (1999) report a higher gross income inequality than non-durable consumption inequality in 1975-76, with income inequality rising further above non-durable consumption inequality from 1975-76 to 1993-94. Tables 4.1 and 4.2 show income inequality had risen to become higher than expenditure inequality in 1993-94, which had been falling before that time. This may reflect the increasing availability of consumer credit to Australian households that from 1988-89 has allowed them to smooth out their expenditure.

The I_0, I_1 and I_2, indices are particularly sensitive to changes in the bottom, middle and top of the welfare distribution, respectively, and allow greater insight into the movements in inequality caused by transfers to different parts of the welfare distribution. The real equivalent expenditure inequality measures presented in Table 4.1, all exhibit the same pattern of movement across the whole sample period, indicating that the movement in expenditure inequality has been consistent amongst the bottom, middle and top of the distribution.

From 1975-76 through to 1988-89, all three of the Shorrocks indices (I_0, I_1, I_2) reported a rise in disposable income inequality, with the I_2 measure reporting a 50% increase from 1984 to 1988-89. The movement in disposable income inequality differs across the distribution from 1988-89 to 1993-94. The I_0, which is sensitive to the lower end of the distribution, records a significant increase while the middle sensitive I_1 reports little change

[5] The SCEF was conducted by staff at the Macquarie and Queensland Universities which sampled 5,500 households, Australia wide. The sample selection and non-response rate of the SCEF has been questioned by Richardson (1979) and Murray (1981), see Section 3.3.3.

and the I_2 measure sensitive to the top of the distribution reports a sizeable fall. Both the bottom and middle sensitive I_0 and I_1 measures report a rise in income inequality from 1993-94 to 1998-99, but the trend in I_2 is again in the opposite direction, downwards. Note that the I_2 measure is half the square of the coefficient of variation and is not transfer sensitive.

Focussing on expenditure inequality in 1998-99, the I_0, I_1 and I_2 estimates show that disparities in equivalent spending of households in the upper tail of the distribution were larger than differences amongst the middle and bottom of the distribution. While for equivalent disposable income, the rise in inequality is higher amongst households in the upper and lower sections of the distribution.

Of special interest is the more recent movement in Australian household inequality, which can be examined due to the recent release of the 1998-99 HES. The strong economic growth from 1993-94 to 1998-99 resulted in a rise in both the mean household real equivalent measures of expenditure (24%) and disposable income (16%), whose growth had been relatively stagnant since 1984. These increases were not uniformly distributed with the I_0 estimate reporting an 18% rise in disposable income inequality and a 4.7% rise in expenditure inequality compared to the I_2 estimate, which reports a 1.3% rise and 1.2% fall respectively.

Given that Blacklow (2002b) demonstrated that employment status of the household head is shown to contribute 20% and 30% respectively of real equivalent expenditure and disposable income inequality in Australia, the impact of economic growth on inequality may be explained by its effect on employment and employment income. While the mean real equivalent measures of welfare grew by approximately 20%, unemployment fell by only 3% and no or little fall in long term unemployment rates. Later in Tables 4.5 and 4.6 the inequality of expenditure by commodity and inequality of income by type or source are examined, to shed more light on reasons behind the movements in aggregate inequality.

4.2 Components of Expenditure and Income Inequality

Table 4.3 provides the I_0 inequality index for Australia by commodity group. This sheds light on which components of household spending are the most unequal and which are chiefly responsible for expenditure inequality in Australia.

Table 4.3 Australian I_0 Inequality of Expenditure by Commodity

I_0	Magnitude	Percentage Change			
Commodity	**Australia 1993-94**	**Australia 1975-76 to 1993-94**		**Australia 1993-94 to 1998-99**	
Food and Non Alcoholic Drinks	0.148	43%	{2.0%}	11%	{2.2%}
Accommodation	0.297	-41%	{-2.9%}	-7%	{-1.4%}
Electricity and Household Fuel	0.238	3%	{0.1%}	-25%	{-5.7%}
Clothing and Footwear	1.732	32%	{1.5%}	4%	{0.7%}
Transport	0.891	33%	{1.6%}	3%	{0.7%}
Health and Personal Care	0.608	-7%	{-0.4%}	15%	{2.8%}
Recreation	0.828	-12%	{-0.7%}	2%	{0.5%}
Alcohol and Tobacco	1.518	25%	{1.3%}	6%	{1.3%}
Miscellaneous and Education	1.009	7%	{0.4%}	3%	{0.5%}

Notes: Figures in { } indicate annualised compound rates of change in I_0.
All measures of income where scaled to be 'real' and 'adult equivalent' by the PS-QAIDS CLI and equivalence scale.

Spending per equivalent adult upon clothing and footwear, alcohol and tobacco and education miscellaneous goods and services was most unequal in 1993-94 (and across all other sample periods). Household expenditure per equivalent adult was most equal for food and beverages, followed by accommodation and electricity and household fuel.

