# The Role of Unobserved Heterogeneity and On-the-Job Training in the Employer Size-Wage Effect in Australia

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ABSTRACT

The positive relationship between employer size and wages is a ubiquitous feature of advanced industrialised economies. The purpose of the present study is to clarify the nature of the employer size-wage effect in Australia by determining the extent to which it can be explained by observed and unobserved quality differences, including difference in on-the-job training. The empirical results are based on analysis of the Household Income and Labour Dynamics in Australia (HILDA) Survey, which is a nationally representative panel data set focused on family income, employment, and well-being. Our findings indicate that for males, quality adjusted employer size-wage effects are quite small and mostly driven by lower wages for workers in the smallest firms (fewer than twenty workers). For females, size-wage effects disappear when unobserved quality differences are accounted for. We also find that accounting for differences in the incidence of job training has no effect on the structure of wage differences by employer size.

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**The findings and views reported in the paper should not be attributed to DEEWR.**

## I. Introduction

The positive relationship between employer size and wages is a ubiquitous feature of advanced industrialised economies. Generally using cross-sectional data and controlling for observed skills, researchers have shown that the relationship holds in several advanced economies, including those of the U.S., the U.K., Germany, Scandanavia, Canada, and Australia.[1] Because employer size-wage effects persist even after controlling for observed skills, researchers have looked to differences in unobserved skills to explain size-wage effects. Differences in unobserved time-invariant skills have generally been controlled for using fixed effects estimation with panel data. The present study advances the size-wage literature by providing the first estimates of size-wage effects for Australia that include controls for unobserved skill differences based on the analysis of the Household Income and Labour Dynamics in Australia (HILDA) Survey, a relatively new nationally representative longitudinal data set.

Although differences in observed and unobserved skills explain part of the wage gap between large and small employers, differences in employer characteristics by employer size may also add to the explanation. Using cross-sectional data that matches individuals with their firms from the U.S., roughly 65% of the wage gap between workers in large and small firms has been accounted for.[2] Such results point specifically to complementarity between workers' skill and capital intensiveness, and to larger firms' practice of matching skilled workers together in larger plants. Because the result still

[1] For research on the U.S see Brown and Medoff (1989) and Oi and Idson (1999), on the U.K see Main and Reilly (1993) and Green, Machin, and Manning (1997), on Germany see Schmidt and Zimmerman (1991), on Scandanavia see Albaek et al. (1998), on Canada see Ferrer and Lluis (2008), and on Australia see Miller and Mulvey (1996), Waddoups (2007), and Waddoups (2008a)

[2] Troske (1999) conducted a comprehensive study of size-wage effects using matched employer-employee data.

leaves a substantial size-wage premium unexplained, researchers have suggested that large firms and their workers are perhaps more likely to invest in firm-specific training, which may be related to size-wage effects. The difficulty in testing this conjecture is that job training is rarely observed in data sets used to examine size-wage effects. Fortunately, the HILDA Survey data contains a battery of questions regarding job training. Thus the present study also advances the literature by being the first study to estimate the direct impact of job training on size-wage effects using individual-level data.

## II. Literature Review

A substantial literature has emerged to document the employer size-wage effect and explain why it occurs (e.g. Brown and Medoff 1989; Oi and Idson 1999; Troske 1999; Belman and Levine 2004). Much of the literature grounds the various explanations in skill differences among workers across the size spectrum. Controlling for differences in observed skill partially reduces the magnitude of the estimated size-wage effect. Thus it is likely that if one could adequately control for unobserved differences in skill, the observed size-wage effect would further diminish.

Several researchers have sought to control for unobserved worker heterogeneity by using longitudinal data when estimating size-wage effects. Notably, Evans and Leighton (1989) find that controlling for unobserved quality differences reduces the cross-sectional estimates by about 60% in the U.S. Similarly, Brown and Medoff (1989) control for unobserved productivity differences using fixed effects estimation and find a reduction of between 5% and 45% in the size-wage premium. Studies using data from Switzerland (Winter-Ebner and Zweimuller 1999), France (Abowd, Kramarz, and

Margolis 1999), and Canada (Ferrer and Lluis 2008) also report evidence that controlling for unobserved quality differences among workers significantly reduces estimates of size-wage effects.

Even after controlling for unobserved skills, a substantial size-wage effect is left unexplained. Brown and Medoff (1989) outline a number of explanations rooted in often-unobserved differences in employer characteristics across the size spectrum. For example, they assess whether wage differences among large and small firms result from variation in working conditions, tenure-earnings profiles, union threat effects, employee selection procedures, and monitoring costs. None of these factors satisfactorily explained the size-wage effect. Along similar lines, Troske (1999) uses a matched employer-employee data set to test whether the larger firms and establishments pay higher wages. He outlines two major themes connected to differences in employers' behavior based on size. The first theme emphasises skill complementarities and returns to skill. Large employers demand more highly skilled workers because of complementarities between skill and the often more highly sophisticated capital deployed in large firms. Troske (1999) also points to complementarities between more highly skilled managers, found in larger workplaces, and more highly skilled workers as an explanation of size-wage effects, suggesting that highly skilled workers are more productive when they work in teams with other highly skilled workers.

A second theme de-emphasises skill and focuses on efficiency wages or labour market imperfections. Thus, large employers are hypothesised to pay more than small ones to reduce monitoring costs, which are naturally higher in larger organizations (Oi 1983). Another efficiency wage idea is that large firms may also share rents with

workers. Because larger employers are more likely to generate rents, wages are expected to be higher. An employer's failure to share rents may elicit shirking, which presumably can be minimised by paying an efficiency wage (Teulings and Hartog, 1998: 180-187). Monopsony search models also predict a positive size-wage elasticity even if workers' skills are the same in large and small firms (e.g. Burdett and Mortensen 1998; Green, Machin, and Manning 1996).

Troske (1999) also conjectures that larger employers not only demand more highly skilled workers, but they produce them through training, and argues that the inability to observe training activities in the data precludes researchers from more fully explaining the size-wage gap. Based on the theory of compensating differences, and assuming that firms and workers share part of the returns to training, trained workers are hypothesised to earn higher wages. Although other researchers have also related the size-wage gap to differences in training (Brown and Medoff 1989; Holtmann and Idson 1991; Oi and Idson 1999), it does not appear that such a hypothesis has been tested empirically. Using HILDA Survey data on job training activities, we shed light on this hypothesis.

## III. HILDA Survey Data

Our research builds on studies that have estimated employer size-wage effects by using longitudinal data and fixed effects estimation. The empirical results are based on analysis of the HILDA Survey, which we used to construct an unbalanced panel originating from the first six waves (2001–2006).[3] In the first wave of data gathered between August and December 2001, a total of 7,683 households representing 66% of all in-scope households were interviewed, generating a sample of 15,127 persons 15 years or older and eligible

[3] Wooden and Watson (2007) provide detailed information on the survey.

for interview. Of these households, 13,969 were successfully interviewed. Subsequent interviews for later waves were conducted about one year apart.

The HILDA Survey contains information on individuals' current labour market activity including labour force status, earnings and hours worked, and employment and unemployment history. For those employed, the HILDA Survey contains information on job characteristics, such as employer size, occupation, industry of employment, and job training activities. The wages used in this study refer to hourly wages in the main job, which is computed by dividing weekly earnings by average hours worked in the main job.[4] Wages are deflated to the first quarter of 2001 using quarterly wage growth rates for males and females separately. One advantage of the HILDA Survey compared to other large nationally representative data sets in Australia is that earnings data are not grouped, thus avoiding possible measurement error.

