

Determining the Minimum Wage: A Household Expenditure Approach

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Abstract

The establishment of a minimum wage, a wage below which no employer can pay able bodied full-time employees, is a common feature in most industrialised societies. In many of these societies the minimum wage is determined by government fiat. In Australia, the prevailing method of minimum wage determination has been by way of industrial tribunals. In their minimum wage role both governments and industrial tribunals need to determine minimum wage criteria as well as mechanisms for operationalising the criteria. This paper proposes 'reasonable living' needs criteria for minimum wage determination. By analysing the Household Expenditure Survey it also suggests the amount which would constitute a 'reasonable living' minimum wage for labourers in Australia.

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1. Introduction

An article in a recent issue of this journal examined the evolution of minimum wage determination and minimum wage concepts in Australia (Plowman 1995). That article highlighted important criteria and developments in wage determination designed to protect low income earners. It concluded that 'finding the appropriate level of minimum wages has required an assessment of both needs and economic capacity. Neither of these concepts has been easy to define and has led to much fruitless searching for formulae' (p. 286). The paper further concluded that in its most recent guise, that of the Arbitrated Safety Net, the minimum wage had become a poorly defined concept lacking any clear criteria and determined on the basis of guesswork. Such a formulation would 'invite further examination of the concept and rationale of minimum wage determination' (p. 287).

This article builds on these findings and proposes a method for determining minimum wage rates. The need for minimum wage formulae which are industrially acceptable, economical feasible and administratively viable is heightened at a time when the Australian Industrial Relations Commission is engaged in a review of the Living Wage.

The paper is presented in a number of sections. The next section defines our meaning of the term 'minimum wage' and highlights some of the key criteria imported from the previously cited work. The third section gives details of the statistical analysis employed in the paper. In doing so it analyses the data sample and expenditure categories contained in the 1993/94 Household Expenditure Survey; provides the basis upon which different expenditure categories were included or excluded in our analysis; gives details of the estimation model used; and reports on other salient features of the analysis. Section 4 presents the results of our findings in a way which allows the relative effects of the various characteristics analysed to be clearly seen. Findings on the following are presented: average expenditure per week for adult labourers; the impact of age on expenditure; the effect of occupation on expenditure; the effect of the principal source of income; the effect of employment status; the effect of household type; and the effect of household size. The final section is by way of summary and conclusion.

2. Definition and Criteria

We have defined the minimum wage to be 'the lowest weekly wage or wage rate payable to an able-bodied full-time employee without regard to the industry or calling in which that employee is employed and having regard

to the reasonable needs of the employee in the Australian community'. This definition accords with industrial tribunal practice over many years.

Apart from pointing to 'reasonable needs' the definition, of itself, does not indicate the way in which the minimum wage should be determined. The criteria employed in this analysis is based on the earlier reported historical analysis. This suggested that the application of some 'needs' concept for reasonable living should be limited to the needs of an individual rather than the needs of a family. It was the role of the social welfare system to augment family income on the basis of actual, rather than hypothesised, needs. The analysis also pointed to the desirability of using gender inclusive criteria and the difficulty in formulating acceptable productivity-based criteria. Our analysis involves using the Australian Bureau of Statistics' Household Expenditure Survey to determine what is needed for 'reasonable living' for labourers without dependents in the Australian community.

3. The Statistical Analysis

In the past, synthetic methods have been used to construct what were deemed to be appropriate weekly expenditure amounts for classes of workers under consideration. Such methods necessarily involve both explicit and implicit value judgments, running the risk of losing touch with the realities of ordinary Australian life and the changing patterns of consumption. An analysis of actual expenditure by Australian households makes it possible to reveal the differences in expenditure between occupational, social and income groups, so revealing the actual consumption level of the group of interest.

If the study was to be limited to the set of households in which each household comprises a single adult labourer with no dependants then it would be restricted to a sample so small that it would not give the required reliability of estimate. An analysis of all of the 8400 Australian households in the Household Expenditure Survey has made it possible to separate out the social and occupational group differences, leaving the expenditure of the single labourer with no dependants clearly identified.

Data Sample and Expenditure Categories

The observations on which the regression is based were obtained from the sample of 8,400 households in the ABS 1993-94 Household Expenditure Survey. The Survey covered households in private dwellings, including long term residents of caravan parks, but excluded residents of special dwellings such as hotels and institutions. Expenditure information was

obtained by questionnaire and special diaries kept by household members. Negative expenditure, resulting from refunds and trade-ins, was included. Information was obtained for the entire household and individuals within the household over a two week period. Major intermittent expenditures were recorded for longer periods as shown in Table 1.