The inequality in Australian accommodation spending has fallen across the survey periods, despite a small rise in 1988-89 due to higher interest repayments on mortgages resulting from high interest rates. The fall in accommodation expenditure inequality has been a major factor behind the fall in real equivalent expenditure inequality from 1975-76 to 1993-

94 in Australia. In contrast the rise in the inequality of food spending in Australia has been rising at 2% a year.

While the overall rise in real equivalent expenditure inequality for Australia over 1993-94 to 1998-99 was small it contained large movements in the inequality of components of spending, as shown in columns 3 and 4 of Table 4.3. Food and non-alcoholic drinks, health and personal care and to a lesser degree, alcohol and tobacco, expenditure inequality rose while, the inequality in household expenditure on fuel and electricity fell. This is possibly reflective of the growth in diversity of tastes for food, alcohol and tobacco and the increase in the proportion of retired households with diverse health expenditures.

The I_0 inequality estimates by source of income are given in Table 4.4. This provides greater insight into the basis of the high magnitude and rise in disposable income inequality recorded for Australia.

Table 4.4 Australian I_0 Income Inequality by Source

I_0	Magnitude	Percentage Change			
Income Source	**Australia 1993-94**	**Australia 1975-76 to 1993-94**		**Australia 1993-94 to 1998-99**	
Disposable Income	0.200	40%	{1.9%}	18%	{4.1%}
Gross Income	0.318	45%	{2.1%}	12%	{2.9%}
Wages	2.779	38%	{1.8%}	1%	{0.3%}
Government Benefits	2.546	-30%	{-2.0%}	3%	{0.8%}
Self Employed Income	4.766	-1%	{-0.1%}	1%	{0.2%}
Investment Income	3.827	17%	{0.9%}	8%	{2.0%}
Other Income	2.814	-2%	{-0.1%}	29%	{6.6%}

Notes: Figures in { } indicate annualised compound rates of change in I_0.
All measures of income where scaled to be 'real' and 'adult equivalent' by the PS-QAIDS CLI and equivalence scale.

The first column of Table 4.4 illustrates that in 1993-94 the income taxation system reduced the I_0 measure of equivalent income inequality by one third. The diversity in the degree of involvement and success in self employment and personal financial investment result in these sources of income being most unequal. Turning to the growth in income inequality, from 1975-76 to 1993-94 it is evident that gross income inequality has been growing at a slightly higher rate than disposable income inequality. The increase in wage inequality in Australia from 1975-76 to 1993-94 was the major influence on the rise of Australia income inequality over this similar period.

The final column of Table 4.4 provides the trend in income inequality by source for Australia from 1993-94 to 1998-99. This indicates a period of rapid growth in disposable income inequality of 4.1% per year. In contrast Australian gross income inequality rose by only 2.9% per year, indicating that the Australian taxation system has significantly contributed to the rise in disposable income inequality from 1993-94 to 1998-99. Over this period inequality of most of the income sources has risen by only a moderate amount, although there has been a considerable rise in investment income inequality. This may be due to the increased ownership of shares in Australia. There has also been a large rise in the inequality of other income, chiefly consisting of child support and maintenance, and workers or accident compensation.

4.3 Sensitivity of Inequality Estimates to the Equivalence Scale

The results reported in Section 4.1 were based upon the use of the PS-QAIDS equivalence scale and cost of living index. This section examines whether the conclusions drawn about the movement and nature of inequality in Section 4.1 are sensitive to the choice of equivalence scale. To reduce the large number of possible results, the sensitivity of equivalence scales in this section focuses on the middle sensitive I_1 index. This section also

provides an insight into the effect of household size and composition on inequality by contrasting the non-scaled per household based measures of inequality, with the inequality based on equivalence scaled measures of welfare.

The inequality of equivalent measures of welfare, are a product of the distribution of per household welfare, household size/composition and the correlation between the two. The greater the variation in household size the greater the measure of inequality so long as, 1 less the economies of scale parameter, $(1-\theta)$ is greater then the covariance between welfare and household size. The smaller the economies of scale, the greater the measure of inequality so long as the product of $(1-\theta)$ and the standard deviation is greater than the covariance between welfare and household size.[6] This provides the framework to examine the sensitivity of inequality to equivalence scale specification. Banks and Johnson (1994) and Jenkins and Cowell (1994) found economies of scale estimates of between 0.3 and 0.4 provided the lowest U.K inequality, while values of 0 and 1 provided the highest estimates.

Tables 4.5 and 4.6 provide the period-to-period percentage change and the magnitude of I_1 inequality in 1998-99, for real expenditure and disposable income respectively for Australia. The movement in equivalent expenditure inequality reported in Section 4.1.1 from 1975-76 to 1998-99 is generally consistent for all the equivalence scales presented as found by Blacklow and Ray (2000) from 1975-76 to 1993-94. When no scale is used, giving per household expenditure inequality, the magnitude of inequality is higher than the other estimates. However only a small fall in inequality is reported across the whole sample, while the per capita estimate reports the largest increase in inequality. Barrett, Crossley and Worswick (1999) discovered a rise in the Gini for consumption inequality from a restricted HES sample from 1975-76 to 1993-94. They found considerable variation in the size of the

trend across scaling methods, with the 'per household' figure reporting the smallest rise and per capita the largest over this period.

