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The "Who, What, When and Where" of Gender Pay Differentials

The Evolving Workplace Series

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Foreword

This document provides data from the new Workplace and Employee Survey (WES) conducted by Statistics Canada with the support of Human Resources Development Canada. The survey consists of two components: (1) a workplace survey on the adoption of technologies, organizational change, training and other human resource practices, business strategies, and labour turnover in workplaces; and (2) a survey of employees within these same workplaces covering wages, hours of work, job type, human capital, use of technologies and training. The result is a rich new source of linked information on workplaces and their employees.

Why have a linked workplace and employee survey?

Advanced economies are constantly evolving. There is a general sense that the pace of change has accelerated in recent years, and that we are moving in new directions. This evolution is captured in phrases such as "the knowledge-based economy" or "the learning organization". Central to these notions is the role of technology, particularly information technology. The implementation of these technologies is thought to have substantial impact on both firms and their workers. Likely related to these technological and environmental changes, many firms have undertaken significant organizational changes and have implemented new human resource practices. Globalization and increasing international competition also contribute to the sense of change.

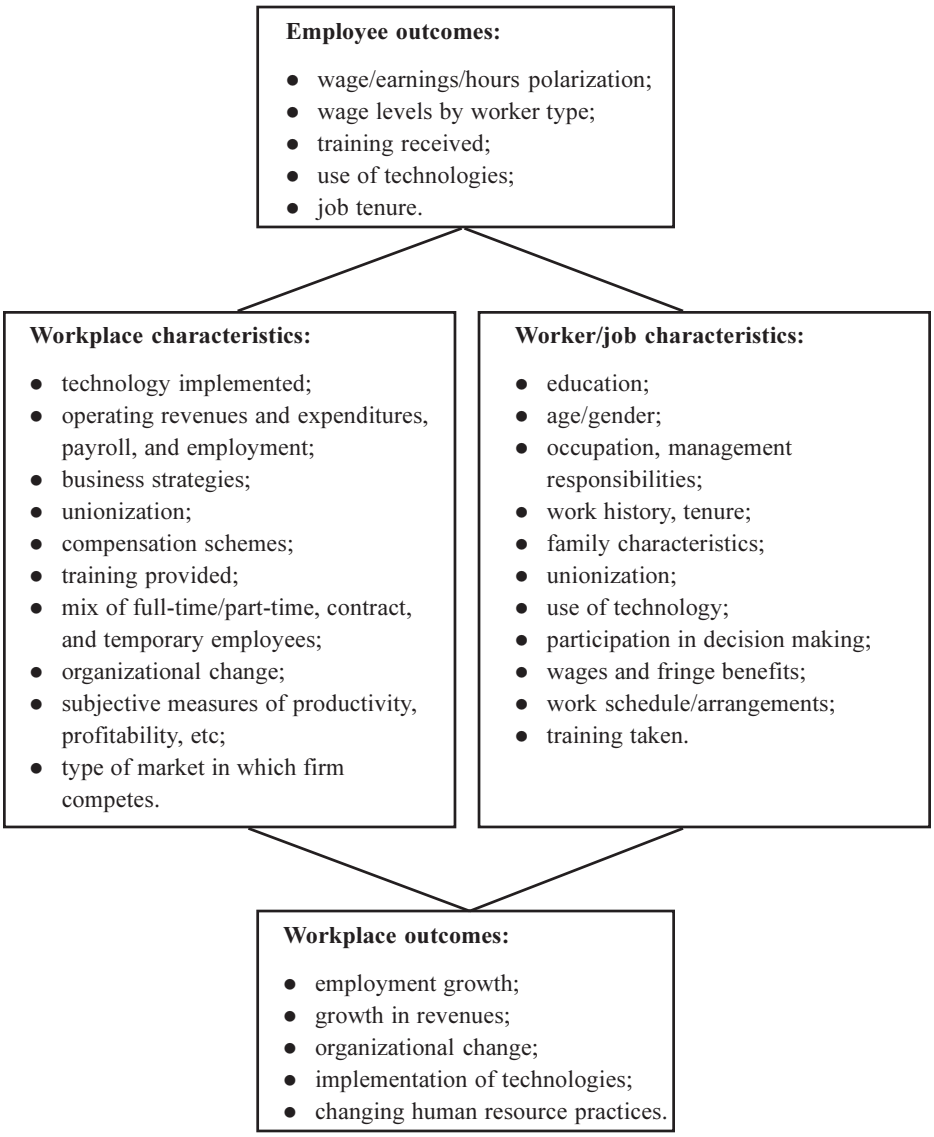
In this environment, greater attention is being paid to the management and development of human resources within firms. Education and training are increasingly seen as an important investment for improved prosperity—both for firms and individual workers.

Thanks to earlier surveys, researchers have a good understanding of workers' outcomes regarding wages and wage inequality, job stability and layoffs, training, job creation, and unemployment. What is missing on the employees' side is the ability to link these changes to events taking place in firms. Such a connection is necessary if we hope to understand the association between labour market changes and pressures stemming from global competition, technological change, and the drive to improve human capital. Thus, one primary goal of WES is to establish a link between events occurring in workplaces and the outcomes for workers. The advantage of a linked survey is depicted in the figure which displays the main content blocks in the two surveys.

The second goal of the survey is to develop a better understanding of what is indeed occurring in companies in an era of substantial change. Just how many companies have implemented new information technologies? On what scale? What kind of training is associated with these events? What type of organizational change is occurring in firms? These are the kinds of issues addressed in the WES.

This report aims to give those interested in computer technologies and skills some useful insights from the initial survey, as well as stimulating their interest in the possibilities provided by these new data.

Link between the workplace survey content, employee survey content, and outcomes

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I. Introduction

Much of the earlier research on the determinants of wages hinged on the assumption that wage outcomes were connected to the attributes of the individual worker. This research relied on data from large household surveys that contained an abundance of information on the worker but limited information on their employers. Over the past decade, researchers have documented the persistence of inter-industry wage differentials (e.g. Krueger and Summers 1988) and firm size wage differentials (e.g. Evans and Leighton 1989) after controlling for differing worker attributes. Due to the lack of data, researchers have been unable to document the potential impact of other firm characteristics on wages.

The fact that men earn more than women continues to be a topical issue. The difference in the wages that men and women earn in the labour market partly reflects the characteristics (such as experience and education) that they bring to the labour market. Yet a sizeable portion of the gender wage gap cannot be explained by gender differences in these attributes (Drolet 2002; Baker et al 1995; Kidd and Shannon 1997).

The *'who, what, when*, and *where'* of gender pay differentials can be examined using the 1999 Workplace and Employee Survey. The *'who you are'* addresses the characteristics of the individual worker, the *'what you do'* focuses on the tasks of the worker and the *'when you work'* addresses the employment contract between the worker and the workplace. The *'where you work'* considers the contribution of specific workplace characteristics such as industry, workplace size, high performance workplace systems, foreign ownership, non-profit organizations, training

expenditures per employee, workplace part-time rate, and the educational requirements of the job to gender pay differentials. No previous Canadian study has examined the male-female earnings differential in this context.

The following section reviews the evidence on gender pay differentials using linked employee-employer data. Then the role of the *'who you are', 'what you do', 'when you work'* and *'where you work'* is examined by considering first, the relationship between wages and '*who, what, when,* and *where'* and second, the distribution of men and women across these dimensions. Finally, the contribution of these factors in explaining gender pay differentials is analyzed. Concluding remarks follow.

II. Literature Review

Many previous studies analyzed gender pay differentials by focusing primarily on differences in the wage-determining characteristics of men and women and how these characteristics are rewarded. From numerous Canadian studies, two stylized facts emerge. First, a substantial portion of the male-female pay gap cannot be explained by gender differences in observable characteristics such as experience, education, and demographics (Drolet 2002; Baker et al 1995; Kidd and Shannon 1997). Second, the reduction in gender pay differentials was accomplished mainly by a decline in the difference in returns to the wage-determining characteristics (Baker et al 1995). These studies alert us to the role of gender differences in productivity-related factors associated with the individual worker such as experience and education but does not provide a complete explanation.

The availability of linked employee-employer data permits research on gender pay differentials to move beyond the individual to consider the importance of the workplace. To date, most studies using linked employee-employer data examine the contribution of gender segregation by occupation, establishment, and within-establishment within occupation (job cells) to the overall gender pay differential.

Groshen (1991), Carrington and Troske (1998) and Bayard et al (1999) find that women are concentrated in low-paying occupations, industries, establishments and occupations within establishments and that gender segregation accounts for a sizeable portion of the overall gender

pay gap.[1] The magnitude of that contribution however, remains unsettled. Groshen (1991) concludes that segregation in establishments, occupations and establishment-occupation cells accounts for essentially *all* of the gender pay gap. While Bayard et al. (1999) estimate that 25% to 50% of the gender wage gap is due to wage differences between men and women in narrowly defined occupations within establishments. The work of Carrington and Troske (1998) departs from that of Groshen (1991) by including controls for worker characteristics and the location of men and women in different plants. They conclude that the gender distribution of blue-collar workers between manufacturing plants accounts for more of the gender wage gap than traditional measures based on worker characteristics.