Table 1. Intermittent Large Expenditures Recorded in the 1993-94. Household Expenditure Survey

Recorded	Type of Expenditure	Excluded from Study¹
Last payment	Health insurance, ambulance insurance etc	
	Electricity, gas, rates, body corporate fees	For other property
	Rent, insurance, loan payments	For other property
	Interest payments	For other property
	Personal insurance and superannuation	
Last 3 months	Health services	
	Telephone operating costs	For other property
	Consumer durables	Air-conditioners, clothes dryers and dish washers
	Repairs and maintenance	For other property
Last 12 months	Travel within Australia	
	Education	School fees
	Land tax, telephone installation, excess water	For other property
	Alterations and additions to property	All
	Vehicle expenses	
Last two years	Travel overseas	All
	Purchase of house or land	

¹ See the next section.

In all, 443 expenditures categories were included in the survey. As detailed in the next section, not all these categories were considered relevant for minimum wage purposes.

Classification of Expenditure

The analysis of expenditure seeks to determine the ‘reasonable living’ expenditure of minimum wage recipients. It follows that expenditure on luxury goods or expenditure beyond that required for a reasonable life should be excluded. Further, since the analysis aims to determine the expenditure of an individual without regard to dependents, any expenditure

on dependents should be excluded. Thus, a key step in the analysis is the distinction between expenditure relevant to the setting of the minimum wage and expenditure which is not relevant.

In classifying expenditures into 'reasonable living' and 'beyond reasonable living' it has to be recognised that the classification system used by ABS is aimed at identifying the type of product or service to which the expenditure is directed rather than identifying the essential or luxury nature of that expenditure. Hence expenditure on a Holden would be classified in the same way as expenditure on a Jaguar or Mercedes. This issue is addressed below in the modelling phase.

In the final analysis 63 of the 443 expenditure categories were discarded for present purposes. Twenty four of these were clearly dependent related expenditures and 39 categories were considered to be not 'reasonable living' expenditures. The latter included expenditures on second properties, paintings, carvings, sculptures, air-conditioners, dishwashers, clothes dryers, swimming pools, caravans, and boats.¹

Variation

In understanding the data it is important to consider the variation around the mean as well as the mean itself. The variation of the *data* about the mean reflects two aspects of the sampling: the choice of households (if different households were in the sample the data would be different); and the choice of the fortnight for each household (if the same households were sampled in a different time of the study year the data would also be different).

The latter variation is undesirable for present purposes since a minimum wage rate needs to provide for expenditures over a longer term. The variation in the data is an artefact of the Survey methodology in this respect.

The former variation reflects the diversity of households in Australia. Some of this diversity in expenditure relates to factors such as household size which are measurable and were recorded in the Survey. In the analysis presented below such explicable variation was quantified and the results adjusted for it.

The remaining variation cannot be separated from the second type of variation due to the choice of fortnight. The variation (as measured by the standard deviation) is approximately 22% of the mean value. If the data was collected over an entire year for each household in the Survey the variation might be reduced to substantially less, perhaps to as little as 5% of the mean.

The Estimation Model

The estimating model is a specific purpose model, being designed to obtain the best possible estimate of the average expenditure of an adult labourer living alone with no dependants. Thus, the regression is so designed that the constant in the resulting equation is that estimate.

Ideally the analysis would use annual expenditure data and would attempt to model a lower quartile of the distributions of incomes since it seems inappropriate to use information from households with a particularly high level of income and correspondingly high level of expenditure. However, since the data is based on a fortnightly sampling, significant extra variability has been introduced to the distribution by expenditure which is irregular or, if regular, is less frequent than fortnightly. For example, expenditure on car maintenance for many households is recorded as zero but this does not imply that their average expenditure over a whole year would be zero – rather they had no car maintenance expenditure during the period for which they were sampled.

An added complication is that many of these irregular or infrequent expenditures are the ones which are possibly most affected by differences in income. Expenditure on the purchase of motor vehicles would be a case in point.