Table 4.5 Australian I_1 Real Equivalent Expenditure Inequality Estimates

I_1	Magnitude	Percentage Change				
Equivalence Scale	**1998-99**	**1975-76 to 1984**	**1984 to 1988-89**	**1988-89 to 1993-94**	**1993-94 to 1998-99**	**1975-76 to 1998-99**
PS-QAIDS	0.1570 (0.0103)	-13.8%	2.8%	-4.7%	3.4%	-12.7% -[1.25]
BART-QAIDS	0.1577 (0.0105)	-13.8%	2.1%	-4.5%	3.2%	-13.3% -[1.29]
ENG-Quad	0.1608 (0.0115)	-17.6%	4.1%	-5.7%	4.5%	-15.4% -[1.41]
Common	0.1646 (0.0105)	-11.2%	0.3%	-3.9%	2.9%	-11.9% -[1.21]
OECD	0.1647 (0.0113)	-15.6%	0.8%	-4.7%	2.9%	-16.6% -[1.60]
Per Capita	0.1892 (0.0133)	-16.8%	-0.1%	-5.9%	3.4%	-19.2% -[1.84]
None	0.2058 (0.0112)	-4.3%	1.6%	-3.7%	5.5%	-1.3% -[0.14]

Notes: Figures in ( ) denote standard errors of the estimates.
Figures in [ ] denote t-ratios of the absolute change in the estimates, for the periods stated.
All estimates are based on 'real' measures of expenditure, using the PS-QAIDS CLI to allow for variations in prices.
The 'Common' scale is specified as $\sqrt{\text{Adults} + \tfrac{1}{2}\text{Children}}$.

The results in Tables 4.5 and 4.6 suggest that ignoring changes in household size by using per household estimates, severely under estimates the movements in expenditure inequality. While giving children the same weight as adults and ignoring economies of scale, as the per capita scale does, severely exaggerates the trend when compared to the other scales. It has consistently been found that the reported per capita magnitude of Australian expenditure inequality is higher than that when equivalence scales are used, see for example Blacklow and Ray (2000), Barrett, Crossley and Worswick (1999), Lancaster, Ray and Valenzuela (1999). The Engel scales also result in a higher reported level of inequality in

[6] Buhmann et. al. (1988, p124) also show that the lower the correlation between nominal welfare and household size, the higher correlation between any two equivalent welfare measures.

1998-99 and more exaggerated movements in expenditure inequality than the Barten and PS scales. The lack of any significant economies of scale in the Engel scales, results in a bigger adjustment for larger households, diminishing their level of Engel scaled welfare. Such larger households seem to dominate in the lower end of the expenditure distribution, as the equivalent inequality for this estimate is larger than the scales that consider economies of scale in household expenditure.

Table 4.6 Australian I_1 Real Equivalent Disposable Income Inequality Estimates

I_1	Magnitude	Percentage Change				
Equivalence Scale	**1998-99**	**1975-76 to 1984**	**1984 to 1988-89**	**1988-89 to 1993-94**	**1993-94 to 1998-99**	**1975-76 to 1998-99**
PS-QAIDS	0.1738 (0.0095)	7.0%	19.6%	1.0%	7.9%	39.5% [3.73]
BART-QAIDS	0.1753 (0.0096)	6.5%	18.7%	1.1%	7.8%	37.8% [3.59]
ENG-Quad	0.1762 (0.0103)	7.1%	19.5%	0.6%	10.4%	42.0% [3.69]
Common	0.1839 (0.0098)	5.7%	16.3%	1.2%	6.7%	32.8% [3.29]
OECD	0.1835 (0.0103)	3.7%	16.1%	0.0%	8.2%	30.3% [2.93]
Per Capita	0.2093 (0.0120)	1.6%	11.6%	-1.8%	9.3%	21.6% [2.19]
Per Household	0.2232 (0.0108)	8.3%	14.5%	1.3%	6.9%	34.3% [3.80]

Notes: Figures in ( ) denote standard errors of the estimates.
Figures in [ ] denote t-ratios of the absolute change in the estimates, for the periods stated.
All estimates are based on 'real' measures of disposable income, using the PS-QAIDS CLI to allow for variations in prices.
The 'Common' scale is specified as $\sqrt{\text{Adults} + \text{½Children}}$.

