

2025 Methodology Review

Wage costs consultation paper - addendum

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Background

- 1 This paper provides an addendum to the original wage costs consultation paper. It presents revised preliminary Commission views and revised consultation questions, following consideration of the recommendations by independent consultant, Professor Alison Preston.
- 2 The consultation questions and preliminary Commission views in this paper replace those in the original consultation paper.

Consultant report

- 3 On 4 September 2023, Professor Preston provided a report in which she examined the Commission's method used in the wage costs assessment, including the conceptual case and the econometric model behind it. The report, which has been provided to the states, made 14 recommendations (Attachment A).
- 4 Professor Preston supports the fundamental approach underlying the Commission's method, that of using a regression of state and human capital variables predicting hourly wages to estimate state wage differences.
- 5 Recommendation 1 in Professor Preston's report supports using private sector wages as a policy neutral proxy for the market pressures faced by public sector employers.
- 6 Recommendation 3 supports the continued use of Characteristics of Employment survey data for the model.
- 7 Professor Preston also made several recommendations aimed at improving the Commission's assessment. After considering these recommendations, the Commission has reconsidered aspects of its proposed approach. These are outlined in further detail below.

Recommendation 2: Using female private sector regional wages

- 8 Professor Preston recommended that, given the different sex composition of the public and private sectors, the Commission give consideration to using the female private sector regional wage structure as a proxy for wage pressures in the state/territory public sector.
- 9 Gender is one of several factors contributing to differences in public and private sector wages. The labour market is also heavily segmented by industry and occupation, and there are differences in the distribution of industries and occupations between the public and private sectors. Ideally, the Commission would restrict its model to private sector workers who are substitutable for public sector workers in the labour market.
- 10 Some private sector workers are near-perfect substitutes for public sector workers, such as those working in private schools and private hospitals. However, private

sector wages in these industries are likely to be heavily influenced by state wage setting policies.

- 11 Restricting the Commission's model to workers with similar characteristics to public sector workers (on gender, occupation or other dimensions) would increase the conceptual validity of the model. However, it would also increase the risk of state policy influence and reduce the sample size available, and hence the reliability of the estimates. There are trade-offs between how accurately drivers of public sector wages are identified, how dependent the estimates are on state policies, and how statistically robust they are. Professor Preston's recommendation to consider using only female private sector workers represents one approach to dealing with these trade-offs.
- 12 Within the survey sample relative state wage levels in the public sector are more highly correlated with relative state wage levels in the private sector as a whole (correlation coefficient of 0.72) than they are with a female only subset of the private sector (correlation coefficient of 0.63).¹ Figure 1 shows relative public sector wages plotted against relative state wages for the entire private sector and against a female only subset of the private sector. It can be seen that the plot of public sector relative wage levels against the total private sector relative state wage levels is generally closer to the diagonal.





Source: Commission calculation from COES data.

¹ The correlation coefficient is a statistical measure that quantifies the strength and direction of the linear relationship between 2 variables. It ranges between -1 and 1, where a positive value indicates a positive linear correlation, a negative value indicates a negative linear correlation, and a value close to 0 indicates a weak or no linear correlation.

- 13 The Commission has considered the impact of using the female private sector workforce and has found that the decrease in sample size means that any increase in accuracy is outweighed by an increase in variance. This means that the dataset with the full private sector sample provides a better reflection of pressure on public sector wages.
- 14 The Commission's preliminary view is that the full sample of private sector employees should be used to proxy for the labour market effects on the public sector.

Consultation questions

- Q1. Do states agree on continuing to use private sector wages as a policy neutral proxy for the market pressures faced by public sector employers?
- Q2. Do states agree that the Commission should continue to use all private sector employees to proxy for public sector drivers of costs?
- Q3. Do states support the continued use of the Characteristics of Employment survey data?