The HILDA Survey asks two questions regarding employer size. The first addresses establishment size, asking how many employees work at the establishment where the respondent is employed. The second deals with firm size by asking how many workers are employed in all the firm's establishments across Australia. Depending on the availability of information, both establishment size and firm size have been used to estimate the employer size-wage effect (Evans and Leighton 1989; Oi and Idson 1999). Based on the lack of sound theoretical justification for preferring one measure of employer size to the other, we examine the effects of both measures. As a first step to reduce measurement error bias (e.g. Freeman 1984), we exclude workers who do not know either the establishment size or firm size of their employer.

[4] Using wages derived from earnings and working hours of all jobs produces virtually identical results.

Our analysis focuses on workers aged 25 or over but under the Australian Age-Pension age. Thus our sample of males includes workers aged 25 to 64 years (inclusive) and the sample of females includes workers aged 25 to 62 years for waves 1 to 4 and aged 25 to 63 years for waves 5 and 6.[5] Full-time students are excluded even if they reported employment. Also excluded are the self-employed, employees of their own businesses, and workers in agriculture. The analysis is conducted for males and females separately. The sample of males includes 12,331 observations representing 2,882 individuals, while the sample of females includes 11,798 observations representing 2,910 individuals.

**Descriptive Statistics**

Table 1 provides summary statistics of the sample on the distribution by establishment size and firm size. A majority of male and female workers (63% for males and 68% for females) are employed at establishments with fewer than 100 employees. Firms with fewer than 100 workers employ between 34 and 36% of Australia's workers. Fifty-one per cent of workers in Australia report employment with firms employing 500 or more workers. This figure is similar to the 49.1% reported by the U.S. Census (2008).

The data also show differences in observable characteristics across the size spectrum. The results in Tables 2 and 3 indicate that wages unadjusted for differences in productivity related characteristics are clearly higher in larger establishments and firms. Among males, workers in 500+ worker establishments earn 50.3% higher wages than workers in establishments with fewer than 20 workers. The difference of 27.5% among

[5] Qualifications for women to receive Age-Pension payments changed in July 1995. The minimum Age Pension age in 2001 and 2002 was 62 years, 62.5 years in 2003 and 2004, and 63 years in 2005 and 2006. To simplify the analysis, we counted 62 years as the female Age Pension age for waves 1-4 and 63 years for waves 5 and 6.

females is significantly smaller. The pattern persists along the dimension of firm size. Male workers in the largest firms (20,000+ employees) earn 38.6% more than their counterparts in the smallest firms (<20 employees). The corresponding wage difference among female workers is 16.1%. The results also show that employees in large establishments and firms have been with their employers longer, have more education, and are more likely to be union members than their counterparts in smaller establishments and firms.

The descriptive statistics show clearly that large employers hire workers with higher levels of observed skill. If such skills are the primary basis for wage differences across workers, then multiple regression analysis, which controls for observed heterogeneity, should significantly lower the wage gap based on employer size. If a substantial gap remains, then unobserved skills may be part of the explanation. The econometric model proposed in the next section is designed to assess the degree to which observed and unobserved characteristics affect the size-wage effect.

## IV. The Econometric Model

The commonly used model for examining size-wage effects is an augmented version of the standard wage equation. Let $w_{it}$ denote the natural log of hourly wages for an individual *i* at time *t*, the wage determination equation is specified as

$$w_{it} = X_{it}'\beta + \psi S_{it} + \varepsilon_{it} \qquad (1)$$

Where $i = 1,..., N$ represents the number of individuals in each wave and $t$ = 1,….6 is the number of waves. The symbol $X_{it}$ represents a vector of observed variables determining wages, and $\beta$ is a vector of associated parameters, $S_{it}$ denotes a vector of dummy variables controlling for firm size, $\psi$ measures the effect of size on wages, which is the parameter vector of interest, $\varepsilon_{it}$ is an error term summarizing all unobserved factors that affect wages.

On the assumption that $\varepsilon_{it}$ is not correlated with $X_{it}$ and $S_{it}$, $\beta$ and $\psi$ can be estimated without bias using ordinary least squares (OLS) on cross-sectional data or pooled panel data. The pooled panel data approach (denoted as pooled OLS) uses the panel as an extended cross-sectional data set and thus provides estimates that would arise from similar analysis on a cross-sectional survey. Estimates from this model should be comparable to other cross-sectional studies. However, if the error term $\varepsilon_{it}$ contains unobserved individual ability that is also correlated with observed variables such as employer size, then the estimates on the observed variables are biased. For example, if employees with high levels of unobserved skills are more likely to be employed by large firms, the effects of employer size on wages will be biased upwards when we estimate equation (1).

With the assumption that unobserved individual ability is fixed over time, panel data provide a way to consistently estimate the effect of observed variables even if they are correlated with unobserved ability. Suppose $\varepsilon_{it}$ can be written as $\varepsilon_{it} = \mu_i + v_{it,}$ where $\mu_i$ refers to unobserved individual fixed effects, and $v_{it}$ refers to time variant random error that is not correlated with observed variables, then equation (1) becomes

$$w_{it} = X_{it}'\beta + \psi S_{it} + \mu_i + v_{it}, \qquad (1')$$

Equation (1') can be estimated using fixed effects models with panel data to obtain consistent estimates for $\beta$ and $\psi$. The differences in the estimates between pooled OLS and fixed effects models provide a way to measure the bias arising from unobserved individual ability in cross-sectional estimation.

## V. Estimation Results

Using an unbalanced panel, we estimate a wage level (pooled OLS) equation and wage change (fixed effects) equation as discussed in the preceding section and report the results in Table 4. In the first estimation we use only establishment size and other control variables to estimate size-wage effects. The omitted size category is fewer than 20 workers. The results in the OLS equation show the familiar increasing wage effect by establishment size. Male workers in establishments with 500 or more employees earn roughly 25% more than those employed in establishments with fewer than 20 workers.[6] Roughly half the raw size-wage differential is accounted for by controlling for observed factors.

For females the establishment size effect is substantially smaller. The OLS results for females suggest that the establishment size-wage effect only becomes statistically significant at the size of 200 – 499 employees, although the coefficients on establishment size are jointly statistically significant at the .01 level. Females employed in 500-plus employee establishments earn only 11% more than their counterparts in

[6] The size-wage effect is computed using the formula exp(β)-1, where β is the estimated coefficient.

workplaces with less than 20 employees. Adjusting for observed characteristics reduces the raw wage gap between large and small establishments by approximately 60% for females. For both males and females the results suggest that workers in larger establishments also have better observed characteristics.

We now turn to results of the fixed effects estimations to assess the effects of unobserved productivity characteristics, which are also located in Table 4. When using the wage change approach, size-wage effects shrink dramatically for men. Notice that while the wage gap between the smallest and larger firms remains statistically significant, the magnitude falls to a relatively narrow range between roughly 4 and 5%. The range of fixed effects estimates for females is somewhat wider at between 0 and 5%.[7] But like in the OLS estimation, only the two coefficients on establishments larger than 200 are statistically significant. The results for both males and females are consistent with the notion of positive selection into larger establishments based on unobserved skills. Thus unobserved characteristics that positively affect the wage also positively affect the probability of being employed in a large establishment. Interestingly, however, for males the effect does not vary much as the size of the establishment increases to 20 or more workers. For example, the equality of the coefficients on all the establishment size variables cannot be rejected at the .05 level of significance. Among females, only for workers in establishments larger than 200 employees is the size effect present. In other words, after controlling for unobserved characteristics, size-wage effects do not exhibit a consistent monotonic increase along with establishment size.

