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The Gender Pay Gap among University Professors: the Role of Individual and Organizational Determinants

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Résumé

Cette étude de cas, composée de trois articles, examine les diverses sources d'explication de l'écart salarial selon le genre chez les professeurs d'une grande université de recherche canadienne.

Le premier article analyse les écarts selon le genre sur les primes "de marché" à partir de données d'un sondage réalisé auprès des professeurs en 2002. Une analyse des correspondances donne une solution à deux facteurs dans laquelle le second facteur oppose clairement les professeurs qui ont reçu une prime à ceux qui n'en n'ont pas reçue. Le genre est fortement associé à ce facteur, la catégorie "femme" se retrouvant du côté de l'axe associé à l'absence de primes de marché. Les résultats de la régression logistique confirment que le secteur d'activité, la fréquence des contrats de recherche, la valorisation du salaire ainsi que le rang combiné à l'ancienneté sont reliés à la présence de primes de marché, tel que proposé par les hypothèses. Toutefois, même après avoir contrôlé pour ces relations, les femmes sont toujours près de trois fois moins susceptibles de s'être vu attribuer des primes de marché que leurs homologues masculins. Dans l'ensemble, les résultats suggèrent que dans un contexte où les salaires sont déterminés par convention collective, la réindividualisation du processus de détermination des salaires — en particulier le versement de primes de marché aux professeurs d'université — peut favoriser la réapparition d'écarts de salaire selon le genre.

Le second article est réalisé à partir de données administratives portant sur les années 1997 à 2006. Les contributions respectives de quatre composantes de la rémunération à l'écart salarial selon le genre y sont analysées, soit le salaire de base, l'accès au rang de professeur titulaire, l'accès aux primes de marché et chaires de recherche du Canada, de même que les montants reçus. Les composantes varient quant à leur degré de formalisation. Ceci permet de tester l'hypothèse selon laquelle l'ampleur de l'écart salarial selon le genre varie en fonction du degré de formalisation des composantes salariales. Nous déterminons également dans quelle mesure l'écart selon le genre sur les diverses composantes de la rémunération varie en fonction de la représentation relative des femmes

professeurs au sein des unités. Les résultats démontrent l'existence de variations dans l'ampleur des différences selon le genre en fonction du degré de formalisation des pratiques de rémunération. Qui plus est, après contrôles, la rémunération est plus faible dans les unités où les femmes sont fortement représentées.

Le dernier article examine les mécanismes pouvant mener à un écart selon le genre en ce qui a trait à l'accès aux primes de marché chez les professeurs de l'institution. Les processus d'attribution de ces suppléments salariaux sont examinés à partir d'entretiens réalisés avec 17 administrateurs à tous les niveaux hiérarchiques de l'institution et dans une diversité d'unités académiques. Les résultats suggèrent que les différences selon le genre pourraient être liées à des caractéristiques spécifiques du processus d'attribution et à une distribution inégale des primes aux unités à forte représentation féminine.

De façon générale, les résultats démontrent que l'écart de rémunération selon le genre chez les professeurs de cette université n'est pas totalement expliqué par des différences dans les caractéristiques individuelles des hommes et femmes. L'analyse révèle que l'écart réside dans des différences selon le genre en ce qui a trait à l'accès aux primes de marché et aux chaires de recherches du Canada et, dans une moindre mesure, au rang de professeur titulaire. Aucune différence n'est observée sur le salaire de base et le montant des primes salariales reçues, que celles-ci soient dites de "marché" ou associées à une chaire de recherche du Canada. Qui plus est, on constate que la rémunération est plus faible dans les unités où les femmes sont le mieux représentées. L'accès différencié selon le genre aux primes de marché qui est observé pourrait être lié à certains processus organisationnels qui limitent les probabilités d'octrois à des femmes. Les femmes pourraient être particulièrement désavantagées dans ce système d'octroi, pour plusieurs raisons. L'existence de différences selon le genre en ce qui a trait aux dispositions ou habiletés des individus à négocier leur salaire est évoquée et supposée par certains administrateurs. Un accès limité aux informations concernant la politique de primes pourrait réduire la probabilité que des femmes tentent d'obtenir ces suppléments salariaux. Les directeurs d'unités, qui sont en majorité des hommes, pourraient être biaisées en faveur des professeurs masculins dans leurs évaluations s'ils tendent à favoriser ceux qui leurs

ressemblent. Il est également possible que les directeurs d'unités où les femmes sont les mieux représentées n'aient pas reçu d'information sur les primes de marché ou que des traditions disciplinaires les aient rendu réticents à demander des primes.

Mots-clés : Écart salarial selon le genre, professeurs d'université, organisation, formalisation des salaires, discrétion salariale, représentation féminine.

Abstract

This case study examines the various sources of explanation of the gender pay gap among professors at a large Canadian research university. It comprises three articles.

The first article analyzes gender differences in "market supplements" using data from a survey of professors conducted in 2000. The correspondence analysis produces a two-factor solution in which the second axis clearly opposes faculty who receive market supplement to those who do not. Gender is strongly related to this factor, with the female category on the side of the axis associated with the absence of market supplement. The results of the logistic regression confirm that field of specialization, frequency of external research contracts, faculty members' values and attitudes towards remuneration and seniority within rank are all related to the award of market supplements, as hypothesized. However, women were still almost three times less likely than men to have been awarded market supplements after controlling for these relationships. Overall, the results suggest that within a collective bargaining context, reindividualization of the pay determination process — notably, the payment of market supplements to faculty — may reopen pay differences by gender.

The second article uses administrative data for years 1997 to 2006. We estimate the respective contributions to the gender pay gap of four pay components: base pay, promotion to full professor, access to market supplements and Canada research chairs as well as the amounts received. These are characterized by various levels of formalization. This allows testing the hypothesis that the magnitude of gender differences in pay varies with the extent of formalization of pay components. We also determine how gender differences on each pay component vary according to the relative representation of female faculty members within units. We find some evidence that the magnitude of gender differences varies with the degree of formalization in remuneration practices. We also find that, other things being equal, pay is lower in units with a high proportion of females.

The last article examines the mechanisms that may lead to gender differences in access to 'market supplements' among professors. The process of awarding pay in excess

for the amounts provided for in a collective agreement are examined based on interviews with 17 administrators at all hierarchical levels and in various academic units. Results suggest that gender differences in the likelihood of receiving an award may be related to specific features of the award process and to an unequal distribution of awards to units with strong female representation.

Overall, the results show that the gender pay gap among professors at this university is not entirely accounted for by differences in the individual characteristics of male and female professors. The analysis reveals that the pay gap resides in gender differences in access to market supplements and Canada research chairs (CRCs) and, to a lesser extent, to the full professor rank. No difference is found on base pay or on the amounts of pay supplements received, whether they are "market" premiums or supplements associated to a CRC. Furthermore, pay tends to be lower in units where female representation is highest. The observed gender differences in access to market supplements could be due to organizational processes that reduce the likelihood of awards to women. There are several reasons why female faculty members are particularly disadvantaged in this award system. Gender differences in the propensity or ability to negotiate are alleged (and assumed) by some of those negotiating. More limited access to information about supplements reduces the likelihood that women will pursue them. Chairpersons, who are mostly males, may allow gender bias to influence their evaluations of faculty members, perhaps because they tend to favor others like themselves. It may also be that chairpersons from the units where women are better represented do not have access to information about market supplements or that disciplinary traditions make them reluctant to request them.

Keywords : Gender pay gap, university professors, organization, pay formalization, pay discretion, female representation.

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Chapter 1 : Introduction

Women's situation in the work place has deeply changed over the last decades. Their presence on the labour market has strongly increased and they have entered several professions previously dominated by men. Their career profiles have become more continuous than before, more similar to those of men. On the legislative front, anti-discrimination and pay equity laws have been voted in order to foster gender equality on the labour market.

Yet, although these laws guarantee formal equality in the professional sphere, substantive equality has not been achieved. The gender pay gap is undoubtedly the most frequently cited evidence of the persisting differences by gender on the labour market. The many explanations offered to account for the gap bespeak its multidimensional character; it is indeed related to factors pertaining to family situations, public policies and to work itself.

With regards to family situations, the pay gap may partly reflect a sexual division of domestic labour that disadvantages women. They still take on a larger share of family responsibilities (Armstrong & Armstrong, 2001) and as a result, they may more often than men reduce their work hours or take part-time jobs, which also tend to be poorly paid (Statistics Canada, 2003; Drolet, 2002; Finnie & Wandell, 2004).

The gender pay gap also reflects insufficiencies in public policies for work-family balance; in particular it is often difficult for families to find affordable, high quality daycare. This problem most acutely affects women because they still are more often than not the primary caregivers of their children (Armstrong & Armstrong, 2001; Rooney et al., 2003).

With regards to the work sphere, the pay gap partly reflects the precariousness of jobs and the poor wages in labour market sectors and industries where women are over-represented, the lesser work experience cumulated by women (partly due to their more recent entry in the labour market) gender differences in fields of study and occupations, women's under-representation in higher hierarchical levels and discrimination (Drolet, 2002; Fortin & Huberman, 2002).

A major change occurred between the 1960's and the 1990's: whereas about two-thirds of the gender pay gap used to be due to between occupation differences in pay and one-third to within occupation differences, the reverse is true today (Fortin & Huberman, 2002). Detailed studies of occupations may thus constitute a sensible strategy to generate a better understanding of the processes that lead to the gender pay gap.

Universities are suitable sites to study gender differences on the labor market to the extent that the intellectual foundations of socio-economic equality between women and men emerged from universities (Goyder, 1992). Furthermore, as Guppy (1989) points out, "...academics often cloak their role in the garb of enlightenment and progressive thinking and so, to the degree that this is more than intellectual posturing, sexist pay practices might be expected to disappear early in this milieu" (Guppy 1989). Finally, university faculty members are purportedly evaluated on the basis of their individual performances, which should in theory trump gender biases. As a result, higher education should logically represent a standard in terms of gender equality.

The pay gap is indeed lower in academia than in the general population or other professions requiring university degrees. In the general population the gender pay gap observed among full-time employees was estimated at 29.4% in 2006, compared to 18.2% among university faculty members (Statistics Canada 2006). It is lower among primary and secondary teachers (9.8%) and among college teachers (12.8%), similar among natural and applied scientists (19.3%) and higher among general practitioners (27.7%), lawyers (34.1%) and senior executives (40.1%; Statistics Canada 2006). Given that gender differences seem less substantial in academia than in other professions, why research them at all? For one thing, it may deepen our understanding of how differences may occur in a context where, prima facie, one could expect equality to be achieved. Second, recent changes in Canadian academia, i.e. the introduction of the Canada Research Chair program in 2000 along with an increased use of market supplements, might aggravate differences between men and women in this profession.

Two general models emerge from the literature on gender differences in the labour market (Sonnert & Holton, 1996; Marry, 2003). The difference model analyzes gender

differences on individual characteristics that are related to the outcome (whether it is employment, wages or promotions). This model rests on explanations such as self-selection, self-exclusion, socialization process and stereotypes that influence choices of academic orientations to account for differential outcomes by gender (Marry, 2003). Explanations related to this model in analyses of the gender pay gap include for instance differences between men and women on human capital, research productivity or mobility. The deficit model refers to formal and informal processes that exclude women. As Sonnert (1999) explains, the difference model focuses on factors at the individual level. The deficit model refers to the way women are treated; it focuses on structural, organizational and social factors. Empirically, the boundary between the two models is not always clear-cut. Nonetheless, the factors associated with the deficit model approximately coincide with those that might be considered discrimination.

Empirical research on gender differences in pay among university faculty members tends to analyze the impact of individual characteristics, variables which are more readily available (Nielsen et al., 2005). Yet salary and promotion decisions are taken at the organizational level and differences may be seen as reflections of organizational practices (Tolbert, 1986; Reskin, 2000a). “Inequality at work does not just happen; it occurs through the acts and the failures to act by people who run and work for organizations.” (Reskin, 2000a, p. 717). The extent of gender differences thus varies with organizational contexts, but this aspect is rarely treated in research. The few studies reviewed in Kulis (1998) tend to show that institutional size and prestige are related to gender differences in rank and pay. Porter, Toutkoushian and Moore (2008) find that the gender pay gap varies by institution type and by field. In Canada, Warman, Woolley and Worsick (2010) find that gender differences in pay tend to be greater in universities where salaries are determined using discretionary judgments of merit rather than seniority. In addition, they observe an increasing differentiation by discipline and institution in the salaries of Canadian professors.

This thesis contributes to our understanding of gender difference on the labour market by analyzing individual and organizational factors related to the gender pay gap as

well as the mechanisms that may produce it. Doing so, the research contributes to our knowledge on specific measures that may foster equality within given contexts. The method used is a case study of a large Canadian research university. The thesis is composed of three integrated articles. First, we review the literature on individual factors potentially related to the gender pay gap among university professors. Second, a discussion of discrimination and results of empirical analysis that attempt to measure its role in the gender pay gap among university professors are presented. Third, cultural and organizational factors potentially related to the gender pay gap among university professors are discussed. Fourth, we present the approach used for this research, followed by a brief description of policy features at the institution under study that are relevant for this research, namely the family leave and remuneration policies. This introductory chapter closes with a presentation of the broad theoretical framework upon which the thesis rests, followed by a brief outline of the three articles in order to make their integration explicit. The articles are then presented in separate chapters, followed by the conclusion chapter.

The gender pay gap among university professors: the role of factors at the individual level

The proportion of female professors in Canadian universities has constantly increased since the mid 70's, from 13% among full-time faculty members in 1973 (Ornstein, Stewart & Drakich, 1998) to 30% in 2002-2003 (Sussman & Yssaad, 2005). Women's presence has also increased within all ranks: between 1990 and 2003, the proportion of female professors has grown from 44% to 55% among lecturers, 33% to 41% among assistant professors, 20% to 33% among associate professors and 8% to 17% among full professors (Sussman & Yssaad, 2005). Women therefore remain under represented within the highest rank. The gender pay gap in Canadian academia has declined from 21% to 14% between 1970 and 2000 (Warman, Woolley & Worsick, 2010). This "raw" gap may be related to various factors at the individual level which will be reviewed in the next section.

Gender differences in human capital

The gender pay gap may in part be due to gender differences in human capital. The human capital theory posits that workers choose to acquire such capital through education and experience on the labour market (Becker, 1993). Men and women may make different choices because of gendered comparative advantages of investing in productive and reproductive work. The general argument is that women do not invest as much in education or avoid rapidly evolving, highly paid fields such as engineering and technical/scientific fields because they expect to be in the labour force for fewer years than men and to interrupt their career to raise children[1]. Nowadays women's average education level is higher than men's, thus taking this factor into account in estimates of the gender pay gap tends to lower the explained part of the gap (Drolet, 2002). However, gender differences in choices of field of education remain and account for part of the gender pay gap (Drolet, 2001). In academia, fields within which women tend to be underrepresented command higher salaries. For instance, in 2001-2002, Canadian female faculty members were underrepresented in two of the four highest paid academic sectors, i.e. engineering/applied sciences as well as mathematics/physical sciences (Canadian Association of University Teachers, 2004). Conversely, they were over-represented in all four sectors offering the lowest average salaries, i.e. health professions and occupations, fine and applied arts, humanities and related sciences, and education.

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[1] Other explanations for this horizontal segregation include gendered socialization and stereotypes (Duru-Bellat, 2004) as well as historical processes that limited women's access to education (Le Doeuff, 1998) and excluded them from acquiring certain types of knowledge (Mosconi, 1994). For instance, Duru-Bellat (2004) suggests that few girls choose to follow scientific orientations in school partly because the characteristics stereotypically associated to researchers, for instance logic, rationality and coolness, are closer to male than female stereotypes. She observes that there is a tendency for girls to self-select into scientific orientations only if their academic results in science are exceptional. LeDoeuff (1998) argues that although women are no longer actively excluded from science nowadays, science is still presented as undeniably masculine, which is tantamount to excluding women. According to Mosconi (1994), the educational choices of boys and girls result in large parts from a reproduction phenomenon; girls' reluctance to choose technical and science fields and their strong tendency to enter literary fields are extensions of the institutional structures established over the 19th century and at the beginning of the 20th century. The author explains that "If one admits that today mathematics have replaced Latin and Greek as symbols of excellence and elite, the relative exclusion of girls from preparatory science classes may be interpreted as proof that despite formal equality in access to education, the policy that tends to exclude girls from the most prestigious knowledge is still having some effects." (Our translation of Mosconi, 1994, p. 219).

In addition, although gender differences in labour market experience have decreased with the recent convergence of male and female employment patterns, women are still on average more likely to interrupt their careers or to work part-time when they have children, which translates in a lower cumulated labour market experience (Altonji et al., 1999). Female professors cumulate less seniority than their male counterparts (Ornstein & Stewart, 1996) and occupy lower academic ranks (Ornstein & Stewart, 1996; Ornstein et al., 1998; Sussman & Yssaad, 2005). Possible reasons for this include women's relatively recent presence in the academic profession, career interruptions, delayed career starts and discrimination (Ornstein & Stewart, 1996; Ornstein et al., 1998; Sussman & Yssaad, 2005).

The sexual division of domestic labour

Researchers have hypothesized that women are responsible for a larger share of domestic responsibilities, which negatively impacts promotion outcomes (Ginther & Hayes, 2001; American Sociological Association, 2004; Perna, 2005). Being an academic implies a heavy workload and high mobility, which can be difficult to reconcile with family responsibilities. In addition, child bearing years usually coincide with a period when academics are working towards becoming tenured. Hannah et al. (2002) suggest that academic careers are shaped on the model of a male breadwinner free from family constraints. On the other hand, female professors use various strategies to avoid potentially detrimental impacts of child rearing on their careers. They are less likely than male professors to become parents and when they do, they have fewer children (Ginther & Hayes, 2001). Many postpone having children until after tenure (Armenti, 2004).

The results of research investigating the impact of family responsibilities on the career outcomes of academics are mitigated. Ginther and Hayes (2001) find that female professors who are mothers are less likely to be promoted than their childless counterparts. Perna (2005) observes no relation between number of children or marital status and promotion among female professors; being married or having children is positively related to the odds of promotion among males. Toutkoushian (1998) finds that male faculty

members benefit from a « marriage premium » on pay: after controls[2], married men are paid on average 4% more than their single male colleagues. The impact of marital status varies by sector, differently so for male and female faculty members. For instance, the marriage premium observed for male faculty members is larger for those working in physical sciences/mathematics (6.6%) than it is for their counterparts in social sciences (4.9%). Female faculty members in social sciences who are cohabiting (without being married) are paid on average 9.3% more than their single colleagues.

If women professors take on a larger share of family responsibilities, this could affect their publication rates. Yet in a research using a 1998-1999 survey answered by 8,544 faculty from 57 American universities, Sax et al. (2002) found that after adjustments were made for factors related to publication rates such as rank, age and field of specialization, the only family-related variable associated to publication rates of women was financial stress[3].

Gender differences in research productivity

A lower average level of research productivity is often cited as one reason accounting for female faculty members' lesser pay. With regards to number of published works, over 50 American studies (Cole & Zuckerman, 1984, in Cole & Singer, 1992), as well as two Canadian studies (Nakhaie, 2002; 2007), have detected a gender gap in average publication rates. Nakhaie (2002) shows that the "raw" gap in career publications is approximately two to one in favor of males. It is for the most part associated with gender differences in rank, field of specialization, seniority, type of institution and time devoted to research. However, the author explains, the causal relationship implied by these associations is unclear. Women tend to hold lower ranks than their male counterparts. Publishing is crucial to rank progression, but it could also be that holding a higher rank

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[2] These controls include measures of human capital (number of years of experience, seniority, age, highest degree earned), publications (number of articles, books and book chapters published over one's career), principal field of teaching (43 categories), institution type (Carnegie classification), length of appointment, whether respondent is a departmental chairperson, region and race.

[3] The other family-related variable used in this research were marital status, number of dependant children, stress from having to take care of an elderly parent and number of hours per week dedicated to taking care of children and housework.

leads to publishing more — that faculty members in higher ranks benefit from a process of accumulation of advantages such as better access to resources for research, a wider professional network, and the recognition that leads to invited publications (Nakhaie, 2002). In his analysis of factors associated with promotion for male and female faculty members, Nakhaie (2007) shows that a gender gap in average number of publications remains in 2000. However, given that the focus of the article is the gender gap in promotion, how much of those gender differences in average number of publications can be accounted for by other factors is unknown.

A study on American faculty revealed very little, if any, gender difference in publication rates in recent cohorts of science faculty (Xie & Shauman, 2003). However, a recent longitudinal study suggests that gender differences emerge over time. Using multilevel longitudinal analysis on survey and CV data collected in 2004, Leahey, Lee and Hunter (2008) analyzed the trajectories of research productivity (as measured by the number of peer-reviewed articles at each point in time) of American faculty of sociology and linguistics. After controls[4], no gender gap in productivity level is detected, but men's rate of growth is larger than women's. Thus, gender differences in productivity emerge over time. Women and men benefit differently from specialization: the former benefit in terms of productivity level and the latter, in terms of productivity rate of growth. Combined with the fact that men specialize slightly more than women, these findings contribute to explain why productivity trajectories differ by gender.

The visibility of publications is another important indicator of an academic's research productivity. The scarce research on gender differences in visibility has produced mixed results. Two studies of science faculty members have shown that women have higher citation rates than their male counterparts. Long's (1992) study of biochemists shows that over the first 17 years of their career, women see their articles cited 9 to 13 times on

[4] These controls are level of specialization (measured by a variable created by the authors using keywords descriptors of published articles), field (sociology or linguistics), number of years elapsed from PhD to start of trajectory, department prestige of PhD institution, rank, two dummy variables indicating the presence of moves from higher prestige to lower prestige institution and vice versa, prestige of current department and cumulative citations. The effects of parental and marital status were also tested and were not significant for either gender.

average, versus 7 to 9 times for men. In their research of science academics, Sonnert and Holton (1996) find that publications by women receive on average 24 citations and those by men, 14. The authors suggest that this could be related to a tendency in women to be more perfectionist and to produce more comprehensive and synthetic work, which in turn could explain their lower average publication rates. In their longitudional study of American faculty of sociology and linguistics, Leahey et al., (2008) also analyzed trajectories of visibility (as measured at each point in time by number of articles weighed by journal impact factors and by number of citations). After controls[5], men's visibility benefits more from previous publications than women's, both in terms of the likelihood of getting articles published in high impact factor journals and number of citations, which translates over time in large gender differences in visibility.

Gender differences in access to research resources and networks

Research on gender difference on access to resources for research has yielded inconsistent results. Wennerås and Wold (1997) found that women's applications to postdoctoral fellowships were underrated compared to those of males and that at equal levels of scientific productivity, the evaluation of women's scientific competences was inferior to those of men. However, in a replication of this study, Sandström & Hällsten (2008) examined relative success by gender in 2004 on research grants applications to the same research council (Wennerås and Wold analyze only post-doctoral fellowships applications), and found that women did a little better than men. In 1999, a highly-publicized report from the Massachusetts Institute of Technology concluded that its women faculty members had limited access to space and to research grants and were excluded from positions of power (MIT, 1999). In Canada, there has been concern expressed about poor female representation among Canada Research Chair holders, which led to a human-rights complaint (PAR-L Electronic Network, 2005) that was recently settled by an agreement on equity in the nomination process for chairholders. The Fifth-Year Evaluation of the Canada Research Chairs Program showed that although the proportion of new female chair

[5] The same controls used in the analysis of productivity trajectories are used in the analysis of visibility trajectories, except cumulative citations of course, which is replaced with cumulative publications.

recipients had increased from 14.1% to 32.0% between 2000 to 2004, only 19.8% of chairholders were women in 2004 (R.A. Malatest & Associates Ltd, 2004) and 22% in 2006 (Canada Research Chairs Program Website).

Given their relatively recent entry in academia, female faculty members may be less integrated into professional networks than males – effectively, strangers in academia (Sonnert & Holton, 1995), excluded from dominant 'old boys networks' (McKenna et al., 2002; MIT, 1999; see also R.A. Malatest and Associates Ltd, 2004). Long's study of American biochemists shows that among professors who publish, male and female collaboration rates are virtually identical (Long, 1992). Women are more likely to collaborate with their spouse because they are more likely than their male counterparts to have a spouse who is also a scientist. A recent study of academic economists in the United Kingdom found that women were less likely than men to have received an outside offer in the five previous years (Blackaby, Booth & Frank, 2005). The authors argue that this finding is consistent with the "loyal servant hypothesis" (Booth, Francesconi & Frank, 2003): family commitments more often limit female than male mobility, prospective employers know this and as a result, they are less likely to make offers to women. Current employers exploit the opportunity that this provides by paying their female employees less. Note, however, that the fact that women had received less outside offers over the five previous years was the only evidence produced by Blackaby et al. (2005). The article contained no direct evidence bearing on the loyal servant hypothesis.

Gender differences in values and attitudes towards pay

Men and women may differ in terms of values and attitudes towards work and pay. The relationship between gender and negotiations has been widely studied. An extensive review of theory and research distinguishes five general theoretical approaches that vary according to the hypothesized origin of gender differences in negotiations: within the mind of the negotiator, within the mind of his opponent, as a product of the interaction, as a product of contextual influences or as a result of the interaction between gender and situational characteristics (Kray & Thompson, 2005). Overall, the research reviewed by Kray and Thompson (2005) suggests the following trends. First, men tend to be generally

more competitive than women, although some contradictory results are cited, and women and men are expected to behave differently in negotiations. Second, most research addressing how men and women are treated in negotiations find that the former are treated more favorably, but again there are contradictory results. Third, studies on the relationship between power and gender in negotiations yield inconsistent findings. Finally, the studies conducted on various situational moderators (e.g. stereotype activation, recipient of negotiations, work vs non-work related negotiations) suggest that these may influence how men and women negociate (Kray & Thompson, 2005).

The evidence on gender differences in negotiations outcomes is mixed. A meta-analysis of 21 studies, 19 of which were laboratory-based, revealed only small gender differences in the outcomes from salary negotiations (Stuhlmacher & Walters, 1999). One study based on a survey investigating the actual experiences of salary negotiation by university graduates in business, psychology, sociology, and history found no gender difference in the incidence of negotiation or in the relative success of negotiation (O'Shea & Bush, 2002). Babcock and Laschever (2003) find that in general, women are less likely than men to negotiate their salaries. Finally, to our knowledge, no research has specifically examined whether women and men academics differ in their attitudes towards salary negotiation. However, a recent study finds no gender pay gap among newly hired faculty, which, according to the authors, casts doubts on the idea that women are less likely to negotiate their wages upon hiring (Porter, Toutkoushian & Moore, 2008).

Another form of the argument that there are gender differences in attitudes to work and pay is based on the idea of compensating differentials (Shirazi, Biel & Fransson, 2002). According to this model, there are gender differences in preferences with respect to job attributes. The results of recent studies on this topic are mixed. Using different data sources and studying different occupations, Tolbert and Moen (1998), Browne (1997), and Shirazi et al. (2002) all report no differences between men and women in the job attributes they most value. In contrast, Barbezat (1992) found significant gender differences in the job attributes preferred by Ph.D. graduates entering the academic job market. Men displayed a greater tendency to prioritize salary than women. Women were more likely to prioritize

student quality, collegiality and opportunities for collaborative work (Barbezat, 1992). However, this research is by no means definitive since it was limited to economists and subjects were at the beginning of their career.

The gender pay gap among university professors: the role of discrimination

Gender differences in pay among university faculty may also result from wage discrimination, which is generally defined as

> …a situation in which persons who provide labor market services and who are equally productive in a physical or material sense are treated unequally in a way that is related to an observable characteristic such as race, ethnicity, or gender. By "unequal", we mean these persons receive different wages or face different demands for their services at a given wage (Altonji & Blank, 1999, p. 3168).

There are three theoretical models of discrimination: systemic, taste-based and statistic.

Systemic discrimination differs from the other types in that it does not necessarily entail discriminative behaviors. This model posits that the disadvantaged positions of some groups results from the practices, values and rules of certain actors on the labour market, among which are unions, businesses and governments (Chicha, 2003).

Taste-based discrimination characterizes a situation where employers, colleagues or clients may have an aversion to cross-group contacts, i.e. contacts across age, ethnicity or sex boundaries (Becker, 1957). Employers prefer hiring individuals from certain groups, employees prefer working with those individuals and clients prefer buying goods or services from them. In the case of sex-based groups, this preference may be related to the beliefs of employers, colleagues or clients about the "social roles" that are appropriate for women and men, which may more or less correspond to social representations associated with various jobs (Blau et al., 2006). For instance, some employers may be more willing to employ women as secretaries than heavy machinery operators. Some male employees may be willing to work with a woman if she is a subordinate but may resist doing so if she is a hierarchical superior. Some clients may prefer to buy clothes from saleswomen and cars from salesmen.

Employers who discriminate consider that a psychological cost is associated with hiring individuals who belong to the groups that they discriminate against. This cost is added to the wages of these individuals, thus discriminating employers are only willing to hire them under the conditions that they are paid less than employees from the preferred groups. Colleagues who discriminate have an aversion to working with members from certain groups and if they can't avoid doing so, they may ask for better wages, which produces inter-group wage differentials. As for clients, if for instance they prefer buying goods or services from employees who belong to certain groups, employees from other groups may have weaker sales or be considered by their employers as less productive, which may create between-group differences in pay (Blau et al., 2006).