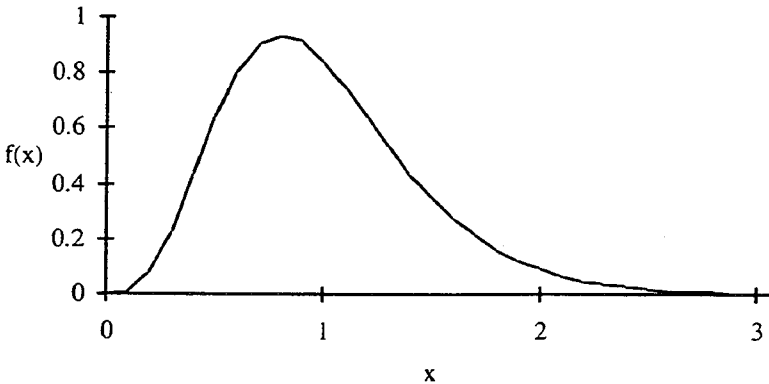
One approach might be to just consider households consisting of a single labourer with no dependents and whose income is predominantly wages and salary. This approach would lead to an unacceptably small sample, lacking the precision required for the current task.

Our approach has been to fit a model to the full dataset and to use this to predict the expenditure a household consisting of a single adult labourer with no dependents and whose income is predominantly wages and salary. To this end, a regression model was fitted with explanatory variables being the: state or territory; the occupation of the principal member of the household, specified by broad single digit codes in the Australian Standard Classification of Occupations; age, in five year groupings; number of dependents; number of income earners in the household; household type; principal source of income; and number of spenders.

On the basis of this analysis it is possible to estimate mean expenditure per week for any household type as specified by the above variables. In particular it possible to estimate the expenditure per week for a household of the type covered by the minimum wage.

The data was inherently asymmetrically distributed with almost all expenditures being moderate but few quite large. This substantial asymmetry means that standard regression methods which assume a normal distribution are not appropriate and have the potential to be quite misleading. Mathematical techniques are available to permit an asymmetrical distribu-

Figure 1. Gamma Distribution of the Type Used in the Study



tion to be assumed for the data. In this case a Gamma distribution was used as a reasonable approximation to the data. The shape of this distribution is illustrated in Figure 1.

The analysis was done at the household level but information about individual items was used to define expenditure classes.

Exclusion of Income

An issue which needed to be considered was the possible effect of income on expenditure and how it should be treated. Ideally the model should not include income since the purpose is to estimate what income is necessary for certain types of household. Including income in the model would give a circular relationship. The purpose of including in the model variables such as occupation and source of income which are income related was to avoid needing to have income explicitly included.

That said, it was necessary to examine whether there remains a component of the variation which can only be explained by income. No such component was found, suggesting that there is no income variable contributing to the explanation of the level of spending. This is not to say that expenditure is independent of income. Spending clearly does depend on income but it was found that personal, occupational, family and other social characteristics explained expenditure so completely that there was nothing left for income to explain, *when treated as additional to the other characteristics.*

The importance of this feature of the model is that expenditure is determined by occupational and social category, so that it provides a firm basis for determining the income needed to sustain a normal lifestyle for a worker in the category of interest.

Use of Categories

Appendix A provides details of the estimates of the different categories employed in the statistical analysis. Although the estimation results in this Appendix can be expressed as a single function of many variables, most of the estimated coefficients are for dummy or category variables. In the estimating model, a category variable has the value 1 if an individual is in the category and the value 0 if an individual is not in the category.

The estimated coefficient is interpreted as a shift, up or down, in the ‘constant’ regression intercept. Results are additive, so that the expenditure for a composite category can be found by adding the individual category coefficients (which may be negative) to the regression constant.

Labourers as the Reference Group

The reference group, the category to which the single labourer belongs is omitted from each of the six classes of category variables, as follows:

Class	Category Omitted
Age	20 to 34 years of age
Occupation	Labourers and related occupations
Principal Source of Income	Wage and salary
Employment Status	Full time
Household Type	Single adult
Household Size	One adult with no dependants

The effect is that the omitted categories are represented, as a composite, by the regression constant. The constant measures the expenditure of a labourer aged between 20 to 34 years, in full-time employment as a wage earner and living alone. Together they fully characterise the income group of interest, which has been made the reference group. The coefficients estimated in each class of category variables are differences from the (omitted) reference category and are presented individually in the Results sections.