Table 4.6 shows that all the estimates of disposable income inequality rose significantly from 1975-76 to 1998-99. However the size of the changes varied from 21.6% for the per capita scale, to approximately 30% for the OECD and Common scale and approximately 40% for the remaining estimated scales. The PS and Barten, AIDS and QAIDS estimated scales, result in similar estimates and trends for I_1 across all sample periods. In ascending order of magnitude, the Common, OECD, per capita and per household

inequality estimates are higher than the estimated equivalence scale estimates in 1998-99. This is consistent with the Barrett, Crossley and Worswick (1999) findings for gross income on a restricted sample of HES for 1975-76, with the exception that their per household estimate of inequality was the lowest estimate of the four. It is also consistent with Banks and Johnson (1994) and Jenkins and Cowell (1994) for the U.K. The trend in the per capita estimate of inequality, which gives a greater weight to children, reports a much smaller rise from 1975-76 to 1988-89 compared to the other scales and shows a fall from 1988-89 to 1993-94 unlike any of the other estimates.

4.4 Sensitivity of Inequality Estimates to the Price Deflator

The results of Section 4.1 on the movement in aggregate inequality for Australia were based upon the use of the PS-QAIDS equivalence scale and cost of living index. This section examines whether the conclusions drawn about the movement and nature of inequality in Section 4.1 are sensitive to the choice of the price deflator. To reduce the permutations of results, the sensitivity of inequality to the choice of price deflator in this section focuses on the middle sensitive I_1. This sections also provides an insight into the effect of price movements on inequality by contrasting the inequality based on nominal measures of welfare with the inequality based on the CPI and CLI price deflated real measures.

The magnitude and trend of Australian inequality estimates of equivalent expenditure and disposable income as presented in Tables 4.7 and 4.8, do not seem overly sensitive to the choice of price deflator. The apparent insensitivity of inequality to the price index is not surprising given that Blacklow (2002a) demonstrated that using the PS-QAIDS CLI resulted in similar rates of inflation for Australian households characterised by different levels of total expenditure and different demographic structures than to the CPI inflation.

The PS-QAIDS CLI that allows for differing price effects for different levels of expenditure, report smaller falls in equivalent expenditure inequality from 1975-76 to 1984 and larger rise from 1993-94 to 1998-99 than the CPI based estimates. The variation in the CLI across households increased over those periods thus reducing the fall in inequality from 1975-76 to 1984 and increasing the rise from 1993-94.

Table 4.7 Australian I_1 Equivalent Expenditure Inequality Estimates by Price Index

I_1	Magnitude	Percentage Change				
Price Index	**1998-99**	**1975-76 to 1984**	**1984 to 1988-89**	**1988-89 to 1993-94**	**1993-94 to 1998-99**	**1975-76 to 1998-99**
PS-QAIDS	0.1570 (0.0103)	-13.8%	2.8%	-4.7%	3.4%	-12.7% -[1.25]
Stone	0.1535 (0.0100)	-12.7%	2.6%	-5.1%	1.4%	-13.8% -[1.35]
CPI	0.1547 (0.0100)	-15.1%	3.5%	-4.7%	1.9%	-14.7% -[1.46]
None (Nominal Figures)	0.1548 (0.0100)	-15.1%	3.7%	-4.8%	2.1%	-14.4% -[1.43]

Notes: Figures in ( ) denote standard errors of the estimates.
Figures in [ ] denote t-ratios of the absolute change in the estimates, for the periods stated.
All estimates are based on 'equivalent' measures of expenditure, using the PS-QAIDS equivalence scale to allow for variations in household size.
The Stone price index is a weighted average of prices where the weights are the actual budget shares of each household.

The use of nominal equivalent income and expenditure, yields inequality estimates that are very similar in magnitude and trend to the CPI based estimates. Since I_1 is mean independent, the CPI only affects inequality through the regional differences in price experiences of the Australian capital cities.[7] The very minor difference between the magnitude and trend in inequality when deflating for prices using the state based CPI and the nominal estimates, indicates that regional price movements did little to alter the trend or magnitude in inequality. The QAIDS CLI, which allows for different price impacts across households, reports a smaller fall in expenditure inequality and a larger rise in disposable income inequality than

[7] Using the national CPI figure, which does not differ across households, results in the same mean independent inequality as using nominal figures.

the CPI over the whole sample period. This is particularly so from 1993-94 to 1998-99, when the price of health commodities rose by 20% and the price of food, which had been rising with the CPI, rose at 16% compared to the CPI, which rose by 11%. The Stone price index, in using households' actual budget shares to estimate a price index individual to each household, may best capture price effects for each household. Deflating nominal welfare measures using this price index, reports a smaller fall in expenditure inequality and a smaller rise in disposable income inequality, particularly from 1993-94 to 1998-99, suggesting that price movements have helped to reduce the inequality in Australia.