Developed by Phelps (1972) and Arrow (1973), the statistical discrimination model posits that employees may evaluate a candidate's potential productivity based on observable characteristics such as gender, race or age when faced with incomplete information with regard to the candidate's qualifications or job attachment (Havet & Sofer, 2002). This may be due to employers' beliefs or measurement error. In the former case, employers are not willing to pay the same wages to members of different groups because they conclude, based on their beliefs or observations, that some are less productive than others. They fill the gaps in the information needed to make compensation decisions with signs that may not be counterfeited and that they believe are related to the qualities that they look for in candidates (Blank, Dabady, & Citro, 2004). Gender, race and age are examples of signs used in such situations. In the case of discrimination related to measurement error, employers use signs such as academic degrees or test results to evaluate potential productivity, but these are not considered as reliable a sign of productivity for individuals belonging to groups that employers discriminate against. For instance, in the case of gender discrimination, this perception could be related to the perceived risk of women leaving the work force (Havet & Sofer, 2002). In the statistical discrimination model, for equal wages individuals from groups that are discriminated against have to perform better than those who are not. For equal performances victims of discrimination receive lower wages.

Consistent with the statistical discrimination model, Valian (1999) argues that female workers may be disadvantaged because individuals' judgments are skewed by gender schemas that tend to associate professional success to individual characteristics that are traditionally male (Valian, 1999). Gender schemas are defined as "hypotheses about what it means to be male or female, hypotheses that we all share, male and female alike." (Valian, 1999, p. 1045). There is a correspondence between professional success and the characteristics traditionally associated to males, such as competitiveness and assertiveness. Professional success is expected of men because it corresponds to the male identity. Our gender schemas of females do not include professional success. Because of this, we all tend, men and women alike, to undervalue females and overvalue males in professional contexts.

Some studies of academia are compatible with the idea that the work of female professors may be undervalued. For instance, Trix and Psenka (2003) compared recommendation letters written for male and female applicants to medicine faculty positions. Those written for females were shorter, which suggests that qualifications were described more succinctly than for males, they contained twice as many ambiguous comments[6] and more adjectives describing how hard-working the female applicants were. The authors argue that while this description may seem positive, if it is not accompanied by words suggesting research excellence, female applicants may generally appear like they work hard, without being particularly skilled. Indeed, letters written for female applicants comprised fewer adjectives suggesting exceptional qualities. The finding by Wennerås and Wold (1997) that women's scientific competence was judged inferior to that of men at equal levels of scientific productivity in postdoctoral fellowships competitions is also consistent with the hypothesis that the work of female academic may be undervalued.

Valian (2005) argues that small differences in evaluations of males and females cumulate over time so that in the long run, males tend to end up in advantageous positions. The academic world is characterized by processes of accumulation of advantages – the so-

[6] For instance, letters written for women contained comments such as "she has a somewhat challenging personality" or "her personal life was in turmoil and in view of the difficulties she was experiencing, […] her performance was especially impressive".

called “Matthew effect” whereby small initial advantages on the outset of one’s career are used to secure further advantages (Merton, 1968) – and of accumulation of disadvantages – which consists in reinforcement over time of small initial disadvantages (Long & Fox, 1995). All advantages and disadvantages are likely to have repercussions for academic careers because they are dominated by fierce competition for ideas and resources (Cole & Singer, 1992). Some research suggests that processes of accumulation of disadvantages tend to characterize the careers of female academics (Nakhaie, 2002; Clark & Corcoran, 1986; Sonnert & Holton, 1996).

The measure of discrimination

Discrimination can seldom be directly observed. Detecting and measuring it is particularly challenging because it entails using causal inference to answer a counterfactual question, i.e. “what would have happened if a person had belonged to a different group?” For instance, the impact of gender discrimination is the difference between a woman’s salary and the salary she would have received had she been a man, after controls for all other relevant salary determinants. Evidently, both cases cannot be observed for a given individual, which is why measuring discrimination is tantamount to a missing data problem. To establish a causal link between discrimination and the situations of individuals, one uses knowledge on average situations in the general population and within specific groups to estimate the average impact of discrimination.

Because discrimination can rarely be observed, in the presence of a pay gap between groups, in order to conclude that the pay gap may result from discrimination, one has to eliminate other possible explanations. Methods differ with regard to what may be included among these other possibilities. For instance, in the classic Oaxaca-Blinder method (Oaxaca, 1973; Blinder, 1973), the other possible explanation of the wage gap is differences in productivity. However, because a measure of actual productivity is rarely available, indicators of potential productivity are often used, for instance measures of human capital such as education level and previous work experience. The BMZ method takes into account the impact of job segregation by including the probability of accessing various jobs (Brown, Moon & Zoloth, 1980). Whatever the method used, the general logic

relies on a partition of the pay gap into two parts, i.e. the explained and unexplained, where the latter is considered as a measure of the extent of discrimination.

Measuring discrimination requires adequate knowledge of the processes that regulate a given outcome both in the presence and in the absence of discrimination. In the case of pay discrimination, one needs to be aware of all the criteria used to determine pay; in order to correctly estimate it, one has to know how a non discriminating employer would act. For instance, based on the human capital model, one may posit that employers who do not discriminate base their pay decisions on the expected productivity of employees. This requires adequate knowledge of all the criteria used by employers to predict employees' productivity (Blank et al., 2004). But in many cases wage levels do not solely depend upon the human capital of individuals; for instance, they may be negotiated.

Complicating matters further, the influence of some important determinants of wages is not straightforward. For instance, the impact of professional experience, which could be the most important factor in explaining differences in salaries between individuals, is related to several processes, i.e. the development of general skills, the returns on seniority (which can reflect both the investments of workers in job-specific skills and employers' incentives) and the returns on job searches over one's career (Altonji & Blank, 1999). Controlling for employment history in a gender pay gap analyses is difficult. Researchers often do not have information on actual job experience; instead they use a measure of potential experiences such as age. Altonji and Blank (1999) point out that this may overestimate women's experience because it does not take into account the fact that they are on average more likely than men to interrupt their careers. This may result in a weaker impact of experience on wages among women, a finding that a researcher may wrongfully attribute to discrimination.

Another serious difficulty with the measurement of gender discrimination is the fact that there are important differences in the characteristics of jobs held by men and women. The labour market is horizontally segregated. Professions and sectors in which women are better represented tend to yield lower wages (Armstrong & Armstrong, 2001; Drolet, 2002; England, Allison & Wu, 2007). How does one go about treating this factor in analyses of

the gender pay gap? Simply controlling for the impact of job characteristics is problematic given that cultural devaluation of traditionally female activities may contribute to gender pay gaps (England, 1992; England, 2005). However, not taking into account gender differences in positions occupied is likely to overestimate the unexplained part of the gap.

Finally, when analyzing gender pay gaps, one has to take into account possible endogeneity and unobserved heterogeneity issues (Beblo et al., 2003). When explanatory variables are not determined exogenously and are related to unobserved determinants of wages (in the present case, when they may be related to discrimination), results are likely to present bias due to endogeneity. Among possibly endogenous employment-related variables in analysis of gender pay gaps are full-time employment and hierarchical position because both are potentially affected by discriminatory processes. Unobserved heterogeneity occurs when unobserved determinants of salaries are related to explanatory variables in the analysis. For instance, if mobility is related to wages and differs by gender, an analysis of the gender pay gap without controls for mobility would overestimate the impact of discrimination. Unobserved heterogeneity may also bias estimates of discrimination downwards in cases where the influence of some determinants in the analysis comprises the impact of retroaction and of past discrimination (Plasman, Plasman, & Rusinek, 2002). This happens when the awareness of being discriminated against in relation to a desirable outcome translates into a reduced motivation to seek the outcome at all (Blank et al., 2004).

Because it is based on a residue, the measure of discrimination ought to be interpreted with great caution (Beblo et al., 2003; Blank et al., 2004). Given the problems associated with the measurement of discrimination, one is left wondering "what is really being measured in analyses of the gender pay gap?" Differential treatment? Unobserved gender differences? Both? Given these uncertainties, it is unsurprising that in most empirical analyses of gender (or race) based inequality, researchers do not specifically attribute the unexplained portion of the differences between groups to discrimination (Fang & Moro, 2010).

Thus, for the time being, one can hardly conclude that the unexplained portion of the pay gap constitutes convincing and unambiguous evidence of discrimination, let alone a measure of it. Convincing empirical evidence of the existence of gender discrimination does exist. For instance, a well-known study of symphony orchestra hiring found that the proportion of female musicians hired increased significantly after blind auditions procedures were adopted (Goldin & Rouse, 2000). However, to our knowledge, convincing and unambiguous empirical evidence of the existence of discrimination has yet to come out of analyses of the pay gap. Despite these problems, when carefully conducted, quantitative analyses of the type used for the measurement of discrimination can certainly contribute to our understanding of gender pay gaps by identifying which factors are related to it and which are not, and by quantifying the portion of the pay gap accounted for by each factor.

Results of empirical analysis of the gender pay gap among university professors

A large body of empirical research has analyzed the extent of the gender pay gap among university professors after controls for relevant pay determinants. Using data from the 1984 Carnegie Foundation for the Advancement of Teaching national survey of American faculty, Smart (1991) examines how gender affects pay and rank both directly and indirectly (i.e. through differences between male and female professors on the determinants of pay and rank). Results show that after controls[7], about 40% of the impact of gender on academic rank is unexplained. The remaining effect of gender is almost entirely due to differences between men and women on seniority and highest earned degree. Gender has a major impact on pay: of the 14 predictors[8] included in the model, it is the third most important determinant of pay, after rank and seniority. Although both direct and indirect effects of gender on pay are significant, the latter is much larger than the former and reflects gender differences in rank, seniority and male-domination of disciplines. About

[7] Predictors include measures of human capital (highest degree earned, career age, years unemployed or employed part-time since receipt of highest degree), time devoted to teaching, research and administrative work, discipline/field (percentage male domination of discipline, hard/soft and pure/applied field), and institution type (prestige of institution, public status of institution, financial health of institution).
[8] Predictors included are the same as the ones used in the analysis of rank, and rank is added.

15% of the gender pay gap is unaccounted for by differences between men and women on other pay determinants.

Using data from the 1968 Carnegie national survey of American faculty, Weiler (1990) estimates gender discrimination in promotion and incorporates this measure into an analysis of the gender pay gap. The results show that using this method instead of simply controlling for rank raises the part of the gender pay gap attributable to discrimination from 15% to 20%, after controls for a large set of pay determinants[9].

Using the 1993 National Survey of Postsecondary Faculty, Toutkoushian (1999) shows that after controls[10], female professors are paid on average 7% less that their male counterparts and are less likely to be tenured and to be full professors. Using data from the same survey for 1999, Bradburn and Sikora (2002) describe the extent of gender differences on several pay determinants. Men tend to hold higher ranks on average and women are more likely than men to be in non-tenure-track positions. Men are more likely to hold doctoral degrees. They also hold more teaching experience, both within their current and previous jobs, but there is no gender difference in the number of higher education jobs held. Given that women's career is on average shorter, these findings mean that women have a higher job turnover rate. Women are better represented in two-year colleges, while men tend to be more present at doctoral institutions. Differences according to fields are also observed: men tend to be in higher proportions in natural sciences and engineering and women more often work in health sciences, social sciences and education. Faculty members also differ by gender with respect to how they report spending their time: men report spending on average 55% of their time on teaching while for women, it reaches

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[9] Controls include measures of human capital (years since earning highest degree, and years since earning highest degree squared, years of seniority [actual number of years of experience if under 30 years], cumulating at least 30 years of experience [binary variable], holding a PhD [binary variable], publications [number of articles, books and book chapters published over one's career], field [11 variables], institution type (3 binary variables: private institution, university rather than 4-year college, located in the south), research as primary activity (binary variable), type of contract, set of 3 binary variables accounting for administrative positions held (currently department chair, formerly department chair, currently holding administrative position outside department), being non-white, being a US citizen and rank.

[10] These controls include measures of human capital (number of years of experience, seniority, age, highest degree earned), publications (number of articles, books and book chapters published over one's career), principal field of teaching (43 categories), institution type (Carnegie classification) and race.

60%. In addition, men are on average more likely than women to report that they are engaged in research (70% of men vs 62% women) and have published more scholarly work over the past two years.

Bradburn and Sikora (2002) estimate the unexplained pay gap at 9% in 1999[11]. This result cannot be compared with the 7% estimate of the unexplained pay gap by Toutkoushian (1999) for the year 1993 of the survey because the controls included are too different. Importantly, Bradburn and Sikora (2002) control for rank, time spent on research, teaching and administrative work as well as number of courses taught; Toutkoushian (1999) does not use these controls, but includes seniority in his analysis. In addition, the measure of publication used by Bradburn and Sikora (2002) is a derived categorical variable of number of recent total publications while Toutkoushian (1999) controls for number of various types of publication over one's career.

Also using the 1999 National Study of Postsecondary Faculty data (NSFOP), Toutkoushian, Bellas and Moore (2007) systematically examine the effects on pay of all possible interactions between gender, race and marital status. After controls for other pay determinants[12], only two two-way interactions (out of 11) and one three-way interaction (out of 6) reach statistical significance. In addition, their inclusion does not add to model fit when compared to a model taking into account only the main effects of the three group variables. In some cases, this may be due to small numbers of faculty members in some categories. The authors suggest focusing on the main effects of gender, race and marital status rather than interactions in future research.

Umbach (2007) uses multilevel analysis on a subsample of the 1999 NSFOP to estimate the contributions of human capital, structural characteristics of 79 academic disciplines and disciplinary labor market conditions on faculty pay. The analysis is restricted to research universities on the premise that within these types of institutions,

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[11] Controls include measures of human capital (number of years since earning the highest degree, highest degree earned, age), publications (number of recent publications in 4 categories), average proportion of working hours devoted to research and teaching, number of courses taught, discipline (43 categories), institution type (Carnegie classification), rank and race.

[12] This research uses the same controls as Toutkoushian (1999), plus measures of length of appointment and region.

disciplinary affiliation will be more important to faculty members than institutional affiliation. The raw gender pay gap is estimated at 21.8%. Adding controls for human capital[13] decreases it to 9.6%. When rank is also accounted for, the gap is further reduced to 7.8%. Adding several discipline-level variables[14], the gender pay gap is at 6.8%. The results show that controlling for human capital, rank and disciplinary-level effects, a 0.3% decrease of average salary within disciplines is associated to each increase of one percentage point of proportion female professors within disciplines.

Porter, Toutkoushian and Moore (2008) conduct multilevel analyses[15] on data from the NSOPF for years 1988, 1993, 1999 and 2004 in order to determine whether the gender pay gap among professors occurs upon hiring, later in their career or both. They find no gender differences in pay among recently hired professors (i.e. assistant professors hired during the three years prior to each survey wave) after controls[16]. In the sample including all faculty members, the unexplained gender pay gap varies between a low of 4% in 1999 to a high of 6% in 1993. Further analysis by type of institution reveal the presence of a substantial, 9% unexplained gender pay gap among newly hired faculty working in research universities. In other types of universities, no unexplained difference among newly hired faculty members is observed. Analyzing the pay gap among the newly hired by aggregated field[17] yields no significant effect. When the full sample is used, unexplained gender differences are observed within each institution type and aggregated field, but the size of the gap varies little across sub-samples (between a low of 4.8% and 5.5%), the only exception being "other fields", where a 9.3% unexplained gap is observed. According to the

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[13] These human capital controls are age, holding an administrative position, years of experience and years of experience squared, seniority and seniority squared, number of patents and publications of various types over one's career, percentage time teaching, currently receiving research funds and highest degree earned.
[14] The disciplinary-level variables are percentage female, percentage unemployed, percentage with funded research, mean career articles, chapters, books and patents and mean percentage time teaching.
[15] Multilevel analysis is used to account for the nested structure of the data, in this case individuals within institutions.
[16] Similar controls as Toutkoushian (1999) are used for human capital, publications and institution type, but a more general field measure (9 categories) instead of a primary teaching field measure is used. Rank, length of appointment and public status of the institution are also accounted for.
[17] The analysis is done using three aggregated fields: natural sciences and engineering; arts humanities and social sciences; all other fields.

authors, given these results, research on the gender pay gap among professors should focus on research universities in the future.

With regard to changes over time, a review of several studies conducted between 1965 and 1984 on national samples finds a reduction in the extent of the unexplained gender pay gap over time, from between 12% and 17% before 1972 to between 5% and 12% during the 1972-1984 period (Ransom & Megdal, 1993). Ransom and Megdal's own estimates, using data from 4 different surveys conducted between 1969 and 1984, show a decrease in the unexplained[18] part of the gender pay gap over the 1970's, but the gap remains roughly stable afterwards. Thus, the results are consistent with an initial decrease of pay discrimination against women, followed by stabilization during the 1980's. In 1984, the last data point studied, the unexplained pay gap is estimated at 10.4%.

More recently, Toutkoushian and Conley (2005) analyzed the gender pay gap using the NSOPF:99 and compared their findings to research conducted by Barbezat (1991) using the Carnegie Foundation for the Advancement of Teaching dataset for years 1968, 1975 and 1984 and by Toutkoushian (1998) using the NSOPF:93. Controlling for several characteristics of individuals and institutions[19] but excluding rank, the unexplained gender pay gap declined from 16.3% in 1968 to 4% in 1999. Including rank, it was at 3.6% in 1999. The authors then estimate the size of the unexplained pay gap (excluding rank) in 1999 using alternative methods[20] and find that there are only small differences in the results obtained (estimates vary from a low of 4.3% to a high of 5.7%). Comparing the size of the unexplained pay gap (excluding rank) between institution types reveals that it is significant only in research (7.3%) and comprehensive universities (4.2%). Finally, comparing the size of the unexplained pay gap in 1999 according to field, the research shows that it is

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[18] Specific measures of pay determinants vary between surveys, but include measures of type of degree earned, years of experience and years of experience squared, years of seniority and seniority squared, number of publications of various types, field and institution type.

[19] Controls included are: highest degree earned, years of experience and years of experience squared, years of seniority and seniority squared, age and age squared, race, number of patents and publications over one's career (articles, books), length of appointment, discipline, institution type, public status of the university and geographic location.

[20] These methods are the single equation, Oaxaca with male salary structure as non-discriminative wage structure, Oaxaca with female salary structure as non-discriminative wage structure and Neumark.

significant in social sciences (4.7%), physical sciences (3.8%) and in "other fields" (6.7%). When compared to 1993, results indicate a significant change in the size of the unexplained gap in arts and humanities, from 9.2% to a non significant 3.4%, and in professional fields, from 10% to a non significant 3.3%.

A number of studies of gender differences in pay among Canadian professors have been published over the past 20 years. One important difference between these and research on American professors is that apart from Ornstein and Stewart's 1996 research, the other studies reviewed do not analyze the impact of research productivity. The datasets used do not include measures for this pay determinant.

Using Statistics Canada's Survey of Full-Time University Faculty in Canada for 1972 and 1986, Guppy (1989) shows that after controls[21], the unexplained gender pay gap is estimated at 7% in 1972 and 5% in 1986. In addition, the impact of some pay determinants differs by gender; for instance, the increase in salary associated with age is larger for males, but holding a PhD has a stronger impact on females' pay.

Analyzing data from Lennards's survey of Canadian faculty, Ornstein and Stewart (1996) find a 16.8% raw gender pay gap in 1986. Adding controls for age and highest degree earned reduces the gap to 9.9%. Adding further controls for experience, research productivity[22], field (15 categories) and university classification (16 categories based on location, size and history), reduces the gender pay gap at 6.5%. Adding rank and several variables describing work experience at different ranks[23], the gap is further reduced to 3.4%.

Using the Survey of Full-Time University Faculty in Canada for the 1957-1994 period, Ornstein, Stewart and Drakich (1998) find a 20.4% raw gender pay gap in 1957. Adding controls for age, highest degree earned, field (8 categories), and institutional

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[21] These controls are age, place of degree, level of highest degree, administrative position, rank, field, size of university and province,

[22] Research productivity is measured by the number of publications of various types over one's career and the number of articles per year.

[23] The variables describing work experience at different ranks are the number of years employed at other universities, the number of years at current university at ranks lower than the current rank, the number of years at present rank, whether respondent ever taught at another university and tenure status.

affiliation does not reduce the gap; in fact taking these determinants into account, the gap reaches 23.5%. When rank is also included, it falls to 10.5%. Almost 40 years later, in 1994, the raw gender pay gap has slightly decreased to 16.8%. Including all controls but rank, it shrinks to 8.1%; adding rank, it is further reduced to 3.9%.

Also using Statistics Canada data, Sussman and Yssaad (2005) show that the raw gender pay gap by 2002-2003 was at 15%. However, because this study uses median salaries instead of averages, the results are not directly comparable to those of Ornstein et al. (1998). Sussman and Yssaad (2005) also find a gender gap in median salaries within rank, ranging from 4% to 6%, depending on rank.

Warman, Woolley and Worswick (2010) use the same survey to analyze the evolution of the gender pay gap among Canadian university professors between 1970 and 2000. The raw gender pay gap declined from 21.1% in 1970 to 13.9% in 2000. Controlling for highest degree earned, country of first degree, country of highest degree, age, age squared, rank, field (11 categories) and institutional affiliation, the unexplained pay gap is estimated at 5.1% in 1970 and 2.6% in 2000. The inclusion of controls for rank likely partly explains why these estimates are small compared to other research. Another important finding of this study is that gender differences in pay tend to be greater in universities where salaries are determined using discretionary judgments of merit rather than seniority. In addition, an increasing differentiation by discipline and institution of the salaries of Canadian professors is observed.

As for gender gender gap in promotion rates, Ornstein, Stewart and Drakich (2007) analyze the Survey of Full-Time University Faculty in Canada for the period spanning between 1985 and 1999 and find no gender difference in the probability of promotion to associate professor; however, median time for promotion to full professor is about a year longer for female faculty members. Substantial variation across fields of study is observed in the extent of this gender difference. Controlling for institutional affiliation, men are promoted to full professorship more than two years earlier than women in rehabilitation, physical education/kinesiology/recreation, and about one year earlier in science, engineering and biology. Interestingly, women are promoted to full professor more rapidly

than men in disciplines with higher female representation: about 1.25 years and 0.68 years earlier in education and humanities respectively. The variation of gender differences in median time to promotion is much larger across institutions. Controlling for detailed disciplines (124 categories), median time for promotion to full professor among female faculty members is longer than for males in medical-graduate institutions (0.64 year difference) and in comprehensive institutions (0.34 year difference), but it is shorter in primarily undergraduate institutions (0.64 year difference). In addition, the gender difference in median time to promotion varies widely within institutional categories. At medical-granting institutions, it ranges from being 4.7 years shorter for women at the Ontario Institute for Studies in Education to 2 years longer at McGill University, at comprehensive institutions, from 1.62 years shorter for women at Simon Fraser University to 3.87 years longer at Memorial University of Newfoundland and at primarily undergraduate institutions, from 6.21 years shorter for women at University College of Cape Breton to 2.95 years longer at Laurentian University.

In sum, the reviewed research shows that the gender pay gap is related to gender differences on human capital, rank and research productivity. The gender pay gap varies according to career stage, discipline and institution type. The influence of marital status and race on faculty pay tends to vary by gender. However, using interactions between gender and marital status and/or race instead of a simpler, main effect of gender on pay does not add to model fit, possibly because of the small size of several categories. The gender pay gap among American and Canadian faculty members has decreased over time, but an unexplained gap remains. It is smaller in Canada than in the United States, even though most Canadian research does not include controls for research productivity.

The gender pay gap among university professors: the role of factors at the cultural and organizational levels

The cultural devaluation of work mainly done by women

As mentioned previously, female professors are overrepresented in relatively poorly paid fields (Canadian Association of University Teachers, 2004). While the human capital

theory suggests that women avoid rapidly evolving, highly paid fields such as engineering and technical/scientific fields, which contributes to explaining the gender pay gap, comparable worth theory suggests that the concentration of women in a field may itself depress that field's pay because cultural norms associate less value to work mainly done by women (England, 1992, 2005). Pay equity policies are based upon this premise. Research showing that care work is less paid than any other type of work with equivalent levels of skill, effort and risk (England, 2005) are compatible with this theory. For academia, evidence in Bellas (1994) and Umbach (2007) confirms that average salaries in a field fall as the proportion of women rises, even after controls for individual characteristics, jobs, and labor market conditions.

Organizational conditions that limit discretion in pay decisions

Reskin (2003) argues that because our perceptions of others are unconsciously influenced by stereotypes, cognitive bias and in-group preferences, we all tend to be more or less biased and discriminative when evaluating them (Reskin, 2000b). Organizations can allow or limit the impact of these biases and discriminative tendencies; these organizational conditions are "the proximate causes of employment discrimination" (Reskin, 2000b, p. 319).

Formalization of pay-setting procedures may limit discretion and reduce the likelihood that women will be paid less than men (Reskin, 2000a, 2003; Kulis, 1998; Silvera, 1996; Rubery et al., 1998; Elvira & Graham, 2002). In a study of gender differences in various pay components within a large financial corporation, Elvira and Graham (2002) showed that the more formalized the pay component, the lesser gender differences in pay. Collective agreements, in particular, tend to tie pay to seniority and to impose salary caps, the effect of which is to prevent one group being advantaged through its member's network ties or the preferences of decision-makers (Ridgeway, 2009). In fact, gender differences in pay are greater in universities where salaries are determined using discretionary judgments of merit rather than seniority (Warman et al., 2010). Further evidence of the effect of the exercise of discretion on gender pay differences is provided by Finland, often considered a model in terms of gender equality. It does indeed have the

highest proportion of female academics in Europe. However, during the 1990s, professorships were awarded both by invitation as well as through open competition. Women were relatively disadvantaged when the very discretionary invitation method was used. In 1997-1998 the proportion of female academics hired was twice as high in cases where there were open competitions (Husu, 2000).

Other organizational conditions that may limit the exercise of discretion include the imposition of accountability, for example, by requiring that decision-makers justify discrepancies by gender (Reskin, 2000b) or publish information that allows for the detection of evidence of discriminatory practices (Petersen & Saporta, 2004).

In sum, research analyzing the influence of organizational conditions on the gender pay gap is scarce; the few studies reviewed here suggest that this may be a fruitful avenue for a better understanding of this issue.

The gender pay gap among university faculty: a case study

The research reviewed in the previous sections shows that the gender pay gap among university faculty has substantially decreased since the end of the 1960's. Yet a gap remains and it is larger at research universities (Porter et al., 2008) and in universities where salaries are determined using discretionary judgments of merit rather than seniority (Warman et al., 2010). Thus, concentrating research efforts on research universities and focusing on discretionary forms of remuneration seems to be a potentially fruitful avenue to better understand the causes of the remaining gender pay gap among university professors. This thesis is a case study of the gender pay gap among professors at a large Canadian research university. A recent increase in the use of market supplements has been observed at this institution. These are determined through a highly discretionary process at this institution, making it a suitable site to analyze the relationship between the gender pay gap and discretionary forms of remuneration.

This study does not attempt to isolate the effect of discrimination on the gender pay gap. Many studies have already done so using much more complete datasets than the ones available to us. Instead, this research analyzes how the gender pay gap is related to various

individual and organizational factors and attempts to identify processes and structures at the organizational level that may contribute to it. Our general objective is to contribute to a better understanding of gender differences on the labour market. Specifically, we wish to produce knowledge that can be used in developing concrete, empirically informed solutions to reduce gender inequalities on the labour market.

Two relevant institutional policies: remuneration and family leave

The remuneration policy

At the university in which this research is conducted, the base pay of professors is determined by collective agreement. There are no merit increments based on judgments of performance. Scale increases with years of service are mechanical. Faculty members may receive pay supplements in addition to base pay. These are administrative, market, and chair supplements. The information used for the description of these supplements comes from various data sources: administrative data on the remuneration of professors, institutional reports and documents, minutes of general university meetings, union publications and interviews with former administrators.

Administrative supplements (or administrative stipends) are automatically awarded to faculty members who hold some administrative positions. The amounts are mostly pre-established and are presented in public institutional documents.

Administrative data from the institution indicate a strong increase in the use of market and chair supplements over recent years. They represented 1.8% of the total payroll in 1997 (the earliest data available) and 6.1% in 2006. The proportion of faculty receiving either type of supplements grew from 22.6% in 1997 to 38.6% in 2006. The average amount of these awards has more than doubled over the years, from about 5,600$ in 1997 to 15,000$ in 2006. Thus, they represent a growing proportion of the total earnings of faculty employed at the university and an even more significant component of those to whom they have been awarded: in 1997, they represented 7.5% of the salary of the recipients, in 2006, 12.8%.

The attribution of market supplements[24] is discretionary. This observation is based on information gathered through our own interviews with administrators and on the fact that no written trace of the criteria used to allocate these supplements or on allocation rules can be found in the organization's documents. In principle, market supplements are offered to attract new professors and retain those likely to leave. They aim to respond to the market demand for individuals and for academic fields. However, in practice they often seem to be awarded in response to requests. In addition, they have been used to recognize research performance. Thus, although their designation as "market" supplements suggests that they are based on the demand for faculty in various disciplines or for individuals because of the excellence of their academic records, in practice their use is varied.