House Payments

The payment of the interest and principal components of mortgages was included in the analysis as 'reasonable living' expenditure. We also sought to include the purchase of the principal dwelling but this proved problematic. The relevant expenditure category (Item 754) includes not only the principal dwelling but also other property, the latter being deemed 'not reasonable living' expenditure for minimum wage purposes. In addition, the inclusion of this item led to a high degree of instability in the analysis due to the variable nature of this expenditure category. Though the average total expenditure on the purchase of property was \$1 per week, the variation was between -\$700 and +\$700. Because of this great variability the expenditure category was not included in our regression. Instead 85% of the average weekly expenditure on this category was added to our estimate of weekly expenditures, that proportion being based on the fact that the interest and principal components of principal dwellings represented 85% of the total of all such payments.

4. Results

Results are presented in sections, so that the relative effects of the various characteristics can be clearly seen. To indicate how reliable each coefficient is, the 95% confidence limits are shown.

Expenditure by a Single Labourer with No Dependants

Figure 2. Comparison of Estimated Weekly Expenditures: Labourer and Selected Occupation Groups with No Dependants. (95% Confidence Limits Shown at the Top of the Labourer)

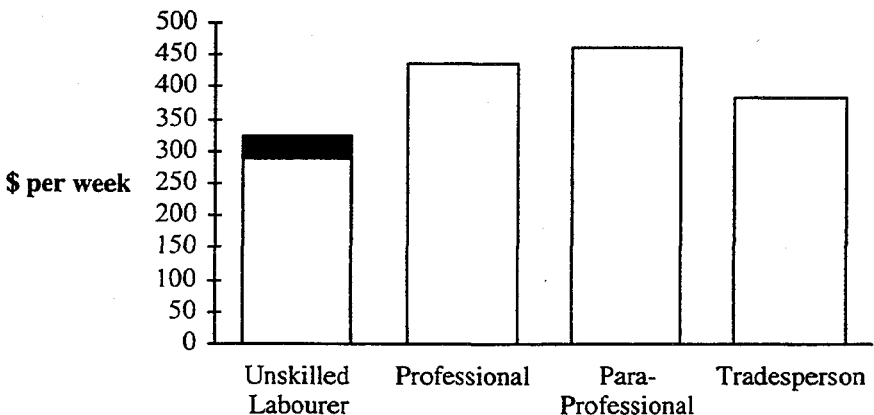
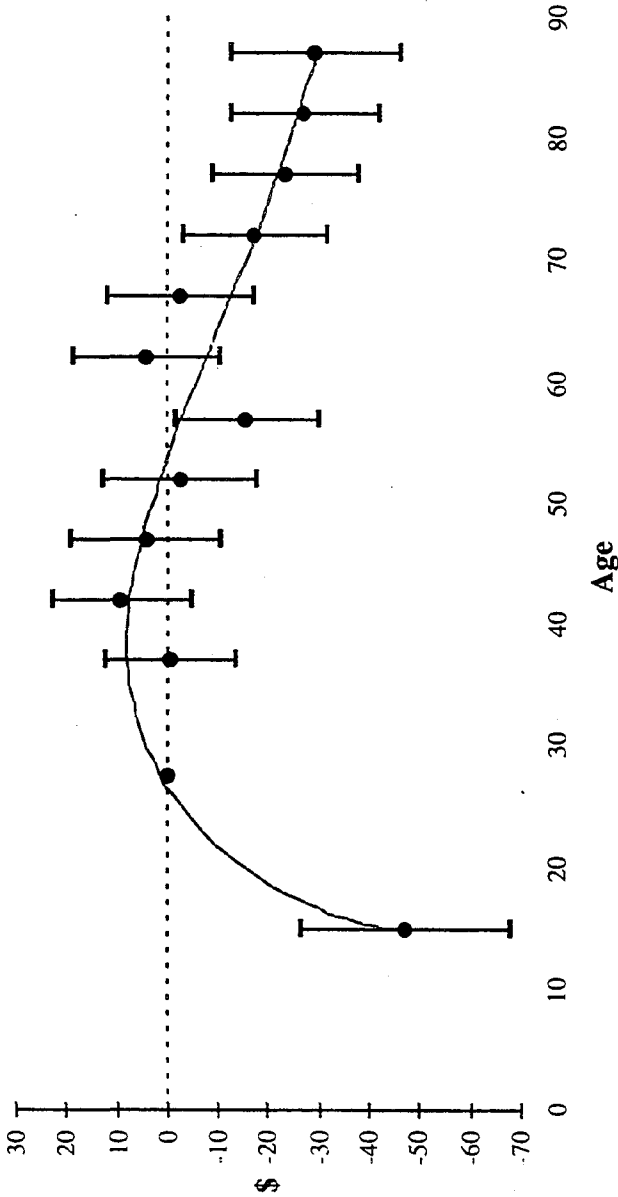