Table 4.8 Australian I_1 Equivalent Disposable Income Inequality Estimates by Price Index

I_1	Magnitude	Percentage Change				
Price Index	**1998-99**	**1975-76 to 1984**	**1984 to 1988-89**	**1988-89 to 1993-94**	**1993-94 to 1998-99**	**1975-76 to 1998-99**
PS-QAIDS	0.1738 (0.0095)	7.0%	19.6%	1.0%	7.9%	39.5% [3.73]
Stone	0.1709 (0.0094)	6.7%	19.8%	0.9%	6.2%	36.9% [3.52]
CPI	0.1728 (0.0094)	6.0%	20.2%	1.3%	7.0%	38.0% [3.62]
None (Nominal Figures)	0.1728 (0.0094)	6.0%	20.4%	1.2%	7.1%	38.3% [3.63]

Notes: Figures in ( ) denote standard errors of the estimates.
Figures in [ ] denote t-ratios of the absolute change in the estimates, for the periods stated.
All estimates are based on 'equivalent' measures of disposable income, using the PS-QAIDS equivalence scale to allow for variations in household size.
The Stone price index is a weighted average of prices where the weights are the actual budget shares of each household.

4.5 Sensitivity of Inequality Estimates to Sample Exclusion

Many studies of inequality frequently restrict the sample of survey data obtained from statistical agencies, by removing certain observations or focussing the study on a certain type of households. This restricts the inequality analysis to those observations or households selected and will bias the result if it is to be used as a national measure of inequality. This study examines the sensitivity of the magnitude and trend in inequality to the exclusion of observations from the sample. In particular, removing: (i) multiple family households, (ii)

non-working aged households, (iii) the top and bottom three percent and (iv) the top and bottom one percent, of observations from the distribution of the welfare variable in question from the sample. In addition to (i) to (iii) the top and bottom one percent of observations from both the expenditure and income distributions are removed (iv) and v) a combination of (i), (ii) and (v) are removed.

Table 4.9 Australian I_1 Real Equivalent Expenditure Inequality Estimates by Sample Exclusion

Observations Excluded		Magnitude	Percentage change				
		1998-99	**1975-76 to 1984**	**1984 to 88-89**	**1988-89 to 93-94**	**1993-94 to 98-99**	**1975-76 to 1998-99**
	None	0.1570 (0.0103)	-13.8% -[1.24]	2.8% [0.26]	-4.7% -[0.54]	3.4% [0.37]	-12.7% -[1.25]
(i)	Number of Families in Household > 1	0.1593 (0.0106)	-15.8% -[1.44]	6.0% [0.55]	-3.4% -[0.38]	2.3% [0.24]	-11.8% -[1.15]
(ii)	Age of HH Head < 25 or Age of HH Head > 60	0.1321 (0.0088)	-14.2% -[1.16]	2.9% [0.25]	-1.8% -[0.18]	0.8% [0.08]	-12.6% -[1.15]
(iii)	Bottom and top 3% of household expenditure	0.1178 (0.0075)	-0.3% -[0.03]	2.1% [0.21]	-7.0% -[0.86]	7.9% [0.88]	2.2% [0.23]
(iv)	Bottom and top 1% of Household expenditure	0.1364 (0.0084)	-7.0% -[0.70]	1.6% [0.17]	-5.3% -[0.66]	6.4% [0.74]	-4.8% -[0.52]
(v)	Bottom and top 1% of household disposable expenditure and income	0.1346 (0.0083)	-7.2% -[0.71]	1.0% [0.10]	-5.4% -[0.68]	5.9% [0.68]	-6.1% -[0.66]
(vi)	Number of Families>1, Age of HH Head < 25 or Age of HH Head > 60, bottom and top 1% of household expenditure and disposable income	0.1163 (0.0076)	-6.4% -[0.57]	0.9% [0.09]	0.6% [0.07]	5.8% [0.63]	0.5% [0.05]

Notes: Figures in ( ) denote standard errors of the estimates.
Figures in [ ] denote t-ratios of the absolute change in the estimates, for the periods stated.
All estimates are based on 'real' 'equivalent' measures of disposable income, using the PS-QAIDS CLI and equivalence scale.

Tables 4.9 and 4.10 provide the real equivalent expenditure and disposable income inequality, respectively, by various sample exclusions. The trend in expenditure inequality appears quite sensitive to the exclusion of observations from the sample. Not surprisingly, eliminating the extreme 1% and 3% of observations based on nominal welfare, reduces the

magnitude of inequality. However it also significantly reduces the fall in expenditure inequality in the full sample, resulting in a reported rise of 2.2% when exclusion (iii) is enforced. Restricting the sample to working aged household heads reduces the magnitude of inequality in 1998-99, but reports similar movements in inequality to the full sample. The exception is from 1993-94 to 1998-99 when it only reports a small rise in inequality when ignoring the increase in the number of lower spending retired households. Restricting the sample to working aged, single family households and removing the extreme 1% of the expenditure and income distribution (ie. exclusion (vi)), results in virtually no change in expenditure inequality over the sample period in contrast to the 12.7% fall reported in the full sample.