Recommendations 4–10: model specification

- 15 Professor Preston made 7 recommendations relating to the specification of the regression model and the choice of control variables. Professor Preston supports the Commission's proposal to move to hourly wages as the dependent variable (Recommendation 4) and the proposed simplifying change to continuous tenure (Recommendation 9).
- 16 Other recommendations made by Professor Preston were to remove from the sample individuals working unusually few or many hours and to reconsider how hours of work are specified in the model. Professor Preston also recommended simplifying the model by reducing the number and complexity of explanatory variables, citing some specific examples, but also more generally.

Response to recommendations 4, 5 and 6

- 17 Professor Preston recommended removing records of people paid for less than 5 hours, or over 60 hours, on the grounds that these people have atypical working patterns. The Commission has found that omitting these records reduces the sample size while not materially affecting average state coefficients. As such, the Commission considers that restricting the sample adds a level of complexity that is not justified.
- 18 Professor Preston supported the Commission's preliminary proposal of moving to hourly rather than weekly wages as the dependent variable in the regression model. However, Professor Preston also highlighted potential issues with using hours of work as an independent variable to predict hourly pay, particularly at the level of complexity proposed by the Commission.

- 19 Following Professor Preston's recommendations, the Commission has revised its proposed approach to significantly reduce the complexity of the hours variables. It agrees that removing paid hours and the interaction between paid and usual hours as independent variables would reduce the prospect of endogeneity and simplify the model, without any significant change in the state coefficients.
- 20 Usual hours of work can affect earning potential. A person who usually works part-time hours does not get the same increase in earnings for each year of experience or for each year of tenure as a person who usually works full-time hours. Similarly, expected returns would be higher for a person who usually works unpaid overtime. On the basis of Professor Preston's recommendation, the revised Commission preliminary view is to specify usual hours with simple dummy variables for part-time, full-time and more than full-time hours.

Response to recommendations 7 and 8

- 21 Including age in 5-year age groups as an independent variable instead of potential experience and potential experience squared simplifies the model by removing the squared term and uses more easily understood variables. It also allows the age earnings profile to be modelled with greater nuance, producing a better fit for the model.
- 22 Adding interactions with highest level of education improves the fit of the overall model but has very little effect on state coefficients. This change proposed in the original consultation paper would increase the complexity of the model, with limited benefit.
- 23 The revised Commission preliminary view is to follow Professor Preston's recommendations and to specify age in 5-year categories as a control and not to interact age with education.

Response to Recommendation 10

- 24 The Commission previously took the 2020 Review model as the starting point and added new controls, provided they improved the overall model fit. Following Professor Preston's recommendations, the Commission proposes to instead start from an extremely simplified model including only state of usual residence. Then the Commission proposes to include control variables from candidate controls, used in Mincer regressions in the literature, that meet a stricter standard. For a control variable to be included in the model the Commission proposes it satisfy 4 criteria:
 - there should be a strong conceptual case for it to affect an individual's wages
 - it should materially affect average state coefficients over the 5 years for which consistent data exist²
 - it should improve the overall fit of the model

² The materiality threshold is around 0.3% for NT, 0.6–0.8% for other states. Statistically significant differences (at 0.05 level significance) are around 3.5% for NT or the ACT, 1.8–2.5% for the other states.

- it should not increase the average standard error of state coefficients over the 5 years for which consistent data exist.
- 25 Under these criteria, a range of models were roughly equivalent. Adding interactions between gender and other variables or between age and education produced only slight changes to the state coefficients, slight improvements in overall model fit and no differences in standard errors. The preliminary Commission view, and consistent with the Commission's supporting principles, is to prefer simplicity and not include any interaction terms in the model.
- 26 Including the detailed industry group (292 categories), rather than the simpler more aggregated industry division (19 categories), as an independent variable does not significantly change the state coefficients but does increase their standard error. Likewise adding the interactions between gender and all the other explanatory variables does not significantly change the state coefficients but does increase their standard error. The analysis of alternative model specifications is detailed in Attachment B.

Proposed model specification

27 The Commission's revised preliminary view is to use a less complex model. This can be achieved by replacing industry group categories with industry division categories and removing the interaction terms between gender and all other independent variables. The revised proposed model is described in Table 1.