In a similar spirit, Reilly and Wirjanto (1999a) provide Canadian evidence of gender segregation at the establishment level and its effects on the gender wage gap using data from the 1979 General Segmentation Survey of the Maritime provinces. Consistent with Carrington and Troske (1998), they find that the proportion of women in the establishment has a negative impact on the wages of both men and women. Reilly and Wirjanto (1999a) conclude that gender segregation at the establishment level accounts for about 26% of the mean gap in log wages. In a companion article, Reilly and Wirjanto (1999b) argue that gender segregation at the establishment level is partly consistent with the discrimination hypothesis but they offer an alternative explanation–'coincidence of needs'–that reflects both worker and workplace preferences for diverse employment contracts.

[1] Groshen (1991) focuses on plastic products, life insurance, non-electrical machinery, banking and computers and data processing industries. Carrington and Troske (1998) focus on the U.S. manufacturing industry. Bayard et al (1999) assemble a dataset that is representative of the U.S. economy.

III. What determines the wages workers earn?

There is no generally accepted recipe to follow when investigating the determinants of wages. Most economists agree that wage structures reflect a variety of human capital factors, demographic characteristics as well as job characteristics. The WES data allow us to move beyond the individual worker to consider a number of factors associated with *'who you are', 'what you do', 'when you work'* and *'where you work'*. Appendix A details the variables used in this study.

Many studies on the determinants of wages rely on the assumption that wages are tied to *'who you are'* in terms of the characteristics (such as work experience and education) that the individual worker brings to the labour market. Previous research emphasizes the importance of actual work experience in accounting for the difference in the pay men and women receive and notes drawbacks in these measures that are important considerations for wage determination (Drolet 2002). The WES offers a measure of actual full-time labour market experience by asking workers the following question:

"Considering all jobs that you held, how many years of full-time working experience do you have?"[2]

Work experience is intended to capture general labour market training and **experience squared** is meant to illustrate the diminishing returns to experience: the returns to experience decline as the years of experience lengthen. Since education is a productivity enhancing investment designed to improve earnings, **educational attainment** is included. **Job tenure** with present employer is considered to be a measure of job-specific knowledge and employers that invest in their workers are more likely to pay higher than market wages in order to reduce turnover.[3] **Marital status** and the **presence of dependent children** are meant to capture differences in household responsibility.[4] **Union status** accounts for differences in wage structures between non-unionized and unionized jobs.

[2] This differs from other measures of actual labour market experience, most notably from the measure used in the Survey of Labour and Income Dynamics (SLID) and the Panel Study of Income Dynamics (PSID). The SLID measure incorporates all labour market experience by including information on the number of hours worked per week (i.e. part-time or full-time) and the number of weeks worked per year (i.e. part-year or full-year) for all jobs held by individuals starting with the individuals first full-time job. The PSID provides evidence on the work experience of American workers but does not have a standard definition nor a specific measure of work experience. Researchers are able to construct a measure using relevant questions available from each wave and define experience as they see fit.

[3] Some economists argue that job tenure is endogenous to wage outcomes and should therefore be excluded from the analysis. If this is the case, excluding job tenure may bias the estimates of other variables such as experience, since experience would capture the impact of both general skills and seniority.

[4] Blau and Kahn (1997) suggest that controlling for marital status and presence of children is problematic when actual labour market experience is used since they may proxy different skills for men and women. As noted in Drolet (2002), including marital status and presence of children will control for differences in work volume that are not accounted for in the measure of actual experience.

Along with *'who you are',* the WES provides information on *'what workers do'*. The WES asks workers for their job title as well as the types of activities or duties they perform and this information is recorded into **occupational groups**. Previous analyses have shown that wages differ by occupation and that the distribution of men and women across occupations is an important factor in explaining the gender earnings gap. In fact, Gunderson (1998) suggests that gender differences in the distribution of men and women across occupation are greater determinants of the earnings gap than wage differences *within* the same narrowly defined occupation, especially within the same establishment.

The 1990s witnessed the emergence of high performance work systems (HPWS). Bailey, Berg and Sandy (2001) argue that the higher earnings of workers in workplaces using HPWS result from the performance of a wider variety of tasks (such as gathering and processing information for problem solving and decision making) and from stronger interpersonal skills. The most intense form of HPWS is **self-directed workgroups**. The WES characterizes these workgroups as accepting responsibility for the product, operating with a high degree of autonomy in work organization, and collecting incentives related to productivity, timeliness and quality. The WES asks workers (employed in workplaces with more than 10 employees) their degree of participation (i.e. never, sometimes or always) in self-directed workgroups.

Linked employee-employer data allow researchers to examine *'when you work'* in terms of both worker and workplace preferences for diverse employment contracts. One aspect that has received considerable attention in the study of gender pay differentials is the **quantity of labour supplied**. The worker portion of the WES asks the individual worker their usual

weekly work hours. **Part-time** is defined as working less than 30 hours per week.

The WES data provide a unique opportunity to examine the **timing of labour** supplied and demanded or what Reilly and Wirjanto (1999b) call the 'coincidence of needs' hypothesis. The term 'coincidence of needs' describes establishments whose demand for labour fit the employment patterns of women. One such employment contract would be work hours that coincide with school hours. Reilly and Wirjanto (1999b) find that establishments that offer employment contracts compatible with constraints faced by women have a higher proportion of women in the workplace and lower average wages.[5] The WES incorporates two measures that may be used to test this hypothesis. Information on whether the worker (1) is **employed during school hours** (i.e. between the hours of 6 a.m. and 6 p.m.) and (2) has **flexible work hours** (i.e. working a core number of hours but varying start and stop times) is included. So long as there is a

[5] Reilly and Wirjanto (1999b) create a 'coincidence of needs' measure using quarterly full-time employment data. If full-time employment in two of the three quarters between October and June is greater than establishment employment during July and September, the establishment is classified as offering employment contracts that coincide with needs. It is unclear whether this measure abstracts for paid vacation leave during the summer months. For example, it is unclear if total employment captures the number of persons at work during the summer months OR if total employment is the number of workers employed by the firm whether these workers are on paid vacation or not.

trade-off between wages and desirable work schedules, the 'coincidence of needs' hypothesis may further our knowledge of gender pay differentials.[6]

More central to the goal of this paper is the role of *'where you work'* in the wage determination process and the extent to which workplace characteristics or wage policies at the workplace level contribute to our understanding of the gender wage differentials. There is a large number of workplace variables available from the WES for inclusion. This study concentrates on variables related to (1) foreign ownership, (2) performance-based pay, (3) non-profit organizations, (4) expenditures on training programs, (5) proxies for gender composition of the workplace or other unmeasured skills, and (6) educational requirements of the job.

A budding literature has emerged regarding **foreign ownership**. Aitkens, Harrison and Lipsey (1996) hypothesize that the wage differentials between foreign-held firms and domestic firms that persist after controlling for firm size arise from productivity differences related to dissimilarities in access to financial assets, technology and innovation as well as to lower

[6] Related to the 'coincidence of needs' hypothesis, Reilly and Wirjanto (1999b) suggest that establishments with stable product/service demand may be better able to plan for the demand of labour and to accommodate women's employment patterns. If this is the case, then women workers may crowd into these workplaces with attractive (i.e. stable employment) but costly (i.e. lower wages) job characteristics. Reilly and Wirjanto (1999b) create a variable for stable product demand based on the following question: 'On a scale of 1 to 9, would you say that this establishment faces a demand that is 1 = highly stable to 9 highly unstable.' The WES does not contain information directly on the stability of product demand but does include performance measures (i.e. increased / decreased / same) for productivity, sales growth and profitability over the previous 12 months. These measures are based on a short period of time (12 months) and a trend of the 'stability in product demand' is impossible to determine with the given data. For this reason, 'stability in product demand' is not included in this analysis. The measure used by Reilly and Wirjanto (1999b) can be criticized since it is unclear whether all establishments used the same reference period and measures to characterize 'stability'.

turnover and greater human capital formation. The WES asks workplaces to report the percentage of their assets held by foreign interests. Workplaces are considered foreign-owned if at least 51% of the assets of the workplace are foreign held.

Another feature of high performance work systems is the provision of **incentive pay** based on individual worker performance. These measures are intended to motivate workers to supply 'discretionary' effort and in this setting, workers earn more because they produce more. The provision of incentive pay may reward greater worker effort but it may also proxy other unobserved worker characteristics such as ability. Parent (1999) has shown that more productive workers will self-select into jobs whose pay is tied to individual performance and should therefore earn more than other workers. Parent concludes that men and women respond differently to performance-based incentives because family responsibilities prevent women from taking full advantage. The WES contains information on whether the worker receives incentive pay (i.e. tips, commissions, piecework, productivity bonuses, profit-sharing and other bonuses).

The role of **non-profit organizations** in the wage determination process and in explaining gender pay differentials has received little attention. On one hand, Handy and Katz (1998) find that non-profit organizations pay lower wages to their managers who tend to be motivated to provide goods with 'positive social effects' while other occupational groups within the non-profit organization are paid similar wages to workers in for-profit organizations. On the other hand, Preston (1989) finds that the wages for managers, sales and clerical staff are lower in non-profit organizations despite their higher level of education. Part of this difference may be attributable to lower unionization rates and higher part-time rates in non-profit firms. Since the non-profit sector employs more women than

men, the identification of non-profit organizations in the WES data may be an important determinant of gender pay differentials.