Table 4 about here

[7] These results are similar to Evans and Leighton (1989) who used data from the U.S. and Ferrer and Lluis (2008) who used data from Canada.

We used OLS to estimate another wage equation in which the establishment size variables were replaced with firm size variables. Recall that firm size represents the number of employees of a given firm throughout Australia. For both males and females the results on firm size variables located in Table 5 are similar to the previous results on establishment size. That is, it appears that larger firms pay substantially more than smaller firms, that the effect is more pronounced among males compared to females, and that there is a roughly monotonically increasing wage by firm size category. In addition, controlling for observed heterogeneity using OLS substantially reduced the magnitude of the initial unadjusted firm size-wage gaps.

Table 5 about here

Similar to establishment size, we estimate a wage change model with individual fixed effects specification to control for unobserved heterogeneity. Our findings show that the estimates on firm size are attenuated much as the results on establishment size, suggesting that part of the firm size-wage effect in the OLS specification may be attributable to unobserved individual quality differences. Such results constitute evidence that workers in larger firms have better unobserved productivity-related characteristics than their counterparts in smaller firms. For males the range of estimates from across the size spectrum is greater in the fixed effects estimates on firm size compared to establishment size. The estimate on the '20 – 99 Workers' variable is .037 compared to .092 on the '20,000+' variable. However, while the coefficients on the '20 – 99 Workers' variable and the '20,000+' variable are statistically different at the .01 level, the coefficients on the firm size variables larger than 100 employees are not statistically different at the .05 level. There is a similar wider spread among females when size is

measured by the number of employees in the firm, rather than in the establishment. Although, again, the coefficients on the firm size variables representing firms with 100 or more employees are not statistically different at the .05 level.

In the next specification, we simultaneously control for establishment size and firm size. The estimates are located in Table 6. For males, both establishment size and firm size are statistically significant determinants of wages in the model estimated using OLS. The fixed effects model reduces the estimates substantially, but the results indicate that both establishment size and firm size matter in explaining the variation in wages of male workers. The much smaller effects in the fixed effects model continue to support the notion of positive sorting by unobserved skill into both larger establishments and larger firms. The attenuation of the coefficients after controlling for unobserved productivity is stronger among the coefficients on firm size than on establishment size.

For females, the OLS coefficients generally remain smaller than for males, but for both establishment size and firm size the coefficients are jointly statistically significant. However, in the fixed effects estimates, neither establishment size nor firm size is jointly statistically significant, although some coefficients are individually significant at the .05 level (e.g. workplace size 200-499 and firm size 5,000-19,999) or at the .10 level (e.g. firm size 1,000-4,999 and firm size 20,000+). Such findings suggest that once unobserved quality differences are accounted for the establishment size and firm size effects virtually disappear for female workers.

Table 6 about here

## VI. Measurement Error and Fixed Effects Estimates

Freeman (1984) noted that access to longitudinal data to control for unobserved individual heterogeneity does not provide a research panacea for problems of biased OLS estimates. In the context of union wage effects, for example, he demonstrated that measurement error can substantially bias the union wage effect downwards in instances where union status is wrongly recorded in just a modest number of observations. The same logic applies to measurement error in employer size variables. That is, mis-reporting size status has the potential to bias estimates of size-wage effects downwards in fixed effects models.

Previous researchers who have estimated firm size-wage effects using wage change models have attempted to control for measurement error that would substantially attenuate size-wage effects. For example, Brown and Medoff (1989: 1038) found that workers who stayed in the same job, but who reported a change in firm size, did not experience a firm size-wage effect. On the other hand, those who changed employers while reporting a change in firm size experienced a size-wage effect. Winter–Ebmer and Zweimuller (1999) found similar results when controlling for measurement error by focusing only on job changers in longitudinal data from Switzerland.

The results presented thus far have been based on a sample that excluded workers who did not know their establishment size or firm size. To further determine whether mis-measurement of employer size variables exerts any meaningful bias on our fixed effects estimates of size-wage effects, we re-estimate the models excluding respondents whose establishment size or firm size changed, but who did not change employers (stayers). Because information about change of employers only became available starting

in the second wave of data (2002), we exclude the first wave from our analysis in this section. This exclusion rule eliminated 1,336 person-year observations among male respondents, leaving a total of 6,619, and it eliminated 1,252 female respondents, leaving 6,642 person-year observations. For convenience, the new estimates located in Table 7 are split into two panels, the first showing the results before job stayers are excluded (the unrestricted sample), and the second showing results after the exclusion (the restricted sample).

If measurement error existing in self-reported employer size variables does attenuate size-wage effects, then excluding those who changed employer size, but who did not change employers, should correct for the error and leave larger estimates in the restricted sample (second panel in Table 7). The results show that while we see increases in the estimates on some establishment and firm size variables, we also see decreases in estimates on other variables. In addition, the differences in the estimates between the restricted and unrestricted samples do not appear to be statistically significant. Therefore, it appears that measurement error in the employer size variables is likely not a problem for our fixed effects estimates.

Table 7 about here

## VII. Training and the Employer Size-Wage Effect

The results thus far suggest that a substantial portion of the size-wage effect is accounted for by unobserved heterogeneity. But there is still some of the size wage effect left unaccounted for, particularly among males. Recall that after estimating size-wage effects

using cross-sectional matched employer-employee data, Troske (1999) finds that 45% of the firm size wage premium is attributable to capital-skill complementarity in larger firms and that 20% of the cross-sectional establishment and firm size-wage premiums are attributable the matching of more skilled workers together in larger plants. He then conjectures that perhaps the remaining size-wage premium may stem from large firms' hiring more skilled workers and engaging in more on-the-job training.[8] Fortunately, the HILDA Survey began observing on-the-job training activities in 2003 (the third wave), which allows us to address Troske's (1999) conjecture about job training and the size-wage effect.

The HILDA Survey respondents were asked several questions about their job training activities in the 12 months prior to the survey interview. The questions specifically addressed whether they engaged in training 1) for getting started on the current job, 2) to improve skills for the current job, 3) to maintain their professional status, 4) to prepare for future jobs, 5) to develop general skills, 6) to address health and safety issues, or 7) for some other purpose. Table 8 lists the questions asked and the proportions of workers answering in the affirmative. For both male and female workers three types of training appear to be nearly equally prominent, 1) enhancing skills for the current job, 2) maintaining professional status, and 3) developing general skills. The results also indicate that incidence of some training increases with the size of either establishments or firms.

[8] Other researchers have connected employer size, wages, and on-the-job training (Barron, Black and Loewenstein 1987; Barron, Black and Loewenstein 1989; Black, Noel, and Wang 1999). In addition, the Australian Bureau of Statistics (ABS) conducts the Survey of Education and Training (SET) every four years and gathers extensive *cross-sectional* data on training activities (ABS 2006). Research using the SET shows a positive correlation between the incidence of training and employer size in Australia (Wooden 1996).

Table 8 about here

In order to determine whether observing on-the-job the training has any impact on employer size variables, we augment the econometric model in equation 1 with a vector of indicator variables for the various types of training listed above. The model takes the following form:

$$w_{it} = X_{it}'\beta + \psi S_{it} + \delta T_{it} + \mu_i + v_{it}, \qquad (2)$$

where $T$ represents training activities of individual i in the 12 months prior to time t and $\delta$ is a vector of parameters to be estimated. Similar to our estimation of equation 1', we first estimate equation 2 using OLS, then using a fixed effects approach. The results are presented in Table 9.