Until about 1998-2000, market supplements were normally used as a temporary adjustment to the base salary. Their amounts reflected the difference between the base salary that was prescribed by the collective agreement and a target salary. As the base salary increased with seniority and negotiated raises, the supplements diminished until the base and target salary matched. Since 2001, they have been negotiated for a period of five years and the amount remains the same for the duration of the agreement. After five years, the agreement may be extended after a performance assessment.

Chair supplements have been used since the Canada Research Chair program was introduced in 2000. They are awarded to all CRC recipients. While the CRC Secretariat uses a formalized application and review process, it does not prescribe standard procedures for nominations; those are determined by universities. Based on information gathered from interviews with administrators, university reports, minutes of general university meetings and union publications, the nomination process appears highly discretionary at the university.

From the beginning, the enactment of the CRC program has been criticized for its lack of transparency at this institution. Two administrators interviewed for this research raised the issue. The only public information provided by the university on the nomination process is a "strategic planning" document published in 2000 in which the administration

[24] Other designations include « market premiums » or « market differentials ».

sets target numbers of Tier 1 and Tier 2 chairs on various research themes. No information is provided on how the targets were established or on the criteria or processes used for nominations. According to the minutes of a general university meeting held in 2001, academic units identify candidates and a leader's committee approves them. During the meeting one faculty members' representative raised concerns about possible conflicts of interest because he felt that the committee members were not impartial. To illustrate this, he cited the example of a department chair who was informed that a new chair would be created within his unit, without having participated in the process that led to this endowment. In 2002, a union publication criticized the administration for failing to consult with democratic instances of the institution in relation to the CRC program. Then, in 2003 the union publication stated that the issue of the selection procedure of CRC recipients was being disputed between the union and the administration, and was submitted for arbitration.

In 2005, a report based on consultations by a university committee with department chairs and deans was published. It was commissioned in 2002 to analyze the impact of the integration of CRC recipients in academic units. It described a generalized perception among administrators that the nomination process for CRCs was lacking transparency. This perception was based on two elements. First, departments and faculties were not consulted on nominations. Secondly, according to the authors of the report, the fact that nominations were made within a very short period of time may have accentuated the perception that the process lacked transparency. Another report was published in 2008, this time by the university's research committee. The topic was broader – it analyzed the impact of the CRC program at the institution – and more importantly, it also mentioned a widely shared impression among faculty members that the nomination process had lacked transparency and that unit assemblies were presented with a *fait accompli*.

Another source of criticism by administrators was the allocation of CRCs to current faculty members. The 2005 report argued that administrators perceived this as problematic because they mistakenly thought that the goal pursued with the allocation of CRCs was to recruit new faculty members. However, these criticisms may have been founded on more than a misperception. Although the "strategic planning" document published in 2000 by the

institution stated that a maximum of 20% of Canada Research Chairs nominations would be for professors already employed at the university, an institutional newspaper published later on the same year reported that despite this decision, 16 of 22 recent nominations were for current faculty members. Questioned on this inconsistency by the journalist, an administrator explained that "it was more simple to operate an internal stabilization to begin with, particularly given very short notice". Our own analysis of the institution's administrative data indicates that the 20% maximum remained exceeded in subsequent rounds of CRC allocations: we find that 46% (31 out of 68) of the chairs allocated between 2000 and 2006 for which we have information, went to faculty members who had been employed at the university for more than 5 years.

According to a university newspaper published in 2008, by 2006, 15% of the recipients of CRCs within the institution were women; yet women represent 31% of the institution's faculty members. Their representation among chairholders is lower than the national average of 22%. This underrepresentation seems unlikely to result from the selection process operated by the CRC Secretariat on the nominations provided by the university; according to the minutes of a university committee meeting held in 2004, all nominations submitted up to that point by the institution to the CRC Secretariat had been successful.

In sum, at this institution, the allocation of market supplements and CRCs (to which chair supplements are automatically attached), resulted from discretionary judgments by the administration. These measures shared a common goal, i.e. to attract and retain faculty members. In addition, the increase of market supplement allocations to retain faculty members over the past years was closely related to the CRC program. Six of the 17 administrators interviewed for this research mentioned that market supplements had to be allocated to faculty members who were deemed qualified enough to receive a CRC, but were not selected in view of the university's strategis plan. In addition, in many cases, faculty members were receiving market supplements before becoming CRC recipients; this pattern is observed for 17 of the 31 professors who became CRC recipients 5 years or more after their appointment.

The family leave policy

If an institution's family leave policy is likely to translate in a larger reduction of working hours or longer career interruptions for women than men, it can potentially contribute to the gender pay gap. According to the collective agreement effective between 1993 and 2003, for mothers, the family leave policy at the university under study included a right to a fully paid maternity leave that could last up to 20 weeks. Starting 1997, a new provision stated that upon request, after returning from maternity leave, professors were granted a yearly, three credit reduction in teaching assignments with full salary until the child had reached the age of two. After her maternity leave, the professor could take an unpaid parental leave for a maximum of two years. The provisions that applied to male faculty members were more limited. Professors whose partner had given birth could obtain upon request a paid leave during which they were required to carry out all duties that did not require their presence at the university, for a maximum duration of four weeks. In addition, paid leaves of a two months duration were also provided for adoptive mothers and fathers and could be followed with an unpaid parental leave for a maximum of two years.

Professors on maternity leave cumulated seniority, but not those on unpaid leave. Thus, women who interrupted their careers for this period would have cumulated less seniority than men hired at the same time. In addition, they could have cumulated fewer publications. However, no written information is available on how many women may have actually taken the unpaid leave; one informant within the institution mentioned that to the best of their knowledge, none did. On the other hand, the reduction in teaching assignments following a maternity leave may have freed some time for research for those who did not take the unpaid leave, limiting the potentially negative effects of childcare responsibilities on their publication records.

Family leave policy became less gender-specific with the 2004 collective agreement. Whereas in the previous agreement, professors whose partner had given birth *could* obtain a paid leave upon request, starting 2004 the agreement simply states that they obtain it upon request. This change implies that parental leaves are now seen as a right, in the same way that maternity leaves are. Adjustments to the teaching schedule of professors

whose partner has given birth are now available. In addition, upon request, professors have their teaching schedule adjusted if they have a child under 12 who attended daycare services. This arrangement likely makes it easier for both men and women professors who have children to fit work and family responsibilities in their schedule.

Despite these changes towards a more gender-neutral family leave policy, the potentially adverse effects of previous, more gender-specific family leave policies on female faculty members may have had a long-lasting effect in their careers. It may have translated into a weaker cumulative publication record for these women, which may in turn affect remuneration. However, it is important to keep in mind that the potential impact of family leave on the careers of men and women professors is necessarily mitigated by the fact that women professors are less likely than male professors to become parents and when they do, they tend to have fewer children (Ginther & Hayes, 2001). In addition, as mentioned previously the results of research investigating the impacts of family responsibilities on the career outcomes of academics are mitigated.

Gender-relations as an organizing concept

Gender-relations provides a useful organizing concept for this case study. Ridgeway (2009) argues that in order to better understand gender differences on the labor market, sociologists ought to try to elucidate how processes at different levels affect each other "beyond simply saying that they generally but not always reinforce one another" (Ridgeway 2009: 146). In an effort to contribute to this endeavor, to go beyond the individual/structural dichotomy, this thesis relies on the organizing concept of gender-relations. This concept is useful for the analysis of the gender pay gap because it provides a general framework that brings together various explanations of the gap. We use the expression "gender-relations" to refer to two very similar concepts used by French and Anglo-Saxon sociologists, i.e. "rapports sociaux de sexe" and "gender-relations" (Daune-Richard & Devreux, 1992; Kergoat, 2005; Ferree & Hall, 2000; Ferree, Khan & Morimoto, 2007).

Gender-relations refer to the idea that the categories "male" and "female" can be understood as groups that are socially constructed as opposed to exclusively biological categories. This model is theoretically opposed to that of "sex roles", which posits that women and men belong to stable categories and adopt social roles which more or less correspond to sex stereotypes. Instead, the processes through which personality traits, behaviors and statuses become associated with men and women can be changing, even contradictory (Ferree et al., 2007). Gender is structural rather than individual, but individuals develop gender identities by internalizing some aspects of gender. Because it manifests in interaction, the settings in which gender is salient is crucial. All social systems are gendered because gender is an integral part of these systems (Acker, 1988).

The existence of biological differences between male and female is not denied within a gender-relations framework, but since gender is considered a social construction, the focus is on what society does with these biological differences (Ferree et al., 2007). Biological sex may be taken into account in gender analysis, but it is not deemed to determine the social relations system of gender (Scott, 1988). Power and domination are central to this model, but they apply as much to men as they do to women:

> … for the gender relations model, both men and women are caught up in gendered social relations. The operation of gender within all-male institutions, be it football or fraternities, is no less interesting than the interactions of women and men across this gendered boundary. Gender as a source of hierarchy, exclusion, and violence is far more sociologically interesting than 'difference' alone could be (Ferree et al., 2007, p. 470).

This historically and socially situated perspective is opposed to dualistic conceptualizations where inequalities between men and women are considered as ensuing necessarily from differences between these groups. Rather, in a gender-relations framework, the processes and structures that may produce inequalities are examined and differences between men and women are considered as resulting from these processes and structures (Ferree & Hall, 2000). For instance, rather than being associated primarily with gender differences in propensity to pursue promotions, gender gaps in promotion may be analyzed as possible outcomes of processes within organizations that make it more difficult for women to reach the higher levels of hierarchies. The situations of men and women are

not homogenous: not all men are in dominant positions and not all women are in subordinate positions. The differences between these groups call for social explanations. One important explanation is the hierarchically organized division of labor along gender lines, which tends to translate into a devaluation of activities associated with females. In addition, the relative positions of males and females are dynamic; they vary according to location and period (Daune-Richard & Devreux, 1992; Kergoat, 2005).

The literature review suggests that there are two types of gendered division of labor among professors, i.e. horizontal (men and women are unevenly distributed among a large proportion of academic units) and vertical (women are underrepresented among full professors). In addition, there may be a cultural devaluation of traditionally feminine activities within academia. This thesis is partly based on an articulation of these concepts. The impact of horizontal segregation on the gender pay gap and the extent of vertical segregation within the organization under study are analyzed. We also analyze the relationship between the proportion of females within academic units and the remuneration of faculty members; finding an inverse relationship would be consistent with the idea that a cultural devaluation of traditionally feminine activities influences the remuneration of professors. In order to investigate other potential structural explanations of the gender pay gap, the influence of formalization of pay components on the gender pay gap is analyzed, and processes through which it may occur are suggested.

The three articles

The body of the thesis comprises three articles. The first analyzes the impact of common explanations of the gender pay gap among professors on the receipt of market supplements, regrouped along five dimensions: field of study, research activity, seniority, attitudes towards pay and family constraints. We use the expression “research activity”, not “research productivity”, because our data does not include indicators of actual research productivity such as number of publications or citations. Instead, available indicators provide information on research contracts received, grants, research chairs, integration in research teams and presence of research assistants, agents and post-doctoral fellows. These are all resources that certainly affect research productivity. Securing those resources also

most certainly results from previous research productivity. For these reasons, the indicators of research activity can be considered proxies of research productivity and we use them as such, but they cannot fully account for the actual research productivity of professors.

This is the first study of gender differences on the access to market supplements among faculty members. One important contribution of this research is that it uses several indicators pertaining to attitudes towards pay and family constraints, two dimensions on which there is much speculation but not much data, in analyses of the gender pay gap among university faculty. Given data limitations, this article focuses on *average* differences by gender, a measure that paints only a partial picture of women's and men's access to pay supplements. This research thus leaves unexplored the potential variations within the organization on the gender gap in access to market supplements on the one hand, and remuneration as a whole on the other.

The second article addresses this limitation by examining the conditions under which remuneration differences occur. Specifically, it seeks to determine the extent to which differences vary according to formalization of remuneration practices and female representation within units. The respective contribution to the gender gap of four remuneration components is estimated, i.e. base pay, access to full professorship, access to pay supplements and amount of pay supplements. These are characterized by various levels of formalization. Variations of gender differences on each remuneration component according to the relative representation of female faculty members within units are also examined. Separate analysis of gender differences are perfomed for three outcomes, i.e. total remuneration, promotion and receipt of either market supplements or CRCs. The use of multilevel analysis allows for the estimation of the respective contributions of individual and institutional determinants of remuneration.

The last article seeks to understand the mechanisms that may have produced gender differences with regard to market supplements among faculty members. It is based on semi-directed interviews conducted with 17 administrators aimed at understanding the processes through which these pay supplements are attributed and how their amounts are determined.

Content analysis of the interviews is performed to uncover the practices and processes that could have produced disadvantages for female faculty. Throughout the interviews and analysis, close attention is paid to claims regarding the rules and procedures that framed decisions because these may limit the possibilities for gender bias (Ridgeway, 2009). The information on market supplements provided to faculty members and academic administrators is examined as well because gender bias may also be limited through the imposition of accountability, for instance by requiring that decision-makers justify discrepancies by gender (Reskin, 2000b) or by publishing information that allows for the detection of evidence of discriminatory practices (Petersen & Saporta, 2004).

It should be noted that although the two first articles account for the receipt of a CRC, their use differs within each article. In the first article, the presence of market supplements since the beginning of professors' appointments is analyzed based on survey data collected in 2002. The dependent variable indicates whether or not faculty members declare having received a market supplements since they were appointed. The analysis includes a control for the receipt of a CRC as an indicator of professors' market value as researchers. This is done because it is plausible that faculty members who were eventually awarded a CRC were also likely to have been recipients of market supplements in recognition for their research performance since the beginning of their appointment.

The data used for the second article includes indicators for the presence of market and chair supplements for each year between 1997 and 2006, for all faculty members who were employed at the institution. A decision was made to analyze market and chair supplements jointly given the relatively small numbers of CRC recipients at the institution and the fact that these measures share important characteristics (their allocation processes are discretionary, they share common goals and the evolution of their use within the institution is closely linked).

Chapter 2

Article 1 : Doucet, C., Durand, C. & Smith, M. (2008). Who Gets Market Supplements? Gender Differences within a Large Canadian University.

Published in : Canadian Journal of Higher Education, Vol. 38, No. 1, pp. 67-103.

Abstract

This study examines the gender pay gap among university faculty by analyzing gender differences in one component of faculty members' salaries – "market premiums." The data were collected during the Fall of 2002 using a survey of faculty at a single Canadian research university. Correspondence analysis and logistic regression analysis are performed in order to identify the characteristics related to the award of market premiums and whether these characteristics account for gender differences. The correspondence analysis produces a two-factor solution in which the second axis clearly opposes faculty who receive market premiums to those who do not. Gender is strongly related to this factor, with the female category on the side of the axis associated with the absence of market premium. The results of the logistic regression confirm that field of specialization, frequency of external research contracts, faculty members' values and attitudes towards remuneration and seniority within rank are all related to the award of market premiums, as hypothesized. However, women were still almost three times less likely than men to have been awarded market premiums after controlling for these relationships. Overall, the results suggest that within a collective bargaining context, reindividualization of the pay determination process — notably, the payment of market premiums to faculty — may reopen pay differences by gender.

Résumé

Cette recherche examine les écarts salariaux selon le genre chez les professeurs d'université en procédant à l'analyse des écarts selon le genre sur une composante spécifique du salaire des professeurs, soit les primes dites "de marché". Les données proviennent d'un sondage effectué en 2002 auprès des professeurs d'une grande université canadienne. L'analyse des correspondances de même que la régression logistique sont utilisées dans le but d'identifier les caractéristiques liées à la présence de primes de marché et d'examiner si ces caractéristiques peuvent expliquer les différences selon le genre. L'analyse des correspondances donne une solution à deux facteurs dans laquelle le second facteur oppose clairement les professeurs qui ont reçu une prime à ceux qui n'en n'ont pas

reçue. Le genre est fortement associé à ce facteur, la catégorie “femme” se retrouvant du côté de l’axe associé à l’absence de primes de marché. Les résultats de la régression logistique confirment que le secteur d’activité, la fréquence des contrats de recherche, la valorisation du salaire ainsi que le rang combiné à l’ancienneté sont reliés à la présence de primes de marché, tel que proposé par les hypothèses. Toutefois, même après avoir contrôlé pour ces relations, les femmes sont toujours près de trois fois moins susceptibles de s’être vu attribuer des primes de marché que leurs homologues masculins. Dans l’ensemble, les résultats suggèrent que dans un contexte où les salaires sont déterminés par convention collective, la réindividualisation du processus de détermination des salaires — en particulier le versement de primes de marché aux professeurs d’université — peut favoriser la réapparition d’écarts de salaire selon le genre.

Introduction

On average, women faculty members in Canadian universities have been paid less than their male colleagues. Using Statistics Canada's *Survey of Full-Time University Faculty in Canada*, Ornstein, Stewart and Drakich (1998) found a 16.8% gender pay gap in 1994. There had been little change by 2002-2003: also using Statistics Canada data, Sussman and Yssaad (2005) reported a gap of 15%. What explains this difference in pay by gender? Ornstein et al. (1998) found that after controls for age, degree, field of specialization, and institutional affiliation, the gender pay gap fell from 16.8% to 8.1%. When rank was added, the difference fell to 3.9%. Sussman and Yssaad (2005) also found a gender pay gap within rank, ranging from 4% to 6%, depending on rank. An unexplained gap thus remains and did not seem to decrease substantially during the period between the two studies.

Clearly, further research on the gender pay gap among academics is warranted. There should and no doubt will be continued efforts to refine the methods and diversify the data sources used to estimate the coefficients of the sort of earnings equation tested by Ornstein et al. (1998). In this paper, however, a *complementary* analytic approach is proposed. Generally speaking, earnings of faculty members in Canadian universities reflect some combination of the following components: (a) pay at the point of hire; (b) seniority, often summarized in a detailed pay scale by years of service; (c) promotion through the ranks; (d) merit increments based on judgments of performance; (e) stipends to compensate for administrative responsibilities; and (f) market supplements paid to attract new faculty members and retain those likely to leave. Scale increases with years of service are mechanical and cannot lead to an unexplained gender gap. However, the other four sources of pay increase as well as pay at the point of hire might do so because they may or do involve discretion.

This paper focuses on one of these discretionary forms of pay increase – market premiums. The rationale for market premiums is to cope either with distinctly robust demand for faculty in various disciplines or with the (sometimes potential) robust demand for individuals because of the excellence of their academic records. These appear to have

become an increasingly important component of the earnings determination process in Canadian universities. At least, this has been claimed by several Quebec faculty unions (Pelletier, 2004; SGPUM, 2001, 2002; SPPUS, 2002; SPUL, 2003).

How pervasive is the use of market supplements among Canadian universities? According to the Canadian Association of University Professors (CAUT), in 2001 most universities either used market supplements or were considering doing so (Fraser & Newark, 2001). Our review of the collective agreements and other salary agreements of the 90 member universities of the Association of Universities and Colleges of Canada (AUCC) shows that 39% (35/90) of universities openly use this practice. This proportion is an underestimate because not all institutions that use market supplements provide public documentation of the fact. For example, the only mention of market premiums in the collective agreement of the university where this research was conducted states that global remuneration comprises a base salary and, if the case arises, an individual premium. According to the agreements reviewed, most institutions allocate supplements on an individual basis (27 institutions). Seven other institutions allocate supplements to specified fields, and one does not provide information on the allocation method. The specified fields include engineering, business administration, law, dentistry, economics, and computer science. In some cases, supplements are part of faculty member's base salary (11 institutions) while in others, they are distinct from it (23 institutions).

In this paper we examine differences by gender in the assignment of market premiums within one major Canadian university. There are interesting features to the process of assigning market premiums at this university. Base salary is fixed by collective agreement while market premiums are discretionary. Premiums may be assigned at the point of hire or at any subsequent point in a person's career. There has been a considerable amount of secrecy surrounding their award (provoking an article by a department chair in the newsletter of the faculty union in April 2000 that expressed outrage at the secrecy surrounding market supplements). No written trace of the criteria used to allocate such supplements can be found in the organization's documents. In principle, they exist to

respond to the market demand for individuals and for academic fields. In practice they seem often to be awarded in response to requests.

Until about 1998-2000, market premiums were normally used as a temporary adjustment to the basic salary. They were seen as the difference between the basic salary that was prescribed by the collective agreement and a target salary. As the basic salary increased with seniority and negotiated raises, the premiums diminished until the basic and target salary matched. Since 2001, premiums have been negotiated for a period of five years and the amount remains the same for the duration of the agreement. After five years, the agreement may be extended after a performance assessment.

Administrative data from the institution indicate that premiums represented 1.8% of the total payroll in 1997 (the earliest data available) and 4.6% in 2002 (the year of the survey used for the present research). They had reached 6.1% by 2006. The proportion of faculty receiving premiums grew from 22.6% in 1997 to 31.9% in 2002 and 38.6% in 2006 (including premiums to Canada Research Chair holders). The average amount of these awards has more than doubled over the years, from about 5,600$ in 1997 to 11,800$ in 2002 and 15,000$ in 2006. Thus, they represent a growing proportion of the total earnings of faculty employed at this university and an even more significant component of those to whom they have been awarded: in 1997 they represented 7.5% of the salary of the recipients, in 2002 11.8%, and in 2006 12.8%.

We begin our analysis of gender and market premiums with a discussion of the broader literature on pay differences by gender, since that is a source of hypotheses that are most closely relevant to the subject.

The pay gap: potential explanations

Part of the gender pay gap is known to be due to gender differences in various characteristics related to pay. Previous research has shown that work experience and education help explain the gap. Unionization and work preferences resulting from different socialization are also possible explanatory factors. Another part of the gap however may be due to employers' discriminatory attitudes towards women. In Canada, the gender pay gap

tended to fall over the 1970's and 1980's. Using data from Canadian censuses and the Survey of Consumer Finances, Baker et al. (1995) found that the gender pay gap among full-year, full-time workers fell from 40% in 1970 to 36% in 1980, to 33% in 1990. This decline is attributed to two types of factors. First, there was a decline in the portion of the gap that is due to gender differences in characteristics related to pay. The average amount of experience and education of women rose during that period. Increasing numbers entered better paid occupations and the proportion unionized increased (Baker et al., 1995; Kidd & Shannon, 1997). Second, the unexplained part of the gap was also decreasing, which may have resulted from a decline in discrimination towards women and/or the convergence of women's and men's unobserved characteristics (Baker et al., 1995; Kidd & Shannon, 1997). Both explanations are plausible. A parallel decrease in the gender pay gap has been observed among university faculty (Ornstein et al., 1998). However, data from the 1996 and 2001 Canadian censuses suggest that the gap tended to remain relatively stable over the 1990's in the general population, at approximately 29% (Statistics Canada, 2003).

The gender pay gap among faculty tends to be higher in the United States. Using data from 1999, Barbezat and Hughes (2005) found a 20.7% unadjusted gender pay gap among American faculty, a figure closer to the 1970's Canadian gender pay gap among Faculty than to the one observed in the early 2000's. Unionization almost certainly partly explains this difference. It tends to be associated with a smaller gap (Baker and Fortin, 1999; Doiron and Riddell, 1994) and Canadian faculty are more highly unionized than their U.S. counterparts. One mechanism through which unionization may reduce the gender pay gap is by promoting transparency and limiting discretion in pay determination processes. In general, transparent pay determination systems are associated with greater equality in pay (Rubery et al., 1998).

Factors accounting for the pay gap between male and female faculty members have been assigned to two models: the difference model and the deficit model (Sonnert & Holton, 1995). The difference model refers to aspects of biography and preferences that may distinguish men and women. The deficit model refers to formal and informal processes that exclude women. As Sonnert (1999) explains, the difference model focuses on factors at

the individual level. The deficit model refers to the way women are treated; it focuses on structural, organizational and social factors. Empirically, the boundary between the two models is not clear-cut. Nonetheless, the factors associated with the deficit model approximately coincide with those that might be considered discrimination.

Five potential explanations of the gender pay gap among faculty are relevant for our purposes. First, fields within which women tend to be underrepresented command higher salaries. Data compiled by the Canadian Association of University Teachers (2004) shows that in 2001-2002, 29.8% of all Canadian full-time faculty members were female but they were underrepresented in two of the four highest paid sectors. The percent female in engineering and applied sciences were 9.9%, and in mathematics and the physical sciences, 13.3% (their presence in the other two – agricultural/biological sciences and social sciences approximately coincides with their presence in the profession as a whole). Conversely, they were over-represented in all four sectors offering the lowest average salaries — 36.9% in health professions and occupations,[25] 38.3% in fine and applied arts, 38% in humanities and related sciences, and 45% in education.

Second, women's average research activity could be lower than men's. Over 50 American studies (Cole & Zuckerman, 1984, in Cole & Singer, 1992), as well as one Canadian study (Nakhaie, 2002), have detected a gender gap in publication rates. Using survey data from 1987, Nakhaie (2002) has shown that when no adjustments were made for factors commonly associated with publication, male faculty members published roughly twice as much in their lifetime as females. Most of this gap was associated with gender differences in rank, field of specialization, seniority, type of institution and time devoted to research. However, as noted by the author, the causal relationship implied by these associations was unclear[26] and the data used for this research was collected in 1987. The

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[25] This sector includes the following fields: basic sciences-medicine, dental specialities, dentistry, medical specialization, medical technology, medicine, nursing, optometry, paraclinical science, pharmacy, public health, rehabilitation medicine, surgery and other health occupations. There is great variability of salaries by field within this sector, and women are greatly over-represented in the fields that command the lowest salaries (i.e., rehabilitation medicine and nursing, where women comprise respectively 74.2% and 93.6% of faculty).

[26] Women tend to hold lower ranks than their male counterparts. Publishing is crucial to rank progression, but it could also be that holding a higher rank leads to publishing more — that faculty members in higher ranks

situation of women faculty members has significantly changed since then, and gender differences in publication rates may no longer exist (Nakhaie, 2002). A recent study on American science faculty revealed very little, if any, gender difference in publication rates in recent cohorts (Xie & Shauman, 2003).

Of course, gender differences in publication rates – if present – could themselves reflect women's lesser integration into the academic culture (O'Leary & Mitchell, 1990, Sonnert & Holton, 1995) and their limited access to resources that promote research productivity. In 1999, a highly-publicized report from the Massachusetts Institute of Technology concluded that its women faculty members had limited access to space and to research grants and were excluded from positions of power. The report concluded that "Differences resulted in women having less or in their being excluded from important professional opportunities" (MIT, 1999, p. 13). In Canada, there has been concern expressed about poor female representation among Canada Research Chair holders, which led to a human-rights complaint (PAR-L Electronic Network, 2005) that was recently settled by an agreement on equity in the nomination process for chairholders. The Fifth-Year Evaluation of the Canada Research Chairs Program showed that although the proportion of new female chair recipients had increased from 14.1% to 32.0% between 2000 to 2004, only 19.8% of chairholders were women in 2004 (R.A. Malatest & Associates Ltd, 2004) and 22% in 2006 (Canada Research Chairs Program Website).

Publication rates are likely to indirectly influence salary in two ways: (a) they may generate a track record that increases the likelihood of better salary offers from other institutions (that may be either accepted or used to bargain with the current employer); (b) they may affect salary through their impact on rank progression. A study conducted by Ornstein and Stewart (1996) suggested a negligible effect of publication record on salary.

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benefit from a process of accumulation of advantages such as better access to resources for research, a wider professional network, and the recognition that leads to invited publications (Nakhaie, 2002). At least two other reasons could account for the higher publication rate of senior faculty. First, in universities with substantial tenure requirements in terms of publication, junior faculty who do not publish may not receive tenure, leaving only more productive faculty at higher ranks. Second, senior faculty may be more productive as a result of their experience in publication and teaching: experience in publishing may lead to a reduction in the time needed to write publications; experience in teaching, which implies an accumulation of lecture notes, may free up time for publication.

But the study used data from 1986. For the reasons given earlier, in many universities the relation between track record and salary has probably strengthened since then.

Third, women and men may differ in terms of values and attitudes towards work and pay. One form of this argument suggests that gender role socialization may have made males more competitive, aggressive, and disposed to dominate in one way or another and women more inclined to prize sensitivity and to be somewhat submissive (Blau, Ferber & Winkler, 2006). Were these characterizations correct, the gender gap in salaries might be a result of men's greater aggressiveness when it comes to negotiating salaries or playing the game of seeking better offers from other institutions in order to force the current employer to match them (Blackaby et al., 2005; Svarstad et al., 2004). However, the evidence on differences in attitudes to work by gender is mixed. A meta-analysis of 21 studies, 19 of which were laboratory-based, revealed only small gender differences in the outcomes from salary negotiations (Stuhlmacher & Walters, 1999). A recent study based on a survey investigating the actual experiences of salary negotiation by university graduates in business, psychology, sociology, and history found no gender difference in the incidence of negotiation or in the relative success of negotiation (O'Shea & Bush, 2002). Finally, to our knowledge, no research has examined whether women and men academics differ in their attitudes towards salary negotiation.

Another form of the argument that there are gender differences in attitudes to work and pay is based on the idea of compensating differentials (Shirazi, Biel & Fransson, 2002). According to this model, there are gender differences in preferences with respect to job attributes. The results of recent studies on this topic are mixed. Using different data sources and studying different occupations, Tolbert and Moen (1998), Browne (1997), and Shirazi et al. (2002) all report no differences between men and women in the job attributes they most value. In contrast, Barbezat (1992) found significant gender differences in the job attributes preferred by Ph.D. graduates entering the academic job market. Men displayed a greater tendency to prioritize salary than women. Women were more likely to prioritize student quality, collegiality and opportunities for collaborative work (Barbezat, 1992).