Labour turnover is costly for employers that require substantial investments in firm specific training. These employers may pay higher than competitive wages for equally productive workers in order to reduce turnover, to improve the quality of applicants, to boost morale or to secure other advantages such as lower monitoring costs (i.e. efficiency wage models Salop 1979; Shapiro and Stiglitz 1984). Labour economic theory suggests that both the costs and benefits of acquiring firm specific training are shared by the firm and worker. Reilly and Wirjanto (1999b) hypothesize that the probability of accepting an employment contract with high investment costs will differ between men and women. In particular, women with less commitment to the paid labour force would be less likely to accept such a contract since the investment in training raises the cost of leaving the employer or the labour market.[7]

Unlike household surveys, WES is able to ask workplaces for their total expenditures on classroom training in the previous 12 months. **Training expenditures per employee** are then calculated using the expenditure information and total employment at the workplace.[8]

[7] Reilly and Wirjanto (1999b) use the ratio of full-time hires to average full-time employment as a measure of turnover. This is not a 'true' measure of turnover since it captures hires due to both replacement and to unfilled labour demand.

[8] The WES contains information on the incidence of (formal and informal) training in the previous 12 months at the worker level. Since the main focus of the paper is on the contribution of workplace variables in explaining gender pay differentials, training expenditures per employee measured at the workplace level better addresses these demand side issues.

Workplace wage differentials may be addressed by 'sorting' explanations of the workforce. Reilly and Wirjanto (1999a) suggest that there may be a tradeoff between the worker and the firm in terms of characteristics and preferences that are not properly accounted for in standard models. Standard models assume that workers employed part-time have lower firm-specific knowledge. The worker portion of the WES asks the individual worker their usual number of work hours while the workplace survey asks for the number of part-time workers receiving a T4 slip at this location. This study includes derived variables for part-time status at the individual worker level and for the workplace part-time rate. The workplace part-time rate is calculated as the ratio of the number of part-time workers receiving a T4 at this location to total employment. This measure is meant to act as a proxy for gender composition of the workplace as well as any unmeasured skills and taste differences among workers that are correlated with wages.[9]

The importance of education in the wage determination process is well documented. However, little attention has been paid to the **'match'** between the **educational requirements of the job and the educational attainment of the worker** in the study of gender pay differentials. Verdugo and Verdugo (1989) and Boothby (2002) find that 'over-educated' workers earn less while 'under-educated' earn more after controlling for educational attainment. Verdugo and Verdugo (1989) use a 'worker quality' explanation to justify this finding and conclude that "over-educated workers may be more prone to morale problems and hence, be seen as less desirable or productive employees … (while) under-educated workers may be excellent performers on the job which would account for their being hired to do a

[9] The workplace part-time rate is meant to proxy gender composition of the workplace since the WES does not collect the number of men and women employed at the workplace. As well, this measure may proxy lower firm specific knowledge.

job despite their lower educational attainments." Boothby (2002) concludes that "the return to under-education for both men and women is in a large part a return to above average literacy skills for their level of schooling and that for men, the return to over-education is in a large part a return to literacy skills which are above average for the job". The WES asks workers for the minimum level of education required for their current job and their highest level of education attained. By comparing the requirements of the job and the actual education attained, measures of 'over-educated', 'under-educated' and 'adequately-educated' are derived.[10]

A point sensibly raised when including the above-mentioned variables, is that they may proxy industry, occupation or workplace size. Failing to control for industry, occupation and workplace size may signal the possibility that these 'new' WES variables are simply capturing these effects. The inclusion of controls for industry, occupation and size will account for any additional unmeasured differences in the workplace that are specific to industry, occupation and size.

However, it is often debatable whether variables associated with *'what you do'* (i.e. occupation) and *'where you work'* (i.e. industry) should be included in the analysis of gender pay differentials. According to Altonji and Blank (1999), if employers differentiate between men and women in their hiring practices, then *'where you work'* and *'what you do'* become an outcome of employer practices rather than individual choice. Analyses that omit variables associated with *"where you work'* and *'what you do'* may overlook the importance of "job choice" on wage outcomes, while

[10] The information on the educational requirements of the job is collected from the responding workers. Thus, the perception of the individual worker is used in creating the measure of 'over-education','under-education' and 'adequately-educated' and this may introduce potential measurement error.

analyses that fully control for these variables may fail to appreciate the importance of labour market constraints on wage outcomes. For these reasons, models that include and exclude industry and occupation are estimated.[11]

[11] This paper does not address the underlying causes of *'where you work'* and *'what you do'*.

IV. Results

(a) How do men and women differ by *'who, what, when,* and *where'?*

Men and women differ in *'who they are'* in the labour market (Table 1). On average, men have 17.5 years of full-time work experience compared with 14.4 for women—a difference of 3.1 years. Alternatively stated, women have about 83% of the male average full-time work experience. There appears to be little difference in the distribution of men and women across levels of educational attainment, job tenure, union status, marital status and presence of dependent children.

The WES provides information on how men and women differ in *'what they do'* (Table 2). Men are more likely to be employed in management and technical occupations while women work in sales and administrative occupations. Another characteristic that has received attention in the past decade is the emergence of high performance workplace systems (Bailey, Berg and Sandy, 2001). Men are more likely to report participating frequently/always in self-directed workgroups than women (36.3% and 29.0% respectively). Workers who participate in self-directed workgroups are more likely to be managers and professionals and to report working longer hours (usual, paid overtime and unpaid overtime). These workers are more likely to receive both formal and informal training, to state that the skills requirements of their job have increased since they began working in their current job and to claim that since beginning to work for the company, the availability of training has

Table 1

Means of selected *'Who you are'* characteristics by sex, 1999

Characteristics of *'who you are'*	Men		Women	
	Mean	Std error	Mean	Std error
Number of workers	13,809		10,493	
Number of workplaces	4,780		4,337	
Average hourly wages	$ 21.54	0.268	$ 17.14	0.268
Average number of years of full-time work experience	17.5	0.253	14.4	0.228
Less than high school	0.118	0.006	0.085	0.007
High school	0.169	0.008	0.175	0.009
Industry certification	0.066	0.006	0.048	0.005
Some college / university	0.148	0.008	0.160	0.008
Trade school	0.133	0.006	0.073	0.006
College	0.170	0.008	0.264	0.010
University	0.126	0.009	0.136	0.009
Greater than university degree	0.071	0.005	0.058	0.006
Job tenure: less than 1 year	0.174	0.009	0.183	0.008
Job tenure: 1-5 years	0.417	0.011	0.441	0.011
Job tenure: 6-10 years	0.186	0.008	0.189	0.009
Job tenure: 11-20 years	0.152	0.007	0.144	0.008
Job tenure: 20+ years	0.071	0.005	0.042	0.004
Single never married	0.217	0.009	0.222	0.010
Married	0.591	0.011	0.535	0.011
Commom law	0.120	0.007	0.117	0.008
Other marital status	0.072	0.005	0.126	0.008
Dependent children	0.454	0.011	0.411	0.011
Covered by a collective bargaining agreement	0.284	0.011	0.248	0.011
Atlantic region	0.067	0.003	0.066	0.003
Quebec	0.262	0.007	0.218	0.007
Ontario	0.383	0.009	0.426	0.008
Prairies	0.063	0.003	0.068	0.003
Alberta	0.102	0.005	0.097	0.005
British Columbia	0.123	0.005	0.125	0.006

Table 2
Means of selected *'what you do'* characteristics by sex, 1999

Characteristics of *'what you do'*	Men		Women	
	Mean	Std error	Mean	Std error
Occupation: managers	0.195	0.010	0.117	0.009
Occupation: professionals	0.137	0.007	0.186	0.009
Occupation: technical	0.491	0.011	0.300	0.011
Occupation: sales	0.035	0.005	0.121	0.009
Occupation: administrative	0.062	0.005	0.214	0.009
Occupation: production	0.080	0.006	0.062	0.007
Participate frequently/always in self-directed workgroup	0.363	0.010	0.290	0.010
Number of observations	13,809		10,493	
Number of workplaces	4,780		4,337	

increased. These workers in self-directed workgroups are also more likely to report receiving additional compensation.

'When men and women work' is an aspect that has received extensive attention in the study of gender pay differentials. Along with the fact that men and women differ considerably in their weekly hours (roughly 92.3% of men and 77.0% of women work full-time), the WES provides a unique opportunity to examine the timing of labour supplied and demanded (Table 3). However, there is no significant gender difference in the likelihood of working inside the hours of 6 a.m. and 6 p.m. yet men are more likely to report having flexible work hours (43.2% and 36.2% respectively).

If it is not surprising that men and women differ in *'who they are'*, *'what they do'* and *'when they work',* then it should not be surprising that men and women differ in *'where they work'*. It is a well-documented fact that there are notable differences in the industries and in the size of the workplaces in which men and women work (Table 4). Men have higher

Table 3

Means of selected *'when you work'* characteristics by sex, 1999

Characteristics of *'when you work'*	Men		Women	
	Mean	Std error	Mean	Std error
Works full-time (30+ hours per week)	0.923	0.007	0.770	0.011
Works part-time (less than 30 hours per week)	0.077	0.007	0.231	0.011
Average weekly hours				
Full-time	41.5	0.156	38.2	0.139
Part-time	17.5	0.534	19.2	0.326
Works inside the hours of 6 am - 6 pm	0.795	0.009	0.776	0.011
Works flexible hours	0.432	0.011	0.362	0.011
Number of observations	13,809		10,493	
Number of workplaces	4,780		4,337	

representation rates in manufacturing as well as in construction, and transportation, wholesale and storage. Women are predominantly concentrated in retail services and education and health industries and are more likely to work in small firms (less than 20 employees). A principal contribution of this article is to demonstrate how the distribution of men and women differs along other workplace characteristics that are available in the WES data.