Table 4.10 Australian I_1 Real Equivalent Disposable Income Inequality Estimates by Sample Exclusion

Observations Excluded		Magnitude	Percentage change				
		1998-99	1975-76 to 1984	1984 to 88-89	1988-89 to 93-94	1993-94 to 98-99	1975-76 to 1998-99
	None	0.1738 (0.0095)	7.0% [0.67]	19.6% [1.62]	1.0% [0.09]	7.9% [0.93]	39.5% [3.73]
(i)	Number of Families in Household > 1	0.1771 (0.0097)	7.2% [0.68]	22.6% [1.80]	1.6% [0.15]	6.8% [0.80]	42.5% [3.95]
(ii)	Age of HH Head < 25 or Age of HH Head > 60	0.1460 (0.0083)	13.4% [1.16]	19.1% [1.45]	5.1% [0.44]	0.2% [0.02]	42.2% [3.63]
(iii)	Bottom and top 3% of household expenditure	0.1623 (0.0088)	8.3% [0.76]	8.6% [0.85]	6.6% [0.73]	10.5% [1.26]	38.4% [3.58]
(iv)	Bottom and top 1% of Household expenditure	0.1690 (0.0091)	7.5% [0.71]	11.5% [1.06]	4.7% [0.50]	10.5% [1.26]	38.7% [3.66]
(v)	Bottom and top 1% of household disposable expenditure and income	0.1484 (0.0080)	10.9% [1.03]	1.1% [0.12]	11.0% [1.35]	14.1% [1.75]	42.1% [4.09]
(vi)	Number of Families>1, Age of HH Head < 25 or Age of HH Head > 60, bottom and top 1% of household expenditure and disposable income	0.1257 (0.0069)	19.4% [1.64]	-3.3% -[0.34]	21.7% [2.48]	7.6% [0.96]	51.3% [4.53]

Notes: Figures in ( ) denote standard errors of the estimates.
Figures in [ ] denote t-ratios of the absolute change in the estimates, for the periods stated.
All estimates are based on 'real' 'equivalent' measures of disposable income, using the PS-QAIDS CLI and equivalence scale.

While Table 4.10 shows that the effect of sample restrictions is not so dramatic on disposable income inequality across the entire period of analysis, the combined exclusion results in considerable differences in the trend of inequality. The combined sample exclusion (vi), implied increases in disposable income inequality from 1975-76 to 1984 and 1988-89 to 1993-94 of approximately 20%, which are much higher than those reported by the full sample. It also reported a fall between 1984 and 1988-89 when compared to the full-sample trend that reported a 20% rise. The inequality of working households' reports a much smaller rise in income inequality than for the full sample, suggesting the distribution of labour income became less unequal relative to household income over the period. Restricting the analysis to single-family households does not seem to alter the magnitude or trend when compared to the full sample for both income and expenditure inequality. This suggests that proportion of households with multiple families is reasonably consistent across the welfare distribution.

5 Conclusions

This paper has examined the economic inequality of Australian households in a framework based on utility maximising household behaviour theory. It has considered the implications for the measurement of inequality of different indicators of inequality, household welfare, equivalence scales, price indices and sample selection. The following points summarise the findings of the paper for Australian inequality:

- Real equivalent disposable income inequality has been consistently rising throughout the period 1975-76 to 1998-99.
- Real equivalent expenditure inequality fell from 1975-76 to 1998-99, but rose in the two sub-periods 1984 to 1988-89 and 1993-94 to 1998-99.

- The inequality of disposable income was lower than that of expenditure at the beginning of the sample but rose to become higher than expenditure by 1993-94, in line with consumption smoothing theories in the absence of credit constraints.

- Disposable income inequality is higher in magnitude, for the I_0 measure, which is more sensitive to the lower part of the distribution than the I_1 or I_2 indices. The I_0 reports smaller falls and larger rises for expenditure and disposable income respectively, across the sample period, suggesting that largest increase in equality has occurred in the lower section of the welfare distribution.

- The fall in inequality expenditure of accommodation, being a large part of household budgets, has been a major source of the fall in Australian expenditure inequality from 1975-76 to 1993-94.

- The rise in wage income inequality for Australia from 1975-76 to 1993-94 was a major influence on the rise in disposable income inequality over this period.

- The rise in disposable income inequality was larger than rise gross income inequality in Australia from 1993-94 to 1998-99, indicating that while the taxation system still reduced income inequality it was not so successful as it had been in the past.

- These movements are broadly consistent for a range of equivalence scales, although the magnitude and the size of the movements vary between different scales. This is especially so for the per capita measures of welfare inequality and to a lesser extent the Engel and non-estimated scales which inflate the magnitude of inequality and exaggerate the movement in inequality, while the per household estimates dampen movements.

- The PS-QAIDS CLI results in smaller rises and falls in expenditure and income inequality from 1975-76 to 1988-89 than the CPI, but larger rises in both from 1993-94 to 1998-99. This suggests that price movements in Australia from 1975-76 had generally helped to reduce inequality but from 1993-94 to 1998-99 they have contributed to inequality.

- Regional price movements have done little to help reduce inequality. Allowing for differing impacts of price movements through the CLI helped to reduce expenditure inequality from 1975-76 to 1993-94, but increased it from 1993-94 to 1998-99.