Table 9 about here

For convenience in comparison, the first panel in Table 9 contains the OLS and fixed effects estimates without controls for training activities.[9] If differences in training by firm size explain some of the size-wage effect, one would expect to find smaller coefficients on the employer size variables in the second panel where the training variables are accounted for. Casual comparison indicates that there are virtually no changes in the OLS estimates of either establishment size or firm size effects once the

[9] We re-estimated the model without controlling for training since the sample here excludes observations in waves 1 and 2. This is because information on training was only collected from wave 3 onwards.

training variables are accounted for. Such findings suggest that differences in training across employer size likely has very little to do with size-wage effects.

The results on the cross-sectional employer size-wage effects suggest that training does not have much of an impact on current wages. For males, enhanced training for the current job and training to maintain professional status appears to exert a mild increase (2.7% and 2.2%, respectively) in wages, but other types of training for example training for 'Getting Started' in the job and health and safety training are negatively correlated with wages. The results for females on the 'maintaining professional status' variable mirror that of males, and the other findings are not statistically significant. It appears, however, that once unobserved heterogeneity is accounted for by estimating individual fixed effects, the size of the coefficients drops and statistical significance evaporates. Perhaps training affects wages to a greater extent over the long term, but in the short term there does not appear to be an effect.[10]

Another possibility is that perhaps firms pay for training investments and then share the returns with workers, which suggests the size of the returns to workers in the form of increased wages may be quite small. It is interesting to note that results from the Survey of Education and Training conducted by the Australian Bureau of Statistics (ABS) in 2005 indicate that 90% of wage and salaried employees who participated in at

[10] We also estimated equation 2 using lagged training variables and the results were very similar to those reported in Table 9. These results are consistent with Booth and Bryan (2005), who used data from the British Household Panel Survey to estimate returns to training and found that employer-sponsored general training with the current employer had no statistically significant effect on wages. Our findings are not strictly comparable because to Booth and Bryan's because the sample includes both workers who remained with their current employers and those who changed employers; however, a majority of respondents in the sample did not change employers. In addition, Booth and Katic (2009) found similar results for Australia, where training increased wages in both current and future employers, but the training wage effect was larger and more precisely determined for workers who received training in one firm and then moved to another.

least one in-house training course considered the skills they obtained to be transferable to other employers, while only 7% reported that their training led to an increase in pay (ABS 2006: 9). With such a large majority of training participants in the SET not experiencing a pay increase based on training, one would not expect to observe much of an impact on wages or the employer size-wage effect in the HILDA Survey data either.

## VIII. Conclusions

A large body of research has documented size-wage effects across industrialised countries. Although the mechanism by which such effects occur is still not completely understood, the use of longitudinal data to control for individual fixed effects has demonstrated that differences in unobserved ability generally account for a substantial part of the size-wage gap. Recently the HILDA Survey, a nationally representative longitudinal data set, has become available so that research similar to that performed elsewhere could be conducted for Australia. Similar to studies using data from other countries, we have found that a significant portion of both establishment and firm size-wage effects in Australia are explained by individual quality differences. The findings are quite different for male and female workers. For males, the familiar pattern of progressively higher wages as establishment size grows is substantially attenuated when unobserved quality differences are accounted for through fixed effects estimation techniques. Our results indicate that to the extent that there are establishment size and firm size effects, they are quite small and are mostly driven by lower wages for workers in firms with fewer than twenty workers. For females, the more modest size-wage effects

found using OLS estimation largely disappear when individual fixed effects are used to control for unobserved quality differences.

Our research also sheds light on Troske's (1999) conjecture that perhaps size-wage effects could be explained by more and better data on differences in job training by employer size. The results using data from Australia suggest that training exerts very little impact on wages after controlling for observed and unobserved individual quality differences. Our findings also suggest that accounting for differences in the incidence of job training has no effect on the structure of wage differences by employer size. In the Australian case, observing differences in training by employer size does not bring us closer to an explanation for why larger employers pay more than their small counterparts.

Because data on employers is lacking in the HILDA Survey, we have not controlled for the factors that arise from firms themselves, such as skill complementarities, monitoring costs, efficiency wages, and rent sharing. Indeed, Troske (1999) showed with a cross-sectional matched employer-employee data set from the U.S. that skill complementarities explain a substantial portion of the size-wage relationship. Combining Troske's (1999) results with those found in the present study (and Evans and Leighton [1989] and Ferrer and Lluis [2008]), it is not unreasonable to expect that if one had access to detailed longitudinal data on both workers and firms to control for both unobserved heterogeneity and employer behaviour surrounding skill complementarities, then most, if not all, of the wage gap between large and small employers could be explained.

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Data Appendix (Selected Variables)

Hourly Wages = Current weekly gross wages and salary from main job divided by combined hours per week usually worked in main job.

Age = Age in years at the time of the survey.

Work Experience = Years in paid employment.

Tenure = Tenure with last employer in years.

Year 11 or Below = 1 if highest level of education is year 11 or below.

Year 12 = 1 if highest level of education is year 12.

Other Post-Secondary Qualification = 1 if highest level of education is a post secondary qualification.

Bach. Degree or Higher = 1 if highest level of education is a bachelors degree or higher.

Married = 1 if currently married or in a de-facto marriage with domestic partner.

Australia Born = 1 if born in Australia.

Born Eng. Speaking Cntry. = 1 if worker is born in an English speaking country.

Born Non-Eng. Speaking Ctry = 1 if worker is born in a non-English speaking country.

art-time = 1 if weekly hours of work is less than 35.

Casual = 1 if work is characterised by casual arrangements (i.e. the ABS definition is no paid holiday leave and no paid sick leave).

Blue Collar = 1 if last or current job is defined as a tradesperson, laborer, production or transport or related worker.

Other White Collar = 1 if last or current job is as a clerical, sales or service worker.

White Collar = 1 if last of current job is as a manager, administrator, or professional.

Union Member = 1 if union member in main job.

Table 1

Proportion of Workers by Establishment Size, Firm Size and Gender

| | Males | Females |
|---|---|---|
| *Establishment Size* | | |
| < 20 | 0.315 | 0.355 |
| 20-99 | 0.311 | 0.313 |
| 100-199 | 0.119 | 0.101 |
| 200-499 | 0.114 | 0.097 |
| 500+ | 0.140 | 0.133 |
| Number | 12,331 | 11,798 |
| | | |
| *Firm Size* | | |
| < 20 | 0.172 | 0.215 |
| 20-99 | 0.172 | 0.151 |
| 100-499 | 0.154 | 0.117 |
| 500-999 | 0.086 | 0.075 |
| 1,000-4,999 | 0.155 | 0.119 |
| 5,000-19,999 | 0.133 | 0.126 |
| 20,000+ | 0.128 | 0.198 |
| Number | 12,331 | 11,798 |

Source: Household Income and Labour Dynamics of Australia (HILDA).