As mentioned previously, another feature of high performance work systems is the existence of pay for performance (additional compensation). Men are more likely to work in firms that offer alternative compensation practices (such as incentives, gainsharing, profit sharing and merit pay) than women (59.0% and 52.5% respectively) yet there is little gender difference in the receipt of additional compensation. About 30.1% of men and 27.0% of women earn additional compensation. However, this

Table 4

Means of selected *'where you work'* characteristics by sex, 1999

Characteristics of *'where you work'*	Men		Women	
	Mean	Std error	Mean	Std error
Industry				
Forestry/Mining	0.029	0.002	0.008	0.001
Labour intensive tertiary manufacturing	0.053	0.003	0.041	0.002
Primary product manufacturing	0.063	0.002	0.013	0.001
Secondary product manufacturing	0.050	0.002	0.021	0.002
Capital intensive tertiary manufacturing	0.084	0.003	0.029	0.003
Construction	0.067	0.002	0.013	0.001
Transportation/Wholesale/Storage	0.144	0.005	0.067	0.005
Communications/Utilities	0.032	0.002	0.015	0.001
Retail trade and commercial services	0.192	0.010	0.273	0.009
Finance and insurance	0.030	0.003	0.066	0.003
Real estate/Rental/Leasing	0.017	0.002	0.018	0.002
Business services	0.093	0.005	0.097	0.005
Education and health care	0.113	0.007	0.314	0.007
Information and cultural industries	0.034	0.003	0.026	0.002
Workplace size				
Less than 20 employees	0.293	0.012	0.345	0.013
20 - 99 employees	0.328	0.014	0.275	0.015
100 - 499 employees	0.194	0.009	0.175	0.011
500+ employees	0.184	0.010	0.205	0.012
Employee receives performance-based pay	0.301	0.010	0.270	0.012
Average training costs per employee	$257.65	11.44	$247.20	14.28
Working for a non-profit organization	0.139	0.007	0.286	0.012
Working for a foreign-held company	0.110	0.009	0.055	0.007
Average workplace rate of part-time employment	0.197	0.008	0.337	0.009
Required education - actual education: Over-educated	0.364	0.010	0.384	0.011
Required education - actual education: Under-educated	0.163	0.007	0.145	0.007
Number of observations	13,809		10,493	
Number of workplaces	4,780		4,337	

aggregate measure may mask interesting heterogeneity related to hierarchies within occupations. Related to occupation, men are more likely to be clustered in managerial positions where the receipt rates are relatively high while women are more likely to be clustered in professional occupations where the receipt rates are generally lower.[12] The WES data does not support the idea that married women respond differently to incentive schemes due to family responsibilities that prevent women from taking full advantage of performance based compensation.[13]

A priori, one would expect a significant gender difference in the average workplace training costs per employee since women tend to be clustered in industries and occupations with lower than average training costs per employee. However, the WES data does not support this proposition. Further exploration uncovered that there is no gender difference in the likelihood of receiving either classroom training or on-the-job training[14] nor in the average number of courses taken within the previous 12 months. There is, however, a slight gender difference in the 'intensity' of classroom training. In the previous twelve months, women

[12] Roughly 19.5% (13.7%) of men and 11.7% (18.6%) of women are employed in managerial (professional) occupations. The receipt rates of additional compensation for men and women are 41.7% and 38.5% in managerial occupations and 29.0% and 23.2% for professional occupations. There is no significant gender difference in the receipt of additional compensation for managers or professionals.

[13] Roughly 25.4% of married women, 29.2% of single, never married women, 25.3% of women with dependent children and 28.9% of women with no dependent children earn any form of additional compensation.

[14] The WES asks respondents if they received any classroom or on-the-job training in the previous twelve months. About 28.8% of men and 31.4% of women participated in on-the-job training while 36.9% of men and 37.4% of women participated in classroom training. The incidence of training is not used in the regression analysis since the impact of training on wages may not be realized immediately (i.e. within the previous 12 months). The impact of training on wages would be more accurately reflected in a measure of training that incorporates all training taken throughout the workers' career.

spent 7.4 days in classroom training compared to 5.8 days for men.[15] The training patterns observed in the WES cast doubt on efficiency wage theories as a potential explanation of gender pay differentials.[16] The greatest gender difference in the receipt of training is among part-time workers and may partially reflect the heterogeneity among part-time workers: roughly 30.5% of part-time women and 17.7% of part-time men received classroom training.[17,18] This finding challenges the assumption that part-time workers have lower levels of firm-specific knowledge and lower labour force attachment.

Other notable differences in the distribution of men and women across workplace characteristics are worth mentioning (Table 4). First, women are more likely to work in non-profit organizations than men (28.6% and 13.9% respectively). Second, the workplace rate of part-time employment is almost two times greater in workplaces where women are employed than where men work (33.7% and 19.6%). Third, there is a slight difference in the distribution of men and women (11.0% and 5.5%) in workplaces where the majority of the workplace's assets are foreign held. Fourth, there is no significant gender difference in the likelihood of being 'over-educated' or 'under-educated'.

[15] This is the average number of days spent in training sessions in the two most recent classroom courses in the previous twelve months.

[16] See discussion in Section III.

[17] Caution should be exercised with the estimate of part-time men receiving classroom training due to high sampling variability.

[18] Among part-time women, 20.7%, 25.5%, 40.7% and 38.0% are employed in professional occupations, service occupations, education and retail trade industries respectively. Part-time men are disproportionately represented in retail trade industry (50.0%) and sales occupations (19.5%). Part-time men have shorter job tenure than part-time women.

b) Do wages differ by *'who, what, when, and where'?*

Before turning to the relationship between wages and workplace characteristics, interested readers can refer to Appendix B for a description of the sample of interest as well as the measure of earnings used in this study. Appendix C details the framework used to describe the relationship between wages and the characteristics of the worker and the workplace. By comparing the earning structures with workplace effects and without workplace effects the importance of the workplace in the wage determination process becomes evident. Two interesting findings are noted (results in Appendix Table A).

First, women are, on average, disproportionately represented in low wage workplaces: women earn about 15% less than men when the workplace is not taken into account compared to about 8% less when controls for the workplace are included. Second, the impact of education and years of full time work experience on wages is smaller when account is taken of the workplace to which the worker belongs. This suggests that some of the individual variation with respect to education and work experience arise from the fact that workplaces offer widely varying returns to education and experience.[19]

Of particular interest is the relationship between wages and *'who you are', 'what you do', 'when you work'* and *'where you work'*. When individual worker characteristics are considered without accounting for the workplace, the results are consistent with *a priori* expectations. That is, experience yields a positive impact on wages that tails off over time.

[19] One should be cautious of this interpretation. No controls were included for unobserved worker heterogeneity and consequently these workplace-specific effects may partially capture the unobserved worker heterogeneity and this heterogeneity may differ systematically across workplaces.

The expected association between wages and union status, educational attainment and occupation are also present (Tables 5 and 6). We next turn to one of the novel features of the analysis—the contribution of new WES variables in the wage determination process—while controlling for the 'traditional' human capital characteristics.[20]

Perhaps the most striking result is the large, negative wage impact (for both men and women) associated with the workplace part-time rate (Table 7). Although the workplace part-time rate is correlated with occupation and industry, these effects hold even after controlling for industry and occupation. The concept of 'elasticity' is used to calculate the responsiveness of wages to changes in the workplace proportion of part-time workers. For the average male worker, the workplace rate of part-time employment elasticity is -0.035 while for women it is -0.055.[21] This difference in elasticities result from the gender difference in the workplace part time rate (19.7% from men and 33.7% for women) rather than the difference in their returns (-0.178 for men and -0.163 for women).

Other wage outcomes related to *'who you are', 'what you do', 'when you work'* and *'where you work'* are worth mentioning (Tables 5, 6 and 7). Men's wages increase with training expenditures per employee while for women, there is no significant association between wages and training

[20] The F-test (adjusted Wald test) suggests that the workplace characteristics are jointly and significantly different from zero. When industry is included among the workplace characteristics hypothesized to be zero, the f statistics are F(28,4508) = 24.98 for men and F(28,4062)=19.46 for women. When industry is excluded from the set of workplace characteristics hypothesized to be zero, the f statistics are F(15,4521) = 25.39 for men and F(15,4075)=11.92 for women.

[21] These elasticities are the product of the proportion of part-time workers in the workplace and the coefficient on the percent working part-time from Model 4. For example, the elasticity for women is calculated as -0.055 = -0.163*0.3371. In other words, the average hourly wages of women decrease by 5.5% when the workplace part-time rate increases by 10%.