However, this research is by no means definitive since it was limited to economists and subjects were at the beginning of their career.

Fourth, men on average have more seniority than their female counterparts (Ornstein & Stewart, 1996) and occupy higher academic ranks (Ornstein & Stewart, 1996; Ornstein et al., 1998; Sussman & Yssaad, 2005). There are several possible reasons for this. The presence of women in the academic profession in large numbers is relatively recent. It is more likely that, because of family constraints or for other reasons including discrimination, their careers were interrupted or that they delayed the start of their careers (Ornstein & Stewart, 1996; Ornstein et al., 1998; Sussman & Yssaad, 2005).

Finally, the academic career is said to have been shaped to match life pattern more typical of males in that it hardly tolerates interruptions, requires working long hours as well as a willingness to travel, and in which large pay increases may require a willingness to be mobile. According to several studies reviewed in an American Sociological Association report (2004: 5), "Mothers often bear the primary family obligations that conflict with the demands and rhythms of academic life." The years when child-bearing and the care of young children are concentrated often coincide with the critical time when an academic must work relentlessly to obtain tenure. Child care may limit the capacity of women to build their reputations and networks through conference participation. And broader family commitments may limit the willingness of women to take jobs that require geographic mobility. The fact that, within couples, women are on average younger than men may play a role. The age differential may imply that women's spouses have been on the labour market for a longer time than the women themselves and are more likely to have an established career. This simple fact may hamper women's choice. In short, women faculty are more likely to be part of dual-career couples.

The evidence on these factors is mixed. The research on child-rearing and promotion has yielded inconsistent results. Ginther and Hayes (2001) and studies reviewed by Bentley and Adamson (2003) suggest that child-rearing slows promotion. Long (2001) and Perna (2003), however, found no effect. In a study of four Australian universities, many women faculty members expressed a reluctance to participate in conferences while

their children were young (Deane et al., 1996). In their research on fellowship recipients of the *National Science Foundation* and the *National Research Council*, Sonnert and Holton (1995) found that mothers were more likely to say that they had accepted post-doctoral fellowships in order to be with their partner. Men, on the other hand, displayed the opposite tendency; the ones who were childless were more likely than the ones who had children to say that they had accepted post-doctoral fellowships in order to be with their partner.

There has been some interesting and relatively recent work on the issue of geographic mobility. In a recent study of academic economists in the United Kingdom, Blackaby, Booth and Frank (2005) found that women were less likely than men to have received an outside offer in the five previous years. They argue that this finding is consistent with what Booth, Francesconi and Frank (2003) call the "loyal servant hypothesis." This argues that the fact that family commitments more often limit female than male mobility and that prospective employers know this, means that those employers are less likely to make offers to women. Current employers exploit the opportunity this provides by paying their female employees less. Note, however, that the fact that women had received less outside offers over the five previous years was the only evidence provided. The article contained no direct evidence bearing on the loyal servant hypothesis.

Since market supplements have not been specifically addressed by previous research, this study derives its hypotheses from the literature reviewed above, which deals with pay differentials by gender. Some of the hypotheses reviewed below have not been supported in previous research. We retain them here because access to market premiums may provide a more precise way to test them than is the case for aggregate pay. Transposing the possible explanations proposed for gender differences in pay to gender differences in market premiums generates the following hypotheses.

A first question asks whether female faculty members are disadvantaged in their access to market premiums as well as in their overall salary. This leads to our first hypothesis.

Hypothesis 1 – Women are less likely to receive market premiums than men.

Our second question is whether this difference – if present – can be understood as an outcome of gender differences in the presence of characteristics that increase the likelihood of having received a market premium. There are four hypotheses related to this question.

Market premiums are aimed at compensating individual or collective differences in the market situation of faculty members. The most common indicators of market situation are field of specialization and faculty members' research activity. So:

Hypothesis 2 – The receipt of market premiums is related to research activity and field of specialization.

The three remaining hypotheses deal with characteristics that are less clearly related to the reasons for which systems of market premiums are introduced. Suppose that market premiums are more likely to be awarded to those inclined to negotiate for them. It is possible that those who rank pay highest in their list of desirable job attributes negotiate with more determination, therefore:

Hypothesis 3 – Those who most value pay raises are more likely to have received market premiums.

Late starts, career disruptions and academic career characteristics are frequently used to account for lower female pay. We would expect, then, that career characteristics of this sort play some role in the process through which market premiums are secured.

Hypothesis 4 – Career characteristics are related to the reception of market premiums.

Finally, in the literature there is much speculation – and not much data – on the consequences of family constraints for the career of faculty members. Therefore:

Hypothesis 5 - Family constraints reduce the likelihood that someone will have received a market premium.

Our core question is, then: after controlling for all the characteristics related to the presence of market premiums, does a gender difference in the receipt of them persist?

Methodology

This is a case study of a single university. This particular university provides an interesting context for an examination of the operation of a system for awarding market premiums. The university is unionized, but the system for awarding market premiums falls outside the collective agreement. The university's administration has not made available to the broader university community information on the operation of the system. In this context, then, market premiums are an area where administrators can exercise complete discretion and have a strong incentive to do so because they cannot exercise discretion in basic pay, which is governed by a collective agreement. Our interest is in whether or not the exercise of discretion produces equivalent outcomes for male and female faculty members.

Data

The data come from a survey conducted in the Fall of 2002, sponsored by the university's faculty union. Questionnaires were sent to all 1249 tenure-track faculty, researchers, lecturers and research associates who were members of the union[27]. The response rate was 51.6%. For the objectives of this research it is a suitable data source since it includes information related to all of the factors discussed above. There are, however, two possible weaknesses. Non-response might be a source of bias. There might also be bias because the data are self-reported.

To check for possible bias the demographic and occupational results from the survey were compared with available administrative data from the university. Note that in the administrative records market supplements and administrative stipends are combined. In the survey data, these are distinguished. For comparative purposes, we combined them. Data presented in appendix A shows that there is little difference in the distributions of characteristics between the two data sets.

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[27] Detailed methodological information, including the questionnaire, is available from the authors.

Measures

The indicator of presence of market premiums available in this analysis is whether or not one had been received since appointment to a tenure-track position. This creates a methodological problem that is addressed in the next section. There are four sets of variables, each set corresponding with the content of hypotheses 2 to 5. There is descriptive information on these variables in appendix B. In addition, appendix C presents the distribution of these variables by gender.

For hypothesis 2, academic sector of employment (reflecting the general market value of various fields of specialization) provides a collective measure of faculty market value. Indicators of individual value are how often faculty members have accepted a private research contract in the last year, being a member of a research team, currently receiving research grants, being the recipient of a Canada Research Chair, being the recipient of any other kind of research chair, and the presence of research assistants, research professionals and post-doctoral fellows. For hypothesis 3, attitudes to remuneration are measured by a question on the priority given to increases in salary as opposed to other aspects of employment. For hypothesis 4, indicators of career stage are seniority within rank, age at appointment, number of years of professional experience prior to appointment, type of previous work experience as well as presence of administrative stipends since appointment.[28] Finally, for hypothesis 5 there are four indicators of family constraints: presence of children under 12, main occupation of spouse, perceived level of difficulty associated with combining professional and family obligations, and presence of demanding family responsibilities over the previous two years.

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[28] Faculty members who have received administrative premiums have been part of the administration at one point, which is an indicator of their career. However, having been part of the administration also means that they have been normally informed of the availability of market premiums, which is not necessarily the case for other faculty members. Thus, they may be more likely to request – and receive – market supplement than faculty members who were never part of the administration. This consideration is particularly relevant in the context of the institution at which this research was conducted, where the presence of a market supplements policy is kept relatively secret.

A measurement gap

Our measure of the salary component under study allows respondents to report receipt of a premium at any point during their appointment at the university under study. Before 1998, the university's practice was to diminish the amounts of the premiums until extinction. So some respondents may have received a premium in the past that had been terminated by the time of the survey. This is a problem: the data available means that we are obliged to examine the relationship between information on respondents' attitudes and research output from 2002, on the one hand, and the receipt of a market premium that may have occurred several years earlier, and may have disappeared, several years earlier.

We have carefully explored this issue. Administrative data from the institution shows that, of those who were receiving premiums between 1997 and 2002, only 9.1% lost them at some point over this period. Moreover, as discussed earlier, it is only since 1998 that market premiums have been widely used. Overall, it seems safe to assume that most market premiums to which faculty referred in their answers were awarded fairly recently and that most faculty who were awarded a market premium still received it at the time of the survey. This information is unfortunately not available in the survey data however.

What about the fact that we are looking for associations between 2002 responses to questions and a market premium award that in some cases would have taken place several years previously? What is at issue here is the relative stability of our measures. Many are (almost) completely stable – this would be true of age at appointment, gender and, for the most part, academic sector.

There is a set of variables related to research performance that may not be stable. A person who received a market premium in 1998 may not have supervised a post-doctoral fellow at that time but have acquired one by 2002. But we know that there is considerable continuity over time in research performance. It is, for example, in the nature of the program, that somebody who had a Canada Research Chair in 2002 normally had stronger than average research performance five or ten years earlier. Then there are family responsibilities – actual and perceived. A professor with a child under 12 in 2002 may not have had one in 1998, when he or she received a market premium. But since the range of

ages spanned is birth to 12 and since there was a marked growth of market premium awards at the end of the 1990s it is likely that in most cases the added family responsibility would have coincided with the period during which the award was made. Moreover responses to the question on the perceived difficulty in combining professional and family responsibilities are likely to have been shaped over some time. Finally, those who have used different valuations of the importance of pay to explain differences in pay by gender must assume that those valuations are relatively stable. Were they not, it is difficult to see how women's pay disadvantage could be produced by a (relative) disinterest in pay, as compared to men.

None of this is to suggest that the use of responses to questions in 2002 to predict awards that in some cases were made several years earlier poses no problems. It is, rather, to suggest that the seriousness of the problem should not be exaggerated. We return to the issue in the interpretation of our results, in the conclusion.

Analyses

Two procedures are used to analyze the data. They differ in the extent to which they assume causal sequencing. First, a correspondence analysis using SPAD v6 is used in order to describe the relationships between variables without an assumption of causal sequence. The procedure is a special case of principal components analysis in which variables are measured at the nominal or ordinal level. Consequently, chi-square instead of correlation is used to assess distances. It is a technique used to visualize data. It projects on a single geometric plane all the relationships between variables so that categories that are chosen by the same respondents are close to each other on the plane (Lebart, Morineau and Piron, 2002)

In correspondence analysis variables may either be used as active or supplementary elements. Active variables and their interrelations determine a map – or maps if more than two factors are retained. For the results to be interpretable, active variables must all relate to the same theme (Morineau, 1993). Supplementary variables do not contribute to the

computation of the factors. Their relationship with the active map determines their projection on the bi-dimensional space defined by the factors

In the present research, the active variables retained are all those that should be related to the receipt of market supplements because they are the prime factors used to justify their presence (i.e. sector of activity, frequency of research contracts, and the indicators of research activity), as well as the receipt of market supplements. Therefore, the active plane provides information on the relationships between market value, research activity and market premiums. It is related to Hypothesis 2 which states that there is a relationship between the market value of faculty and receipt of market premiums.

The supplementary variables that are projected on this plane are those that might be expected not to be related to market supplements, if market premiums were only a reflection of market value and, of particular interest for our purposes, gender. They are related to hypotheses 1, 3, 4, and 5. If the supplementary variables are related to market premiums, they will load significantly on the same factor that includes the presence of market premiums. This is a first test of our hypotheses.

A limit to correspondence analysis is that it is difficult to compare its results with those of studies published elsewhere. Another is that it does not generate an estimate of the extent of gender differences that are unaccounted for by other variables. This sort of residual difference is a major focus of interest in most of the relevant research. To supplement the correspondence analysis, then, we also present analyses using logistic regression, which tends to assume a causal sequence. As observed before, we return to the plausibility and implications of this assumption in the conclusion.

Hierarchical logistic regressions are used in order to assess the impact of adding explanatory variables on the relationship between gender and the receipt of market premiums. Therefore, gender is entered first, followed by the variables found to be related to the presence of market premiums in the correspondence analysis. These variables were entered in blocks in order to estimate their added contribution and to check for possible interactions. Finally, we present the most parsimonious model which retains only the

variables that have a significant or substantial relationship with the receipt of market premiums. [29]

Results

Correspondence Analysis

The Cattell Scree test yielded two factors. The first accounts for 15.6% of the total variance, the second for 10.0%, for a fairly substantial 25.6% of the total variance. There is little difference between the eigenvalues of the following factors, which suggests that the second factor is the threshold for retaining factors to be considered.

Figure 1 describes the results of the analysis[30]. Significant t-test scores of the factor loadings are presented in appendix D. The first factor is clearly and almost solely defined by research activities, opposing the more active researchers to the less active. The t-tests of the significance of the factor loadings of the different categories vary from 5.1 to 19.9. The variables that most contribute to this axis are, in descending order of importance, research grants, being a member of a research team, presence of research assistants, research agents and post-doctoral fellows, frequency of research contracts and sector of activity. On the more active researcher side of the axis, the characteristics that reflect the presence of human and financial resources for research tend to be present while on the less active researcher side, they are absent. Academic sector is also related to this factor. Those in the Faculty of Medicine are most active, those in "other faculties" (Architecture, Law, Theology and Kinesiology) less active. Receipt of a market premium is not related to this axis.

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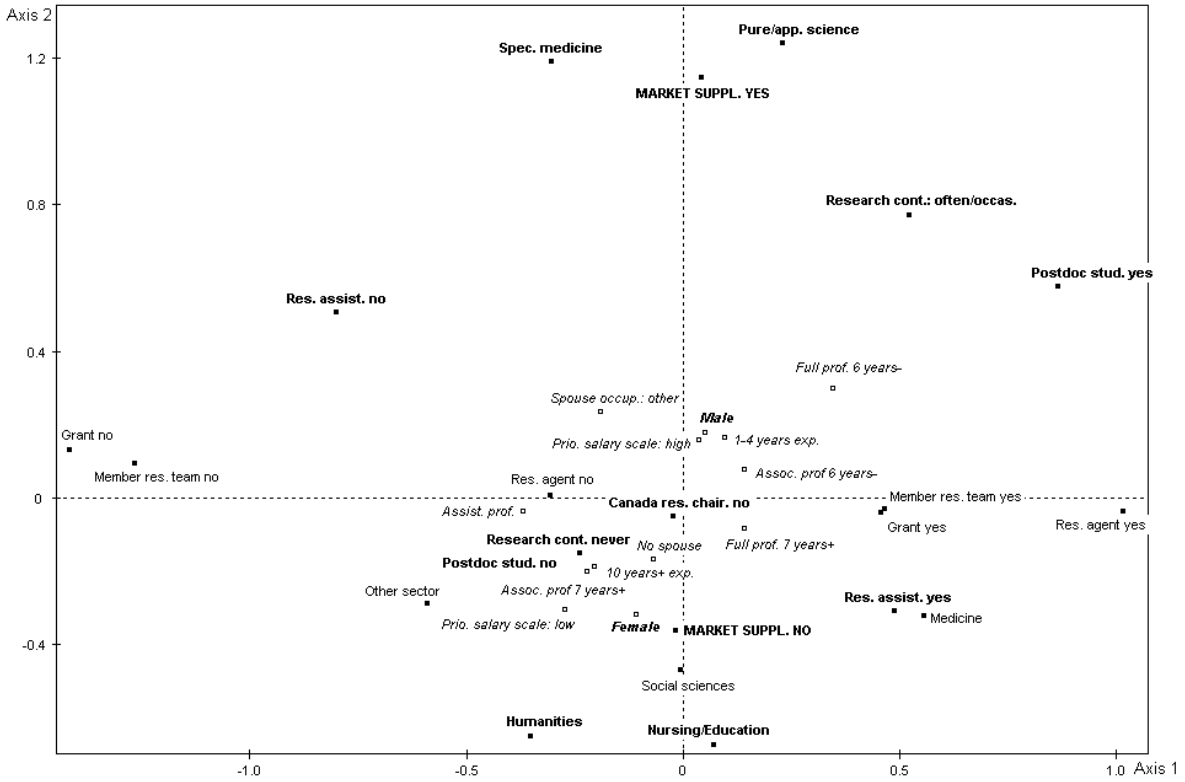
[29] This study uses the entire population of union members as opposed to a sample of this population. For this reason, the statistical tests that are used do not apply in a strict sense. The term "significant" should thus be understood as an indication of substantial differences.

[30] In examining the graph, the reader has to be conscious that the position of the various categories of variables on the map is not uniquely determined by the importance of the relationship between a given variable and its categories and the factors as illustrated by the axes. It is the structure of relationships that determines the plan. Hence, a category with very few cases may be positioned further on a given axis but it may not be a significant contributor to the axis if there are not enough cases to warrant signification. The interpretation uses the statistical contribution of the different categories, not their positioning on the axes.

Figure 1. Graphical representation of the first two factors – correspondence analysis[31]



The presence of market supplements is by far the largest contributor to the second factor, as indicated by the high t-test associated with the yes category of this variable (15.9). This factor clearly opposes faculty who receive market supplements to those who do not and is orthogonal to the first factor. The remaining variables contributing to this axis may all be thought of as being more or less directly related to the market value of faculty. Receipt of a market premium is on the same side of the axis as working in the pure and applied sciences or in specialized medicine (Dentistry, Optometry, Pharmacy, Veterinary Medicine), holding a Canada Research Chair, post-doctoral supervision, and at least occasional research contracts. On the absence of market supplements side of the axis are the Humanities, Literature, Nursing, and Education. This shows that research activity of a

[31] In order to make the results more readable, the central area of the graph produced by Spad is magnified. Since the 'yes' category of the variable 'award of a Canada research chair' lies outside of this area (coordinates: 1.26 on axis 1 and 3.41 on axis 2), it does not appear in the graph. Italics indicate supplementary variables. Characters in bold indicate both active and supplementary variables that load the most significantly on axis 2.

particular kind was related to the award of market supplements – the sort of activity that leads to a Canada Research Chair and involves post-doctoral fellows – both of which have been more common in the natural and biological sciences.

The contribution of the supplementary variables is consistent with the interpretation of the first factor as more/less active researcher. The variables that are most related to this factor are seniority within rank and type of prior professional experience. Full professors with six years or less of seniority within rank and faculty who had prior research experience tend to be found on the more active researcher side of the axis, while assistant professors and those who had teaching experience and a substantial work history prior to their appointment at the university under study tend to be found on the less active researcher side of the axis. The relationship between this factor and the remaining categories is fairly weak (t-test <2.5). They include, on the more active researcher side, some characteristics that are related to age like the presence of children under the age of 12 and having a spouse who has another type of professional occupation.

The supplementary variables that interest us in this analysis are those related to the factor dominated by the award of market supplements. The variable most related to this factor is gender. Women are clearly on the side of the axis where those not receiving market supplements cluster. In order of importance, on the side of the axis where those who received market supplements cluster, we find those who assigned the most importance to salary, were recently appointed to the rank of full professor, were appointed to the university under the age of 30, and had entered directly into an academic position. These are all consistent with a portrait of a faculty star.

This correspondence analysis is informative. It shows that gender is associated with the receipt of market supplements. The limit to this analysis is that it does not allow us to determine whether or not the relationship between gender and market supplements is due to the fact that men and women tend to differ on various other characteristics related to the award of a supplement. This issue is addressed in the next section.

Logistic Regression Analysis

The variables in the correspondence analysis related to the factor determined by the presence of market supplements are retained for this new analysis. They are entered in five sets – as defined in the literature review and in the hypotheses. This allows us to estimate the relationship between each set and the award of a market supplement as well as the impact of their inclusion on variables already present in the analysis. The order of entry is the same as the order of the hypotheses. Gender is entered first, followed by the variables that, most obviously, should be related to market supplements. The variables related to attitude, career, and family constraints are entered subsequently. Thus, at each step, it is possible to estimate whether the inclusion of the variables has an impact on the relationship between gender and the presence of market supplements. Finally, we fit a parsimonious model that includes only the variables that are related to the odds of receiving market supplements.

The results of the hierarchical logistic regression are displayed in table 1. The first column shows that the likelihood of receiving a market supplement is associated with gender, with women being 2.4 times[32] less likely than their male counterparts to receive market supplements. In fact, 3.9% of the variance in market supplement awards is related to gender[33]. This result is consistent with those obtained using correspondence analysis.

Five indicators of market value were components of the second factor identified in the correspondence analysis – academic sector, frequency of research contracts, holding a Canada Research Chair, having research assistants, and post-doctoral fellows. Of these, academic sector and research contracts are related to market supplements in the logistic regression analysis. Holding a Canada Research Chair is close to significance. As compared to faculty members in the Humanities, members in all other sectors – except the Faculty of Medicine[34] – were more likely to have received market supplements. The odds range from

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[32] To make the description of the results more readily understandable, the negative odds (exp β of less than 1) are presented as 1/exp β. A value of 0.42 for exp β gives a value of 2.4 for 1/exp β, which means that women are 2.4 times *less* likely than men to receive such supplements.

[33] Values of Nagelkerke R^2 can be interpreted in the same way as Pearson's R^2.

[34] Professors at the Faculty of medicine in this sample are the non clinicians who teach in the Faculty. They may be professors/researchers in physical and occupational therapy, public health, health administration, etc. They benefit from a different and higher basic pay scale.

4.4 in Nursing and Education to more than 25 in specialized medicine. Faculty members who had often or occasionally accepted private research contracts were 2.3 times more likely to have received market supplements than those who had never accepted such contracts[35]. Canada Research Chair holders were almost 8 times more likely than others to have been awarded a market supplement. The remaining market value indicators – the presence of post-doctoral fellows and of research assistants – are unrelated to the receipt of market supplements, net of the presence of the other indicators. Their relationship with market supplements reflects differences between academic sectors[36].

With these indicators of market value the variance explained by the model rises to 26.1%. Hypothesis 2 is supported. Note, furthermore, that the coefficient for gender falls somewhat: the odds ratio goes from 2.4 to 2.1, but this change is not large enough to be significant.

The third column shows that those who most value salary scale improvements were more likely to have received market supplements – 2.7 times more likely than those who saw it as a low priority. Adding this indicator has a negligible effect on the coefficients of the other predictors and increases the variance explained by 2 percentage points. Hypothesis 3 is supported, but there is no evidence that differences in this attitude explain the women's lower probability of being awarded market supplements. In fact, in this sample, the relationship between gender and priority given to salary scale improvement is weak (see appendix C).

Of the five available indicators of career characteristics, only seniority within rank is clearly related to receipt of a market premium. The broad pattern is that assistant professors were most likely to have been awarded a market premium. As compared to them, full professors in the rank for seven or more years were 4 times less likely to have got

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[35] The impact of research contracts on the market value of faculty may differ substantially by field. These contracts are highly valued in engineering and management, but less so in humanities and social sciences. However, our data does not include faculty from engineering and management because they are not members of the university's faculty union.

[36] Research assistants are more likely to be used in Pure and Applied Sciences and in Specialized Medicine (Chi square=42.1, p=0.000). Post-doctoral fellows are more likely to be found in Pure and Applied Sciences and in the Faculty of Medicine (Chi square=62.1, p=0.000).

one, full professors with less than seven years seniority 3.6 times less likely, and associate professors with seven or more years seniority 2.4 times less likely. [37] This result differs from what we found using correspondence analysis which put full professors with less than seven years of seniority on the "presence of market supplements" side of axis 2. This discrepancy may be explained by the relationship between variables already in the analysis, in particular academic sector.

Faculty members who had previously received administrative stipends were almost twice as likely to have obtained market supplements than those who never received such stipends. Age at appointment, number of years of work experience prior to academic appointment, and type of prior experience are unrelated to the probability of receiving a market supplement in this analysis.

Adding career characteristics to the model increases the explained variance from 28.1% to 33.9%. Hypothesis 4 is also supported. However, most important for our purposes, adding seniority in rank and administrative stipends does not significantly change the gender coefficient.

Finally, neither of the indicators of family constraints (children under 12, spouse employed or not) is significantly related to the award of market supplements and the coefficients of the indicators already in the model remain roughly the same when these new variables are introduced. Their presence in the correspondence analysis is likely due to their relationship with career variables, which are related to age. The fifth hypothesis is thus rejected.

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[37] This may seem odd. However, market supplements have been substantially attached to hiring and faculty are generally hired at the assistant professor level and, as at other Canadian universities, standards have been increasing at this institution.

Table 1. Hierarchical logistic regression of the presence of market supplements

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
Variables in analysis	ß	exp ß	ß	exp ß	ß	exp ß	ß	exp ß	ß	exp ß	ß	exp ß
Gender	W: 11.77 p=0.001		W: 6.82 p=0.009		W:6.50 p=0.011		W: 10.20 p=0.001		W: 10.88 p=0.001		W: 12.41 p=0.000	
Women	-0.88**	0.42	-0.74**	0.48	-0.73*	0.48	-1.00**	0.37	-1.08**	0.34	-1.05***	0.35
Sector (ref.: humanities)			W: 52.34 p=0.000		W: 49.13 p=0.000		W: 44.31 p=0.000		W : 45.46 p=0.000		W: 54.91 p=0.000	
Pure and applied science			2.63***	13.88	2.57***	13.08	2.82***	16.73	2.92***	18.48	2.41***	11.18
Social science/psychology			1.82**	6.15	1.74**	5.70	1.77**	5.88	1.83**	6.21	1.36*	3.89
Medicine			0.83	2.28	0..77	2.15	0.82	2.28	0.91	2.49	0.10	1.10
Specialized medicine			3.25***	25.73	3.14***	23.08	3.13***	22.76	3.27***	26.41	2.67***	14.49
Nursing/education			1.48*	4.41	1.47*	4.34	1.33	3.80	1.46	4.30	0.98	2.65
Other sector			1.78**	5.91	1.82**	6.14	1.81**	6.09	1.89**	6.59	1.45**	4.27
Frequency of research contracts (ref. : never)			W: 8.38 p=0.015		W: 6.58 p=0.037		W: 5.96 p=0.051		W: 5.72 p=0.057		W: 8.02 p=0.018	
Often or occasionally			0.82**	2.28	0.74*	2.10	0.77*	2.16	0.76*	2.14	0.84**	2.31
Rarely			0.49	1.64	0.43	1.54	0.39	1.48	0.43	1.54	0.35	1.41
Award of Canada Research Chair			W: 3.82 p=0.051		W: 3.68 p=0.055		W: 3.10 p=0.078		W: 2.97 p=.085			
Yes			2.07+	7.93	2.21+	9.10	2.05+	7.73	2.04+	7.68		
Research assistants			W: 0.93 p=0.335		W: 0.89 p=0.34		W: 2.926 p=0.087		W: 3.37 p=.066		W: 2.28 p=0.131	
Yes			0.25	1.28	0.25	1.28	0.48+	1.62	0.53+	1.70	0.40	1.49
Post-doctoral fellows			W: 1.38 p=0.240		W: 1.58 p=0.208		W: 0.54 p=0.464		W: 0.40 p=0.526			
Yes			-0.35	0.71	-0.38	0.69	-0.25	0.78	-0.22	0.80		
Priority: improv. of salary sc. (ref.: low/not a priority)					W: 7.28 p=0.026		W: 7.20 p=0.027		W: 7.50 p=0.023		W: 7.62 p=0.022	
High priority					1.03*	2.80	1.00*	2.71	1.03*	2.80	0.87*	2.38
Medium priority					0.53	1.71	0.42	1.53	0.43	1.54	0.27	1.31
Seniority within rank (ref.: assistant prof.)							W: 17.14 p=0.002		W: 18.00 p=0.001		W: 19.79 p=0.001	
Associate prof. 6 years -							-0.28	0.76	-0.28	0.76	-0.20	0.82
Associate prof. 7 years +							-0.90*	0.41	-1.01*	0.36	-0.97*	0.38
Full professor 6 years -							-1.28**	0.28	-1.33**	0.27	-1.10**	0.33
Full professor 7 years +							-1.48***	0.23	-1.63***	0.20	-1.52***	0.22

Table 1 continues

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
Variables in analysis	ß	exp ß	ß	exp ß	ß	exp ß	ß	exp ß	ß	exp ß	ß	exp ß
Age at appointment (ref.: under 30)							W: 2.35 p=0.504		W: 2.13 p=0.546			
31-35 years old							0.07	1.07	0.07	1.07		
36-40 years old							-0.40	0.67	-0.40	0.67		
41 years old +							0.19	1.21	0.14	1.16		
Nb. years of prior experience (ref.: None)							W: 2.28 p=0.516		W: 2.30 p=0.513			
1-4 years							0.69	1.99	0.68	1.97		
5-9 years							0.58	1.79	0.57	1.77		
10 years+							0.70	2.10	0.73	2.07		
Type of experience (ref.: teaching)							W:0.19 p=0.91		W:0.21 p=0.90			
Research							-0.05	0.95	-0.05	0.95		
Other							0.12	1.13	0.13	1.14		
Receipt of administrative stipends							W: 2.77 p=0.096		W: 2.82 p=0.093		W=3.13 p=0.077	
Yes							0.61+	1.83	0.62+	1.85	0.60+	1.82
Presence of children									W: 0.88 p=0.349			
Yes									-0.28	0.76		
Spouse main occupation (ref.: univ. prof.)									W: 1.16 p=0.762			
Other profes. occupation									-0.34	0.71		
Other occupation									-0.10	0.91		
No spouse									-0.05	0.95		
Nagelkerke R2	0.039		0.261		0.281		0.339		0.345		0.317	
-2Log likelihood	528.290		446.217		438.452		414.132		411.512		458.003	
df	1		12		14		27		31		17	

To construct a final parsimonious model we initially only included the indicators related to the award of market supplements at a p-value of 0.1 or less in the complete model. Subsequent tests were performed to examine whether the variables with a p-value greater than 0.05 in this more parsimonious model might also be excluded. The conclusion drawn from these tests was that the award of a Canada Research Chair could be left out. Doing so did not substantially change any of the coefficients and the model fit remained about the same. However, receipt of administrative stipends and the presence of research assistants were retained because their inclusion did improve model fit. The fit provided by the final parsimonious model presented in the last column of table 1 is as good as that of the complete model. We compared the two models using the difference in deviance and degrees of freedom which is distributed as chi square. A common criterion of significance is a chi-square divided by the degrees of freedom that exceeds 4. In this case, the difference between the models is not significant (chi square = 46.5 with 14 degrees of freedom, criterion=3.3).