- The exclusion of certain observations from the sample has a significant effect in altering the magnitude and trend in expenditure inequality. For example removing the top and bottom 1% of the reported expenditure distribution, halves the reported rise from 1975-76 to 1984 and doubles the rise from 1993-94 to 1988-89 reported by the whole sample. Removing a large number of 'outlying' observations even results in no reported fall in expenditure inequality over the period 1975-76 to 1998-99. Sample exclusions also alter the size of the magnitude and trend in disposable income inequality within periods but still report a significant rise from 1975-76 to 1998-99.

An interesting result revealed in this study for Australia is that while disposable fortnightly income inequality has increased significantly from 1975-76 to 1998-99, fortnightly expenditure inequality has fallen slightly. This may suggest that the income rich are earning more but spending less, while the income poor are earning less but spending more. This could have dire consequences for the poor if maintained over a longer period, eroding their wealth and sending them bankrupt. This begs the question of examining the trend and magnitude of the inequality of household wealth in Australia.

Unfortunately the cross sectional data used in this study for Australia only provides a fortnightly snapshot of households' savings behaviour and their investment income. Extrapolating this into wealth is problematic as the survey responses to income questions are often understated and is sensitive to the assumed rate of return on a household's investments. Thus to analyse the inequality of households lifetime welfare and/or wealth requires either, a panel data set tracking household income, expenditure and characteristics over time or a series of cross-sectional data on households that includes wealth is required.

A greater allowance could be made for the heterogeneity of household characteristics or situations that affect household behaviour, such as employment status, data allowing. This could provide more accurate equivalence scales and price indices, providing a more accurate picture of inequality. Greater disaggregation of commodities in the demand system analysis, may result in a more useful cost of living index, capturing price movents in goods other than from the nine commodity groups used in this study. Developments in modelling the household demographic cost function, may allow the independence of base utility assumption to hold, theoretically justifying the use of equivalence scales to make welfare comparisons across households.

Appendix

Appendix Table 3.1 Broad Expenditure Goods

Number	Broad Expenditure Goods	CODE
1	Food and Non Alcoholic Beverages	FOOD
2	Accommodation	ACCOM
3	Electricity and Household Fuel	POWER
4	Clothing and Footwear	CLOTH
5	Transport	TRANS
6	Health and Personal Care	HEALTH
7	Alcohol and Tobacco	ALCT
8	Recreation	REC
9	Miscellaneous and Education	MISC

Appendix Table 3.2 Child/Dependent Categories

Young Children	n_{k1}	children under 5 years [a]
Children	n_{k2}	children 5 to 14 years [a]
Dependents (Students)	n_{k3}	dependents 15 to 24 years
Total Children (and dependents)		$n_k = n_{k1} + n_{k2} + n_{k3}$

Appendix Table 3.3 PS-QAIDS Cross Price Term Parameter Estimates

γ_{ij}	1	2	3	4	5	6	7	8	9
1	0.1166 (0.0186)	-0.1001 (0.0093)	-0.0535 (0.0055)	0.0654 (0.0092)	-0.0359 (0.0163)	0.0081 (0.0061)	0.0144 (0.0136)	0.0528 (0.0105)	-0.0676 (0.0000)
2		-0.1688 (0.0177)	-0.1049 (0.0059)	0.0210 (0.0095)	0.2118 (0.0155)	0.0022 (0.0064)	0.0178 (0.0112)	0.1192 (0.0094)	0.0018 (0.0000)
3			-0.0198 (0.0034)	0.0275 (0.0044)	0.0576 (0.0092)	0.0641 (0.0030)	0.0236 (0.0060)	0.0465 (0.0056)	-0.0411 (0.0000)
4				0.1037 (0.0093)	-0.0440 (0.0115)	-0.0282 (0.0054)	-0.0923 (0.0086)	-0.0587 (0.0079)	0.0056 (0.0000)
5					-0.2697 (0.0291)	0.0352 (0.0079)	0.0497 (0.0150)	-0.0414 (0.0161)	0.0368 (0.0000)
6						-0.0711 (0.0046)	-0.0351 (0.0059)	0.0039 (0.0048)	0.0208 (0.0000)
7							0.0581 (0.0151)	-0.0502 (0.0095)	0.0141 (0.0000)
8								-0.0717 (0.0127)	-0.0004 (0.0000)
9									0.0301 (0.0111)