Table 5

Log wage regressions results: *'who you are'*, 1999

Who you are	Males		Females		Pooled	
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Years of full-time experience	0.0133	0.0021	0.0075	0.0018	0.0084	0.0015
Experience squared	-0.0144	0.0053	-0.0043	0.0053	-0.0025	0.0039
Education (reference group: High school)						
Less than high school	-0.0919	0.0174	-0.0570	0.0165	-0.0780	0.0114
Industry certification	0.0492	0.0222	0.0579	0.0286	0.0643	0.0179
Incomplete	0.0505	0.0175	0.0842	0.0181	0.0702	0.0124
Trade school	0.0817	0.0160	0.0991	0.0192	0.1125	0.0127
College diploma	0.0761	0.0157	0.1341	0.0209	0.1033	0.0155
University degree	0.2257	0.0251	0.2853	0.0210	0.2702	0.0178
Greater than university	0.2638	0.0245	0.3597	0.0354	0.3271	0.0208
Job tenure (reference group: 1-5 years)						
Less than 1 year	-0.0109	0.0155	-0.0580	0.0125	-0.0395	0.0099
6-10 years	0.0633	0.0132	0.0331	0.0116	0.0446	0.0090
11-20 years	0.0303	0.0144	0.0431	0.0159	0.0374	0.0121
20 + years	0.0379	0.0211	0.0519	0.0205	0.0463	0.0154
Marital status (reference group: married)						
Common law	-0.0552	0.0131	-0.0216	0.0141	-0.0405	0.0096
Single, never married	-0.1003	0.0129	-0.0418	0.0145	-0.0669	0.0099
Other	-0.0085	0.0193	-0.0468	0.0188	-0.0554	0.0146
Dependent children	0.0312	0.0108	0.0187	0.0090	0.0357	0.0073
Covered by a collective bargaining unit	0.0991	0.0110	0.0743	0.0129	0.0990	0.0088
Region (reference group: Ontario)						
Atlantic provinces	-0.1551	0.0153	-0.1884	0.0138	-0.1678	0.0107
Quebec	-0.0412	0.0147	-0.0788	0.0132	-0.0528	0.0104
Prairies	-0.1093	0.0156	-0.1338	0.0181	-0.1180	0.0137
Alberta	-0.0102	0.0170	-0.1256	0.0187	-0.0681	0.0138
British Columbia	0.0567	0.0137	0.0805	0.0182	0.0718	0.0122
Constant	2.2800	0.0345	2.3759	0.0481	2.3342	0.0307

Standard errors are adjusted for complex survey design effects and the non-independence of error terms for workers in the same workplace and the part of the error term that is workplace specific but is constant across workers.
Results from wage equation (3) and model 4 as described in Appendix C. R squares reported in Appendix C.

Table 6

Log wage regressions results, *'what you do'* and *'when you work'*, 1999

	Males		Females		Pooled	
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
What you do						
Occupation (reference group: technical)						
Managers	0.2453	0.0171	0.2004	0.0195	0.2319	0.0132
Professionals	0.1546	0.0130	0.1992	0.0154	0.1716	0.0105
Sales	-0.0434	0.0313	-0.1318	0.0306	-0.1282	0.0269
Administrative	-0.1180	0.0139	-0.0648	0.0128	-0.1177	0.0093
Production workers	-0.1034	0.0178	-0.1453	0.0251	-0.1297	0.0159
Participates in self-directed workgroups (reference: never)						
Not applicable	-0.0019	0.0247	-0.0378	0.0343	-0.0106	0.0211
Sometimes	-0.0030	0.0135	0.0241	0.0258	0.0124	0.0146
Frequently/Always	0.0643	0.0100	0.0024	0.0131	0.0403	0.0088
When you work						
Part-time	0.0902	0.0212	0.0595	0.0164	0.0622	0.0142
Works flexible hours	0.0285	0.0089	0.0038	0.0132	0.0212	0.0081
Works inside the hours of 6 a.m. - 6 p.m.	0.0633	0.0127	-0.0190	0.0143	0.0132	0.0111
Receives overtime pay	0.0543	0.0110	0.0163	0.0163	0.0484	0.0128

Standard errors are adjusted for complex survey design effects and the non-independence of error terms for workers in the same workplace and the part of the error term that is workplace specific but is constant across workers.

Results from wage equation (3) and model 4 as described in Appendix C. R-squares reported in Appendix C.

Table 7

Log wage regressions results: *'where you work'*, 1999.

	Males		Females		Pooled	
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Education-job match (reference group: adequately educated)						
Job requires no minimum education	-0.0898	0.0128	-0.1120	0.0159	-0.1030	0.0094
Under-educated	0.0073	0.0115	0.0627	0.0132	0.0373	0.0099
Over-educated	-0.1136	0.0107	-0.1039	0.0147	-0.1065	0.0088
Workplace size (reference group: less than 20 workers)						
21 - 99 employees	0.0180	0.0212	-0.0226	0.0295	0.0050	0.0178
100 - 499 employees	0.1081	0.0227	0.1041	0.0303	0.1031	0.0191
500+ employees	0.2190	0.0229	0.1456	0.0326	0.1846	0.0197
Non-profit	-0.0208	0.0149	0.0407	0.0228	0.0110	0.0171
Foreign ownership	0.0943	0.0155	0.0277	0.0144	0.0749	0.0129
Receives additional compensation	0.1583	0.0110	0.1279	0.0163	0.1421	0.0096
Workplace part-time rate	-0.1780	0.0262	-0.1630	0.0239	-0.1822	0.0182
Training expenditures per worker	3.67e-05	1e-05	0.0000	1.41e-05	0.0000	8.72e-06
Industry (reference group: Retail trade)						
Forestry/Mining	0.4303	0.0264	0.4755	0.0316	0.4603	0.0215
Labour intensive manufacturing	0.0531	0.0236	0.0300	0.0241	0.0454	0.0177
Primary product manufacturing	0.2333	0.0244	0.2625	0.0263	0.2726	0.0203
Secondary product manufacturing	0.1798	0.0233	0.1276	0.0270	0.1691	0.0195
Capital intensive manufacturing	0.2360	0.0281	0.2049	0.0248	0.2506	0.0227
Construction	0.3556	0.0280	0.3055	0.0324	0.3783	0.0239
Transportation/wholesale	0.2411	0.0235	0.2043	0.0241	0.2469	0.0182
Communications/Utilities	0.3154	0.0243	0.3044	0.0225	0.3303	0.0178
Finance and insurance	0.2328	0.0281	0.2273	0.0244	0.2158	0.0180
Real estate/Rental/Leasing	0.2036	0.0392	0.2588	0.0467	0.2517	0.0339
Business services	0.2024	0.0245	0.1324	0.0286	0.1612	0.0201
Education and health care	0.1514	0.0283	0.1389	0.2240	0.1289	0.0177
Culture	0.2528	0.0247	0.1916	0.0203	0.2277	0.0188

Standard errors are adjusted for complex survey design effects and the non-independence of error terms for workers in the same workplace and the part of the error term that is workplace specific but is constant across workers.
Results from wage equation (3) and model 4 as described in Appendix C. R-squares reported in Appendix C.

expenditures. Male workers that 'always' participate in self-directed workgroups earn more than other men. However, among women, participation in self-directed workgroups does not influence their wages.[22] Foreign ownership appears to be associated with a wage premium for men but not for women.[23] Workers receiving variable compensation earn more than other workers. Looking at the 'coincidence of needs' hypothesis, working between the hours of 6 a.m. and 6 p.m. has no significant impact on wages while having flexible work hours are associated with higher wages for men but not for women. After controlling for other characteristics, 'over-educated' women earn less than women who are adequately educated while 'under-educated' women earn more than adequately educated women. There are no significant differences for men.

In models that include industry and occupation (Model 2 and Model 4), there are no statistically significant differences in the intercept term between men and women. However, in specifications that exclude industry and occupation, there are statistically significant differences. Other studies (e.g. Drolet 2002) note that there are large differences on the intercept of men and women signifying the existence of large and important differences in the earnings of women and men that are unrelated to the choice of explanatory variables. The intercept term incorporates the effects of other factors that are either missing or not perfectly captured in the model and is also a function of the 'omitted' or 'reference group' from each set of dummy variables. The fact that there is no difference in intercept terms

[22] For women, the F-test (adjusted Wald test) reveals that the variables on the degree of participation in self-directed workgroups are jointly and significantly different from zero when industry and occupation are excluded (Model 3) but when industry and occupation are included (Model 4), these variables are not jointly significantly different from zero.

[23] The gender difference in the returns to the foreign-held workplaces is statistically significant at the 5% level.

suggests that there is no difference in the earnings of men and women with zero values for the continuous variables and who belong to the reference groups for the categorical variables as described in Tables 5, 6 and 7.[24]

(c) What 'explains' gender pay differentials?

In 1999, women workers earned on average $17.14 per hour while male workers received $21.54 per hour. In other words, women earned 79.6% of the average male hourly wage. In terms of mean log wages, the gender hourly wage gap is 0.2285 (Table 8).[25]

Questions related to gender pay differentials are often framed in a manner that examines the extent to which women are paid the same as comparable men. This paper focuses on the results from the male-base decomposition since it provides the most useful comparison to the existing literature on the gender pay differentials.[26]

Tables 8 and 9 present a summary of the decompositions of the gender wage gap into a portion "explained" by gender differences in worker characteristics and differences in the types of workplaces in which men and women are employed and a portion "unexplained" by the model variables. The main findings are as follows.