The results displayed in the last column of table 1 show that the direction of the effects is the same as in the complete model. Taken together, the predictors included in the final model account for 31.7% of the variance in the receipt of market supplements which constitutes a substantial proportion for this type of research.

The central question addressed in this article is whether gender differences in the receipt of market premiums are fully accounted for by the other characteristics associated with market premiums. The results of this analysis indicate that they are not. On the contrary, after controlling for the effects of market value, attitude toward remuneration, and career characteristics, women's disadvantage in access to market premiums is not modified They remained almost three times (2.85) less likely than men to be awarded one.

Discussion and conclusion

Our results are consistent with all but one of our hypotheses. Market premiums were more likely to have been awarded to faculty members likely to have a higher market value,

to those who most stressed pay as a job attribute, and to those at the beginning of the career. Most importantly for our purposes, however, women were less likely to have received market premiums than men and that disadvantage persisted even after the significant number of controls we added. Our results provide substantial support for Hypothesis 1. Interestingly, Hypothesis 5 was not supported. There was no evidence that family constraints influenced the likelihood that someone would be awarded a market premium, whether that person was a man or a woman.

Clearly, one should not exaggerate the importance of the results of an analysis of an aspect of salary policy in a single university. Nor, we would argue, should the importance of these results be underestimated. Pay differences by gender increasingly originate within occupations rather than between them (Fortin & Huberman, 2002). We also know that the magnitude of the pay difference by gender varies by occupation. For example, Robson and Wallace (2001) found no gender pay gap among Canadian lawyers in 1994, after suitable controls. For a similar period, Tanner (1999), in contrast, did find a pay disadvantage for women among pharmacists. There is good reason to think that the largest pay-offs to the study of pay differences by gender will come from studies that, implicitly, control for a wide range of effects by focusing on a single occupation. This study, of course, is within a single occupation within a single organization. This means that we have controlled more effectively for a wider range of effects than is the case in the bulk of the research on pay differences by gender. What do the results suggest?

First, in this university context family constraints had no effect on the likelihood of receipt of a market premium. How is this possible? Note first that there is little direct evidence in the existing research of a family constraint effect. Furthermore, universities may provide more flexibility in work hours than most employers. Family obligations may make it difficult for a faculty member to devote the amount of time to research that he or she would wish to, given the performance requirement built into the tenure process. On the other hand, the limited number of student contact hours in a research university do allow many faculty members to move between work, in particular research, and family obligations in a way that is less likely to be possible in many other highly paid professions.

Consistent with the sort of argument found in Esping-Andersen (2004), our results may suggest the importance of family-friendly work arrangements for gender equity in pay (though, in a comparison of the rates of access to senior management positions in the U.S. and Sweden, Milgrom and Petersen (2006) raise the possibility that family-friendly policies of the Swedish sort damage women's careers by facilitating choices that reduce the amount of career-enhancing experience acquired by women).

Second, it remains the case that in the results presented, women were less likely to receive market premiums than men, after the inclusion of a wide range of controls in the estimation of the various equations discussed above. A likely explanation could be that relevant factors were not sufficiently controlled for. Academic fields were too aggregate. For example, the market demand for social scientists may on average be greater than is the case for humanists, but the market demand within the social sciences is greater for economists than for anthropologists. The measures used are not sufficiently refined to allow us to control for that. Clearly, we would prefer to have had more direct measures of research productivity — say, number and quality of publications. The indirect controls that were included in the analysis to cover various aspects of research activity are likely to have accounted for most of the effect of faculty members' individual market value as researchers. Still, they may not entirely account for this effect. Nor do we adequately control for differences in values and attitudes. We had no direct measures of attitudes towards salary negotiation, a characteristic that was hypothesized to differentiate genders and to contribute to explaining the gender gap in pay (Blackaby et al., 2005; Svarstad et al., 2004). Finally, we may not have adequately controlled for relevant factors because of the lag between our measurements of faculty characteristics and the fact of having been awarded a market supplement.

These are limitations to our capacity to draw conclusions from the research described above. But a reasonable case can be made that the measurement limitations in this work are no greater, and are probably less, than are those in most of the other relevant work. In some cases, our measures are distinctly superior to those used in the bulk of the relevant literature. This is the case, in particular, for our measures of career and of family

constraints. In addition, we do have attitudinal controls that are not present in the research described earlier on the pay of university professors described earlier. Moreover, with a survey from a single university, we implicitly control for differences across universities in the characteristics of faculty members and in the policies through which salaries are determined. That, in our view, is a substantial advantage. All this is to say that a conservative interpretation of our results would still allow the conclusion that women are disadvantaged in the pay-determination process, even within the highly meritocratic context of a modern Canadian research university.

The occupation of university faculty member has some interesting characteristics that are relevant to the understanding of the pay-determination process. Where pay is determined by a collective agreement with rates set by rank and seniority, it is very difficult for gender differences to emerge. The introduction of discretionary components does allow gender differences to emerge. The introduction of market premiums by universities – as noted earlier, a recently common phenomenon – has the effect of individualizing compensation. In this case study, at least, individualized compensation appears to have operated, on average, to the disadvantage of women. Why that should be so remains an important question for future research.

A reasonable position is that unexplained gender differences in pay, for example, those produced by differences in the awarding of market premiums, ought to be explained or eliminated. The results presented here suggest a plausible line of research and, perhaps, policy concern. In this study women proved to be disadvantaged within a system of discretionary awards of market premiums, a system probably introduced precisely because of the limits on discretion imposed by the collective agreement that sets the basic rates of pay. The development of a program of market premiums moved the pay determining process at this university in an individualizing direction. There may be much to be said for a more individualized pay determination process. But such a policy comes with the risk that particular groups may be disadvantaged, groups that are less likely to be disadvantaged within a pay system governed by a collective agreement. The conclusion to be drawn from the analyses is that market premiums require care when implemented.

There is, of course, the more fundamental problem of the relative roles of structure and individual choice in the production of pay differences by gender. This distinction underlies that between the deficit and difference models that we discussed earlier, two models that organize much of the discussion in the literature on differential labor market outcomes by gender. In fact, these issues are more complicated than would be implied by the mechanical application of these two models. Consider the effect of academic sector. Suppose that the pay disadvantage of women were substantially explained by their sector of employment. That might indicate an effect of personal choice on pay differences. It also might reflect a process through which pay is lower in the sectors in which women are employed because women are employed in them rather than because of a neutral market process. This research, alas, does not much advance our capacity to answer that question. We think, however, that our capacity to do so would be much improved by more studies of individual universities, like the study reported here, that examine in detail processes of pay determination. Such studies are more likely to provide the institutional detail that makes it possible to tease out these more complicated issues. Further insight is likely to be gained from longitudinal studies. Administrative records, when available, will often provide such data.

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Appendix A. Comparison of survey data with administrative data

		Survey	Admin. data	Resp. rate
Total (N)		N = 645	N = 1249	51.6%
Gender	Male	65.0%	68.2%	48.4%
	Female	35.0%	31.8%	55.8%
	Total	100.0% (637)	100.0% (1249)	
Field of specialization	Male — Humanities	9.8%	7.3%	68.1%
	Female — Humanities	5.1%	3.4%	74.4%
	Male — Social science and psychology	10.4%	13.0%	40.7%
	Female — Social science and psychology	5.2%	6.2%	42.9%
	Male — Pure and applied science	13.1%	12.7%	52.2%
	Female — Pure and applied science	1.9%	1.9%	50.0%
	Male — Medicine	13.6%	14.3%	48.0%
	Female — Medicine	8.2%	7.5%	55.9%
	Male — Specialized medicine[38]	8.5%	9.1%	47.4%
	Female — Specialized medicine	4.3%	3.8%	57.4%
	Male — Nursing/education	2.5%	2.6%	48.5%
	Female — Nursing/education	5.9%	5.1%	58.7%
	Male — Other	6.8%	9.2%	37.4%
	Female — Other	4.7%	3.9%	62.5%
	Total	100.0% (633)	100.0% (1249)	
Seniority within rank	Male assistant professor	12.6%	11.5%	55.9%
	Female assistant professor	13.1%	9.5%	70.3%
	Male associate professor 6 years -	13.0%	12.3%	53.6%
	Female associate professor 6 years -	7.4%	7.3%	51.6%
	Male associate professor 7 years +	7.4%	7.2%	52.2%
	Female associate professor 7 years +	4.6%	3.6%	64.4%
	Male full professor 6 years -	10.7%	12.0%	45.3%
	Female full professor 6 years -	4.1%	5.3%	39.4%
	Male full professor 7 years +	21.0%	24.0%	44.3%
	Female full professor 7 years +	6.0%	5.1%	59.4%
	Male — other	n/a	1.4%	n/a
	Female — other	n/a	0.9%	n/a
	Total	100.0% (633)	100.0% (1249)	
Gender by receipt of market supplement or administrative stipend	Male — yes	26.7%	24.9%	54.7%
	Male — no	38.3%	43.4%	45.0%
	Female — yes	8.3%	8.2%	52.0%
	Female — no	26.7%	23.5%	58.0%
	Total	100.0% (637)	100.0% (1249)	

[38] Veterinary medicine, dentistry, pharmacy, optometry

Appendix B. Descriptions of variables

Variable set	Variable	Description
Dependent variable	Receipt of market supplements	Having received market supplements since appointment: 0 = no; 1 = yes.
Gender	Gender	0 = male; 1 = female.
Market value / Research activities	Sector	Sector in which faculty is employed: 1 = humanities; 2 = social science and psychology; 3= pure and applied science; 4 = medicine; 5 = specialized medicine (veterinary medicine, dentistry, pharmacy, optometry); 6 = nursing/education; 7 = other (law, physical education, environmental design, music, theology.)
	Frequency of research contracts	Frequency at which faculty have accepted private research contract over the last year: 1 = often/ occasionally; 2 = rarely; 3 = never.
	Member of a research team	Being a member of a research team within the institution or outside the institution: 0 = no; 1 = yes.
	Research grants	Currently receiving research grants: 0 = no; 1 = yes.
	Award of a Canada Research Chair	Being the recipient of a Canada Research Chair: 0 = no; 1 = yes.
	Award of other kind of research chair	Being the recipient of a research chair other than Canada Research Chair: 0 = no; 1 = yes.
	Research assistants	Presence of research assistant supervised over the last year: 0 = no; 1 = yes.
	Research agents	Presence of research agents supervised over the last year: 0 = no; 1 = yes.
	Post-doctoral fellows	Presence of post-doctoral fellows supervised over the last year: 0 = no; 1 = yes.
Values and attitudes towards remuneration	Prioritization of salary scale	Level of priority attributed to the improvement of the salary scale: 1 = high priority; 2 = medium priority; 3 = low priority/not a priority.
Career characteristics	Seniority within rank	Variable created by combining rank and seniority: 1 = assistant professor; 2 = associate professor six years and under; 3 = associate professor seven years and over; 4 = full professor six years and under; 5 = full professor seven years and over.
	Receipt of administrative stipends	Having received administrative stipends since appointment: 0 = no; 1 = yes.
	Number of years of prior experience	Number of years of professional experience prior to appointment, followed by categorization: 1= none; 2=1-4 years; 3=5-9 years; 4=10 years+.
	Type of experience	Type of previous work experience: 1 = none; 2 = teaching; 3 = research; 4 = management/other.

Variable set	Variable	Description
	Age at appointment	Variable created by subtracting year of birth from year of appointment, followed by categorization: 1=30 years old or less; 2=31-35 years old; 3=36-40 years old; 4=41 years old +.
Family constraints	Main occupation of spouse	1 = university professor; 2 = other professional occupation; 3 = other occupation; 4 = no spouse.
	Presence of children	Presence of children aged 12 years old and under living in the household at least half the time: 0 = no; 1 = yes.
	Difficulty of combining professional and family obligations	Perceived level of difficulty associated with combining professional and family obligations: 1 = often difficult; 2 = sometimes difficult; 3 = rarely difficult; 4 = never difficult.
	Demanding family responsibilities	Having fulfilled demanding family responsibili-ties over the previous two years: 0 = no; 1 = yes.

Appendix C. Differences between men and women faculty on the variables of interest

Variable set	Indicator	Categories		Men	Women	N
Market value/ research activities	Academic sector (χ^2= 50.84; p=0.000)	Humanities		15.1%	14.3%	95
		Social science and psychology		16.1%	14.8%	99
		Pure and applied science		20.2%	5.4%	94
		Medicine		21.0%	23.3%	138
		Specialized medicine		13.2%	12.1%	81
		Nursing/education		3.9%	16.6%	53
		Other		10.5%	13.5%	73
			Total	100.0%	100.0%	633
	Frequency of research contracts (χ^2=10.45; p=0.005)	Often or occasionally		23.8%	13.7%	119
		Rarely		13.8%	11.3%	76
		Never		62.4%	75.0%	392
			Total	100.0%	100.0%	587
	Member of a research team (χ^2=0.33; p=0.565)	Yes		26.6%	28.7%	174
		No		73.4%	71.3%	463
			Total	100.0%	100.0%	637
	Research grants (χ^2=1.26; p=0.261)	Yes		83.2%	79.4%	483
		No		16.8%	20.6%	106
			Total	100.0%	100.0%	589
	Award of a Canada Research Chair (χ^2=4.81; p=0.028)	Yes		2.3%	0.0%	9
		No		97.7%	100.0%	577
			Total	100.0%	100.0%	586
	Award of other kind of research chair (χ^2=0.09; p=0.767)	Yes		2.0%	1.6%	10
		No		98.0%	98.4%	519
			Total	100.0%	100.0%	529
	Presence of research assistants (χ^2=2.55; p=0.111)	Yes		60.5%	67.0%	391
		No		39.5%	33.0%	232
			Total	100.0%	100.0%	623
	Presence of research agents (χ^2=0.27; p=0.601)	Yes		23.7%	21.8%	145
		No		76.3%	78.2%	485
			Total	100.0%	100.0%	630
	Presence of post-doctoral fellows (χ^2=5.27; p=0.022)	Yes		28.4%	20.0%	160
		No		71.6%	80.0%	469
			Total	100.0%	100.0%	629
Values and attitudes towards remuneration	Prioritization of salary scale (χ^2=6.15; p=0.046)	High priority		54.8%	45.5%	315
		Medium priority		34.3%	37.9%	217
		Low priority or not a priority		11.0%	16.6%	79
			Total	100.0%	100.0%	611
Career characteristics	Seniority within rank (χ^2=32.99; p=0.000)	Assistant professor		19.5%	37.2%	163
		Associate professor 6 years -		20.0%	21.1%	129
		Associate professor 7 years +		11.5%	13.0%	76
		Full professor 6 years -		16.6%	11.7%	94
		Full professor 7 years +		32.4%	17.0%	171
			Total	100.0%	100.0%	633
	Receipt of admin. stipends (χ^2=8.43; p=0.006)	No		80.2%	88.8%	530
		Yes		19.8%	11.2%	107
			Total	100.0%	100.0%	637

Variable set	Indicator	Categories	Men	Women	N
	Number of years of prior experience (χ^2=1.34; p=0.720)	None	18.2%	17.9%	113
		1 - 4 years	35.6%	32.1%	215
		5 - 9.5 years	21.6%	21.6%	135
		10 years +	24.6%	28.4%	162
		Total	100.0%	100.0%	625
	Type of experience (χ^2=8.66; p=0.034)	None	18.4%	17.9%	113
		Teaching	18.9%	22.0%	124
		Research	50.2%	40.4%	290
		Management/other	12.4%	19.7%	93
		Total	100.0%	100.0%	620
	Age at appointment (χ^2=6.21; p=0.102)	30 years old or less	28.0%	23.0%	159
		31-35 years old	37.3%	34.9%	221
		36-40 years old	23.4%	23.9%	143
		41 years old +	11.3%	18.2%	83
		Total	100.0%	100.0%	606
Family constraints	Main occupation of spouse (χ^2=53.85; p=0.000)	University professor	5.8%	18.4%	64
		Other professional occupation	50.0%	42.9%	299
		Other occupation	28.2%	10.6%	139
		No spouse	16.0%	28.1%	127
		Total	100.0%	100.0%	629
	Presence children ages 12 and under (χ^2=0.99; p=0.319)	Yes	36.2%	32.3%	222
		No	63.8%	67.7%	415
		Total	100.0%	100.0%	637
	Difficulty of combining profes-sional and family obligations (χ^2=8.29; p=0.040)	Often difficult	25.6%	31.7%	162
		Sometimes difficult	39.1%	41.7%	234
		Rarely difficult	19.2%	18.6%	111
		Never difficult	16.1%	8.0%	78
		Total	100.0%	100.0%	585
	Demanding family responsibilities-previous year (χ^2=2.85; p=0.091)	Yes	25.1%	31.4%	170
		No	74.9%	68.6%	453
		Total	100.0%	100.0%	623

Appendix D. Correspondence analysis – t-tests of significant effects on the two factors

Factor 1 : Significant active categories in order of importance

Variable label	Category label	Test-Value	Weight
Research grants	No	-19,91	149
Member of a research team	No	-18,99	164
Research assistants	No	-14,94	221
Research agents	No	-13,29	457
Post-doctoral fellows	No	-12,00	445
Frequency of research contracts	Never	-8,91	423
Sector	Other	-5,11	67
CENTRAL AREA			
Frequency of research contracts	Often or occasionally	6,01	109
Sector	Medicine	7,09	128
Post-doctoral fellows	Yes	12,29	151
Research agents	Yes	13,70	140
Research assistants	Yes	15,09	370
Member of a research team	Yes	18,73	439
Research grants	Yes	19,62	454

Factor 1 : Significant supplementary categories in order of importance

Variable label	Category label	Test-Value	Weight
Seniority within rank	Assistant	-5,33	156
Type of experience	Teaching	-4,14	117
Number of years of prior experience	10 years +	-2,99	158
Prioritization of salary scale	Low priority or not a priority	-2,55	77
Main occupation of spouse	Other	-2,45	132
Presence of children ages 12 and under	No	-2,36	391
Type of experience	Other	-2,21	86
Seniority within rank	Associate professor 7 years +	-2,05	76
CENTRAL AREA			
Seniority within rank	Full professor 7 years +	2,12	163
Presence of children ages 12 and under	Yes	2,20	212
Main occupation of spouse	Other professional occupation	2,28	284
Seniority within rank	Full professor 6 years -	3,42	84
Type of experience	Research	5,01	278

Factor 2 : Significant active categories in order of importance

Variable label	Category label	Test-Value	Weight
Receipt of market supplements	No	-15,72	457
Award of a Canada Research Chair	No	-9,89	594
Research assistants	Yes	-9,53	370
Post-doctoral fellows	No	-8,24	445
Sector	Humanities	-6,73	91
Frequency of research contracts	Never	-5,66	423
Sector	Nursing/education	-5,10	52
CENTRAL AREA			
Post-doctoral fellows	Yes	8,19	151
Frequency of research contracts	Often or occasionally	8,88	109
Research assistants	Non	9,45	221
Award of a Canada Research Chair	Yes	10,31	9
Sector	Specialized medicine	10,92	74
Sector	Pure and applied science	12,82	91
Receipt of market supplements	Yes	15,89	146

Factor 2 : Significant supplementary categories in order of importance

Variable label	Category label	Test-Value	Weight
Gender	Female	-5,63	206
Prioritization of salary scale	Low priority or not a priority	-2,88	77
Number of years of prior experience	10 years+	-2,78	158
Age at appointment	36-40 years old	-2,44	135
Receipt of administrative stipends	No	-2,41	492
Presence of children ages 12 and under	No	-2,29	391
Type of experience	Teaching	-2,22	117
Main occupation of spouse	No spouse	-2,06	119
CENTRAL AREA			
Presence of children ages 12 and under	Yes	2,40	212
Number of years of prior experience	1-4 years	2,79	198
Age at appointment	30 years or less	2,86	153
Seniority within rank	Full professor 6 years -	2,94	84
Main occupation of spouse	Other	3,03	132
Prioritization of salary scale	High priority	3,71	293
Gender	Male	5,91	393

Chapter 3

Article 2 : Doucet, C., Smith, M. & Durand, C. (Under revision). It's Not Only About Who You Are, What You Do or How Good You Are at it: Pay Structure, Female Representation and the Gender Pay Gap among University Professors.

Submitted to : *Relation industrielles/Industrial relations* in January 2011; Revise and resubmit, June 2011.

Abstract

This study uses a case study of faculty members in a large Canadian research university to explore the sources of the gender pay gap. We examine the contributions to the total pay gap of the following: base pay, promotion to full professor, access to pay supplements, and amounts of pay supplements. We show that the effects of these factors vary with the proportions of female faculty members within units, that pay is lower in units with a high proportion of females, and that the magnitude of gender differences may vary with the degree of formalization in remuneration practices.

Keywords: Gender pay gap, organization, pay structure, female representation.

Despite women's increasing labor market success over the last decades gender pay differences persist. Researchers advance explanations of these differences pitched at two levels (Marry, 2003; Sonnert & Holton, 1996). At the *individual* level, differences in labor market outcomes are sometimes attributed to gender-specific preferences. At the *structural/institutional* level, organizational practices may penalize women, or laws may offset the effects of these practices. Recent work has sought to transcend this theoretical dichotomy by simultaneously examining the processes at both levels that may cause gender pay gaps (Ridgeway, 2009). The research on gender differences in pay at a large Canadian research university takes this latter, synthetic, approach.

Universities provide an interesting context for the examination of gender pay gaps. First, "...academics often cloak their role in the garb of enlightenment and progressive thinking and so, to the degree that this is more than intellectual posturing, sexist pay practices might be expected to disappear early in this milieu" (Guppy 1989: 744). Second, most research universities attempt to tie pay to performance. *In principle*, if applied properly, this should reduce or eliminate gender bias. Higher education, then, might be expected to set a standard in terms of gender equality.

The pay gap in academia *is* relatively low. In 2006 female faculty members earned 18.2% less than males as compared to gaps of 29.4% in the general population, 34.1% among lawyers, 27.1% among general practitioners, and 40% for senior executives (Statistics Canada, 2006). Nonetheless, the difference is appreciable. Moreover, as we will see, the introduction of the Canada Research Chair (CRC) program has influenced the relative pay of males and females, to some degree to the disadvantage of the latter.

Female Faculty in Canadian Universities

Since the 1970s both the presence of women in faculty positions (at all ranks) and their relative pay has increased. The proportion of full-time female academics rose from 13 percent in 1973 (Ornstein, Stewart & Drakich, 1998) to 30 percent in 2002-2003 (Sussman & Yssaad, 2005). Ornstein, Stewart & Drakich (1998) reported a fall in the female pay disadvantage from 22 to 17 percent between 1970 and 1994. More recent studies report

gaps of 14% and 15% respectively (Warman, Woolley and Worsick, 2010; Sussman and Yssaad, 2005). The gap decreases further when field and rank are controlled. Still, even after controls the gap does not disappear and the proportion of women who are full professors remains small (17% according to Sussman and Yssad, 2005).

Perhaps the trend means that gender differences in labor market outcomes will disappear? There is reason to doubt this. Universities are more aggressively tying pay to the market value of either fields or individuals. A study of the award of 'market premiums' at one Canadian research university found that female academics were almost three times less likely than their male colleagues to have received a market supplement since their appointment (Doucet, Durand & Smith, 2008), after controls for career stage, research activities, academic field, individual attitudes towards remuneration, and family situation. The more aggressive exercise of discretion seemed to reduce the relative pay of females.

The competitive allocation of CRCs since 2000 seems to have had a similar outcome. Relatively few women have been awarded CRCs (R.A. Malatest and Associates Ltd, 2004). In 2003 a group of female academics filed a complaint with the Canadian Human Rights Commission, observing that only 15% of chairs went to women in 2001 and 18% in 2002.[39] The situation has since improved. Still, in 2006 only 22% of chairholders were women.[40] Significant pay supplements are attached to CRCs, so their effect will have been to increase the gender pay gap.

Further evidence on the effect of the exercise of discretion on gender pay differences is provided by Finland, often considered a model in terms of gender equality. It does indeed have the highest number of female academics in Europe. However, during the 1990s, professorships were awarded both by invitation and through open competition. Women were relatively disadvantaged when the very discretionary invitation method was used. In 1997-1998 the proportion of female academics hired was twice as high in cases where there were open competitions (Husu, 2000).

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[39] See http://www.unb.ca/PAR-L/PCR1.htm.
[40] See http://www.unb.ca/PAR-L/PCR8.htm.

Our general point is that, in Canadian academia, salaries are increasingly individualized and there is some evidence that this process disadvantages women.

Gender Pay Gaps, Gender Relations and Gendered Organizations

Gender pay gaps, it is argued, reflect socially constructed gendered relations within organizations (Daune-Richard & Devreux, 1992; Kergoat, 2005). For example, they may originate in a division of labor that is hierarchically organized along gender lines. Or they may originate in informal practices or job descriptions. Whatever the organizational practice, the result may be a devaluation of women's activities (Acker, 1990). Evidently, gendering processes are likely to change over time and across locations. In universities, organizational components or practices likely to influence pay include research productivity, research networks, evaluations of research contributions, vertical and horizontal segregation, and remuneration procedures.

Research productivity, research networks and evaluations of research contributions

Women's pay might be lower because they publish less. The evidence on this is mixed. Using Canadian data for 1987 and 2002 Nakhaie (2002, 2007) found lower publication rates on the part of women. However, the difference with men was substantially explained by gender differences in rank, field, seniority and university type (research versus others). An American study of science professors suggests that differences have been minimal in recent cohorts (Xie & Shauman, 2003).

Suppose women do publish less than men: why might that be so? Given their relatively recent entry in academia, female faculty members may be less integrated into professional networks than males – effectively, strangers in academia (Sonnert & Holton, 1995), excluded from dominant 'old boys networks' (McKenna et al., 2002 MIT, 1999; see also R.A. Malatest and Associates Ltd, 2004). Networking may provide career-relevant resources: knowledge of professional norms, expectations and opportunities at the institutional level, opportunities to meet and influence powerful decision makers, recognition by peers as well as affective and professional support (Lin, 2001).

Also, male and female research contributions may be evaluated differently. Wennerås and Wold (1997) found that women's applications to postdoctoral fellowships were underrated compared to those of males and that at equal levels of scientific productivity, the evaluations of women's scientific competences were inferior to those of men. Nakkhaie reports that accumulating publications translated more readily into the promotion of males than females which, the author said, "…tends to support the allegation of discrimination in Canadian universities." (2007: 382). There is contradictory evidence, however. Sandström & Hällsten (2008) replicated the Wennerås & Wold study, examining relative success by gender across a wider range of competition, and found that women did a little better than men.

Vertical and horizontal segregation

Academic pay is tied to rank (vertical segregation) and academic field (horizontal segregation). Ornstein, Stewart and Drakich (2007) found no gender difference in the probability of promotion to associate professor but promotion to full professor took women about a year longer than men. This average conceals fairly substantial variation across fields of study. Men were promoted to full professorship more than two years earlier than women in rehabilitation, physical education/kinesiology/ recreation, and about one year in science, engineering and biology. Interestingly, women were promoted to full professor more rapidly than men in disciplines with higher female representation: about 1.25 years and 0.68 years earlier in education and humanities respectively.

With respect to horizontal segregation, women are overrepresented in relatively poorly paid fields (Canadian Association of University Teachers, 2004). The concentration of women in a field may itself depress that field's pay (England, 1992; England, 2005). Evidence in Bellas (1994; see also Umbach, 2007) confirms that average salaries in a field fall as the proportion of women rises, even after controls for individual characteristics, jobs, and labor market conditions.

Quebec's Bill 143 (adopted in 2000) required that universities adopt equal access employment programs to increase their proportion in fields where women were underrepresented. In principle, then, horizontal segregation in Quebec universities should have fallen over the last decade.