Figure 3. Differences from the 20-34 Age Group in Weekly Spending and 95% Confidence Limits: Weibull Function Approximation to the Estimates



The central result is the estimated expenditure of a single labourer with no dependants. This is the constant or intercept in the regression result. The estimates are:

Average Expenditure	\$307.39
Standard Error of the Estimate	\$9.10
95% Confidence Limits	\$289.55 to \$325.07

This (1993/94) expenditure is compared with three other occupation groups in Figure 2. For the sake of comparability, the latter have been treated as single with no dependants. The 95% confidence limits are shown at the top of the labourer bar to indicate its size in relation to the total expenditure by this group. Confidence bands for the other groups are given in the following sections.

The Impact of Age on Expenditure

The differences in spending due to age are relatively small, the estimates being up to seven dollars above the base and as much as forty-five dollars below. Because there is a non-linear relationship between age and spending, a series of twelve category (0-1) variables were used to represent age groups, in five-year intervals. The 20 to 34 age group was taken as the base or reference group, so that the estimate for each was in relation to this reference group. The results are shown in Figure 3, which shows the 95% confidence limits for each estimate. Also shown in Figure 3 is a Weibull function which has been used to give a smooth and fairly close approximation to the category estimates. This function expresses the difference D (\$ per week) from the reference group expenditure in the following form:

$$D = k\beta x^{\beta-1} e^{-x\beta} - m$$

Where:

$$k = 70$$

$$\beta = 1.6$$

$$x = \frac{\text{Age} - 14.99}{43}$$

$$m = 45$$

The only substantial deviations from the function are in the pre and post retirement years. The fall in expenditure before retirement and the rise after, other things being equal, can be interpreted as deferred spending on such things as travel followed by a small upsurge in such spending when the retiree has the time for it.

Figure 4. Amounts by which Weekly Spending of Other Occupation Groups Differ from Labourers and Related (95% Confidence Limits)

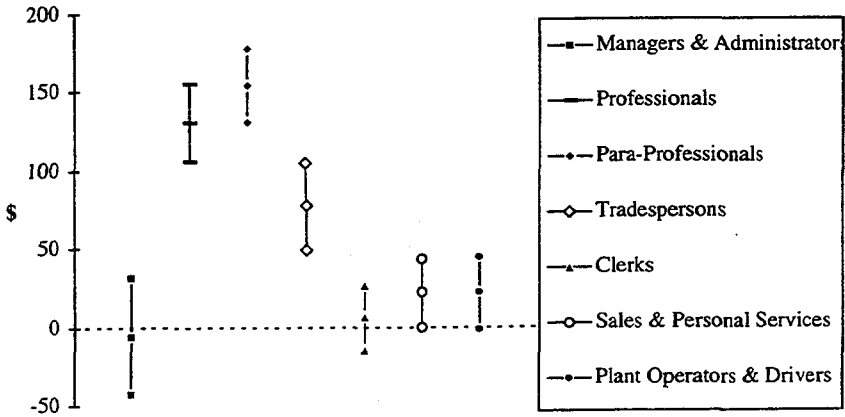
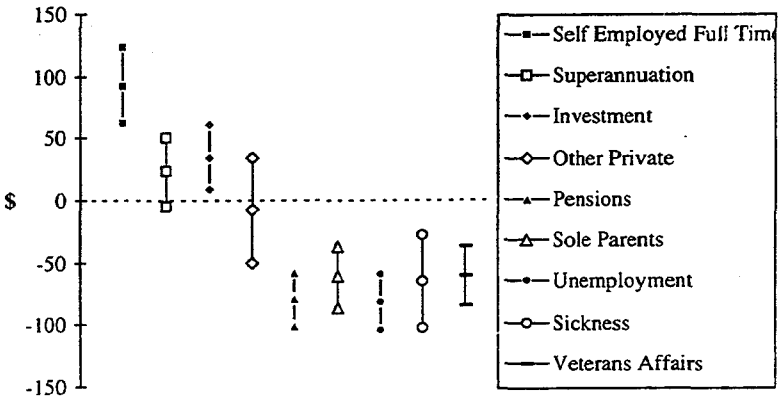


Figure 5. Amounts by which Groups whose Principal Source of Income is not Wage and Salary Differ from the Wage and Salary Group in Weekly Spending (95% Confidence Limits)



The Effect of Occupation on Expenditure

The results for seven occupation group category variables are presented in Figure 4. The 'Labourers and Related' occupation has been taken as the reference group, so that the estimate for each of the other groups is in relation to this reference group. The length of each vertical bar shows the 95% confidence limits for that estimate.