First, gender differences in returns tend to dominate gender differences in characteristics when industry and occupation are excluded.

[24] Alternatively stated, these models work from equivalent baselines for men and women.

[25] This estimate is consistent with Drolet (2002) using the hourly wage rate data from the 1997 Survey of Labour and Income Dynamics. The estimate is statistically significant at the 1% level.

[26] Appendix D describes the decomposition techniques and Appendix Table B reports the results based on alternative pay structures used in the decomposition.

Table 8

Log wage decompositions, 1999. Standard errors in parentheses

	Model			
	(1) worker characteristics	(2) worker + industry + occupation	(3) worker + workplace character-istics	(4) worker + workplace + industry + occupation
Unadjusted differential	0.796	0.796	0.796	0.796
Gap	0.229	0.229	0.229	0.229
Male-based decomposition				
Gap (in logs)				
...Explained	0.053	0.134	0.089	0.140
	(0.001)	(0.001)	(0.001)	(0.001)
...Unexplained	0.176	0.095	0.140	0.088
	(0.002)	(0.002)	(0.002)	(0.002)
Explained due to				
...Who you are	0.028	0.024	0.025	0.024
	(0.001)	(0.001)	(0.001)	(0.0004)
...What you do	not applicable	0.033	0.006	0.036
		(0.001)	(0.0003)	(0.001)
...When you work	0.025	-0.001	0.008	-0.003
	(0.001)	(0.001)	(0.001)	(0.001)
...Where you work	0.001	0.078	0.050	0.083
	(0.0002)	(0.001)	(0.001)	(0.001)
Adjusted differential	0.839	0.909	0.869	0.916

Standard errors calculated using bootstrap weights.
The adjusted differential refers to women's hourly wages as a percentage of men's after controlling for differences in observable characteristics.

Table 9

Fraction of the gender wage gap attributable to specific characteristics, 1999

	Model			
Characteristics	(1)	(2)	(3)	(4)
'who you are'				
Experience	13.0	10.2	11.9	10.1
Education level	-2.4	-1.6	-2.8	-1.8
Job tenure	0.6	0.5	0.7	0.5
Marital status	1.7	0.9	0.6	0.3
Dependent children	0.6	0.6	0.6	0.6
Unionized	0.4	1.4	1.0	1.6
Region	-1.8	-1.4	-0.9	-0.7
'what you do'				
Occupation		14.5		13.7
Participation in self-directed workgroups			2.5	2.1
'when you work'				
Part-time status	10.8	-0.6	-1.1	-6.0
Inside the hours of 6 a.m. - 6 p.m.			0.7	0.5
Works flexible hours			1.5	0.9
Receives overtime pay			2.1	3.2
'where you work'				
Firm size	0.5	0.2	-0.6	-0.6
Non-profit organization			-1.0	1.3
Foreign-held			2.4	2.2
Worker receives performance-based pay			2.3	2.2
Training expenditures per employee			0.3	0.2
Workplace part-time rate			17.7	10.9
Required-actual education mismatch			1.8	1.0
No minimum education required for job			-1.0	-0.7
Industry		33.8		19.7
Total explained	23.4	58.5	38.7	61.2
By *'who you are'*	12.1	10.6	11.1	10.6
By *'what you do'*	0.0	14.5	2.5	15.8
By *'when you work'*	10.8	-0.6	3.2	-1.4
By *'where you work'*	0.5	34.0	21.9	36.2
Total unexplained	76.6	41.5	61.3	38.8
Total	100.0	100.0	100.0	100.0

The differences in the breakdown of the gender wage differential between Table 8 and 9 are due to rounding errors.

For example, about 76.6% and 61.3% of the wage gap is attributable to gender differences in the returns to worker and workplace characteristics (Table 9, Model 1 and 3). However, gender differences in characteristics dominate the gender differences in coefficients when industry and occupation are included. Roughly 58.5% to 61.2% of the gender wage gap is "explained" by the differences in the characteristics of men and women (Table 9, Model 2 and 4).

Second, *'where you work'* accounts for *more* of the difference in pay men and women receive than *'who you are', 'what you do'* and *'when you work'*. When industry and occupation are excluded (Table 9, Model 3), gender differences in *'who you are'*, *'what you do'*, *'when you work'* and *'where you work'* account for 11.1%, 2.5%, 3.2% and 21.9% of the difference in the pay men and women receive. The numbers for Model 4 are 10.6%, 15.8%, -1.4% and 36.2% respectively.[27] This finding suggests that *'where you work'* accounts for a substantial part of gender pay differentials.

Third, the principal contribution of the paper is to identify the characteristics of the workplace that are most influential in explaining gender pay differentials (Table 9). The workforce part-time rate acts as a proxy for the gender composition of the workplace or other unmeasured skills that are correlated with wages and explains 17.7% of the gender wage gap when controls for industry and occupation are excluded. Since the workplace part-time rate is highly correlated with industry, the representation of men and women in different industries partially captures this effect. When industry and occupation are included, the proportion of

[27] The portions explained by '*who you are*', *'what you do', 'when you work'* and *'where you work'* are significantly different from one another.

the gender wage gap attributable to the workplace part-time rate falls to 10.9%. It should be noted that the contribution of the workplace part-time rate is similar in magnitude to the contribution of full-time work experience in explaining gender pay differentials.

The fact that men are more likely to work in foreign held firms and that foreign held firms pay more, foreign ownership 'explains' about 2.2% of the gender pay gap. High performance work systems as measured through self-directed workgroups and the receipt of additional compensation explain about 2.1% and 2.2% respectively of gender pay differentials (Model 4). Unfortunately there are no controls available in the WES data for hierarchy *within* occupations that would allow a more thorough examination of gender concentrations at higher levels within a given occupation and where performance-based compensation is more lucrative.

Gender pay differentials can only be 'explained' if men and women differ in the characteristics that they bring to the labour market OR in the types of workplaces to which they belong AND if the factors being considered are themselves essential determinants of their pay. Variables related to training expenditures, the educational requirements of the job and the "coincidence of needs" play a negligible role in explaining gender pay differentials (0.2%, 1.0% and 1.4% respectively). Although women are more likely to be employed in non-profit workplaces, there is no significant association between wages and non-profit organizations and hence explains 1.3% of gender pay differentials.

Another important finding of this paper is the contribution of industry to gender pay differentials. When industry and occupation are included, the 'explained' component jumps from 23.4% (Model 1) to 58.5% (Model 2). Notably, the contribution of industry is considerably higher in the

current analysis than in other studies: the fact that women are clustered in low-wage industries explains about 33.8% of the gap (Model 2). Using household data from the Survey of Labour and Income Dynamics (SLID), Drolet (2002) illustrates that differences in the industry to which men and women belong accounts for about 15% of the gender wage gap. This large difference in the portion attributable to industry between SLID and WES may partly reflect the fact that the industry variable is collected from the responding workplace in WES and from the individual respondent or proxy respondent in SLID.[28]

The distribution of men and women across industries tends to be the driving force behind the explained component of the gender pay differential. When controls for industry and occupation are included in both the worker model (Model 2) and in the full model (Model 4), about 58.5% and 61.2% of the gender wage gap is 'explained' respectively. Since workplace characteristics, in particular the workplace part-time rate, are highly correlated with industry, the representation of men and women in different industries partially captures the differences between men and women in the types of workplaces to which they belong. The contribution of industry to gender pay differentials falls from 33.8% when worker characteristics are considered (Model 2), to 19.7% when both worker and workplace attributes are considered (Model 4). However, the inclusion of industry and occupation does not perfectly capture the contribution of other workplace variables such as foreign ownership, pay for performance, and self-directed work groups in explaining gender pay differentials.

[28] The proportion of the gender wage gap attributable to occupation is about 14.5% using WES data (Model 2) and 6.8% using SLID data (Drolet 2002). This discrepancy in the contribution of occupation may partly reflect the fact that unlike the SLID data, the WES data does not include education level by major field of study. Since occupation and major field of study are correlated, part of the occupation effects observed in the current analysis may reflect differences in the field of study.

Despite the addition of a rich variety of workplace variables, a substantial portion of the gender wage gap remains baffling. After accounting for differences in worker characteristics, women's average hourly wage rate is 83.9% of the men's average (Table 8, Model 1). Once differences in the characteristics of the workplace to which men and women belong are controlled for, women's average hourly wage rate is 86.9% of men's average (Table 8, Model 3). The inclusion of industry and occupation yield considerably larger adjusted gender pay differentials: women earn roughly 91.6% of comparable men (Table 8, Model 4). [29]

[29] The adjusted gender wage ratio refers to women's hourly wages as a percentage of men's hourly wages after controlling for differences in observable characteristics. To convert the reported differences in mean log earnings to ratios of female to male earnings the following calculation is performed: adjusted ratio = exp(-unexplained estimate).

V. Conclusion

This paper has attempted to address the *'who, what, when* and *where'* of gender pay differentials. Most other studies on the gender wage gap relied on the assumption that wages were tied to the individual worker and this approach has dominated the empirical literature. The main reason for this approach is the data widely available to researchers—that is, large household surveys containing an abundance of individual information but very little information about employers.