Characteristics of pay systems

Pay-setting procedures that are formalized in a way that limits discretion reduce the likelihood that women will be paid less than men (Reskin, 2000a, 2003; Kulis, 1998; Silvera, 1996; Rubery et al., 1998; Elvira & Graham, 2002). Collective agreements, in particular, tend to tie pay to seniority and to impose salary caps, the effect of which is to prevent one group being advantaged through its members network ties or the preferences of decision-makers (Ridgeway, 2009). In fact, gender differences in pay are greater in universities where salaries are determined using discretionary judgments of merit rather than seniority (Warman et al., 2010).

Research hypotheses

The review above suggests that gender differences in pay are likely to be influenced by formalization and the concentration of women in an academic field. Hence, the following two hypotheses:

H1: The magnitude of gender differences varies according to the degree of formalization in remuneration components.

H2: All else being equal, the level of female representation in a given context is negatively related to remuneration.

Methodology

Data

We use administrative data from a major Canadian research university. Information collected by the university administration between 1997 and 2006 on faculty members' remuneration is provided annually to the Faculty Union. This data set excludes clinicians in

the Faculty of medicine and faculty who occupy administrative positions during their mandate because they are not Union members. It is population data, not a sample. It comprises 1,882 faculty members, for which there are from one to ten records (depending on the number of years each faculty member was employed and a union member at the university), for a total of 11,170 observations across 64 units. Units are either non departmentalized Faculties, Schools (within Faculties or autonomous) or departments (within Faculties). Data can be conceptualized as being at three levels: level 1 is the level of time. It is nested within individuals (level 2) who are themselves nested within units (level 3).

Measures

Given the longitudinal character of the data, some of the variables are time-varying while others are not. The main dependent variable is total salary. It varies with time. The natural log of the variable is used because it is usual with this type of distribution and because it allows for comparability with other studies. The second dependent variable is the speed of access to promotion as full professor. Finally, the third dependent variable is access to pay supplement.

At the time level, the main independent variables include year, rank and access to pay supplements. These variables vary with time. Rank has three categories, assistant, associate and full professor. There are two variables measuring pay supplements, one for so-called “market supplements” and one for Canada Research Chairs (CRC).

At the individual level, stable characteristics of faculty members are considered. These include gender together with career characteristics such as year of appointment and pay grade at the first measurement occasion. This latter variable is a proxy for recognized experience at hiring. Year of appointment is only used in the analysis of promotion to full professor. It allows a control of the evolution in promotion policies as well as taking into account the fact that faculty members hired in the 50’s, 60’s or early 70’s who have not yet been promoted are most certainly less likely than those hired later to become full professor

at each observation point. It is grouped into three categories, i.e. those hired between 1958 and 1972, between 1973 and 1984 or between 1985 and 1996. This allows for the detection of possible threshold effects.

Finally, at the unit level, sector of activity of the unit and proportion of female faculty within units at the beginning of the period of observation in 1997 are considered. Female representation per quintile is used instead of the variable in its continuous form to allow for detection of threshold effects and nonlinearities. Given the small numbers of female faculty members in units at quintiles 1 to 3, those are aggregated. The female representation variable thus comprises three categories: units at quintiles 1 to 3 (0-29% female), at quintile 4 (30-39% female) and at quintile 5 (40%+ female). The sector of activity is measured using eight dichotomous variables reflecting professorship in pure and applied science, in social sciences/psychology, in humanities, in medicine, in specialized medicine[41], in nursing/education, in a sector combining economics, law and computer science, or in the "other" category[42]. Academic sector partly accounts for the variations in faculty members' job opportunities which may in turn affect pay. In addition, men and women are unequally represented in the various academic sectors (cf. Appendix 1), and this factor may explain part of the gender pay gap.

Analyses

Multilevel models are used for the analyses of total salary and of access to pay supplements. These models deal with the fact that individuals are "nested" within social structures (Hox, 2002). The nesting – or clustering -- of the data violates a major assumption of regression analysis, i.e., that sampling units are independent from each other. Multilevel models deal with this problem, producing accurate standard errors. In addition, they allow the partitioning of variance between levels of analysis, making it possible to quantify the proportion of variation attributable to differences between individuals and between contexts respectively. For the analyses of total salary and access to market

[41] This sector includes faculty members in optometry, pharmacy, dentistry and veterinary medicine.
[42] This sector includes the School of environmental design as well as the departments of music, theology and kinesiology.

supplements or CRCs, three-level models are used with time as level 1, faculty as level 2 and unit as level 3. This approach is used because information for each year is nested within faculty members, themselves nested within units.

Survival regression (Cox model) is used for the analysis of promotion to full professor. This model is suitable for event outcomes for which data is right censored. Such is the case of our data on promotion: some faculty members were promoted to full professor during the observation window while others were not, and we know the number of years each faculty member was eligible for promotion to full professor. This analysis is thus restricted to these cases - 314 women and 734 men who cumulated at least 10 years in seniority during the observation window, for a total of 1,048 faculty members.

The strategy used for analysis is to enter gender first in order to detect initial differences according to gender and then enter the other variables in order to detect whether and to what extent they explain the gender gap. These latter variables are entered in a hierarchical fashion where first, when applicable, variables related to the passage of time are entered, then, variables related to faculty – whether stable with time or not -- and variables related to units. Finally, cross-level interactions are entered when relevant. At each step, it is possible to assess whether there is a significant contribution of the variable to the explanation of the dependent variable and whether this contribution mediates the effect of gender. The final models are parsimonious and retain only the variables that have a significant relationship with the outcomes.

To test hypothesis 1 we first estimate the size of gender differences in total salary, in promotion to full professor and in access to pay supplements. Since base pay and promotion to full professor are determined by formal procedures within the institution, we expect gender differences in them to be small. We expect larger gender differences in access to pay supplements and in their amounts because these are substantially discretionary. To test hypothesis 2, we estimate the effect on remuneration of the proportion of female within units.

Results

Total salary

Table 1 presents the results of the first analysis, pertaining to total salary. Variables are indented in the table to indicate the level of analysis to which the variable is assigned – from lowest to highest from left to right.

The base model (0), includes only year as an independent variable. It indicates that variance is significant at each of the three levels: 7.8% of the salary variance is intra-individual, 85.5% between individuals, and 6.7% is between units. Consequently, predictors are added at all three levels in subsequent models.

Model 1 estimates variance in salary associated with gender, a level 2 variable, in 1997. It shows that females were paid significantly less than their male counterparts. Evidently, gender does not account for intra-individual variance over time but does account for 5.7% of the faculty member variance within units and 21.7% of the variance between units.[43]

Rank which varies with year and is therefore a level 1 variable together with pay grade at the start of the period, a level-2 variable, are added in model 2. This substantially reduces female pay disadvantage - from -0.113 to -0.015, a coefficient which nonetheless remains significant. Adding these controls substantially reduces the variance to be explained: by 29.1% at level 1, by 86.6% at level 2 and by 52.6% at level 3. This is not surprising: seniority and rank are the principal determinants of total pay.

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[43] These variances are calculated for each level by dividing the difference between the variances to be explained in models 0 and 1 by the variance to be explained in model 0. Thus, the equation used to calculate the contribution of gender in the explanation of the level 1 variance is (0.0037 – 0.0037)/0.0037 = 0; that used to calculate the level 2 variance is (0.0403 – 0.0380)/0.0403=0.057, etc.

Table 1. Longitudinal multilevel regressions on natural log of total pay

	Model 0	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Intercept model							
Salary in 1997	11.073***	11.108***	10.757***	10.720***	10.720***	10.715***	10.710***
Female on salary in 1997		-0.113***	-0.015**	-0.006	-0.004		
Academic sector on salary in 1997							
Social science/psychology						ref	ref
Pure/applied science						0.002	0.006
Humanities						0.004	0.000
Medicine						0.039***	0.041***
Specialized medicine						-0.009	-0.010
Nursing/education						0.012**	0.014***
Econ., law, computer sc.						0.010	0.002
Others						0.000	0.002
Female represent. on salary in 1997							
0-29%						ref	
30-39%						-0.011	
40%+						-0.003	
Pay grade			0.012***	0.011***	0.012***	0.012***	0.012***
Change model							
Year	0.052***	0.052***	0.044***	0.041***	0.041***	0.041***	0.041***
Associate professor			0.141***	0.141***	0.141***	0.141***	0.141***
Full professor			0.275***	0.274***	0.274***	0.273***	0.273***
Market supplement				0.121***	0.122***	0.103***	0.115***
Female on market suppl.					-0.003		
Academic sector on market suppl.							
Social science/psychology						ref	ref

Table 1 continues

	Model 0	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Pure/applied science						-0.015	-0.026+
Humanities						-0.051*	-0.038*
Medicine						0.047**	0.041*
Specialized medicine						0.001	-0.004
Nursing/education						-0.015	-0.018
Econ., law, computer sc.						0.043	0.052
Others						-0.027	-0.030*
Female represent. on market suppl.							
0-29%						ref	
30-39%						0.030	
40%+						0.014	
CRC				0.285***	0.293***	0.287***	0.289***
Female on CRC					-0.045		
Variance components							
Within-person	0.0037***	0.0037***	0.0026***	0.0016***	0.0016***	0.0015***	0.0015***
Between person: salary in 1997	0.0403***	0.0380***	0.0051***	0.0040***	0.0040***	0.0038***	0.0038***
Between units : salary in 1997	0.0032***	0.0025***	0.0012***	0.0007***	0.0007***	0.0002***	0.0002***
Deviance	-23 383	-23 497	-30 196	-35 467	-35 482	-35 848	-35 812
Difference (df)		113.86 (1)	6699.94 (3)	5270.11 (2)	15.05 (2)	366.84 (15)	-36.22 (4)
N at level 1 (within-person)	11 170	11 170	11 170	11 170	11 170	11 170	11 170
N at level 2 (individuals)	1 882	1 882	1 882	1 882	1 882	1 882	1 882
N at level 3 (units)	64	64	64	64	64	64	64

p<,001*** p<,01** p<,05* p<,10 +

The gender coefficient becomes insignificant when receipt of market premiums and CRC awards are added in model 3. Clearly, gendered access to these contributes to the gender pay gap. Given that we now control for receipt of market premiums and CRC awards, the coefficients for intercept and year respectively reflect the *base* salary in 1997 and the average yearly increments in *base* salary. Since the gender coefficient associated with the intercept is no longer significant, we can therefore conclude that there are no gender differences in base salary.

Models 4 and 5 add cross-level interactions. Model 4 reveals no *significant* difference by gender in the effect of market supplements and CRCs on total pay. The point estimate for CRCs is, however, quite large: -0.045 for women. Given that few chairholders are women (12 compared to 53 men), a gendered effect may be undetectable in our data.

Models 5 and 6 remove non significant level 2 variables related to gender and focus on level 3 variables, i.e. academic sector and percent of female within units and their possible impact on salary and on market supplement. There are not enough faculty members holding CRCs to separately examine these same effects among them. Model 5 shows that total salary tends to be higher in Medicine and Nursing/education than in the Social sciences/psychology sector and that the size of market supplements – their effect on total pay – is larger in Medicine and smaller in Humanities than in the Social sciences/psychology sector. The percent female in a unit does not influence salary nor the size of market supplements after control for rank. In Model 6, then, we drop proportion female from the final, parsimonious, model. This does not substantially modify the impact of sector of activity though one effect now appear significant, namely a negative impact in the "others" sector. The variables in the model account for 58.2% of the intra-individual variance in total salary, 90.6% of the variance between individuals and 94.0% of the variance between units.

This analysis has shown that the effect of gender on pay is explained by gender differences in rank, pay grade at entrance, and access to market premiums and CRCs. It is not due to gender differences in the value of market premiums. In addition, female representation within units is not related to total pay or to the value of pay supplements.

Since the gender pay gap is partly attributable to differences in rank and in access to pay supplements, the remainder of the analysis will determine whether male and female faculty members have equal access to full professorships, market premiums, or CRCs.

Promotion to full professor

Model 1, Table 2, shows that, before controls, at each observation point female faculty members were 1.3 times less likely to granted full professorship. Model 2 adds year of appointment. Faculty members hired between 1985 and 1996 were 1.37 times more likely than those hired between 1958 and 1972 to become full professors at each observation point. Adding this control decreases the female coefficient from -0.261 to -0.303, a change due to the fact that female faculty members were on average hired more recently.

Table 2. Cox regressions of promotion to full professor

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	B	B	B	B	B	B
Female	-0.261**	-0.303***	-0.198**	-0.196**	-0.167*	-
Year of appointment						
1958-72		ref	ref	ref	ref	ref
1973-84		0.051	0.043	0.112	0.106	0.108
1985-96		0.316***	0.291***	0.294***	0.288***	0.284***
Academic sector						
Social sc./psycho.				ref	ref	ref
Pure & applied sc.				0.606***	0.561***	0.592***
Humanities				0.148	0.081	0.145
Medicine				0.150	0.151	0.150
Specialized med.				0.185	0.136	0.169
Nursing/education				-0.333**	-0.284*	-0.312**
Econ., law, computer. sc.				-0.370**	-0.397***	-0.382**
Others				0.565***	0.500***	0.560***
Female representation						
Quintiles 1-3			ref		ref	-
Quintile 4			0.012		0.038	-
Quintile 5			-0.337***		-0.159	-
Female*female represent.						
Male						ref
Female quintiles 1-3						-0.097
Female quintile 4						-0.204
Female quintile 5						-0.272
-2Log likelihood	9553.7	9541.9	9528.4	9478.3	9475.7	9477.3
χ^2 (df)	9.98 (1)	22.10 (3)	34.18 (5)	89.28 (10)	91.30 (12)	89.96 (12)
N	1 048	1 048	1 048	1 048	1 048	1 048

p<,001*** p<,01** p<,05* p<,10 +

Model 3 adds female representation. It shows that faculty members working in units where female representation is highest were 1.4 times less likely to become full professor at each observation point than those in units where female representation is lowest. Adding this variable substantially increases the female coefficient.

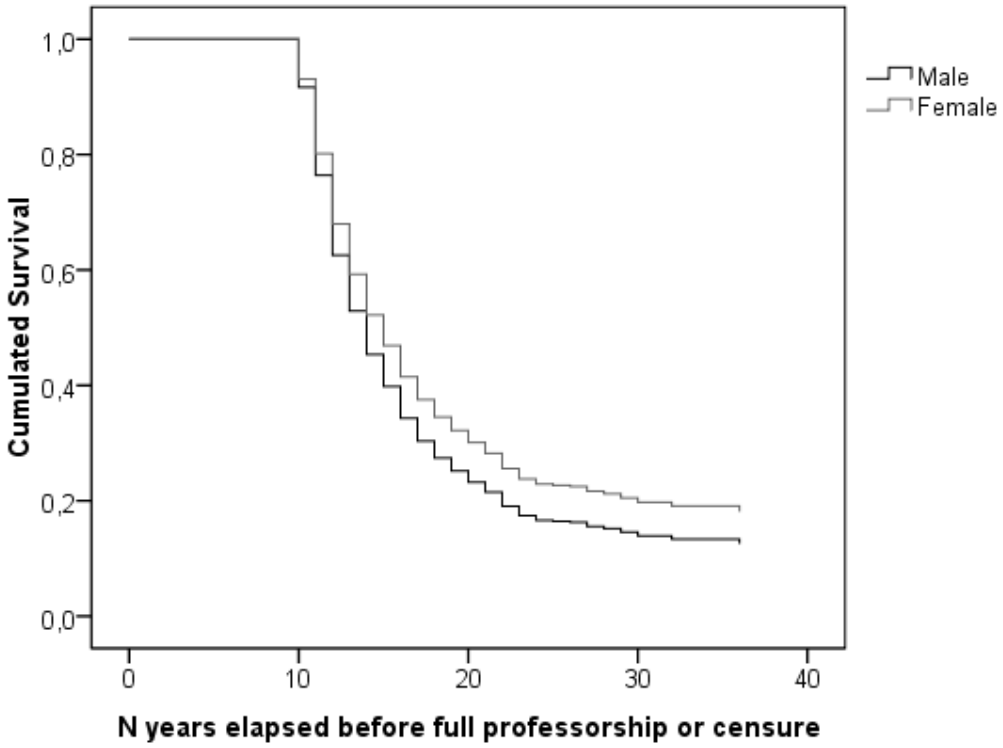
Model 4, which replaces the proportion female with academic sector, shows that time to promotion was lower in Pure and applied sciences and in Economics, law, and computer science and higher in Social sciences/psychology, Nursing/education, and in the 'Other' category.

Model 5 estimates the joint effects of academic sector and female representation. It shows that the negative effect of proportion female disappears when sector is added. Evidently, women are concentrated in sectors for which promotion rates are low.

Model 6 provides a final test of the influence of female representation within units by replacing the gender and female representation variables with an interaction of these two variables. The results indicate that the interaction is not significantly related to time to promotion.

We take model 4 as our final, parsimonious model. The corresponding survival curves are displayed in Figure 1. After ten years seniority the proportion of men promoted increases progressively relative to that of women, then after 15 years the difference stabilizes.

Figure 1. Survival function of time to promotion to full professor (males and females)



Access to market supplements and CRCs

Table 3 reports estimates of the determinants of access to either a market supplement or a CRC during the observation period. Model 0 is the base model. It shows that year is positively related to access to market supplements or CRCs, i.e., that access to these supplements has increased from 1997 to 2006.

Model 1 adds gender. The coefficient for female is negative and significant. Without controls, female faculty members were 1.3 times less likely to access market supplements or CRC's.

Model 2 adds rank. Being an associate or a full professor rather than an assistant professor was negatively related to access to market supplements or CRCs: assistant professors were more likely to have access to them. The coefficient for gender is hardly affected by the addition of rank.

The level 3 variables are entered separately in models 3 and 4, and then jointly in model 5. In model 3, the level 3 variance estimate is reduced by 15.6% when proportion female is added to the analysis. The coefficients for units with 30-39% female faculty members are negative for both males and females, but only the former reaches statistical significance. Furthermore, in units with 40 percent or more female faculty members, the odds of accessing market supplements or CRCs are significantly lower for both males and females compared with their counterparts in departments where less than 30 percent of faculty are female: 2.2 and 2 times lower respectively.

Model 4 replaces the proportion female with academic sector. Compared to model 2 (which contains no level 3 variables), the addition of academic sector reduces level 3 variance by 79.5%. As expected, academic sector is a *major* contributor to the explanation of access to supplements or CRCs. Compared to the Social sciences/psychology sector, access to supplements was 6.6 times higher in Economics, law and computer science, 5.9 times higher in Specialized medicine, but 1.8 and 1.5 times lower in Humanities and Nursing/education respectively. It also shows that the impact of being female on access to supplements and CRCs varies by sector. As compared to faculty members in Social sciences/psychology, those in the 'Others' sector were 3.1 times less likely to have access to market supplements or CRCs.

Table 3. Multilevel logistic regressions of the presence of market supplements and CRCs

	Model 0		Model 1		Model 2		Model 3		Model 4		Model 5	
Intercept model	β	Exp(β)	β	Exp(β)	β	Exp(β)	β	Exp(β)	β	Exp(β)	β	Exp(β)
Intercept	-1.24***	0.29	-1.17***	0.31	-1.00***	0.37	-0.77**	0.46	-1.26***	0.28	-1.16***	0.31
Academic sector on intercept												
Social science/psychology									ref		ref	
Pure/applied science									0.31	1.36	0.22	1.25
Humanities									-0.59*	0.55	-0.44+	0.64
Medicine									-0.39+	0.68	-0.43+	0.65
Specialized medicine									1.78***	5.93	1.75***	5.76
Nursing/education									-0.41	0.67	-0.34	0.71
Econ., law, computer sc.									1.88***	6.55	1.90***	6.69
Others									-0.19	0.83	-0.21	0.81
Female represent. on intercept												
0-29%							ref				ref	
30-39%							-0.53*	0.59			-0.34	0.71
40%+							-0.71*	0.49			-0.13	0.88
Female on intercept			-0.28*	0.76	-0.33**	0.72	-0.11	0.89	-0.30	0.74	0.17	1.19
Acad. sector on female												
Social science/psychology												
Pure/applied science									0.36	1.44	-0.09	0.91
Humanities									-0.28	0.76	-0.32	0.73
Medicine									-0.57	0.56	-0.71*	0.49
Specialized medicine									0.11	1.12	-0.24	0.79
Nursing/education									-0.02	0.98	0.02	1.02
Econ., law, computer sc.									0.28	1.32	0.14	1.15
Others									-1.14**	0.32	-1.34**	0.26
Female represent. on female												
0-29%							ref				ref	

Table 3 continues

	Model 0		Model 1		Model 2		Model 3		Model 4		Model 5	
30-39%							-0.24	0.79			-0.45	0.64
40%+							-0.77*	0.46			-0.82*	0.44
Change model												
Year	0.08***	1.08	0.08***	1.08	0.09***	1.09	0.09***	1.09	0.11***	1.11	0.11***	1.11
Associate professor					-0.20*	0.82	-0.20*	0.82	-0.23*	0.79	-0.23*	0.80
Full professor					-0.27*	0.76	-0.26*	0.77	-0.28*	0.75	-0.27*	0.76
Variance components												
Between person: intercept	7.104***		7.081***		7.153***		7.172***		7.201***		7.227***	
Between units : intercept	3.370***		3.236***		3.261***		2.751***		0.668***		0.540***	
N at level 1 (within-person)	11 170		11 170		11 170		11 170		11 170		11 170	
N at level 2 (individuals)	1 882		1 882		1 882		1 882		1 882		1 882	
N at level 3 (units)	64		64		64		64		64		64	

Estimation using full Penalized Quasi-Likelihood (PQL) with Bernoulli distribution at level-1. Parameter estimates are reported from the population-average model. p<,001*** p<,01** p<,05* p<,10 +

Finally, model 5 contains estimates of the joint effects of female representation and sector on access to supplements or CRCs. Relative to model 2, the level 3 variance estimate shrinks by 83.4% when both level 3 variables are included in the analysis. The joint effect of the variables is thus larger than their separate impact, which means that they both contribute to explaining access to market supplements and CRCs. The net impact of proportion of female is insignificant for males but significant for females. Women working in units with 40 percent plus females were 3.8 times less likely to have access to pay supplements than those working in units with less than 30% of women. Furthermore, adding proportion of female in units brings the effect of gender within Medicine to significance; female faculty members in Medicine were 2 times less likely to access market supplements or CRCs than faculty members in the reference sector. Both female representation and sector, then, contribute to the explanation of gender differences in access to pay supplements.

Discussion and conclusion

Hypothesis 1 suggested that formalized pay-setting reduces gender differences in earnings. Base pay at the University studied is determined through collective bargaining. It is highly formalized. There are procedures that govern promotion to full professor. Nonetheless, *when* someone is reviewed for promotion involves substantial discretion as do judgments with respect to what constitutes a suitable track record to warrant promotion. The award of market supplements or CRCs is highly discretionary. We therefore, expected no difference in base pay by gender, some difference in promotion rates, and a larger difference in the numbers of pay supplements awarded and their amounts. Consistent with Hypothesis 1, we found no gender differences in base pay, some evidence that it took longer to promote women, and large differences in the probability of receiving a supplement. However, we find no gender difference in supplement amounts, after controls. This result is inconsistent with our hypothesis. Given the large gender difference in the probability that a supplement will be awarded, however, we think this result requires further research rather than the rejection of Hypothesis 1.

Our results tend to confirm Hypothesis 2 which suggested that larger proportions female tend to depress remuneration. After controls, proportion female reduced the likelihood that either a market premium or CRC would be awarded. Interestingly, men's access to supplements and CRCs was the same, whatever the proportion female in a unit. The relation between remuneration and female representation appears not to be a consequence of a depreciation of stereotypically feminine activities. Were this the case, we would have expected male faculty members in those units to have been equally disadvantaged, which they were not.

Two factors may have produced the proportion female result. One is the University's affirmative action policy. Québec's Bill 143, adopted in 2000, mandated increased employment of females in fields where they were underrepresented. This may have generated inter-university competition for females in the relevant fields which, in turn, would have improved the bargaining position of women in those fields. This advantage would only have applied to market supplements because they are the sole negotiable pay component at this institution. Conversely, women in units disproportionately composed of females may not have benefited from this bargaining advantage because the policy did not apply to their units. Given the informal character of the University's market supplements policy, administrative positions membership in intra-University networks might plausibly facilitate access to information on the policy and ways to exploit it. To the extent that women are less likely to access these networks or key institutional positions, they might have been less likely to secure market supplements.

Our results should be considered with caution. They do not take into account one potentially important factor - gender differences in research productivity. One of the goals of market supplements and CRC policies is precisely to attract or retain the most productive researchers and some studies have found gender gaps in research productivity (Cole & Zuckerman, 1984; Nakhaie, 2002, 2007; Xie & Shauman, 2003). There is not space for a detailed review of the research on gender differences in research productivity. Still, a case can be made that accounting for these differences is not essential to the validity of our results.

Most of the research on gender gaps in publication includes multiple institutions. Nakhaie (2002) shows that gender differences in publication rates are partly accounted for by differences in university types. The present study deals with a single university. Evidently, institution type is irrelevant to the research. *If* differences in publication rates by gender exist they must be weaker compared to those found in studies investigating several institutions. Moreover there is evidence from this University that research activity did not differ by gender (identifying reference).[44] Finally, research productivity may be considered a 'corrupt' variable. There is some evidence that women receive less than their fair share of research funding (MIT, 1999; R.A. Malatest and Associates Ltd, 2004) and that their research contributions may not be valued as much as males' contributions (Wennerås & Wold, 1997; Nakhaie, 2007). Insofar as this is the case, controlling for productivity may lead to an underestimate of female disadvantage. Finally, there is another reason why our results may underestimate earnings female disadvantage. From the very beginning of the analysis we control for salary level. It is possible, however, that the salaries of women at the point of hire are lower than those of men. Overall, then, these results from a single Canadian research university are consistent with continuing female pay disadvantage, even in an ostensibly 'progressive' institutional context.

[44] The analysis did not include publication rates but did use several indicators of research activity - research grants, research contracts, use of research assistants, research agents or post-doctoral fellows, and membership in a research team.

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A data appendix with additional results, and copies of the computer programs used to generate the results presented in the paper, are available from the first author at Département de sociologie, Université de Montréal, C.P. 6128, succursale Centre-ville, Montréal QC Canada H3C 3J7.

Appendix A. Descriptive statistics for years 1997 and 2006

	1997			2006		
	Males	Females	Total	Males	Females	Total
Dependent variables						
Rank	(χ^2 = 53.698; p=0.000)			(χ^2 = 42.777; p=0.000)		
Assistant professor	11.7%	23.0%	170	16.5%	29.8%	249
Associate professor	32.0%	44.0%	407	28.4%	33.3%	357
Full professor	56.4%	33.0%	580	55.1%	36.8%	582
Total	100.0%	100.0%	1157	100.0%	100.0%	1188
Average total pay	(F(1, 1155)=67.658; p=0.000)			(F(1, 1189)=62.302; p=0.000)		
	$74 700	$68 167	$72 955	$104 916	$95 263	$101 674
Presence of market supplement	(χ^2 =14.912; p=0.000)			(χ^2 = 6.934; p=0.008)		
No	73.6%	84.5%	885	63.0%	70.7%	779
Yes	26.4%	15.5%	272	37.0%	29.3%	409
Total	100.0%	100.0%	1157	100.0%	100.0%	1188
Presence of chair supplement				(χ^2 =7.052 ; p=0.008)		
No	n/a			93.3%	97.0%	1123
Yes				6.7%	3.0%	65
Total				100.0%	100.0%	1188
Independent/control variables						
Gender	73.3%	26.7%	1157	66.4%	33.6%	1188
Academic sector	(χ^2 =88.692; p=0.000)			(χ^2 = 54.608; p=0.000)		
Social sciences/psycho.	18.3%	21.4%	221	17.7%	21.6%	226
Pure and applied sciences	19.1%	3.6%	173	15.5%	5.8%	145
Humanities	12.3%	14.9%	150	12.0%	12.3%	144
Medicine	13.9%	16.5%	169	16.2%	19.5%	206
Specialized medicine	11.7%	8.7%	126	12.8%	12.3%	150
Nursing/education	5.5%	18.8%	105	4.8%	13.3%	91
Econ., law, computer sc.	9.7%	6.1%	101	10.4%	6.3%	107
Others	9.6%	10.0%	112	10.5%	9.0%	119
Total	100.0%	100.0%	1157	100.0%	100.0%	1188
Female representation within unit (quintiles, base: 1997)	(χ^2 =198.102; p=0.000)			(χ^2 =104.966; p=0.000)		
Quintile 1 (0-6%)	19.6%	1.6%	171	14.2%	7.8%	167
Quintile 2 (7-17%)	28.2%	10.0%	270	27.4%	14.3%	273
Quintile 3 (18-29%)	21.6%	18.1%	239	23.3%	17.0%	252
Quintile 4 (30-39%)	17.8%	25.3%	229	15.5%	24.8%	237
Quintile 5 (40%+)	12.8%	45.0%	248	14.6%	36.1%	259
Total	100.0%	100.0%	1157	100.0%	100.0%	1188
Year of appointment	(F(1, 1155)=38.351 p= 0.000)			(F(1, 1189)=38.599 p= 0.000)		
	1978.54	1982.58	1979.62	1989.73	1993.96	1991.15
Average pay grade	(F(1, 1155)=46.020 p=0.000)			(F(1, 1189)=32.658; p=0.000)		
	18.51	15.59	17.73	24.10	21.62	23.26
Average market supplement (among recipients)	(F(1, 258)=0.000; p=0.989)			(F(1, 402)=3.423; p=0.065)		
	$5 891	$5 880	$5 889	$13 295	$11 029	$12 646
Average chair supplement (among recipients)	n/a			(F(1, 63)=1.559; p=0.216)		
				$35 602	$28 028	$34 204

Chapter 4

Article 3 : Doucet, C. Gender and the Use of Discretionary Pay Supplements among University Faculty Members.