The zero (base) line in Figure 4 represents expenditures by the Labourers and Related group. Thus, the dollar amounts on the vertical scale are the amounts by which the other occupation groups spend more or less than they do, other things being equal. The relative spending levels of professionals, para-professionals and tradespersons have already been shown in Figure 1. Clerks have virtually the same average expenditure level as labourers, while the sales and personal services group and the plant and machine operators and drivers are a little above. A surprising outcome was that the manager and administrator categories had low expenditures. We believe that these designations are used in a variety of low status jobs such as 'managing' a small corner store, 'night fill manager', and 'petrol pump manager'.

The variability of spending, shown by the 95% confidence limits is similar for all groups except 'Managers and Administrators' which is appreciably more variable. Nevertheless, with standard errors of the difference from the base ranging from \$10.72 to \$18.93, the variability within groups is relatively small.

The Effect of Principal Source of Income

Spending by occupation group and spending by source of income are far from being independent of each other. The non-independence leads to multicollinearity between the occupation variables in Figure 4 and the source of income variables in Figure 5. However, the result of multicollinearity is to increase the standard errors of all of the affected variables, which is reflected in the lengths of the 95% confidence bands shown in both Figure 4 and Figure 5. Thus, the effect of multicollinearity can be seen to be only a minor problem for the estimation and its impact is fully represented by the length of the confidence bands.

Nine category variables are used for income types, wage and salary earners being omitted because they are the reference category. In this case, labourers are included in a group, wage and salary earners, which reflects their characteristics very little. Wage and salary earners are the dominant income group with the highest average expenditures, and labourers are a relatively insignificant component. The vertical scale in Figure 5 shows the

Figure 6. Amounts by which Weekly Spending of Other Employment Status Groups Differ from Full Time Wage and Salary (95% Confidence Limits)

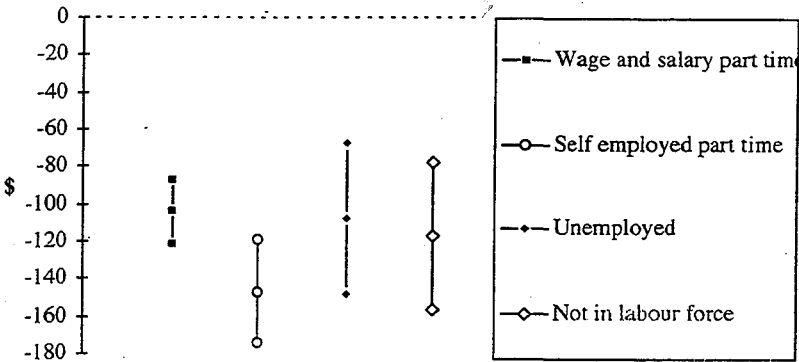
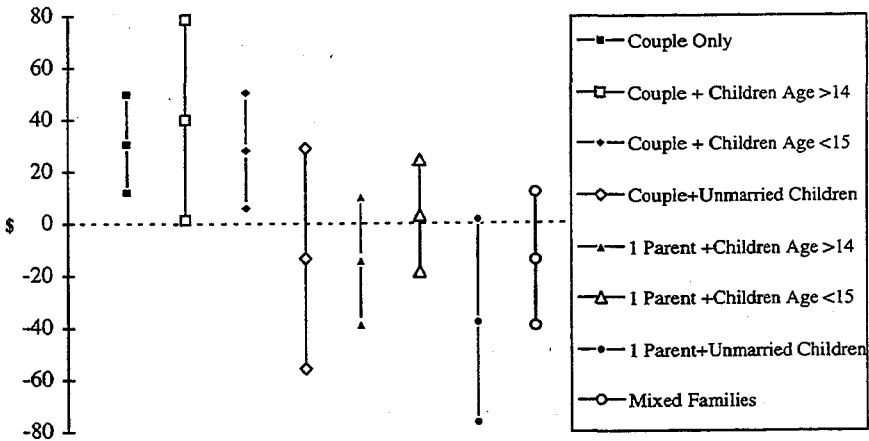


Figure 7. Amounts by which Weekly Spending of Other Household Types Differs from Single Adult Households (95% Confidence Limits)



dollar amounts by which the other income groups spend more and less than wage and salary earners, other things being equal.