Using matched employee-employer data from the 1999 Workplace and Employee Survey, the contribution of workplace characteristics such as high performance workplace practices, foreign ownership, non-profit organizations, training expenditures, desirable employment contracts and the workplace part-time rate to gender pay differentials are explored. Like other studies that use standard decomposition techniques, men still enjoy a wage advantage over women. Unlike other studies that estimate the explained component to be about 50% of the gap, the inclusion of workplace characteristics—in particular more accurate industry measures—increase the explained component to 61% of the gap. The *'where you work'* accounts for more of gender pay differentials than *'who you are'*, *'what you do'* and *'when you work'*: about 36.2%, 10.6%, 15.8% and -1.4% respectively. Yet despite the inclusion of the new WES variables, a significant portion (38.8%) of gender pay differentials remains unexplained.

Matched employee-employer data sets are quite valuable research tools for the study of gender wage determinants. Further insights into the gender wage gap will be realized when longitudinal data become available. More accurate estimates of the contribution of workplace characteristics to explaining gender pay differentials will be realized once controls for unobserved worker heterogeneity are incorporated.

Appendix A: Description of variables

"Who you are" **variables**

Years of full-time work experiences	– full-time work experience of all jobs held by the worker
Education level	– highest level of education attained by worker
Job tenure	– derived variable based on start date of particular job
Marital status	– current legal marital status of worker
Dependent children	– dichotomous variable = 1 if worker has child(ren) less than 18 years of age, 0 otherwise
Covered by a CBA	– dichotomous variable = 1 if the worker is covered by a collective bargaining unit, 0 otherwise
Region	– based on region of employment

"What you do" **variables**

Participates in self-directed workgroup	– in workplaces with more than 10 employees, workers are asked about their participation in self-directed workgroups (always or frequently, sometimes, never). Three dichotomous variables are created: – N/A: (workplaces less than 10 employees) = 1, 0 otherwise – report participating always = 1, 0 otherwise

	– report participating sometimes = 1, 0 otherwise
	– reference group: never participated
Occupation	– 6 groups based on reported job-title and activities, converted to SOC91

"When you work" **variables**

Part-time	– dichotomous variable = 1 if the usual work week is less than 30 hours, 0 otherwise
Working inside 6 a.m. - 6 p.m.	– dichotomous variable = 1 if worker reports working between the hours of 6 a.m. and 6 p.m., 0 otherwise
Works flexible hours	– dichotomous variable = 1 if worker reports being able to vary start and end times but working core hours, 0 otherwise

"Where you work" **variables**

Workplace size	– total employment at the workplace in the last pay period of March 1999
Industry	– 14 groups based on WES / NAICS conversion
Non-profit organization	– dichotomous variable = 1 if the workplace reports being a non-profit organization, 0 otherwise
Foreign-held	– dichotomous variable = 1 if over 50% of workplace assets are held by foreign interests, 0 otherwise

Training expenditures per worker	– total training expenditures between April 1, 1998 and March 31, 1999 divided by total employment at the workplace in the last pay period of March 1999
Workplace part-time rate	– total number of part-time employees receiving a T4 slip at the workplace in the last pay period in March divided by total employment at the workplace in the last pay period of March 1999
Receives additional compensation	– dichotomous variable = 1 if worker reports earning incentives and/or bonuses, 0 otherwise
Over-educated	– derived variable: dichotomous variable = 1 if highest educational attainment of worker is greater than the minimum educational requirements of the job (as reported by the worker), 0 otherwise
Under-educated	– derived variable: dichotomous variable = 1 if highest educational attainment of worker is less than the minimum educational requirements of the job (as reported by the worker), 0 otherwise
Adequately-educated	– derived variable: dichotomous variable = 1 if highest educational attainment of worker is equal to the minimum educational requirements of the job (as reported by the worker), 0 otherwise
Job requires no education	– dichotomous variable = 1 if worker reports that the job requires no minimum level, 0 otherwise


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Appendix B: The Data

(a) The sample

The sample used for the analysis consists of paid workers, aged 18-64. The analysis is based on 24,302 observations in 5,798 workplaces—13,809 jobs held by men in 4,780 workplaces and 10,493 jobs held by women in 4,337 workplaces. Of the sample workplaces chosen for this study, roughly 10.6% have one responding employee while four or fewer employees were sampled from 55.2% of workplaces. This limits the types of analyses that can be undertaken.

(b) The measure of earnings

The analysis of the gender wage differential is based on a measure of total compensation reported by the responding worker for the previous 12 months. This measure is based on the usual wage and salary before taxes and includes any other earnings (i.e. tips, commissions, bonuses, overtime pay) and other types of variable pay such as profit-sharing, productivity bonuses and piecework. Total compensation is then converted into a measure of hourly wages.

The WES allows respondents to report different bases of pay (i.e. hourly, daily, weekly etc.). The wages of workers reporting a unit of wage other than hourly are converted to an hourly wage rate based on their reported earnings and hours. This flexibility in the respondent's unit of reporting wages may introduce measurement error in the conversion to hourly wages. However, there is a tradeoff between potential error in hours worked and efficiencies gained through more accurate reporting of earnings. As well,

converting to a per hour measure of earnings completely controls for work volume and as shown in previous work (Drolet, 2001), is important in a study of gender pay differentials.

Appendix C: The methodology

(a) Estimation method that does not take account of the workplace

Traditional models of wage determination assumed that wages were tied to the characteristics of the individual worker. The relationship between hourly wages and the characteristics of the worker were estimated in semi-logarithmic form:

$$\ln \boldsymbol{w_i} = \alpha + \boldsymbol{X_i}\beta + \boldsymbol{e_i} \qquad (1)$$

where $\ln \boldsymbol{w_i}$ is the natural logarithm of hourly wage rate of worker i, $\boldsymbol{X_i}$ is a vector of individual-specific characteristics of worker i, β is a vector of estimated slope coefficients for the worker-specific characteristic, α is the intercept term. The coefficient estimates, β can be interpreted as the approximate percentage change in wages for a one-unit change in the explanatory variable.

(b) Estimation methods that take account of the workplace

A **fixed effects** method can be used to take account of the workplace in the wage determination process. The relationship between hourly wages and worker-specific variables is estimated in semi-logarithmic form and the differences in the wage outcomes across workplaces are captured in the constant term (workplace fixed effects). The following wage equation is estimated:

$$\ln \boldsymbol{w_{ik}} = \sum_{\boldsymbol{k}=1}^{\boldsymbol{K}} \alpha_{\boldsymbol{k}} \boldsymbol{d_k} + \boldsymbol{X_{ik}}\beta + \boldsymbol{e_{ik}} \qquad (2)$$

where $\ln \boldsymbol{w_{ik}}$ is the natural logarithm of hourly wage rate of worker i in workplace k, $\boldsymbol{X_{ik}}$ is a vector of individual-specific characteristics of worker i in workplace k, β is a vector of estimated slope coefficients for the worker-specific characteristic, α_k is workplace k's wage differential and $\boldsymbol{d_k}$ is a dummy variable corresponding to workplace k and takes the value of 1 for workplace k and 0 otherwise. There are a total of K workplaces. The coefficient estimates, β can be interpreted as the approximate percentage change in wages for a one-unit change in the explanatory variable. In other words, Equation (1) is simply a linear regression with a large set of workplace dummy variables (i.e., a dummy variable for each workplace). The worker's wages become a function of their characteristics $\boldsymbol{X_{ik}}$ as well as a workplace specific fixed effect α_k. This model estimates the set of coefficient estimates, β, that are assumed to be the same across all workplaces and represents the effect of the independent variables on log wages controlling for differences across locations. The workplace fixed effects model does not account for the specific characteristics of the workplace unless a second regression is run whereby the workplace-specific fixed effect α_k is regressed against a set of workplace characteristics.

Taking advantage of the unique WES data, the relationships between hourly wages and observed worker AND workplace characteristics can also be explored by estimating the wage structures of men (m) and women (w) in semi-logarithmic form:

$$\ln \boldsymbol{w_{ik}} = \alpha + \boldsymbol{X_{ik}}\beta + \boldsymbol{Z_{ik}}\delta + \boldsymbol{e_{ik}} \qquad (3)$$

where $\boldsymbol{w_{ik}}$ is the hourly wage rate of worker i in workplace k, $\boldsymbol{X_{ik}}$ is a vector of individual-specific characteristics of worker i in workplace k, β is a vector of estimated slope coefficients for the worker-specific characteristic, $\boldsymbol{Z_k}$ describes the characteristics of workplace k for worker

i, δ is a vector of estimated coefficients of workplace characteristics and e_{ik} is an error term. There are a total of K workplaces. The coefficient estimates, β and δ, can be interpreted as the approximate percentage change in wages for a one-unit change in the explanatory variable.

The WES operates as a two-stage survey—the first stage draws a sample of workplaces and the second stage draws a sample of workers from each workplace. For each workplace, one or more wages are observed. As noted by Wooden and Bora (1999) and Reilly and Wirjanto (1999a), estimation of equation (2) by ordinary least squares (OLS) ignores the hierarchical nature of the data and violates the OLS assumption of independence since the disturbances are correlated for workers employed in the same workplace. Wooden and Bora (1999) suggest a more appropriate error structure $e_{ik} = \mu_{ik} + \lambda_k$ where μ_{ik} has the usual properties—varying independently across workers both within and across workplaces—and λ_k—varying across workplaces but is constant for workers in the same establishment. Reilly and Wirjanto (1999a) interpret λ_k as capturing unobserved characteristics at the workplace-level that affects the productivity of *all* workers in the workplace.[30] Any workplace effects that are not captured in λ_k are assumed to be random and part of the disturbance term.