Table 2

Descriptive Statistics by Establishment Size: HILDA Survey Data (2001-2006)

| | Establishment Size | | | | | |
|---|---|---|---|---|---|---|
| | < 20 | 20-99 | 100-199 | 200-499 | 500+ | All |
| *Males* | | | | | | |
| Wages | 18.7 | 22.3 | 23.7 | 25.2 | 28.1 | 22.5 |
| s.d. | 9.4 | 19.9 | 16.1 | 19.0 | 15.1 | 16.3 |
| Age | 40.8 | 41.6 | 42.5 | 41.4 | 41.4 | 41.4 |
| s.d. | 9.9 | 9.6 | 9.7 | 9.4 | 9.4 | 9.7 |
| Tenure | 6.4 | 8.2 | 9.5 | 8.9 | 9.9 | 8.1 |
| s.d. | 7.7 | 8.6 | 9.1 | 8.2 | 9.0 | 8.5 |
| Year 11 or Below | 23.8 | 19.5 | 17.6 | 16.1 | 11.0 | 19.0 |
| Year 12 | 12.1 | 9.9 | 10.5 | 12.2 | 10.9 | 11.1 |
| Other Post-School Qualification | 45.3 | 41.4 | 40.3 | 40.7 | 30.8 | 40.9 |
| Bach. Degree or Higher | 18.9 | 29.2 | 31.6 | 31.0 | 47.3 | 29.0 |
| Blue Collar | 42.6 | 33.6 | 32.6 | 33.7 | 23.7 | 34.9 |
| Other White Collar | 33.3 | 31.3 | 28.5 | 29.6 | 26.7 | 30.8 |
| White Collar | 24.0 | 35.1 | 38.9 | 36.7 | 49.5 | 34.3 |
| Union Member | 23.6 | 35.5 | 45.6 | 47.0 | 43.9 | 35.4 |
| Number of Observations | 3,886 | 3,838 | 1,468 | 1,407 | 1,732 | 12,331 |
| *Females* | | | | | | |
| Wages | 17.8 | 19.0 | 19.4 | 20.2 | 22.7 | 19.2 |
| s.d. | 11.6 | 9.5 | 8.3 | 11.2 | 8.9 | 10.4 |
| Age | 41.7 | 41.6 | 41.7 | 41.7 | 41.0 | 41.6 |
| s.d. | 9.5 | 9.3 | 9.4 | 9.7 | 9.3 | 9.4 |
| Tenure | 5.2 | 7.8 | 7.5 | 6.9 | 8.0 | 6.8 |
| s.d. | 6.2 | 7.8 | 7.1 | 6.5 | 7.5 | 7.1 |
| Year 11 or Below | 33.1 | 21.1 | 22.2 | 25.4 | 16.9 | 25.3 |
| Year 12 | 16.5 | 13.0 | 12.6 | 15.4 | 11.2 | 14.2 |
| Other Post-School Qualification | 27.7 | 27.9 | 24.4 | 22.8 | 19.0 | 25.8 |
| Bach. Degree or Higher | 22.8 | 38.0 | 40.8 | 36.4 | 53.0 | 34.7 |
| Blue Collar | 9.8 | 6.5 | 8.7 | 10.4 | 4.6 | 8.0 |
| Other White Collar | 65.7 | 48.7 | 46.7 | 51.5 | 39.6 | 53.6 |
| White Collar | 24.5 | 44.7 | 44.6 | 38.1 | 55.8 | 38.4 |
| Union Member | 17.6 | 37.8 | 45.7 | 44.9 | 42.9 | 32.8 |
| Number of Observations | 4,188 | 3,693 | 1,195 | 1,150 | 1,572 | 11,798 |

Source: Household Income and Labour Dynamics of Australia (HILDA) Survey.
Note: the number of observations are person years.

Table 3

Descriptive Statistics by Size of Firm: HILDA Survey Data (2001-2006)

| | Firm Size | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | < 20 | 20-99 | 100-499 | 500-999 | 1,000-4,999 | 5,000-19,999 | 2,0000+ | All |
| *Males* | | | | | | | | |
| Wages | 17.6 | 20.4 | 23.2 | 24.6 | 25.2 | 24.1 | 24.4 | 22.5 |
| s.d. | 9.5 | 15.7 | 23.2 | 15.2 | 20.6 | 10.0 | 12.1 | 16.3 |
| Age | 40.0 | 40.6 | 42.1 | 42.3 | 42.2 | 41.6 | 41.7 | 41.4 |
| s.d. | 10.1 | 9.5 | 9.7 | 9.5 | 9.5 | 9.4 | 9.6 | 9.7 |
| Tenure | 5.0 | 5.7 | 7.3 | 8.3 | 9.2 | 10.8 | 12.2 | 8.1 |
| s.d. | 6.2 | 6.6 | 7.4 | 8.4 | 8.7 | 9.5 | 10.4 | 8.5 |
| Year 11 or Below | 25.8 | 22.5 | 17.5 | 14.9 | 15.5 | 17.7 | 15.8 | 19.0 |
| Year 12 | 11.9 | 11.8 | 11.5 | 10.1 | 9.4 | 10.5 | 11.6 | 11.1 |
| Other Post-School Qual. | 45.9 | 40.4 | 41.5 | 37.9 | 39.9 | 42.1 | 36.3 | 40.9 |
| Bach. Degree or Higher | 16.4 | 25.4 | 29.5 | 37.1 | 35.2 | 29.7 | 36.3 | 29.0 |
| Blue Collar | 53.8 | 38.5 | 33.3 | 31.1 | 29.2 | 27.4 | 24.2 | 34.9 |
| Other White Collar | 27.1 | 29.8 | 26.9 | 26.5 | 32.1 | 38.9 | 34.7 | 30.8 |
| White Collar | 19.1 | 31.7 | 39.8 | 42.5 | 38.7 | 33.7 | 41.1 | 34.3 |
| Union Member | 14.2 | 22.2 | 34.3 | 39.0 | 41.1 | 52.2 | 56.6 | 35.4 |
| Number of Observations | 2,123 | 2,115 | 1,902 | 1,055 | 1,917 | 1,641 | 1,578 | 12,331 |
| *Females* | | | | | | | | |
| Wages | 17.4 | 18.2 | 19.6 | 20.3 | 19.6 | 20.4 | 20.2 | 19.2 |
| s.d. | 12.8 | 12.1 | 8.5 | 11.6 | 7.6 | 8.0 | 9.0 | 10.4 |
| Age | 41.7 | 41.2 | 41.5 | 40.8 | 41.2 | 41.3 | 42.4 | 41.6 |
| s.d. | 9.6 | 9.4 | 9.9 | 9.3 | 9.2 | 9.2 | 9.2 | 9.4 |
| Tenure | 4.6 | 5.3 | 5.4 | 6.6 | 6.8 | 7.6 | 10.6 | 6.8 |
| s.d. | 5.5 | 6.0 | 5.7 | 6.5 | 6.8 | 7.0 | 8.8 | 7.1 |
| Year 11 or Below | 34.8 | 24.7 | 22.9 | 19.5 | 22.5 | 24.1 | 21.6 | 25.3 |
| Year 12 | 18.0 | 15.2 | 14.8 | 12.2 | 14.6 | 13.1 | 10.2 | 14.2 |
| Other Post-School Qual. | 26.3 | 26.7 | 25.4 | 22.6 | 25.3 | 23.2 | 27.8 | 25.8 |
| Bach. Degree or Higher | 21.0 | 33.4 | 36.9 | 45.7 | 37.7 | 39.7 | 40.4 | 34.7 |
| Blue Collar | 12.2 | 8.5 | 9.6 | 8.3 | 6.3 | 5.4 | 4.8 | 8.0 |
| Other White Collar | 67.3 | 56.1 | 48.3 | 43.8 | 52.3 | 54.3 | 44.0 | 53.6 |
| White Collar | 20.5 | 35.4 | 42.1 | 47.9 | 41.4 | 40.3 | 51.1 | 38.4 |
| Union Member | 9.6 | 19.7 | 30.0 | 37.2 | 33.5 | 44.2 | 60.2 | 32.8 |
| Number of Observations | 2,535 | 1,776 | 1,385 | 879 | 1,402 | 1,484 | 2,337 | 11,798 |

Source: Household Income and Labour Dynamics of Australia (HILDA) Survey.
Note: the number of observations are in person years.