	R2020 model	Proposed model (revised)				
Dependent variable	Log of weekly wage	Log of hourly wages				
Variable of interest	State of usual residence	State of usual residence				
Control variables	Log of usual hours	Usual hours (3 categories)				
	Log of usual hours if usual hours <16					
	Log of usual hours if usual hours >59					
	Education (8 categories)	Education (8 categories)				
	Imputed work experience	Age (11 categories)				
	nputed work experience squared					
	Tenure (5 categories)	Tenure (continuous)				
	Permanent status (dummy)	Permanent status (dummy)				
	Migrant status (7 categories)	Migrant status (7 categories)				
	Marital status (dummy)	Marital status (dummy)				
	Dependent child (dummy)	Dependent child (dummy)				
	Occupation (~120 categories)	Occupation (~120 categories)				
	Industry group (~260 categories)	Industry division (19 categories)				
	Gender (dummy)	Gender (dummy)				
	Gender*Every other control (>400 terms)					
Total coefficients estimated	>800	~180–185				

Table 1 Proposed model specification compared with 2020 Review method

Consultation questions

- Q4. Do states agree the Commission should use hourly wages rather than weekly wages as the dependent variable?
- Q5. Do states support including usual hours of work in the model as 3 categories, part-time, full-time and more than full-time hours?
- Q6. Do states support replacing imputed work experience and imputed work experience squared with 5-year age groups?
- Q7. Do states agree with the Commission's proposed criteria for including control variables in the model?
- Q8. Do states support using a less complex model by replacing industry group categories with industry division categories and removing the interaction terms with gender and every other independent variable?

Recommendation 11: Improving accuracy and reducing volatility

28 Professor Preston recommends, to reduce the volatility of the geographic wage relativities, that the Commission consider alternative approaches to that contained in the original consultation paper, such as pooling data over a moving 3-year period when estimating the geographic wage structure.

- 29 Professor Preston acknowledges that the proposed approach in the original consultation paper to reduce volatility by using indexed and weighted annual data since 2016–17, is sound but complex. An alternative, simpler approach recommended by Professor Preston is to use pooled data over a moving 3-year period.
- 30 By using data from more than 3 years, the Commission's proposed approach further increases the effective sample size and therefore reduces the sampling variability. Contemporaneity would be preserved by indexing older estimates with the wage price index and discounting less contemporary data.
- 31 Between 2019–20 and 2021–22, the average absolute annual movement in state relative wages using the Commission's initial proposed approach was 0.3%. Using Professor Preston's approach it was 0.6%. This difference primarily reflects a higher sensitivity to the survey sample when using the pooled sample approach.
- 32 The estimates for each of the 3 assessment years for the 2023 Update using the 2 methods of combining data can be seen in Figure 2 and Figure 3 below.





Notes: Annual estimates were generated using the proposed model in Table 1, with individuals working fewer than 5 or more than 60 hours per week omitted from the sample.

Figure 3 Estimates of relative state wage levels using 3-year pooled samples, 2019–20 to 2021–22



Notes: These estimates were generated using the proposed model in Table 1, with individuals working fewer than 5 or more than 60 hours per week omitted from the sample.

Source: Commission calculation.

33 The Commission proposes to use the full time series of available survey estimates of relative state wage costs, beginning from 2016–17, to estimate relative wage costs in each assessment year, and to revise assessment year data as more data become available. These estimates would be generated by indexing and weighting the estimates from each contributing year. The Commission remains of the view that the increase in complexity is warranted by the decrease in volatility and reduced risk of bias.

Consultation question

Q9. Do states agree with the proposed approach to combine estimates of relative differences in states' wages across years?

Discounting of the wage costs assessment

34 Professor Preston's report did not raise any issues that suggest the 12.5% discount should be changed. The Commission's preliminary view regarding proposed changes to the wage costs assessment should improve reliability and reduce volatility. However, there remains a low level of uncertainty from using private sector wages as a proxy for public sector wage costs and other elements of the assessment, such that the low-level discount of 12.5% remains appropriate.

Consultation questions

Q10. Do states agree that a 12.5% discount remains appropriate?