Notes: Figures in ( ) denote standard errors

Appendix Table 3.4 PS-QAIDS Parameter Estimates

Intercepts		Slopes		Curvature		Demographic	
α_1	0.7505 (0.0168)	β_1	-0.1026 (0.0066)	λ_1	0.0010 (0.0006)	υ_1	0.0089 (0.0006)
α_2	0.8456 (0.0310)	β_2	-0.2093 (0.0113)	λ_2	0.0185 (0.0010)	υ_2	-0.0015 (0.0007)
α_3	0.4766 (0.0040)	β_3	-0.1364 (0.0017)	λ_3	0.0101 (0.0002)	υ_3	0.0001 (0.0002)
α_4	-0.2488 (0.0216)	β_4	0.0969 (0.0079)	λ_4	-0.0074 (0.0007)	υ_4	0.0027 (0.0003)
α_5	-0.3158 (0.0369)	β_5	0.1101 (0.0132)	λ_5	-0.0048 (0.0012)	υ_5	-0.0021 (0.0007)
α_6	-0.0871 (0.0148)	β_6	0.0691 (0.0056)	λ_6	-0.0074 (0.0005)	υ_6	-0.0038 (0.0003)
α_7	-0.2254 (0.0280)	β_7	0.0825 (0.0099)	λ_7	-0.0039 (0.0009)	υ_7	-0.0039 (0.0005)
α_8	-0.2778 (0.0194)	β_8	0.1271 (0.0074)	λ_8	-0.0120 (0.0007)	υ_8	-0.0059 (0.0003)
α_9	0.0821 (0.0176)	β_9	-0.0373 (0.0062)	λ_9	0.0059 (0.0006)	υ_9	0.0055 (0.0004)
						θ	0.3700 (0.0063)
						κ_1	0.2937 (0.0331)
	Log Likelihood		1,149,264			κ_2	0.4481 (0.0332)
						κ_3	0.6074 (0.0472)

Notes: Figures in ( ) denote standard errors
Almost all parameters are significant at the 1% level of significance

Appendix Table 3.5 Australian Estimated Equivalence Scales [1]

Household Type [2]				PS QAIDS	PS AIDS	Barten QAIDS	Barten AIDS	Engel Quadratic	Engel Linear	OECD	Common
n_a	n_{k1}	n_{k2}	n_{k3}								
1	0	0	0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1	1	0	0	1.18	1.18	1.23	1.21	1.04	1.03	1.50	1.41
1	0	1	0	1.26	1.29	1.34	1.33	1.40	1.39	1.50	1.41
1	0	0	1	1.35	1.37	1.44	1.41	1.65	1.63	1.50	1.41
1	1	1	1	1.71	1.76	1.91	1.86	2.08	2.04	2.50	2.00
2	0	0	0	1.55	1.55	1.57	1.56	1.96	1.95	1.70	1.41
2	1	0	0	1.69	1.70	1.75	1.73	2.00	1.97	2.20	1.73
2	0	1	0	1.76	1.78	1.84	1.82	2.36	2.32	2.20	1.73
2	0	0	1	1.83	1.85	1.93	1.90	2.60	2.56	2.20	1.73
2	1	1	1	2.14	2.19	2.34	2.28	3.03	2.96	3.20	2.24
2	0	2	0	1.95	1.99	2.10	2.07	2.76	2.70	2.70	2.00
2	1	2	0	2.08	2.12	2.26	2.21	2.79	2.72	2.70	2.24
2	1	2	1	2.32	2.38	2.57	2.50	3.43	3.33	3.70	2.45
3	0	0	0	2.00	2.00	2.03	2.02	2.91	2.87	2.40	1.73
4	0	0	0	2.39	2.41	2.45	2.43	3.86	3.78	3.10	2.00

Notes: 1. Equivalence scale is given by $\left(n_a + \kappa_1 n_{k1} + \kappa_2 n_{k2} + \kappa_3 n_{k3}\right)^{(1-\theta)}$ and is normalized at unity for a single adult household.

2. n_a is the number of adults in the household.
n_{k1} is the number of children aged less than five years in the household.
n_{k2} is the number of children aged five and under fifteen years in the household.
n_{k3} is the number of dependents aged fifteen years and over in the household.

Appendix Table 3.6 CLI Estimates compared to CPI, 1975-76 to 1998-99

Real Equivalent Expenditure:	CLI for				CPI
	Low	Average	High	Average	
	No Dependents			Two Dependents	
1975-76	0.325	0.325	0.326	0.326	0.351
1984	0.721	0.719	0.716	0.718	0.704
1988-89	1.000	1.000	1.000	1.000	1.000
1993-94	1.243	1.253	1.262	1.249	1.192
1998-99	1.384	1.398	1.408	1.393	1.316
1975-76 to 1984	9.8%	9.8%	9.7%	9.7%	8.5%
1984 to 1988-89	7.5%	7.6%	7.7%	7.6%	8.1%
1988-89 to 1993-94	4.4%	4.6%	4.8%	4.5%	3.6%
1993-94 to 1998-99	2.2%	2.2%	2.2%	2.2%	2.0%
1975-76 to 1998-99	6.50%	6.55%	6.57%	6.52%	5.91%

Notes: The low (mean – std. dev.), average (mean) and high (mean + std. dev.) real equivalent expenditure levels are based upon the distribution of log expenditures in the 1993-94 HES using the PS-QAIDS a(***p***) price term and equivalence scale.
The 'Average' real equivalent expenditure in nominal 2001 dollars is approximately $374 per week.

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