Table 4

OLS and Fixed Effects Estimates of Establishment Size on Ln Wages: HILDA 2001 - 2006

| | Males | | | | Females | | | |
|---|---|---|---|---|---|---|---|---|
| | OLS | | Fixed Effect | | OLS | | Fixed Effect | |
| Variables | Coeff. | Std Err. | Coeff. | Std err. | Coeff. | Std Err. | Coeff. | Std err. |
| 20 - 99 Workers | 0.102 | 0.013 | 0.038 | 0.009 | 0.013 | 0.011 | 0.006 | 0.010 |
| 100 - 199 | 0.118 | 0.017 | 0.051 | 0.012 | 0.025 | 0.017 | 0.021 | 0.014 |
| 200 - 499 | 0.166 | 0.016 | 0.047 | 0.013 | 0.069 | 0.016 | 0.048 | 0.015 |
| 500 + | 0.223 | 0.019 | 0.052 | 0.013 | 0.106 | 0.015 | 0.035 | 0.015 |
| Union Member | 0.078 | 0.014 | 0.052 | 0.011 | 0.036 | 0.012 | 0.020 | 0.012 |
| Age | 0.006 | 0.010 | 0.022 | 0.022 | -0.005 | 0.006 | -0.016 | 0.020 |
| Age Sq. | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bach. Degree or Higher | 0.277 | 0.023 | -0.013 | 0.071 | 0.184 | 0.018 | 0.045 | 0.061 |
| Other Qualification | 0.118 | 0.015 | 0.025 | 0.047 | 0.054 | 0.014 | 0.016 | 0.030 |
| Year 12 | 0.090 | 0.024 | 0.034 | 0.063 | 0.045 | 0.018 | 0.028 | 0.052 |
| Experience | 0.0150 | 0.0044 | 0.0201 | 0.0178 | 0.0155 | 0.0036 | 0.0657 | 0.0137 |
| Experience Sq. | -0.0001 | 0.0001 | -0.0002 | 0.0002 | -0.0003 | 0.0001 | -0.0004 | 0.0002 |
| Tenure with Employer | 0.0074 | 0.0020 | 0.0034 | 0.0017 | 0.0100 | 0.0019 | 0.0034 | 0.0019 |
| Tenure Sq. | -0.0001 | 0.0001 | -0.0001 | 0.0001 | -0.0002 | 0.0001 | -0.0001 | 0.0001 |
| Married | 0.091 | 0.014 | 0.019 | 0.013 | 0.032 | 0.011 | -0.005 | 0.014 |
| Born English Speaking Cntry. | 0.023 | 0.020 | --- | --- | 0.029 | 0.016 | --- | --- |
| Born Non-English Speaking Cntry. | -0.050 | 0.021 | --- | --- | 0.002 | 0.017 | --- | --- |
| Part Time | 0.026 | 0.041 | 0.200 | 0.024 | 0.053 | 0.011 | 0.111 | 0.011 |
| Casual | 0.053 | 0.020 | 0.052 | 0.014 | -0.024 | 0.027 | 0.007 | 0.019 |
| Part Time*Casual | 0.017 | 0.053 | -0.089 | 0.030 | 0.044 | 0.030 | 0.011 | 0.022 |

Source: Estimates computed from the Household Income and Labour Dynamics of Australia (HILDA) Survey.
Note: A series of industry, occupation, and regional control variables were included. The full results can be obtained from the authors.

Table 5

OLS and Fixed Effects Estimates of Firm Size on Ln Wages: HILDA 2001 - 2006

| | Males | | | | Females | | | |
|---|---|---|---|---|---|---|---|---|
| | OLS | | Fixed Effect | | OLS | | Fixed Effect | |
| Variables | Coeff. | Std Err. | Coeff. | Std err. | Coeff. | Std Err. | Coeff. | Std err. |
| 20 - 99 Workers | 0.083 | 0.017 | 0.037 | 0.012 | 0.011 | 0.014 | 0.012 | 0.013 |
| 100 - 499 | 0.135 | 0.019 | 0.072 | 0.014 | 0.059 | 0.016 | 0.031 | 0.015 |
| 500 - 999 | 0.143 | 0.024 | 0.050 | 0.016 | 0.022 | 0.023 | 0.029 | 0.017 |
| 1,000-4,999 | 0.192 | 0.020 | 0.065 | 0.015 | 0.049 | 0.016 | 0.035 | 0.015 |
| 5,000-19,999 | 0.201 | 0.020 | 0.083 | 0.016 | 0.084 | 0.016 | 0.049 | 0.015 |
| 20,000 + | 0.182 | 0.021 | 0.092 | 0.017 | 0.057 | 0.015 | 0.038 | 0.016 |
| Union Member | 0.070 | 0.014 | 0.051 | 0.011 | 0.032 | 0.012 | 0.019 | 0.012 |
| Age | 0.006 | 0.010 | 0.021 | 0.022 | -0.005 | 0.006 | -0.016 | 0.020 |
| Age Sq. | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bach. Degree or Higher | 0.290 | 0.024 | -0.007 | 0.071 | 0.190 | 0.018 | 0.041 | 0.061 |
| Other Qualification | 0.117 | 0.015 | 0.028 | 0.047 | 0.052 | 0.014 | 0.015 | 0.030 |
| Year 12 | 0.0954 | 0.0237 | 0.0416 | 0.0628 | 0.0458 | 0.0176 | 0.0241 | 0.0520 |
| Experience | 0.0151 | 0.0044 | 0.0193 | 0.0178 | 0.0155 | 0.0036 | 0.0662 | 0.0137 |
| Experience Sq. | -0.0001 | 0.0001 | -0.0002 | 0.0002 | -0.0003 | 0.0001 | -0.0004 | 0.0002 |
| Tenure with Employer | 0.0075 | 0.0020 | 0.0030 | 0.0017 | 0.0101 | 0.0019 | 0.0034 | 0.0019 |
| Tenure Sq. | -0.0002 | 0.0001 | -0.0001 | 0.0001 | -0.0002 | 0.0001 | -0.0001 | 0.0001 |
| Married | 0.090 | 0.014 | 0.018 | 0.013 | 0.030 | 0.011 | -0.006 | 0.014 |
| Born English Speaking Cntry. | 0.026 | 0.020 | --- | --- | 0.032 | 0.016 | --- | --- |
| Born Non-English Speaking Cntry. | -0.049 | 0.021 | --- | --- | 0.004 | 0.017 | --- | --- |
| Part Time | 0.021 | 0.041 | 0.198 | 0.024 | 0.049 | 0.011 | 0.111 | 0.011 |
| Casual | 0.057 | 0.020 | 0.055 | 0.014 | -0.024 | 0.027 | 0.008 | 0.019 |
| Part Time*Casual | 0.023 | 0.053 | -0.086 | 0.030 | 0.050 | 0.030 | 0.012 | 0.022 |

Source: Estimates computed from the Household Income and Labour Dynamics of Australia (HILDA) Survey.
Note: A series of industry, occupation, and regional control variables were included. The full results can be obtained from the authors.