Proposed assessment

Differences from the 2020 Review approach

- 35 Subject to state views the Commission proposes 2 changes:
 - changing the specification of the regression model to increase the robustness of survey estimates and reduce the complexity of the model
 - combining annual survey estimates to increase the reliability and reduce the volatility of estimated relative state wage levels.
- 36 The Commission proposes to use the full-time series of available survey estimates of relative state wage costs, beginning from 2016–17, to estimate relative wage costs in each assessment year. These estimates would be generated by indexing and weighting the estimates from each contributing year.
- 37 The Commission proposes to change the model specification as outlined in Table 1.

New data requirements

- 38 No new data will be required from states.
- 39 The wage cost proportions for each expense category will be recalculated from the ABS' Government Finance Statistics data for 2021–22 to 2023–24 and frozen for the life of the 2025 Review methods, following the same method as the 2020 Review.

Consultation

- 40 The Commission welcomes state views on the consultation questions identified in this paper (outlined below) and the proposed assessment. State submissions should accord with the 2025 Review framework. States are welcome to raise other relevant issues with the Commission.
- 41 State submissions on the wage costs assessment paper should be with the Commission by **13 November 2023**.

- Q1. Do states agree on continuing to use private sector wages as a policy neutral proxy for the market pressures faced by public sector employers?
- Q2. Do states agree that the Commission should continue to use all private sector employees to proxy for public sector drivers of costs?
- Q3. Do states support the continued use of the Characteristics of Employment survey data?
- Q4. Do states agree the Commission should use hourly wages rather than weekly wages as the dependent variable?
- Q5. Do states support including usual hours of work in the model as 3 categories, part-time, full-time and more than full-time hours?
- Q6. Do states support replacing imputed work experience and imputed work experience squared with 5-year age groups?
- Q7. Do states agree with the Commission's proposed criteria for including control variables in the model?
- Q8. Do states support using a less complex model by replacing industry group categories with industry division categories and removing the interaction terms with gender and every other independent variable?
- Q9. Do states agree with the proposed approach to combine estimates of relative differences in states' wages across years?
- Q10. Do states agree that a 12.5% discount remains appropriate?

Attachment A: Consultant recommendations

Recommendation 1: The Commission continue to use the regional wage structure in the private sector as a proxy for labour market pressures in the state/territory public sector.

Recommendation 2: Given the different sex composition of the public and private sectors, the Commission give consideration to using the FEMALE private sector regional wage structure as a proxy for labour market pressures in the state/territory public sector.

Recommendation 3: The Commission remain with the COES for estimation purposes.

Recommendation 4: The Commission use hourly wages as the dependent variable.

Recommendation 5: The Commission deals with potential measurement error in hourly wages by excluding sample members who report working less than 5 hours per week in their main job and those working 60 or more hours per week in their main job.

Recommendation 6: If the Commission has strong a-priori reason to believe that the hours-wage relationship differs across the distribution the recommendation is to adopt a simpler specification using a dummy variable approach with controls for part-time hours and long-hours.

Recommendation 7: The Commission should use a series of age dummy variables to capture labour market experience rather than a measure of potential experience.

Recommendation 8: The Commission does not include age-education (interactions) in its model.

Recommendation 9: The Commission include tenure as a continuous variable.

Recommendation 10: The Commission seek to estimate a parsimonious model (fewer predictor variables).

Recommendation 11: To reduce the volatility of the geographic wage relativities the Commission consider alternative approaches such as pooling data over a moving threeyear period when estimating the geographic wage structure.