To be submitted following revisions, journal to be determined.

Abstract

This research examines the mechanisms that may lead to gender differences in access to ‘market supplements’ at a large Canadian research university. The process of awarding pay in excess of the amounts provided for in a collective agreement are examined based on interviews with 17 administrators at all hierarchical levels and in various academic units. Results suggest that gender differences in the likelihood of receiving a supplement may be related to specific features of the award process and to an unequal distribution of awards which disadvantages units with strong female representation.

Keywords: Gender pay gap; faculty; pay discretion; content analysis.

Introduction

The use of market premiums to supplement the base salary of faculty members has become widespread in universities in Canada (Doucet, Durand & Smith, 2008) and Australia (Lyons & Ingersoll, 2006). These policies have been criticized for their potentially adverse effects (Pelletier, 2004; SGPUM, 2001, 2002; SPUL, 2003; SPPUS, 2002)[45], for being unnecessary if the same results can be achieved with a sensible promotion system (Stilwell, 2003), and for being potentially discriminatory towards female faculty members (Canadian Association of University Teachers, 2004). There have been studies of the operation of market-based pay systems in university settings. Doucet et al. (2008) examined gender differences in the receipt of market supplements at a large Canadian university. Nichols-Casebolt (1993) studied faculty perceptions of the attribution process of salary market adjustments in one large American research university. However, there has been no research on the operation of these pay systems in practice or on the mechanisms through which they may lead to gender differences in pay. The research reported here addresses these two issues.

Market-based pay: general principles and potential problems

Scholars working on compensation describe market-based pay as a mean to establish optimal salary levels for the attraction and retention of qualified employees (Leavitt & Morris, 2008). This is usually done by comparing the compensation levels of target positions to similar positions in the relevant market (Milkovich & Newman, 2005). Organizations use wage surveys to find out how much competitors pay to fill comparable jobs.

Organizations may run into several problems when implementing these pay systems. First, decision-makers may use survey data to justify decisions that have been made on other grounds (Nelson & Bridges, 1999).

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[45] SGPUM, SPUL and SPPUS are the faculty unions of Université de Montréal, Université Laval and Université de Sherbrooke.

Second, market-based pay may lead to faculty morale problems. Linking wages to market demand may produce situations where poor performers in a high demand field receive higher wages than strong performers in a low demand field (Nichols-Casebolt, 1993). It may also lead to salary compression, where the difference between the wages of junior and senior faculty members is reduced or even eliminated (Hearn, 1999; Amey VanDerLinden, 2002). Either outcome may negatively impact collegiality (Amey VanDerLinden, 2002).

Finally, market data may "reflect discriminatory practices by employers against minorities and women" (Heneman, 2003, p. 50). Within the academic profession, women and men are to some degree segregated by discipline. Using American data for 1999, Umbach (2007) found a negative relationship between the proportion of female faculty members and average wages within fields after a range of controls (e.g., human capital, academic rank, the percentage of faculty members in the field with funded research, proportion of time spent on teaching). The negative relation between the proportion of women in an occupation and wages may reflect the devaluation of work done by women (Bellas, 1994).

The academic labour market

Academia, it is generally agreed, involves multiple labour markets (Hearn, 1999; Toutkoushian, 2006). There are field-based differences in the salaries paid to faculty members in Canada (Sussman and Yssaad, 2005) as there are in United States (Thornton, 2007). Faculty salaries also vary between individuals within fields: they are influenced by rank, mobility, and performance - mostly research performance (Perna, 2003). Definitions of performance may vary within universities (Hearn, 1999). Administrators may sometimes assign a broad value to the reputation of faculty members based on student enrollments in their courses and the grants they receive (Grant, 1993).

Several processes within academic departments are likely to mediate the assignment of market premiums. Departments vary in the decision-making discretion they are permitted. Unconvinced by available candidates they may not appoint at all. Conversely, if

they become aware that a suitable candidate is available they may be able to open a position. Variations in governance practices and composition may also be relevant. Pfeffer and Langton (1988) found less variation in salaries within departments characterized by greater social contacts between faculty members, demographic homogeneity, and democratic and participative governance. Salary variation was greater in larger departments, in private institutions and in departments where faculty members tended to work alone. There is some evidence that the negotiating of market premiums may be easier for chairpersons who benefit from their deans' support (Musselin, 2005). This support may depend on criteria such as departments' centrality to the mission of the institution, productivity and quality, as well as demographic composition, departmental power and service to dominant external constituencies (Volk et al., 2001).

The production of gender differences in pay at the organizational level

There are two types of explanations of pay differences by gender among faculty members: those referring to gender differences in characteristics related to pay and those based on structural, social and organizational factors (Sonnert, 1999). Doucet et al. (2008; submitted) consecutively focused on each type of explanation. In a first study they found a gender gap in the receipt of market supplements even after controls that one might expect to be associated with their award: field of specialization, research activities[46], attitudes towards remuneration and seniority within rank. After controls female faculty members were almost three times less likely than males to report that they had received a market supplement since their initial appointment (Doucet et al., 2008).

In a second paper the same authors focused on two potential organizational determinants of gender differences in pay: formalization of pay practices and female representation in units (Doucet, Smith & Durand, submitted). Their main findings were the

[46] This research uses indicators of research activities (research contracts received, grants, research chairs, integration to research teams and presence of research assistants, agents and post-doctoral fellows). These resources for research certainly affect research productivity and securing them also most certainly results from previous research productivity. Thus, they are used as proxies of research productivity; however they do not account for actual research productivity.

following: after relevant controls,[47] i) there was no difference in base pay by gender; ii) women were slightly less likely to be have been promoted to full professor; iii) consistent with the first paper, there were substantial gender differences in access to pay supplements; iv) there were no gender differences in the size of the pay supplements awarded; v) the probability that a woman would receive a pay supplement was substantially decreased if she worked in a unit containing a large proportion of women. All this leaves open the question: what mechanisms produced these outcomes differences?

Stereotypes, cognitive bias, and in-group preferences are likely to influence judgments, including judgments of performance. Organizations may allow or limit the impact of such biases (Reskin, 2000b). Suitable rules and procedures limit the possibilities for gender bias (Ridgeway, 2009). So might the imposition of accountability, for example, by requiring that decision-makers justify discrepancies by gender (Reskin, 2000b) or publish information that allows the detection of evidence of discriminatory practices (Petersen & Saporta, 2004). It has been argued, more generally, that gender differences in pay may be limited in settings where compensation is established through formalized processes (Reskin, 2000a; Kulis, 1998; Silvera, 1996; Rubery et al., 1998; Elvira & Graham, 2002).

Still, unexplained gender differences in pay can be found in formalized pay systems. Roth (2006) shows how women can be disadvantaged in a merit pay system despite a highly formalized process based on evaluations by managers, peers and subordinates. Homophily among coworkers, subordinates and managers, as well as cognitive bias in evaluations generated these differences. Nelson and Bridges (1999) find that processes of organizational politics and organizational reproduction of cultural advantage play a role in maintaining differences between the salaries paid in jobs predominantly held by women and those predominantly held by men, despite the use of methods designed to tie salary levels to market.

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[47] Separate analysis were performed for total pay, access to full professorship and access to pay supplements, using for each relevant controls among the following : year of appointment, pay grade at the beginning of the observation period, yearly increments in base pay, rank and academic sector.

Research on academe has identified a number of mechanisms producing disadvantage. Women's pay may be lower because they receive less outside job offers (Reskin, 1992; Blackaby, Booth, and Frank, 2005) either because women are less willing to be geographically mobile or are *perceived* to be less mobile. Salary variability between departments in response to differences in labour market conditions may largely reproduce the depression of salaries in fields traditionally occupied by women (Reskin, 1992). The individual negotiation of starting salaries may penalize women if they negotiate less forcefully and effectively or if those with whom they negotiate take a harder line against women (Babcock & Laschever, 2003).

In sum, the literature on compensation suggests that the need to attract and retain faculty members and external equity concerns may motivate the use of market supplements. Organizations may face certain difficulties when operating these pay systems: the use of survey data to inform decisions may be challenging, the recourse to market supplements may lead to morale problems among employees and may even be discriminatory. In academia, market supplements may be associated with fields or individuals but determining which fields and individuals should be rewarded may be problematic, for the reasons given above. Generally speaking, we might expect that, to varying degrees, rules, procedures, and transparency are all likely to reduce the likelihood of discriminatory behavior. Conversely, discretion and secrecy are likely to encourage it.

Research design

Understanding how inequalities are generated requires not only taking into consideration the point of view of those who are subjected to these inequalities, but also that of decision-makers. With the exception of the research conducted by Nelson and Bridges (1999), based on the court defenses of organizations in pay equity cases, research on gender inequalities has neglected this point of view. This study uses semi-directed interviews conducted during the summer and fall of 2007 with academic administrators at all hierarchical levels in one large Canadian research university. Base salary at this institution is established by collective agreement while market supplements are negotiated

separately on an individual basis. This is an important methodological advantage because it allows isolating the possible effects of individual negotiation and administrative discretion on pay. Over the last decade there has been a large increase in the use of market supplements at that institution. This case offers a good opportunity to observe how practices that may potentially generate inequalities are put in place, justified, and used.

The institution at which this research was conducted is located in a competitive environment for the hiring and retention of faculty members. It is a large research university situated in a metropolitan area where there are several universities, one of which is, along with the institution under study, considered to be among the top ten research universities in the country. Other important competitors include several universities in the neighboring province and American states as well as private industries in the area, such as pharmaceuticals, aerospace, software engineering and telecommunications.

Informants were selected in relation to their unit affiliation, which could mean school, department, or faculty, depending on whether or not faculties are departmentalized. Using administrative data from the institution for 2006, units were classified along two dimensions: the proportion of faculty who were receiving supplements (coded as low, moderate or high) and the proportion of women in the units (also coded as low, moderate or high). Table 1 presents details of this classification and of the selection of informants.

The classification yielded nine unit types, each including between 5 and 16 units. One exception to this was the type characterized by high percentages of women as well as of supplement recipients; there were only three of these. Within each type, the selection process excluded small units (less than ten faculty members) because it seemed likely that informants would be reluctant to share information were it likely that the interview would allow the identification of specific faculty members. The selection process favored units where one could find potential informants who had held administrative positions between 1999 and 2005, a period characterized by substantial increases in the awards of supplements and in their amounts. In addition, informants who no longer held administrative positions were preferred since we expected that they would share information more freely. The selection process was designed to include all seven academic

sectors of the institution,[48] but collaboration could be obtained with administrators for six sectors. For every unit selected, the administrator at the next hierarchical level was also interviewed when possible (deans or vice-presidents, depending on the type of unit).

Table 1. Details of unit selection

% of faculty members who are recipients	Female representation within units		
	Low (0-23%)	Moderate (24-45%)	High (46%+)
Low (0-14%)	**AA1 :** 1 Chairperson 16 units in total	**AB1 :** 1 Chairperson 8 units in total	**AC1 :** 1 Chairperson 7 units in total
Moderate (15-38%)	**BA1 :** 1 Chairperson 7 units in total	**BB1c :** 1 Chairperson **BB1d :**1 Dean 14 units in total	**BC1 :** 1 Dean 5 units in total
High (39%+)	**CA1 :** 1 Chairperson 7 units in total	**CB1 :** 1 Chairperson 6 units in total	**CC1 :** 1 Dean 3 units in total

The final sample included seven chairpersons, two vice-deans, six deans, one vice-president and the former President, for a total of 17 informants. This sample covers the range of situations that theory suggests may have an influence on the allocation of market supplements: it includes units that vary in terms of their labour market situation, departmental influence within the institution and the amount of institutional support provided to it, governance processes, customs, and proportion of women.

The interviews were designed with two purposes: 1) to understand the various ways in which market supplements are allocated in different units; 2) to uncover the practices and processes that could have produced disadvantages for female faculty members. To this end, the following themes were discussed: how the decision to award a market premium was made, the rules that framed these decisions, the information on market supplements provided to faculty members and academic administrators, changes in the practice over time, and criticisms of market supplements. The issue of gender differences was not directly raised. Because it is a sensitive issue at the institution under study, raising it in interviews could have discouraged open discussion by making informants adopt a defensive

[48] Sectors at this institution are Pure and Applied Science, Social science/Psychology, Humanities, Medicine, Specialized Medicine, Law, Nursing/Education and Others.

posture. Instead, a final question about equity between faculty members *in general* was used to prompt informants able and willing to share information in relation to gender differences, to do so.

The analytical strategy consisted in a two-stage content analysis of the interviews. The first stage focused on four aspects: the justifications for the use of supplements, the award process, the use of market indicators to inform decisions and the criticisms directed at the use of market supplements. The second stage focused on identifying processes that might have generated gender differences in access to supplements.

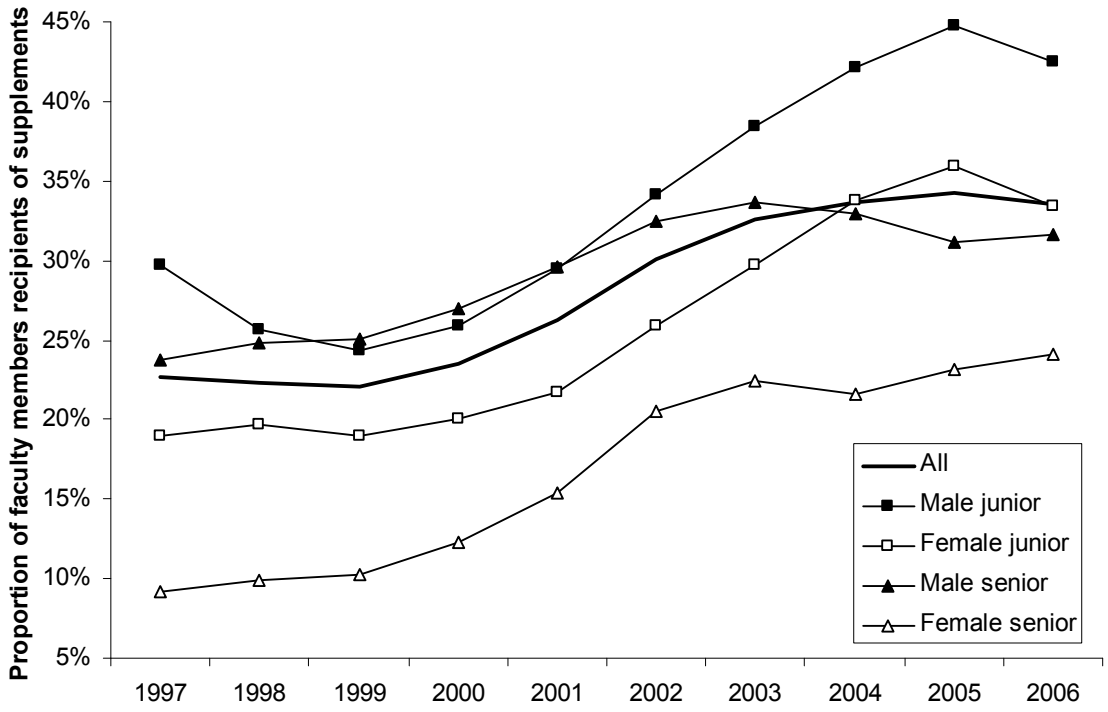
The context: a substantial increase in the use of market supplements

Administrative data collected by the institution shows that there was a significant increase in the use of market supplements between 1999 and 2005. The proportion of faculty members receiving market supplements increased from 22% in 1999 to 34.2% in 2005, which represents a 55.5% relative growth over six years (see figure 1). Gender differences tended to diminish over time but did not disappear. The decrease in gender differences was mainly limited to senior faculty members. In 1997, among junior faculty members, 29.7% of males and 19% of females were receiving market supplements, a 10.7 percentage point difference. In 2006, 42.5% of male and 33.5% of female junior faculty members were receiving market supplements, a 9.1 percentage point difference. Among senior faculty members, 23.7% of males and 9.2% of females were supplement recipients in 1997, a 14.5 percentage point difference. In 2006, these proportions had reached 31.6% and 24.1% respectively, a gap of 7.5 percentage points. Thus, there was a 1.6 percentage point decrease in the gender gap among junior faculty members during the observation period, while among senior faculty members, the gender gap was reduced by seven percentage points.

Previous research (Doucet et al., 2008) has shown that a substantial part of this gender gap could not be explained by field of specialization, research activity, attitudes towards remuneration, career stage, or family constraints. Related research reveals no gender gap in base salary and in the amounts of supplements received, and weak

differences in access to full professorship, after relevant controls (Doucet et al., forthcoming). Access to market supplements, then, appears to be the main source of pay disadvantage for women at this institution.

Figure 1. Proportions of faculty members receiving supplements by gender and seniority, 1997-2006



Results

Why use market supplements?

Market supplements have been used for both hiring and retention. The President explained that the institution had a long history of using market supplements, sometimes because of competition with the private sector, but the decision to transform the institution into a leading research university mandated an increase in their use. Recruitment efforts had increasingly extended beyond national borders, the university sector had expanded, and competition for academic staff became stiffer. In addition, confronted with a financial crisis

at the end of the 1990s, the institution offered retirement incentives the take-up of which had caused understaffing at the senior level. While the base salary at this institution was high compared to other equivalent Canadian institutions it was deemed insufficient for the hiring and retention of the most eminent academics, the President said. Supplements were considered almost unavoidable in some fields, but their award to all faculty members within these fields was never considered a viable option because supplements go to individuals, not fields.

However, one senior administrator reported that an exception was made to this unwritten rule in order to "save" a faculty. On several occasions, the faculty dean had approached senior administrators for assistance with allegedly acute recruitment and retention problems. He was asked for a report with specific details on these problems and a proposition to solve them. As a result, a "supplement scale" was devised for this Faculty, which translated into the award of supplements to nearly all members of it.

Two senior administrators claimed that hiring supplements were necessary because the more recently hired were, on average, better qualified than their predecessors. Most had held post-doctoral appointments prior to being hired and came to the institution with a publication record, accomplishments that were less common among earlier cohorts.

There was disagreement among informants about the impact of teaching performance on the award of market supplements. The Vice-President, the Dean and the Vice-Dean of one departmentalized faculty all argued that teaching performance played a role in decisions to award supplements. But only one chairperson (out of seven) reported that this was the case and the President was categorical: to him, supplements were completely unrelated to teaching performance.

Attitudes towards, and justifications of, market supplements varied across units according to the extent of their use. All three chairpersons of units where supplements were rarely used mentioned that the scarcity of available jobs and the ease of finding excellent candidates to fill faculty positions meant that supplements were rarely necessary. One said that, in a context where the senior administration was reluctant to let some units replace retired faculty members, "Being authorized to hire new faculty members *is* a premium." A

Chairperson and a Faculty Dean identified features of their field that tended to limit the use of market supplements: the salaries of professionals in their field were modest and the field itself lacked of prestige, requiring a constant battle for recognition.

> For us, [market supplements are] inaccessible. In Medicine, of course, to begin with they are paid on a different salary scale, they command higher salaries. We are in no position to negotiate. Our profession is not recognized, not prestigious. […] It fights for its survival and recognition. So market supplements in this context…we [have] no way of getting our hands on those. […] We [are] in the minor league with regard to wages. (Informant AB2)[49]

This informant also said that market supplements clashed with the field's disciplinary culture, which tended to value the collectivity rather than individuals. The informant was able to provide evidence of this orientation to the collectivity:

> Some faculty members were extremely generous. During periods of financial difficulties, they would try to obtain a bit more money when negotiating external contracts. This was used, for instance, to create a fund that offered grants to attract students. […] This is a good example of the spirit and mentality of this department. […] There is a very strong collective spirit. (Informant AB2)

The President argued that some units rarely recommended market supplements because of concern at the tensions their use might cause. Corroborating this, a chairperson from one such reported that he played no part in the few awards made in his unit; all requests had come from hierarchical superiors.

Informants from all three units where supplement use was low emphasized the exceptional nature of the awards. One Dean strongly resisted the use of market supplements based on a perception that the practice was inequitable; the informant only used supplements to match the salaries to ensure that newly appointed faculty members leaving a position at another institution would not suffer a wage cut. In another unit, supplements were only used for retention, and were dependent upon outstanding research performance,

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[49] The first letters in the labels associated to informants refer to the extent of supplements use in informants' units and the second letter refers to the extent of female representation in the informants' units (A=low; B=moderate; C=high). The numbers refer to the hierarchical level (1=unit level; 2=faculty level).

as reflected by the quality of publications and the extent of research funding. In the remaining unit, the only award ever approved by the chairperson was to a full professor who received an employment offer from a competitor, who was deemed exceptional, and whose wages had been at the top of the salary scale for some years.

In units where the use of supplements was moderate, informants justified them as a way of recognizing outstanding research performance and on the grounds that the base salary provided by the collective agreement was sometimes insufficient to attract or retain faculty members. Indeed, as mentioned previously, although the base salary was considered high compared to equivalent Canadian institutions, this university did not have a formal pay differentiation system like other institutions. Another distinct characteristic of these units was the fact that informants tended to portray negotiations with hierarchical superiors for the awards as collaborative.

As in units where supplement use was moderate, in units where they were widely used, informants emphasized the need to recognize research performance and the perceived insufficiency of the base salary at this institution. Two of the three chairpersons from these units emphasized the ease of finding employment outside academia and the shortage of academic staff in many institutions. In fact, in these two units, all faculty members hired in recent years had received a supplement. Chairpersons in these units spoke readily of strategic negotiations with senior administrators and portrayed themselves as advocates for faculty members. They tended to approach supplements in a proactive way; all three chairpersons of these units said that there had been instances where they took the initiative to request a supplement for a faculty member. One Chairperson mentioned going through the professional record of every faculty member on a yearly basis and offering to request a market supplement for those that he thought deserved one. This was done to prevent faculty members from seeking offers from other employers and was considered altogether less costly than waiting and letting faculty members initiate requests for pay increases that might prove very large.

The award process

All informants in the sample agreed on a number of elements. First, information on supplements had not been directly transmitted to faculty members, most had been unaware of the award process and did not know who received supplements in their units. Nor had chairpersons been systematically informed about the award process; their knowledge of it was highly variable. Second, there was no pre-established institutional or unit-specific fund for market supplements; the informants who had used supplements reported that they requested them as and when they were needed. Third, no instructions were given to chairpersons on how to evaluate the "market value" of faculty members.

The general award process tended to be similar across units: no difference was observed according to unit type. Whether supplements were used for hiring or retention, chairpersons first consulted with their "hierarchical superior", who made the final decision to award a supplement and determined the amount. In departmentalized faculties, the hierarchical superior who made these decisions were the deans while in other faculties, this responsibility belonged to a vice-president. When requests exceeded a specified range (usually between $5,000 and $10,000, however in more recent years, amounts could reach $20,000), they were asked to justify the requests in front of a committee composed of three vice-presidents (executive, research and academic affairs). When the members of the committee could not agree, the President could be approached to settle the case. In the words of one senior administrator, "there were multiple filters in award decisions, more so when requests were substantial".

Requests were usually initiated at the unit level. However, they may also have been initiated by hierarchical superiors, either on their own initiative or following requests by faculty members themselves. This happened, for instance, when a chairperson refused to award a requested market supplement. Resorting to supplements can create tensions within units; this is why, according to senior administrators, chairpersons were free to use them or not.

Supplements were usually awarded for five years, at which point a performance review determined whether or not the award would be renewed for another five years. This was purportedly done to promote continuing performance in recipients. However, administrative data reveal very few instances of faculty members *actually* losing a supplement after five years.

The use of market indicators

By definition, *market* supplements should be related to some aspect of the labour market. So, which market indicators were used? In fact, at the unit level, nearly all informants who ever had to request supplements on behalf of faculty members said that information on publications and grants were the main indicators used. Only one chairperson mentioned using external labour market indicators - that is, wage information collected and published by a professional organization.

Senior administrators (some deans, vice-deans, the President and a vice-president) did report that they had consulted external labour market indicators. Two main sources of information were used: salary information on other comparable universities Canadian and American research universities and wage surveys. Wages in the private sector were also examined, but several informants vigorously insisted that the institution refused to compete with the private sector. They considered the two sectors to be in parts of the labour market too different to be compared and emphasized the financial limitations of the institution as well as the non financial advantages of working in academe. Internal sources of information were used to inform decisions and to ensure internal equity. Such information included the professional track-records of faculty members and unit-specific, recent, information on voluntary turnover, difficulties in hiring first choice candidates or, more generally, difficulty in filling academic positions. In determining the amounts to award administrators took into account previous hiring supplements in the targeted unit and in the institution as a whole. In addition, all senior administrators said that when retention supplements were requested based on outside offers they asked for written proof.

Criticisms directed at the use of market supplements

Despite the strong criticisms of market supplements expressed by some informants, none was altogether opposed to the practice. Even informants who, on ethical grounds, were reluctant to use supplements in their own units nonetheless believed that the practice was justified in units facing significant hiring and retention problems.

Chairpersons of units in which market supplements were widely used expressed few, and mostly superficial, objections to the practice. Informants from units where supplements were used scarcely or moderately were much more critical. Furthermore, all informants from the senior administration were critical with respect to some aspects of the practice. The most vivid and frequent criticism was related to the perception that market supplements were inequitable; out of 17 informants, 10 spoke of perceived inequities resulting from the award process. Most often viewed as problematic was the fact that some faculty members who, according to the informants, deserved a supplement had not received one because of resistance toward the practice in their unit or because they never asked one (an "injustice by oversight", in the words of one informant). Reservations were also expressed about the awarding of retention supplements in response to outside offers. One informant cynically recalled being told by a senior administrator: "If you want a supplement, get an outside offer." In this chairperson's opinion, this method was questionable because it entailed making a colleague from another institution waste time on a mock job application only to get an offer on paper. Besides, it was suggested, encouraging faculty members to consider outside offers was risky; it might turn out that the outside offers would induce them to leave.

Several informants perceived inequities between junior and senior faculty members resulting from the award of supplements to newly hired academic staff. One informant was worried that morale problems could ensue. There was also a perception among some informants that market supplements reinforced existing inequities between units and faculties. That is, the advantages of some units with respect to access to research funds and

funds for hiring were further consolidated through their opportunities to offer market supplements.

Several informants lamented transparency problems. The lack of precise rules, criteria and general information about this policy made it questionable in their eyes. Asked how market supplements were introduced at this institution, one senior administrator began his answer as follows:

> …there is a lack of transparency, what I would call 'hearsay culture' […] Some would have us believe [that the awards are more transparent nowadays] but I am under the impression that sleight of hands are still performed sometimes, what we call 'discretionary judgments', I suppose. (Senior administration)

One informant who was not aware of the existence of market supplements before consulting a senior administrator about hiring problems, commented on transparency issues at this institution:

> When money matters are brought up [...], people become mute. Because the more you understand how things work, the more you ask questions; and the more you ask questions, the less clear and precise the answers become. And this is when you understand that different faculties are managed in very different ways. […] Our faculty was kept in the dark. (Informant BC1)

According to one informant, cynicism developed among deans of faculties where supplements were scarce as a result of this lack of transparency. Some informants were particularly suspicious of the extensive use of market supplements in the Economics Department. Commenting on the creation by senior administrators of a document containing guidelines for the awards around 2004, one informant explained that this had become necessary to control the increasing volume of supplement requests, a tendency partly attributed by this senior administrator to faculty members in the Economics Department:

> Economists have developed the academic market well. They acted as levers [for the use of market supplements at this institution]. But in some ways, the phenomenon can be artificially created. Everything is not positive in the awards, I believe it is essential to have some leverage, but there can be a tendency for inflation to develop […] as with hockey players. (Senior administration)

Speaking of a yearly job market event for economists, another senior administrator explains that

> …economists often have the advantage when negotiating work conditions […] I used to tell them: "You guys created a nice market for yourselves, you raise your conditions, others raise their conditions, and so on." We were not fooled by this. (Senior administration)

According to this informant, the administration was aware of possible inflationary effects of the salary offers generated by candidates in some fields, such as Economics. The senior administration did not try to match these offers; instead, wage information from other sources was gathered to inform decisions.

Some chairpersons and senior administrators tended to see the merit component of the existing supplement systems as a deficient alternative to a formal merit pay scheme, where part of the salary of faculty members would be dependent upon yearly performance evaluations. When asked about possible inequities in the attribution of supplements, one informant suggested how these could be solved with a systematic merit pay system:

> We already offer merit pay by giving supplements to faculty members who have the nerve to request one or who receive outside offers. Personally, I think it would be fairer to do it for everyone. Say, we would automatically examine professional records every number of years and based on evaluations by an objective committee, using well defined criteria, the best [faculty members] would be offered more substantial salary raises than others. This would solve the justice matter. (Informant BB1c)

The senior administration proposed a merit pay policy during the round of collective bargaining negotiations at the beginning of the 1990s. It was believed that this system would provide internal incentives, which would be especially useful to motivate full professors to perform. It would also promote recruiting and retention of the better performers while being better structured, more transparent, and equitable than the supplements system. The proposition was almost adopted but according to a senior administrator, it failed because the employer denied the union's requests in return for approval of the merit pay scheme. According to one informant, the lack of a formal merit

pay scheme puts this institution at a disadvantage in the competition for the hiring and retention of faculty members.