Table 6

OLS and Fixed Effects Estimates of Establishment and Firm Size on Ln Wages: HILDA 2001 - 2006

| | Males | | | | Females | | | |
|---|---|---|---|---|---|---|---|---|
| | OLS | | Fixed Effect | | OLS | | Fixed Effect | |
| Variables | Coeff. | Std Err. | Coeff. | Std err. | Coeff. | Std Err. | Coeff. | Std err. |
| *Establishment Size* | | | | | | | | |
| 20 - 99 Workers | 0.076 | 0.015 | 0.026 | 0.011 | 0.001 | 0.013 | -0.003 | 0.012 |
| 100 - 199 | 0.073 | 0.019 | 0.030 | 0.014 | 0.002 | 0.018 | 0.008 | 0.016 |
| 200 - 499 | 0.119 | 0.018 | 0.026 | 0.014 | 0.049 | 0.017 | 0.035 | 0.017 |
| 500 + | 0.172 | 0.021 | 0.034 | 0.015 | 0.095 | 0.017 | 0.021 | 0.017 |
| *Firm Size* | | | | | | | | |
| 20 - 99 Workers | 0.027 | 0.020 | 0.021 | 0.014 | 0.012 | 0.017 | 0.014 | 0.016 |
| 100 - 499 | 0.070 | 0.021 | 0.054 | 0.016 | 0.050 | 0.018 | 0.025 | 0.017 |
| 500 - 999 | 0.051 | 0.026 | 0.030 | 0.017 | -0.018 | 0.024 | 0.022 | 0.019 |
| 1,000-4,999 | 0.101 | 0.023 | 0.046 | 0.016 | 0.021 | 0.018 | 0.029 | 0.017 |
| 5,000-19,999 | 0.106 | 0.023 | 0.062 | 0.017 | 0.051 | 0.018 | 0.042 | 0.017 |
| 20,000 + | 0.092 | 0.024 | 0.072 | 0.018 | 0.029 | 0.018 | 0.031 | 0.018 |

Note: Regression equations contain controls for same variables as listed in the note in Table 4.

Table 7

OLS and Fixed Effects Estimates of Establishment and Firm Size on Ln Wages: HILDA 2001 - 2006
(Excludes Size Changers with Same Employers)

| | Males | | | | Females | | | |
|---|---|---|---|---|---|---|---|---|
| | OLS | | Fixed Effect | | OLS | | Fixed Effect | |
| Variables | Coeff. | Std Err. | Coeff. | Std err. | Coeff. | Std Err. | Coeff. | Std err. |
| 1. Unrestricted sample (waves 2-6) | | | | | | | | |
| *Establishment Size* | | | | | | | | |
| 20 - 99 Workers | 0.080 | 0.016 | 0.026 | 0.012 | 0.005 | 0.013 | -0.002 | 0.014 |
| 100 - 199 | 0.075 | 0.020 | 0.039 | 0.015 | 0.003 | 0.018 | 0.001 | 0.018 |
| 200 - 499 | 0.118 | 0.019 | 0.030 | 0.016 | 0.046 | 0.019 | 0.033 | 0.019 |
| 500 + | 0.178 | 0.022 | 0.040 | 0.017 | 0.102 | 0.018 | 0.021 | 0.019 |
| *Firm Size* | | | | | | | | |
| 20 - 99 Workers | 0.034 | 0.021 | 0.010 | 0.016 | 0.005 | 0.018 | -0.003 | 0.018 |
| 100 - 499 | 0.068 | 0.022 | 0.042 | 0.018 | 0.053 | 0.019 | 0.020 | 0.020 |
| 500 - 999 | 0.059 | 0.026 | 0.019 | 0.020 | -0.015 | 0.025 | 0.011 | 0.021 |
| 1,000-4,999 | 0.102 | 0.023 | 0.031 | 0.019 | 0.018 | 0.019 | 0.010 | 0.019 |
| 5,000-19,999 | 0.110 | 0.024 | 0.042 | 0.020 | 0.044 | 0.019 | 0.025 | 0.020 |
| 20,000 + | 0.093 | 0.024 | 0.042 | 0.021 | 0.020 | 0.019 | 0.023 | 0.020 |
| 2. Excludes size changers with same employers (waves 2-6) | | | | | | | | |
| *Establishment Size* | | | | | | | | |
| 20 - 99 Workers | 0.053 | 0.017 | 0.024 | 0.014 | 0.022 | 0.018 | -0.012 | 0.018 |
| 100 - 199 | 0.055 | 0.022 | 0.057 | 0.018 | 0.003 | 0.025 | -0.019 | 0.022 |
| 200 - 499 | 0.084 | 0.022 | 0.030 | 0.019 | 0.037 | 0.023 | 0.010 | 0.023 |
| 500 + | 0.146 | 0.026 | 0.048 | 0.019 | 0.108 | 0.025 | 0.012 | 0.023 |
| *Firm Size* | | | | | | | | |
| 20 - 99 Workers | 0.068 | 0.024 | 0.018 | 0.020 | -0.019 | 0.023 | -0.004 | 0.024 |
| 100 - 499 | 0.098 | 0.025 | 0.041 | 0.022 | 0.039 | 0.025 | 0.039 | 0.026 |
| 500 - 999 | 0.080 | 0.030 | 0.014 | 0.024 | -0.034 | 0.037 | 0.036 | 0.028 |
| 1,000-4,999 | 0.134 | 0.027 | 0.037 | 0.023 | 0.009 | 0.028 | 0.034 | 0.026 |
| 5,000-19,999 | 0.146 | 0.028 | 0.045 | 0.024 | 0.032 | 0.025 | 0.043 | 0.027 |
| 20,000 + | 0.146 | 0.028 | 0.048 | 0.025 | 0.015 | 0.025 | 0.055 | 0.028 |

Note: Regression equations contain controls for same variables as listed in the note in Table 4. The sample excludes respondents who reported a change in establishment size or firm size, but not a change in employer.