Attachment B: Comparing models

- 42 Following the report from Professor Preston, the Commission has decided to reconsider the regression model starting from a very simple specification, rather than from the 2020 Review model. For a control variable to earn a place in the model the Commission proposes that it should satisfy 4 criteria:
 - there should be a strong conceptual case for it to affect an individual's wages
 - it should affect average state coefficients over the 5 years for which consistent data exist
 - it should improve the overall fit of the model
 - it should not increase the average standard error of state coefficients over the 5 years for which consistent data exist.
- 43 To measure prospective models against these criteria, the Commission ran a series of prospective regression models on the data. Starting with a simple model including only the state of usual residence and the sex of individuals, then adding variables individually or in related groups. The order in which variables are added would make a difference to the final optimised model. The order has been based on the Commission's view, informed by Professor Preston's work, of the relative conceptual strength of each variable.
- 44 These models were all run once for each survey year from 2018 to 2022 inclusive. The average coefficients, standard errors and model fit statistics for each model over the 5 survey years are presented below in Figures B-1 to B-4 and Tables B-1 to B-3.
- 45 While there is no single model that optimises all criteria, the Commission considers that a model including all variables up to usual hours is most appropriate.
- 46 Model fit as measured by R squared, adjusted R squared and log-Likelihood continues to increase for all tested models. Model fit as measured by the Bayesian information criterion is optimised in the model with interactions between sex and family variables added, one variable more than the Commission's preferred approach. Model fit as measured by the Akaike information criterion is optimised when including detailed industry coefficients but not interacting everything with sex, 4 variables more than the Commission's preferred approach.
- 47 The average standard errors for state coefficients are minimised in the model that includes all variables up to interaction between education and age, 2 variables more than the Commission's preferred approach. Including limited interaction terms would not materially change state coefficients, but it would slightly reduce the average standard errors. Each additional variable up to and including the usual hours categories changes most state coefficients in a consistent direction in all 5 years of data. Additional variables beyond that point have inconsistent effects for most states. This suggests that after usual hours, additional variables reflect the particular sample in that year, rather than underlying differences between the actual labour markets in different states.

48 Overall, the Commission considers that any model between that including usual hours and that including age by sex have very similar statistical comparability and reliability. Following Professor Preston's advice to place some value on simplicity in the model, the Commission's preliminary position is to choose the simplest of these. This means that there are no interaction terms in the model.



Figure B-1 Average state coefficients when including additional control variables in the regression model (2018–22)

Notes: Horizontal gridlines represent the approximate amount of change that would materially affect the GST distribution for an average state.

The vertical gridline at usual hours represents the Commission's preliminary proposed model.

Employment includes a permanent/casual indicator and tenure in current job.

Person characteristics include marital status, migrant status and having dependent children.

Family by sex allows for marital status and dependent children to have a different effect on male and female wages.

Individuals working fewer than 5 hours or 60 or more hours are excluded from the model.



Figure B-2 Average standard errors of state coefficients when including additional control variables in the regression model (2018–22)

Notes: See notes to Figure B-1. Source: Commission calculation.





Notes: See notes to Figure B-1. Source: Commission calculation.



Figure B-4 Average model fit statistics of regression models including additional variables (2018–22)

Notes: See notes to Figure B-1. Source: Commission calculation.

Table B-1Average state coefficients when including additional control variables in the
regression model (2018–20)

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT
State and sex	0.0390	0.0245	-0.0398	0.0584	-0.0626	-0.0955	0.0903	-0.0143
Education	0.0185	-0.0030	-0.0189	0.0639	-0.0436	-0.0645	0.0527	-0.0051
Employment	0.0124	-0.0098	-0.0152	0.0645	-0.0501	-0.0712	0.0635	0.0058
Age (5 year groups)	0.0161	-0.0090	-0.0145	0.0597	-0.0510	-0.0689	0.0709	-0.0033
Person characteristics	0.0217	-0.0033	-0.0260	0.0559	-0.0562	-0.0786	0.0752	0.0114
Occupation (broad)	0.0141	-0.0047	-0.0238	0.0587	-0.0520	-0.0678	0.0633	0.0120
Occupation (detailed)	0.0085	-0.0039	-0.0242	0.0497	-0.0477	-0.0555	0.0552	0.0179
Industry (broad)	0.0097	0.0009	-0.0240	0.0309	-0.0449	-0.0517	0.0619	0.0171
Usual hours	0.0099	0.0018	-0.0255	0.0298	-0.0437	-0.0486	0.0627	0.0137
Family by sex	0.0098	0.0015	-0.0256	0.0299	-0.0441	-0.0492	0.0623	0.0154
Education by age	0.0107	0.0030	-0.0253	0.0288	-0.0444	-0.0482	0.0627	0.0128
Age by sex	0.0111	0.0031	-0.0247	0.0288	-0.0444	-0.0484	0.0627	0.0117
Industry (detailed)	0.0122	0.0042	-0.0241	0.0273	-0.0442	-0.0476	0.0642	0.0080
Everything by sex	0.0117	0.0026	-0.0236	0.0288	-0.0447	-0.0467	0.0621	0.0097

Notes: See notes to Figure B-1.