The Effect of Employment Status

The effects of source of income should also be considered in relation to employment status. In particular, Figure 6 indicates the effect on spending of part time work. This figure shows the amounts by which the average spending of four groups whose employment status is not full-time wage and salary differs from the base. The base reference group for Figure 6 is full-time wage and salary earners. The length of each vertical bar shows the 95% confidence limits for that estimate.

The Effect of Household Type

Eight category variables are used for household types. Single adult households are the reference group, including labourers without dependants, and the estimate for each of the other types was in relation to this reference group. The results are presented in Figure 7, the length of each vertical bar showing the approximate 95% confidence limits for that estimate. The zero (base) line represents Single Adult Households, so that the dollar amounts on the vertical scale are the amounts by which the other household types spend more or less than they do, other things being equal.

The Effect of Household Size

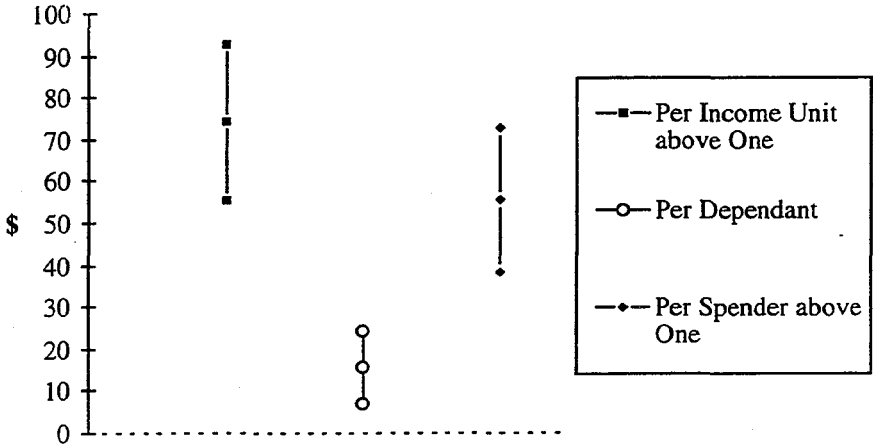
Only three category variables are used for household size. The results are presented in Figure 8, the length of each vertical bar showing the approximate 95% confidence limits for that estimate. The zero (base) line represents a single income earner with no dependents, so that the dollar amounts on the vertical scale are the amounts by which individuals in multiple income or multiple spender households spend more than they do, other things being equal.

In this case, each variable can take the values 0, 1, 2 etc. With each increment, spending increases by the amount shown.

Indexation

The estimates used in the above analysis are based on information collected in 1993-94. The question arises as to how these estimates relate to the current context. Since the expenditure is restricted to items essentially for a reasonable standard of living, the changes since then are largely ones of price. The adjustment is therefore linked to the Consumer Price Index (CPI) compiled by the Australian Bureau of Statistics.

Figure 8. Amounts by which Weekly Spending of Multiple Income and/or Multiple Spender Households Differs from Single Income no Dependant Households (95% Confidence Bands)



The CPI is based upon the Household Expenditure Survey, providing the weights used in combining the items in the basket which is regularly priced in the eight capital cities of Australia. Ideally the adjustment should be carried out using only the items in our ‘reasonable living’ expenditure categories. In practice, the CPI uses all of the ‘dependent’ expenditure categories omitted from our analysis and also includes most of the expenditure categories we have deemed as ‘not reasonable living expenditure’. By contrast, the CPI does not include five items included in our ‘reasonable living’ expenditure list, namely income tax, the principal component of mortgage payments on the principal dwelling, insulation, superannuation and annuities, and life insurance.

As the information used to update the CPI is not available at the level of detail to precisely estimate the effect on our ‘reasonable living’ expenditure categories we have adjusted the 1993-94 average expenditure by the ‘All Groups’ CPI after adding 85 cents per week for voluntary payments on the principal of dwellings (see section on House Repayments). The figure of \$308.24 may be adjusted by 7.7%, the CPI change between June 1994 and June 1996.