Table 8

Training Incidence by Type of Training, Gender, and Employer Size

| | New Employee Orientation | Enhance Skills for Current Job | Maintain Profess. Status | Prepare for a Future Job | Develop General Skills | Health and Safety | Other Training |
|---|---|---|---|---|---|---|---|
| | | | | *Males* | | | |
| *Establishment Size* | | | | | | | |
| less 20 | 0.025 | 0.249 | 0.211 | 0.092 | 0.169 | 0.110 | 0.004 |
| 20-99 | 0.020 | 0.308 | 0.263 | 0.110 | 0.214 | 0.130 | 0.006 |
| 100-199 | 0.017 | 0.366 | 0.284 | 0.145 | 0.243 | 0.138 | 0.005 |
| 200-499 | 0.037 | 0.376 | 0.284 | 0.155 | 0.255 | 0.151 | 0.001 |
| 500+ | 0.033 | 0.385 | 0.301 | 0.166 | 0.278 | 0.123 | 0.008 |
| *Employer Size* | | | | | | | |
| less 20 | 0.020 | 0.166 | 0.146 | 0.062 | 0.114 | 0.082 | 0.003 |
| 20-99 | 0.022 | 0.237 | 0.200 | 0.079 | 0.152 | 0.101 | 0.005 |
| 100-499 | 0.019 | 0.310 | 0.256 | 0.113 | 0.224 | 0.118 | 0.002 |
| 500-999 | 0.019 | 0.347 | 0.265 | 0.129 | 0.235 | 0.138 | 0.004 |
| 1000-4999 | 0.029 | 0.388 | 0.305 | 0.158 | 0.288 | 0.152 | 0.006 |
| 5000-19999 | 0.034 | 0.389 | 0.310 | 0.154 | 0.247 | 0.145 | 0.005 |
| 20000+ | 0.035 | 0.436 | 0.359 | 0.184 | 0.303 | 0.169 | 0.010 |
| | | | | *Females* | | | |
| *Establishment Size* | | | | | | | |
| less 20 | 0.027 | 0.276 | 0.211 | 0.081 | 0.182 | 0.071 | 0.007 |
| 20-99 | 0.024 | 0.407 | 0.305 | 0.128 | 0.291 | 0.116 | 0.006 |
| 100-199 | 0.033 | 0.425 | 0.326 | 0.135 | 0.301 | 0.124 | 0.004 |
| 200-499 | 0.040 | 0.383 | 0.265 | 0.164 | 0.269 | 0.133 | 0.007 |
| 500+ | 0.024 | 0.416 | 0.289 | 0.145 | 0.279 | 0.093 | 0.010 |
| *Employer Size* | | | | | | | |
| less 20 | 0.015 | 0.202 | 0.149 | 0.054 | 0.122 | 0.042 | 0.004 |
| 20-99 | 0.026 | 0.344 | 0.248 | 0.101 | 0.231 | 0.090 | 0.008 |
| 100-499 | 0.029 | 0.339 | 0.238 | 0.110 | 0.245 | 0.097 | 0.005 |
| 500-999 | 0.027 | 0.400 | 0.298 | 0.127 | 0.261 | 0.107 | 0.012 |
| 1000-4999 | 0.043 | 0.390 | 0.278 | 0.153 | 0.281 | 0.120 | 0.006 |
| 5000-19999 | 0.028 | 0.451 | 0.319 | 0.169 | 0.322 | 0.115 | 0.003 |
| 20000+ | 0.030 | 0.465 | 0.372 | 0.144 | 0.330 | 0.142 | 0.009 |

Source: Household Income and Labour Dynamics of Australia (HILDA), 2003-2006.

Table 9

Estimates of Establishment, Firm Size, and Training on Ln Wages: HILDA 2003 - 2006

| | Males | | | | Females | | | |
|---|---|---|---|---|---|---|---|---|
| | OLS | | Fixed Effect | | OLS | | Fixed Effect | |
| Variables | Coeff. | Std Err. | Coeff. | Std err. | Coeff. | Std Err. | Coeff. | Std err. |
| | No Controls for Training | | | | | | | |
| *Establishment Size* | | | | | | | | |
| 20 - 99 Workers | 0.0761 | 0.0178 | 0.0263 | 0.0141 | 0.0060 | 0.0150 | -0.0086 | 0.0161 |
| 100 - 199 | 0.0780 | 0.0223 | 0.0544 | 0.0179 | 0.0023 | 0.0218 | 0.0122 | 0.0207 |
| 200 - 499 | 0.1052 | 0.0213 | 0.0282 | 0.0189 | 0.0502 | 0.0208 | 0.0425 | 0.0218 |
| 500 + | 0.1744 | 0.0234 | 0.0221 | 0.0191 | 0.1035 | 0.0200 | 0.0256 | 0.0217 |
| *Firm Size* | | | | | | | | |
| 20 - 99 Workers | 0.0404 | 0.0237 | 0.0154 | 0.0190 | -0.0045 | 0.0202 | -0.0063 | 0.0207 |
| 100 - 499 | 0.0720 | 0.0243 | 0.0362 | 0.0211 | 0.0568 | 0.0217 | 0.0146 | 0.0233 |
| 500 - 999 | 0.0617 | 0.0284 | 0.0108 | 0.0232 | -0.0227 | 0.0292 | -0.0052 | 0.0248 |
| 1,000-4,999 | 0.1180 | 0.0259 | 0.0349 | 0.0221 | 0.0162 | 0.0222 | -0.0047 | 0.0226 |
| 5,000-19,999 | 0.1170 | 0.0268 | 0.0535 | 0.0233 | 0.0295 | 0.0214 | 0.0050 | 0.0230 |
| 20,000 + | 0.1029 | 0.0260 | 0.0406 | 0.0248 | 0.0081 | 0.0218 | 0.0191 | 0.0236 |
| | Controls for Training | | | | | | | |
| *Establishment Size* | | | | | | | | |
| 20 - 99 Workers | 0.0760 | 0.0177 | 0.0261 | 0.0141 | 0.0055 | 0.0150 | -0.0093 | 0.0161 |
| 100 - 199 | 0.0774 | 0.0223 | 0.0536 | 0.0179 | 0.0021 | 0.0218 | 0.0112 | 0.0207 |
| 200 - 499 | 0.1055 | 0.0211 | 0.0280 | 0.0189 | 0.0516 | 0.0208 | 0.0422 | 0.0218 |
| 500 + | 0.1750 | 0.0232 | 0.0224 | 0.0191 | 0.1034 | 0.0199 | 0.0249 | 0.0217 |
| *Firm Size* | | | | | | | | |
| 20 - 99 Workers | 0.0408 | 0.0236 | 0.0153 | 0.0190 | -0.0024 | 0.0202 | -0.0073 | 0.0207 |
| 100 - 499 | 0.0727 | 0.0243 | 0.0370 | 0.0211 | 0.0587 | 0.0217 | 0.0144 | 0.0233 |
| 500 - 999 | 0.0626 | 0.0285 | 0.0108 | 0.0232 | -0.0207 | 0.0294 | -0.0062 | 0.0248 |
| 1,000-4,999 | 0.1202 | 0.0258 | 0.0357 | 0.0222 | 0.0196 | 0.0223 | -0.0057 | 0.0227 |
| 5,000-19,999 | 0.1183 | 0.0267 | 0.0541 | 0.0233 | 0.0322 | 0.0215 | 0.0026 | 0.0231 |
| 20,000 + | 0.1057 | 0.0258 | 0.0424 | 0.0248 | 0.0112 | 0.0219 | 0.0166 | 0.0237 |
| *Training Activities* | | | | | | | | |
| Getting Started | -0.0550 | 0.0266 | -0.0076 | 0.0225 | -0.0237 | 0.0223 | 0.0229 | 0.0232 |
| Enhanced Skills | 0.0265 | 0.0123 | 0.0069 | 0.0096 | -0.0084 | 0.0106 | 0.0067 | 0.0101 |
| Maintain Prof. Status | 0.0222 | 0.0131 | -0.0030 | 0.0099 | 0.0202 | 0.0115 | 0.0078 | 0.0105 |
| Prepare for Future Jobs | -0.0148 | 0.0149 | -0.0121 | 0.0118 | -0.0164 | 0.0125 | -0.0088 | 0.0124 |
| Develop General Skills | -0.0237 | 0.0155 | -0.0191 | 0.0103 | 0.0018 | 0.0111 | 0.0038 | 0.0106 |
| Health and Safety | -0.0336 | 0.0138 | 0.0081 | 0.0115 | -0.0290 | 0.0139 | -0.0238 | 0.0134 |
| Other Training | -0.1214 | 0.0794 | -0.0517 | 0.0456 | -0.0705 | 0.0376 | -0.0348 | 0.0427 |

Note: Regression equations contain controls for same variables as listed in the note in Table 4.