[30] Bootstrap weights were used in estimation and considers the non-independence of error terms for workers in the same workplace and the part of the error term that is considered workplace-specific but is constant across workers. The bootstrap weights correctly adjusts for the variation due to the two-stage sample (employee survey) as well as the complex survey design of the WES. With respect to the complex survey design, adjustments are made for (1) the variance associated with 'dead' employers (2) 'stratum jumpers' or misclassified units (e.g. if a large unit is misclassified as a small unit, there will be a large impact on the estimated variance since this unit would have a large weight and would report employment numbers larger than other units in the stratum) (3) calibration or separate ratio estimation. Statistical packages do not account for the design effect and can underestimate the WES standard errors by a factor up to 50.

(c) Models used in the analysis

Using equation 3, four models are estimated. As a starting point, only individual worker characteristics are used. These variables include full-time work experience, experience squared, education level (8 groups), tenure (5 groups), marital status (4 groups), and binary indicators for the presence of dependent children, part-time status and unionized, region (6 groups), firm size (4 groups) (Model 1). Model 2 builds on the traditional model by including industry (14 groups) and occupation (6 groups). [31] Model 3 incorporates the individual worker characteristics described in Model 1 as well as the 'new WES' variables. These variables include the degree of participation in self-directed work groups (4 groups), workplace part-time rate, training costs per employee, and the match between the educational requirements of the job and the educational attainment of the worker as well as binary indicators for non-profit organization, foreign-owned firms, worker receiving additional compensation, working between the hours of 6 a.m. – 6 p.m. and working flexible hours. Model 4 includes the regressors of Model 3 as well as industry and occupation.

(d) Variation in individual wages

Also of interest is the significance of worker and workplace characteristics in explaining the variation in individual wages of men and women (R squares). Roughly 25% of the variation in log wages is accounted for

[31] There is considerable debate over the inclusion of industry and occupation as explanatory variables since occupational segregation is a mechanism whereby wage discrimination may occur and their inclusion may undervalue the importance of labour market constraints on wages or alternatively, may over-justify gender pay differentials. However, excluding occupation and industry may neglect the importance of background or individual decisions with respect to wage outcomes.

when wages are tied solely to the individual worker characteristics (Model 1). When both worker and workplace characteristics are included, about 45% of the variation in log wages of Canadian women and men are explained (Model 4).


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Appendix D: The decomposition

The gender pay differentials can only be 'explained' if first, men and women differ in the characteristics that they bring to the labour market as well as in the types of workplaces to which they belong AND second, if the factors being considered are themselves essential determinants of their pay.

Traditional methods of decomposing gender wage differentials are rooted in the work of Oaxaca (1973) and Neumark (1988).[32] From the estimated wage equation (3), the difference in the mean log wages between men and women is decomposed as follows:

$$\bar{w}_m - \bar{w}_f = (\bar{X}_m - \bar{X}_f)\beta^* + (\bar{Z}_m - \bar{Z}_f)\delta^* + \left[(\hat{\beta}_m - \beta^*)\bar{X}_m + (\beta^* - \hat{\beta}_f)\bar{X}_f + (\hat{\delta}_m - \delta^*)\bar{Z}_m + (\hat{\delta}_f - \delta^*)\bar{Z}_f\right] \quad (4)$$

where β^* and δ^* reflect the choice of competitive wage structure. The first term and second on the right-hand side of equation 4 represents the 'explained' portion, which includes gender differences in worker $\bar{X}_m - \bar{X}_f$ and workplace characteristics, $\bar{Z}_m - \bar{Z}_f$. The residual or 'unexplained' includes differences in the returns to worker and workplace

[32] The decomposition is made possible by the property that the sample average wage, $\bar{w}$, is equal to the product of the average vector of characteristics, $\bar{X}$, and the estimated regression coefficients, $\hat{\beta}$.

characteristics and consists of a male advantage: $\hat{\beta}_m - \beta^*$ and $\hat{\delta}_m - \delta^*$ and a female disadvantage: $\hat{\beta}_f - \beta^*$ and $\delta^* - \hat{\delta}_f$.[33]

Three decompositions are calculated: (1) the male base decomposition is computed using $\beta^* = \hat{\beta}_m$, (2) the female base decomposition is computed using $\beta^* = \hat{\beta}_f$, (3) a pooled decomposition calculated from the least squares estimates of a combined male-female model.

[33] Oaxaca and Ransom (1999) show that the estimated contribution of sets of dummy variables to the total explained component, to the total unexplained component and to the overall decomposition are not sensitive to the choice of reference group. Separate contributions of sets of dummy variables to the unexplained component as well as the contribution of the intercept term are not invariant since the estimated coefficients are sensitive to the omitted category.

Appendix Table A

Coefficients from pooled OLS regression and workplace fixed effects model, N=23,689

Variables	Pooled OLS		Workplace Fixed Effects	
	Coefficient	Standard error	Coefficient	Standard error
Female	-0.1583	0.0095	-0.0825	0.0002
Years of full-time experience	0.0150	0.0016	0.0087	0.0003
Experience squared	-0.0155	0.0039	-0.0077	0.0001
Education (reference group: High school)				
Less than high school	-0.0918	0.0140	-0.0463	0.0003
Industry certification	0.0110	0.0164	-0.0293	0.0004
Incomplete	0.0545	0.0134	0.0090	0.0003
Trade school	0.0878	0.0150	0.0225	0.0003
College diploma	0.1145	0.0162	0.0382	0.0003
University degree	0.2921	0.0156	0.1678	0.0003
Greater than university	0.3178	0.0176	0.1942	0.0004
Job tenure (reference group: 1-5 years)				
Less than 1 year	-0.0448	0.0104	-0.0398	0.0002
6-10 years	0.0298	0.0104	0.0330	0.0002
11-20 years	0.0151	0.0126	0.0193	0.0003
20 + years	0.0318	0.0161	0.0481	0.0004
Marital status (reference group: married)				
Common law	-0.0570	0.0122	-0.0109	0.0002
Single, never married	-0.0959	0.0116	-0.0652	0.0003
Other	-0.0480	0.0130	-0.0325	0.0003
Dependent children	0.0399	0.0081	0.0353	0.0003
Part-time	-0.0042	0.0130	0.0791	0.0002
Covered by a collective bargaining unit	0.1532	0.0086	0.0152	0.0003
Occupation (reference group: technical)				
Managers	0.2186	0.0165	0.2767	0.0003
Professionals	0.2673	0.0105	0.1892	0.0003
Sales	-0.2352	0.0255	-0.0524	0.0002
Administration	-0.0606	0.0096	-0.1241	0.0003
Production	-0.1506	0.0218	-0.1367	0.0002
Constant	2.5409	0.0160	2.5870	0.0003

Note: For the pooled OLS model, only workers from workplaces with two or more responding workers were included since this is equivalent to the sample used in the workplace fixed effects model. There are 23,689 observations.

Appendix Table B

Log wage decomposition based on alternative wage structure, 1999
Standard errors in parentheses

	Models			
	(1) worker characteristics	(2) worker + industry + occupation	(3) worker + workplace character-istics	(4) worker + workplace + industry + occupation
Unadjusted differential	0.796	0.796	0.796	0.796
Gap	0.229	0.229	0.229	0.229
Female-based decomposition				
Gap (in logs)				
...Explained	0.02	0.088	0.041	0.098
	(0.001)	(0.002)	(0.002)	(0.002)
...Unexplained	0.209	0.141	0.188	0.131
	(0.002)	(0.002)	(0.002)	(0.002)
Explained due to				
...*Who you are*	0.015	0.014	0.014	0.015
	(0.001)	(0.001)	(0.001)	(0.001)
...*What you do*	not applicable	0.025	0.007	0.027
		(0.001)	(0.001)	(0.001)
...*When you work*	0.005	-0.003	-0.006	-0.007
	(0.001)	(0.001)	(0.001)	(0.001)
...*Where you work*	0.000	0.052	0.026	0.062
	(0.001)	(0.001)	(0.001)	(0.001)
Adjusted differential	0.811	0.868	0.829	0.877
Pooled decomposition				
Gap (in logs)				
...Explained	0.053	0.142	0.094	0.152
	(0.001)	(0.001)	(0.001)	(0.001)
...Unexplained	0.176	0.087	0.135	0.077
	(0.002)	(0.002)	(0.001)	(0.001)
Explained due to				
...*Who you are*	0.033	0.025	0.030	0.026
	(0.001)	(0.001)	(0.001)	(0.001)
...*What you do*	not applicable	0.039	0.008	0.040
		(0.001)	(0.001)	(0.001)
...*When you work*	0.019	-0.001	0.008	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
...*Where you work*	0.001	0.079	0.048	0.087
	(0.001)	(0.001)	(0.001)	(0.001)
Adjusted differential	0.839	0.917	0.874	0.926

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The Workplace and Employee Survey

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