5. Summary and Conclusion

This paper has sought to determine the minimum wage for full-time able bodied employees. By regressing the 1993/94 ABS Household Expenditure Survey on a number of important variables it has sought to estimate the minimum wage applicable to labourers without any consideration of the number of dependents they have. The analysis suggests that the appropriate weekly wage in 1993/94 was \$307.39. With a Standard Error of Estimate in the order of \$9.10, the 95% Confidence Limits are given by the range of \$289.55 to \$325.07. It is suggested that a further 85 cents per week be added to this figure for voluntary home repayments. When the resultant figure of \$308.24 is indexed, it suggests that a the time of writing the appropriate minimum wage should be in the order of \$332 per week.

Note

- 1 A list of the expenditure categories grouped by 'reasonable living', 'not reasonable living' and 'dependent' is available from the authors.

Reference

- Plowman, D. H. (1995) 'Protecting the Low Income Earner: Minimum Wage Determination in Australia', *The Economic and Labour Relations Review*, Vol. 6, No. 2, pp. 252-287.

Appendix A

Estimate	S.E.	t Statistic	Probability	
Age group				<i>Relative to ages 20-34</i>
-47.16	10.35	-4.56	0.0000	Ages below 20
-0.44	6.49	-0.07	0.9465	Ages 35-39
9.03	6.82	1.32	0.1858	Ages 40-44
4.25	7.31	0.58	0.5612	Ages 45-49
-2.42	7.54	-0.32	0.7485	Ages 50-54
-15.79	7.16	-2.21	0.0274	Ages 55-60
4.04	7.25	0.56	0.5770	Ages 61-64
-2.73	7.26	-0.38	0.7069	Ages 65-69
-17.34	7.03	-2.47	0.0137	Ages 70-74
-23.34	7.14	-3.27	0.0011	Ages 75-79
-27.25	7.40	-3.68	0.0002	Ages 80-84
-29.24	8.43	-3.47	0.0005	Ages 85 and above
Occupation				<i>Relative to labourers</i>
-5.96	18.93	-0.32	0.7528	Managers and administrators
130.20	12.49	10.42	0.0000	Professionals
153.99	12.21	12.61	0.0000	Para-professionals
77.10	14.03	5.50	0.0000	Tradespersons
6.09	10.72	0.57	0.5698	Clerks
21.57	11.12	1.94	0.0525	Sales persons & personal service operators
21.43	11.78	1.82	0.0689	Plant and machine operators and drivers
-25.65	11.20	-2.29	0.0221	Inadequately described
76.52	181.03	0.42	0.6725	Not stated
Household type				<i>Relative to single adult</i>
30.64	9.52	3.22	0.0013	Couple only
39.76	19.63	2.03	0.0429	Couple with children aged 15 or more
28.06	11.32	2.48	0.0132	Couple with children aged less than 15
-13.45	21.61	-0.62	0.5337	Couple with children
-14.04	12.34	-1.14	0.2553	One parent family with children aged >14
3.11	11.06	0.28	0.7788	One parent family with children aged <15
-37.59	19.76	-1.90	0.0571	One parent family with children
-13.90	12.97	-1.07	0.2838	Mixed families in the household
Principal source of income				<i>Relative to wage and salary</i>
92.48	15.37	6.02	0.0000	Self employed
23.66	14.01	1.69	0.0913	Superannuation
34.85	12.93	2.69	0.0071	Investment
-7.87	21.38	-0.37	0.7127	Other private
-78.91	10.97	-7.19	0.0000	Pensions
-61.28	12.49	-4.90	0.0000	Sole parents
-81.58	11.50	-7.09	0.0000	Unemployment
-65.11	18.88	-3.45	0.0006	Sickness
-60.80	11.92	-5.10	0.0000	Veterans Affairs
-28.16	20.26	-1.39	0.1646	Family payments
-62.92	13.42	-4.69	0.0000	Other
-15.30	19.38	-0.79	0.4299	Not specified
Employment status				<i>Relative to wage and salary full time</i>
-103.84	8.83	-11.76	0.0000	Wage and salary part time
-146.82	14.02	-10.47	0.0000	Self employed
-107.27	20.56	-5.22	0.0000	Unemployed
-116.86	19.92	-5.87	0.0000	Not in labour force
Household size				
74.01	9.37	7.90	0.0000	Number of income units <i>above one</i>
15.60	4.27	3.65	0.0003	Number of dependants
55.49	8.81	6.30	0.0000	Number of spenders <i>above one</i>