	NICH			10/0	C 1	-	ACT	NIT	
	NSW	VIC	Qid	WA	SA	las	ACT	NI	Average
State and sex	0.0102	0.0102	0.0107	0.0129	0.0116	0.0145	0.0237	0.0210	0.0144
Education	0.0095	0.0097	0.0100	0.0120	0.0108	0.0137	0.0225	0.0205	0.0136
Employment	0.0093	0.0088	0.0095	0.0117	0.0110	0.0130	0.0223	0.0199	0.0132
Age (5 year groups)	0.0092	0.0088	0.0095	0.0119	0.0106	0.0130	0.0213	0.0197	0.0130
Person characteristics	0.0089	0.0087	0.0095	0.0114	0.0103	0.0124	0.0201	0.0185	0.0125
Occupation (broad)	0.0088	0.0081	0.0088	0.0107	0.0101	0.0119	0.0190	0.0180	0.0119
Occupation (detailed)	0.0085	0.0081	0.0085	0.0100	0.0101	0.0116	0.0175	0.0172	0.0114
Industry (broad)	0.0084	0.0082	0.0086	0.0098	0.0098	0.0116	0.0177	0.0169	0.0114
Usual hours	0.0082	0.0081	0.0086	0.0097	0.0098	0.0115	0.0176	0.0170	0.0113
Family by sex	0.0082	0.0082	0.0086	0.0097	0.0098	0.0115	0.0176	0.0169	0.0113
Education by age	0.0083	0.0079	0.0086	0.0097	0.0099	0.0113	0.0174	0.0169	0.0112
Age by sex	0.0083	0.0079	0.0086	0.0097	0.0099	0.0114	0.0175	0.0171	0.0113
Industry (detailed)	0.0084	0.0080	0.0090	0.0098	0.0103	0.0114	0.0181	0.0177	0.0116
Everything by sex	0.0087	0.0083	0.0093	0.0100	0.0105	0.0116	0.0189	0.0178	0.0119

Table B-2Average standard errors of state coefficients when including additional controlvariables in the regression model (2018–20)

Notes: Minimum average standard errors for each column are in bold.

See notes to Figure B-1.

Source: Commission calculation.

Table B-3Average model fit statistics of regression models including additional variables(2018–22)

	R ²	R ² (adj)	log Likelihood	AIC	BIC
Sex	0.0198	0.0193	-12,863	25,747	25,823
Education	0.1345	0.1336	-11,878	23,790	23,920
Employment	0.1832	0.1823	-11,422	22,881	23,027
Age (5 year groups)	0.2402	0.2389	-10,853	21,763	21,985
Person characteristics	0.2592	0.2575	-10,652	21,378	21,661
Occupation (broad)	0.3116	0.3097	-10,075	20,237	20,574
Occupation (detailed)	0.3563	0.3503	-9,545	19,385	20,513
Industry (broad)	0.3671	0.3605	-9,411	19,152	20,418
Usual hours	0.3700	0.3633	-9,375	19,085	20,366
Family by sex	0.3720	0.3652	-9,351	19,040	20,336
Education by age	0.3802	0.3708	-9,246	18,964	20,773
Age by sex	0.3826	0.3729	-9,215	18,923	20,808
Industry (detailed)	0.4016	0.3829	-8,969	18,894	22,557
Everything by sex	0.4232	0.3894	-8,682	19,101	25,757

Notes: Optimal model based on each statistic is in bold.

See notes to Figure B-1.