> Our competitors have tools that we don't. We're giving ourselves some tools [market supplements], but they are used ad hoc and are inadequate. (Senior administrator)

In an article published in 2003, another informant lamented the impact of the use of supplements instead of a formal internal incentives system:

> While it's a valuable solution for some [faculty members], supplements become a poison for the organization as a whole and a puzzle for administrators who strive to maintain equity without being able to rely on a coherent, transparent and accepted system of rules for granting these rewards. (Senior administration)

Features of the award process and gender differences in access to market supplements

Several features of the award process may have contributed to gender differences in access to market supplements, although their influence cannot be directly tested. The effects are situated at both the individual and the unit level.

At the individual level

Four features of the award process were identified as potential individual level explanations of gender differences in access to market supplements: the individualization of market supplement negotiations, the lack of formalization of the policy, discretion and secrecy in decision making, and the influence of outside offers.

i) The individualization of negotiations

One informant from the senior administration commented on how the individualization of negotiations might disadvantage women:

> One thing is for sure, women make fewer requests, and this is not limited to salaries. […] It's as if women are so happy to get a position that when they are presented with one, they accept whatever is offered. (Senior administrator)

According to this informant, gender differences may have reflected a tendency among female faculty members to make fewer requests and negotiate less after hiring. This senior administrator also wondered whether the fact that fewer requests for female faculty

members made their way to the senior administration meant that they were less likely to ask for supplements or that as many of them made requests, but were less inclined to pursue the matter:

> Perhaps these women asked their chairperson for supplements, but gave up more rapidly. No data indicating how many did ask their chairperson is available. (Senior administrator)

Interestingly, the only other spontaneous mention of gender in the interviews was a chairperson's impression that market supplements were more of a "guy thing", meaning something likely to be discussed mostly among male colleagues. This perception was based on the informant's observation of a stronger tendency among males than females within the unit to compare their work conditions with those at a nearby university.

ii) The lack of formalization of the policy on market supplements

If women were less likely to know that there was a program of market supplements they would also be less likely to request one. This might be the result of a lack of formalization of the policy. There are indeed some indications in our data that access to information about the policy was gendered at this institution. First, of the 17 informants interviewed for this research, four were unaware of the existence of market supplements before their appointment as chairpersons. Out of these four, three were women (five women were interviewed in total). Two of them found out about the existence of supplements during meetings with senior administrators where they discussed hiring or retention problems within their units. The third woman was unaware, at the time of the interview, that some faculty members in her own unit were receiving market supplements. This is probably related to the fact that, in this faculty, supplements were negotiated by the dean. Given their position as administrators, these women were likely to have greater access than regular female faculty members to information on the inner workings of the compensation system of the university. Thus, any gender difference at the administration level could mean even greater differences at the academic level.

Second, the mention by an informant that fewer requests were received for female than for male faculty members is consistent with the idea that women faculty members lacked the necessary information to request supplements.

Third, the reduction over time of the gender gap in the receipt of supplements observed in the administrative data is consistent with this hypothesis. As more faculty members received supplements, more women likely became aware of their existence and of the award process, and acted accordingly. The fact that the faculty union wrote about market supplements in its newsletter several times between 2001 and 2007 also makes it more likely that with time, knowledge about market supplements has become widespread. In fact, some of these articles specifically addressed gender-based inequalities in market supplements, which would have raised female faculty's awareness that the program existed and that maybe they were not receiving their fair share of supplements.

The fact that the observed decrease in gender differences is for all practical purposes limited to senior faculty members also adds to the plausibility of this hypothesis. Indeed, knowledge about supplements may not have been as important in determining the receipt of a hiring supplement as it was for a retention supplement. In the former, chairpersons usually initiated the request on behalf of faculty members while in the latter, faculty members often initiated requests.

iii) Discretion and secrecy in decision making

Discretion and secrecy may be conducive to gender bias and favoritism. The interviews provided some evidence of this. Two informants alluded to the fact that senior administrators sometimes used their influence to facilitate access to market supplements in some units. Two other informants mentioned that some influential faculty members managed to get supplements through channels higher in the hierarchy than their unit's chairperson (unit types AA and CB). Chairpersons and senior administrators may have been more likely to defend the interests of male faculty members if they had stronger relationships with them than with female faculty members (as a result of homophily for instance) or if male faculty members held more power in their unit or in the university. In other words, male faculty members could generally have been more visible to

administrators. This in turn may have made them less likely than their female counterparts to be subjected to what one informant calls an "injustice by oversight", meaning that some faculty members who were entitled to market supplements did not receive one as a result of the way the system works.

iv) The influence of outside offers

Given the way the system of market supplements works, female faculty members would also be disadvantaged if they were less likely to receive or respond to outside offers. Two informants said that they evaluated the limits on faculty members' mobility (the financial and psychological costs of moving) when deciding on counter-offers. If women were *perceived* as less mobile they may be offered less. However, the interviews provide no direct information on this question.

At the unit level

Gender differences may result from the over-representation of female faculty members in units where market supplements are scarce and/or their under-representation in units where market supplements are widely used. The experiences of two units at opposite ends of the continuum of proportions female and male illustrate how this worked at this institution.

One unit was male-dominated unit with a tradition of using market supplements that had developed in response to perceived faculty shortages that were associated with the perception that the base salary was too low. Members of this unit accepted this practice. In the Chairperson's experience, most prospective faculty members expressed astonishment at the University's salary scales and responded by initiating negotiation over wages. There had indeed been a faculty shortage in this unit in the 1980s, when the informant was hired. But they had been much less problematic in recent years. However, administrative data clearly shows that there was recently a substantial increase over one year in the use of market supplements for faculty members already employed in the unit, long after faculty shortages ceased to be a problem.

The second case was a female-dominated unit in which the use of market supplements was moderate. The Chairperson resisted using them despite the fact that the unit was almost constantly short-staffed. This reluctance was in part due to the lack of transparency that characterizes the practice: the Chairperson claims to have been unaware of the availability of market supplements until after being appointed, when a faculty member requested a renewal of his supplement. In addition, it was only later on that this informant was told that hiring supplements were also available.

The informant considered confronting the senior administration about the relative scarcity of awards in the unit at one point, but then the senior administration announced plans for changes in the budgeting policy: in the future, funds for market supplements would have to be drawn from the units' budgetary envelope. With an already tight budget, this Chairperson concluded that awarding more supplements would become impossible. In addition, a senior administrator told the informant that market supplements would no longer be used in the future; given base salary increases negotiated in 2005, it was believed that they would become unnecessary. The informant expressed doubts over this claim, wondering what it would mean in practice. It is worth pointing that this Chairperson expressed strong distrust towards the senior administration throughout the interview, mentioning on several occasions how the unit was kept in the dark on matters such as market supplements (see quote: informant BC1, page 114).

This Chairperson had observed resistance toward the use of market supplements among the academic staff of the unit. They were unhappy that the program sometimes created pay inversion - newly hired faculty members were sometimes paid more than senior faculty members. Moreover, faculty members who had not received market supplements had become reluctant to ask for them after an administrative error caused the unit's academic staff to be informed of the amount of a market supplement awarded to a particular faculty member. This information fostered resentment which culminated in a stormy faculty meeting shortly after the informant's appointment, where many faculty members denounced what they felt was inequitable treatment.

Discussion

At the beginning of the 2000s a set of circumstances favored a growth in use of market supplements at this university. The academic leadership wanted the institution to become a leading research university. A program to encourage early retirement at the end of the 1990s left the university short-staffed. The higher administration was of the view that the institution's base salaries made it impossible to compete effectively for talent in some fields. Base pay was established by collective agreement and there was no merit pay scheme, and the administration had failed in its attempt to introduce one. The President, known for defending the use of market supplements as early as in the 1980s, argued that supplements provided administrators some of the flexibility needed to hire and retain top academics.

Labour market forces were seen as important determinants of market supplement allocations at this institution. Informants consistently emphasized that the main determinants of market supplement awards were hiring and retention problems in certain fields, and the exceptional track records of some individuals. In practice, however, there was no formal way of relating the award of supplements to market conditions. The policy developed in an *ad hoc* fashion. Some informants suggested that, strictly speaking, it was not a policy at all. In fact there was only one indicator on the use of which all informants agreed - an internal one: the professional record of faculty members.

Processes within academic units strongly affected the use of supplements. In one unit the Chairperson explained their infrequent use as a result of the spirit of solidarity among faculty members. This finding is consistent with research by Pfeffer and Langton (1988) who observed weak variations in salaries in academic units characterized by greater social contacts between faculty members, demographic homogeneity, and democratic and participative governance.

Administrators exercised considerable discretion over the decision to make an award. Subjective judgments played a role in their reasoning. For instance, two informants mentioned that when deciding on counter-offers, they took into account the likelihood that

a faculty member might be willing to move. Second, the decision to resort to market supplements at all within a unit was, substantially, a prerogative of chairpersons. There may also have been instances of misuse of market supplements or at least misinterpretation of their functioning. The fact that two informants attributed the recent surge in market supplements to greater relative qualifications of newly hired junior faculty members in comparison to senior faculty members at the beginning of their career suggests that this was present. The relevant comparison should have been with those with whom the applicants were competing.

The market supplement policy created internal equity problems (lamented by several informants). Interestingly, however, none of them altogether opposed it. Even in cases where the basis for disagreement was ethical informants believed that market pressures justified the use of supplements in some units. Universities are sometimes characterized as organized anarchies within which disagreements on problems and solutions are likely to be common (Cohen & March, 1986). That *all* respondents were willing to accept this solution as valid, for some units at least, is rather odd. One reason for this may be that "market value has face validity to employees [and] appears to be more objective than other work evaluation approaches" (Heneman, 2003, p. 50).

Some safeguards may have prevented the system from becoming overly inequitable. First, more than one decision-maker was involved in awards. Second, requests for large amounts were closely scrutinized. Third, senior administration informants argued that they kept a close watch on the use of market supplements across the institution. The fact that they intervened to limit the awards around 2004 supports this claim. Fourth, the union had been informed of the awards made each year starting in 1997. Although the information transmitted to the union was minimal,[50] it did allow for the detection of inequalities across

[50] The information included the amount received by each faculty member, but no indication was given on the reasons for the awards or on the type of supplement each specific award belonged to (administrative stipends, chair supplements or market supplements). Without this information, it would have made it difficult for the union to determine why each individual supplement was awarded, which would also have made a better understanding of eventual inequities difficult. The categorization of awards types, which required several days of careful examination of the data, as well as combination with other data sources, was eventually performed by the author as part of her doctoral thesis.

rank by seniority (union publication, 2001), gender by rank (union publication, 2002), and gender by unit membership (union publication, 2004). In the end, administrators exercised little discretion over the amounts of supplements, which may partly explain why no gender difference in the amounts of supplements was found in a previous stage of this research (Doucet et al., submitted).

However, administrators did exercise discretion in decisions to award supplements. There were, in fact, no formal rules and procedures to guide these decisions. Accountability was almost nonexistent and the system completely lacked transparency. No information was available to allow individual faculty members to judge whether they were being treated inequitably. Detection of possible individual-based or unit-based inequities was prevented by the lack of information on awards and by comparison problems. The lack of codification of the supplements policy meant that awards were characterized by a "one of a kind aspect" (Ridgeway & England, 2007, p. 203) which, as suggested by Ridgeway and England (2007), may act to limit comparisons and increase the subjectivity of evaluations. In the same way, it may be difficult for some administrators at the unit level to compare their own units with others, which may make the detection of possible inequities between units unlikely. Several informants at the unit level expressed ambivalence with regard to the distribution of market supplements across units. While they felt that supplements were a necessity in some units they wondered about the extent to which differences across units were justified. Overall, the evidence produced in this research makes it clear that the use of market supplements at the institution was infused with "opportunities for discrimination" (Petersen & Saporta, 2004).

The comparison of two units at opposing ends of the spectrum in their proportion of females suggests that a combination of contextual influences and of processes such as those identified in Bridges and Nelson (1989) may have contributed to producing and maintain gendered inequalities at the unit level: specifically, organizational politics, the organizational reproduction of cultural advantage, and women's limited access to privileged information. In the male-dominated unit there was a strong tradition of market

supplement use and faculty members tended to perceive them positively. Even though staff shortages had become less problematic in recent years the use of market supplements still grew radically. In contrast, there was no such tradition in the second unit. Quite the contrary: the Chairperson reported strong resistance towards the practice, which, evidently, would have contributed to the relative scarcity of market supplements within the unit.

Given its tradition and acceptance of market supplements, the unit with high male representation was obviously in an advantageous position when the institutional context became favorable to the proliferation of the practice. The second unit was unable to take advantage of the opportunities provided by the changed context because of both a lack of enthusiasm within the unit and, possibly, a lack of institutional support. This, along with the tense relationship between the Chairperson of the female-dominated unit and the senior administration, may have translated into a weakened capacity to negotiate awards to unit members. The opposite was the case in the male-dominated unit. Ill timing may also have contributed to the enduring, relative scarcity of market supplements in the female-dominated unit: at about the same time that the Chairperson decided to confront the senior administration on the matter of market supplements a senior administrator announced plans to reduce access to them.

Conclusion

Overall, organizational processes may have reduced the likelihood of awards to women. There were several reasons why female faculty members were particularly disadvantaged in this award system. Gender differences in the propensity or ability to negotiate were alleged (and assumed) by some of those negotiating. It may also be that women had limited access to information about supplements, but given the small number of cases used, we can only conjecture. Chairpersons, who were mostly males, may have allowed gender bias to influence their evaluations of faculty members, perhaps because they tended to favor others like themselves. It may also be that chairpersons from the units where women were better represented did not have access to information about market supplements or that disciplinary traditions made them reluctant to request them.

The impact of compensation policy features such as those observed in this research may be greater in cases where the possibilities of accessing pay supplements are concentrated in a limited period of time. There was clearly a period at this institution when it became more difficult to receive a market supplement. The data presented here suggest that some units were particularly disadvantaged by this. The unit apparently most disadvantaged had high female representation.

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Conclusion

This thesis examines various sources of the gender pay gap among professors within a large Canadian research university for the 1997-2006 period. It comes at a suitable time given recent findings that the gender pay gap among American university professors is larger among research universities than other types of universities (Porter et al., 2008). It covers a longer period of time and analyzes more recent data than the latest studies on the topic for Canadian faculty – the most recent data used was for 2002-2003 (Sussman & Yssaad, 2005).

The stated goal is to contribute to a better understanding of gender differences on the labour market. Using gender-relations theory as an organizing paradigm, we analyze how determinants at individual and cultural/organizational levels contribute to the gender pay gap among university professors. We find that determinants at both levels contribute to this gap. In the case of the gender difference in the receipt of a market supplement or a Canada Research Chair, we find that determinants at both levels interact in the explanation; the impact of being female varies according to contexts (i.e. the proportion of females in academic units and sectors). This is in line with gender-relations theory, according to which the situations of men and women are not homogenous; not all men are in dominant positions and not all women are in subordinate positions. Gendered outcomes are dependent upon the contexts in which individuals are situated. Also in line with this concept, we find that both horizontal and vertical segregations contribute to the gender pay gap at the institution studied. However, our results are not consistent with the idea that the division of labor along gendered lines translates into a devaluation of activities associated to females. In addition, we suggest organizational processes that may contribute to explaining the gender pay gap.

The first article examines potential individual determinants of gender differences on one pay component, i.e. market supplements. The determinants pertain to four factors potentially related to the receipt of market supplements and to gender, i.e. field of specialization, research activity, attitude towards pay, career characteristics and family constraints. Only the indicators of field of specialization and research activity are found both to be related to the receipt of market supplements and to contribute to explain the

female disadvantage in access to market supplements. However, although taking into account their impact in the analysis increases the negative female coefficient, the *change* in the coefficient does not reach statistical significance.

The remaining factors do not contribute to explaining the gender gap in the receipt of market supplements. Interestingly, family constraints, a factor for which there is much speculation in the literature, but not much data when it comes to accounting for the gender pay gap among professors, is unrelated to the receipt of market supplement. A significant gender difference is found on attitudes towards pay, but it does not contribute to explaining the difference in the receipt of a market supplement. In addition, men and women are more similar than expected with regards to indicators of research activity; there is no significant gender difference on five out of eight indicators of research activity (presence of research grants, membership in a research team, presence of a research chair other than a CRC, presence of research assistants and presence of research agents), but we do find a significant difference on the other three (frequency of research contracts, presence of a CRC and presence of post-doctoral fellowships). Only the frequency of research contracts remains significant in the logistic regression analysis of the presence of market supplements.

Our results show that after controls, women are almost three times less likely to declare having been recipients of market supplements since the beginning of their appointment. With this first article, we are able to make a reasonable case that the gender pay gap among professors at the university under study is not entirely accounted for by differences in relevant individual characteristics between male and female professors. This confirms the necessity of looking beyond gender differences in individual characteristics when attempting to understand the often disparate outcomes of men and women on the labor market.

The second article examines the contribution to the gender pay gap of base pay, promotion to full professor, access to market supplements and CRCs as well as the amounts of market and CRC supplements. We find that the effects of these factors vary with the proportions of female faculty members within units. Indeed, the proportion of female

faculty members within units is not related to base pay, amounts of market supplements and CRCs or promotion to full professor, but it is related to access to these pay supplements. Women working in units with 40 percent plus females are 2.3 times less likely to have access to pay supplements than those working in units with less than 30% of women. Therefore, pay is lower in units with a high proportion of females. We argue that these results could be related to two factors, i.e. the University's affirmative action policy, which may have provided an advantage in salary negotiations for women in units where female representation was low, and the lack of formalization of the University's market supplements policy, which may have reduced the probability that the remaining women would receive market supplements. These findings are significant because they confirm that not all women necessarily suffer the same disadvantage within an organization.

Our second article also demonstrates that the pay gap between male and female faculty members at the institution resides in gender differences in access to market supplements and CRCs and, to a lesser extent, to full professorship. These findings provide some support for the hypothesis that the magnitude of gender differences vary according to the degree of formalization in remuneration components. However, the finding that there are no gender differences on the amounts of pay supplements received, whether they are "market" supplements or supplements associated with a CRC, contradicts this hypothesis. Still, this result suggests that degree of formalization in remuneration practices may constitute an organizational-level determinant of gender differences in pay.

The last article examines the mechanisms that may have lead to the gender gap in access to market supplements. Mechanism-based explanations of gender differences on the labour market may allow for a better understanding of the specific ways in which inequalities may be reduced and indicate areas where actions to this end could prove fruitful. Four features of the award process were identified as potentially related to the gender gap: the individualization of negotiations, the lack of formalization of the policy on market supplements, discretion and secrecy in decision making and the influence of outside offers. Gender differences in access to market supplements may also have been related to an unequal distribution of market supplements between units with strong female

representation and those with strong male representation. This unequal distribution may have resulted from the influence of several factors: 1) differences between units with regards to the approval by faculty members and chairs of the use of market supplements; 2) political processes where some actors use their relationships within the institution in order to get market supplements; 3) processes of reproduction of cultural advantages in "masculine fields"; 4) potentially limited access of female faculty members to privileged information on award practices.

In addition, the results suggest that the impact of compensation policy features such as those observed in this research may be more substantial in cases where access is concentrated in a limited period of time. With time, it became more difficult to receive a market supplement at the institution and some academic units may have been particularly disadvantaged by this. Comparing two units at opposite ends of the spectrum with respect to female representation, we find that the unit apparently most disadvantaged had high female representation. Interestingly, although it was not mentioned in the article, a timing factor may also have played a role in the enduring scarcity of female faculty members among recipients of Canada Research Chairs at this institution. Following the 2006 judgment by the Canadian Human Rights Tribunal, all Canadian universities were instructed to implement measures to ensure better female representation among recipients. Questioned on the institutions' actions in response to this directive during a University council, a senior administrator answered that the institution was discussing a policy, although none had been defined internally. He added that the institution wished to promote a better distribution of chairs between men and women faculty members, but had little leeway given that they all had already been awarded.

Some findings from the third article shed some light on two unexplained results described in the second article. First, we had found no gender difference in the amounts of market supplements awarded to faculty members, which ran against our hypothesis. We had expected to find a gender difference in these amounts because they were likely determined through an unformalized decision-making process. In our view, this lack of formalization meant that unit administrators would be able to exercise discretion when

deciding how much to award individual faculty members, which could translate in a disadvantage for female faculty members. However, it became clear throughout the interviews that despite this lack of formalization, individual administrators did not actually exercise discretion with regard to the amounts of awards because these were for the most part pre-established by senior administrators.

Second, with the data used in article #2, we were unable to account for the finding that female faculty member in the "others" sector were less likely than all other faculty members to access market supplements or CRCs. A plausible explanation came from interviews with three administrators from this sector. They argued that market supplements were seldom used within their units because these were perceived negatively by faculty members and by themselves. The few supplements that were awarded went to faculty members deemed exceptional on all accounts. Some research suggests that women are underrepresented among the most highly productive researchers (Sax et al., 2002). If this were the case at the university under study, then female faculty members could be less likely to be perceived as exceptional. As a result, in a context where market supplements are exclusively awarded to exceptional faculty members, female faculty members may be less likely to receive them. Or, it may also be that the aversion towards the use of market supplements in this particular context created a climate where administrators, who were mostly males, were inclined to reserve their use for faculty members whom they knew better – i.e. male colleagues. Alas, we cannot tell from the present data whether or not these explanations can plausibly apply to our findings.

The study's contribution

We provide the first analysis of the potential impact on the pay gap of two recent trends among Canadian universities, i.e. the growth in allocations of market supplements and the implementation of the CRC program. The average gender pay gap at the university was 11.3% in 1997. This is smaller than estimated using national Canadian data around the same time, i.e. 16.8% in 1994 (Ornstein et al., 1998) and 13.9% in 2000 (Warman et al., 2010). This is expected given that our analysis is for a single institution; potential inter-individual variations are more limited within institutions. Controlling for rank and pay

grade at the start of the period decreases the estimated pay gap dramatically, from 11.3% to 1.5%. Adding controls for the receipt of market supplements and CRCs renders the gender coefficient insignificant, which we interpret as an indication that gendered access to these contributes to the gender pay gap. Further analysis confirms that there are substantial gender differences in access to market supplements and CRCs, both characterized by discretionary allocation processes at this institution.

Analyzing remuneration components separately enables us to determine that the extent of gender differences varies by component. Other researchers have studied salary and promotion separately (e.g. Smart, 1991; Toutkoushian, 1999), but to our knowledge, none have disaggregated salary into base pay and pay supplements. Our results suggest that this approach may produce findings that better identify potential sites for intervention; for instance, our study suggests that where base pay is determined through a collective agreement, a gender pay gap may emerge on pay components determined through processes that lie outside of the agreement's reach.

Pay components are conceptualized as varying with respect to their level of formalization. We estimate the extent of gender differences according to the formalization level of pay components, which had never been done for faculty members (a similar analysis by Elvira & Graham (2002) was conducted on all employees of a large financial firm). Our findings show mitigated support for the hypothesis that the magnitude of gender differences varies according to the degree of formalization of remuneration components.

We estimate the impact of the proportion of female professors in academic units on remuneration, which had yet to be done for Canadian professors (Umbach (2007) does it for professors in American research universities). We find that larger proportions of female professors in units tend to depress remuneration; after controls, proportion of females reduces the likelihood that either a market premium or a CRC will be awarded.

All studies of gender differences in pay among faculty members use controls for academic field. Because it uses multilevel analysis, the research presented in our second article provides a better control for the gendered distribution of professors by academic unit and provides more accurate estimates. In addition, using cross-level interactions, we are

able to determine how gender differences vary according to the characteristics of academic units. Other studies have used multilevel analysis on gender differences in pay among university faculty. Umbach (2007) used separate levels for individuals and detailed academic disciplines, but did not estimate how gender differences vary according to characteristics of the disciplines. Porter et al. (2008) provided separate estimates of the gender gap in three aggregated fields, but the analytical levels used were individuals and institutions, not detailed academic units or disciplines. Thus, their estimate of the gender pay gap may be biased upwards.

Reviewed studies of gender differences in values and attitudes towards pay tend to either examine the extent of these differences (Babcock & Laschever, 2003; Barbezat, 1992; Browne, 1997; Shirazi et al., 2002; Tolbert & Moen, 1998; see also the research reviewed by Kray & Thompson, 2005), or use laboratory experiments or actual experiences of salary negotiations to investigate gender differences in outcomes of negotiations (Stuhlmacher & Walters, 1999; O'Shea & Bush, 2002; see also the research reviewed by Kray & Thompson, 2005). Our research offers an original contribution by relating a measure of attitude towards pay, i.e. the prioritization of salary scale improvements, to an actual pay outcome, i.e. the receipt of market supplements. We observe small gender differences on this attitude, but they do not contribute to explain the gender gap in the receipt of market supplements, all else being equal.

We also offer a first test of the relationship between family constraints and the gender pay gap for Canadian professors. We find that for the institution under study, family constraints are not related to the receipt of a market supplement and do not contribute to the explanation of gender differences on this outcome. Our results appear to contradict those of other studies that observe such a relation (Toutkoushian, 1998; Ginther & Hayes, 2001; Perna, 2005), but we cannot exclude the possibility that the divergent findings are due to the fact that different outcomes are analyzed (other studies analyzed either salary or promotion), or to organizational, time-related or even cultural differences.

In the third article, we study the decision makers' point of view with regard to the gender pay gap. To our knowledge, the only other research available on this point of view

is that by Nelson and Bridges (1999), based on the court defenses of organizations in pay equity cases. Our analysis reveals several mechanisms at the individual and unit level that could be related to the gender gap in access to market supplements at this institution. Given the limited evidence upon which our findings are based, they are by no means definitive and merely identify potential areas for future research.

Finally, our research of one institution is in line with observations by Warman et al. (2010) that the salaries of Canadian university professors are becoming increasingly differentiated. At the institution under study, this occurs through an increase in the frequency of use and amounts of market supplements, and through CRC allocations.

Limits and strengths of the research

Studying a single university means that the possibility of generalizing our findings to other universities and employers is limited. On the other hand, it enables a close examination of both individual and organizational determinants of the gender pay gap and of the mechanisms that may produce it. In addition, through our use of varied data sources that complement each other, we are reasonably confident that we provided an accurate picture of the problem studied. As in any research of the gender pay gap, another important limit of this research resides in our inability to control adequately for potentially relevant factors, i.e. actual research productivity, academic field (in the first article) and values and attitudes towards pay. Another limit is that we are unable to test the impact of family constraints on outcomes other that the receipt of market supplements. We review the consequences of these limits in more detail.

Research productivity controls

As previously mentioned, in the first article, no significant differences according to gender were found on five out of eight indicators of research activity. Besides, only one indicator out of the other three indicators of research activity – frequency of research contracts – remains significant in the logistic regression analysis of the presence of market supplements.

The indicators of research activity that we use are indirect controls for research productivity; thus they may not account for the actual research productivity of professors. This is an important matter because our interviews with administrators reveal that market supplements are sometimes used to recognize research performance. However, we also control for other variables that are found to account for a large part of gender differences in publication rates in other research, such as rank, field of specialization and seniority (see Nakhaie, 2002). Given that our study is limited to one institution, we also control for institution type. Still, the fact remains that we do not account for all potential gender differences in research productivity. It is thus possible that the gender gap in the receipt of market supplements is overestimated.

A potential gender gap in publication rates could also account for some of the gender differences that we observe in the second article. Because research performance is crucial to rank progression, if women are less productive, it could take them longer to reach the rank of full professor. Therefore, it may be that the gender gap in access to the rank of full professor that we observe is related to an unmeasured gender gap in research productivity.

In addition, we find gender differences in the receipt of market or chair supplements only in academic units with the highest female representation. A potential gender gap in research productivity could explain this differential access if one of the two following scenarios applies to our data.

1. All else being equal, there are no gender differences in research productivity in units where female representation is lower, but women working in units with the highest female representation have lower research productivity than their male counterparts.
2. All else being equal, all female faculty members have lower research productivity than their male counterparts, but this does not decrease the probability that women professors in units with lower female representation will receive a market or a chair supplement.

How plausible is each scenario? Regarding scenario 1, we know that women who secure an appointment as faculty members in scientific and engineering fields have already successfully crossed three major barriers, i.e. self-selection into science, selection into college and university degrees, then selection by their employer (Fox, 2010). If this were also true for women at the institution under study, then it could translate in differences in productivity rates between women working in these fields – where female representation is lowest – and fields where women are better represented, which would be compatible with scenario 1. Regarding scenario 2, it is possible that in units with lower female representation, special efforts to hire and retain women professors were made in line with the institution's affirmative action policy. Then, women in these units could be more likely than men to receive market supplements for hiring or retention purposes, but not for research recognition purposes, because being more productive researchers, men would be more likely to receive those, as well as chair supplements. The end result would be consistent with our observation that there is no gender difference in the receipt of a market or a chair supplement in units where the female representation is lower.

We cannot discriminate between these scenarios, nor can we tell whether or not there are actual gender differences in research productivity within this institution. Had we been able to match the datasets used for the first and second article, we could have partly accounted for the impact of potential gender differences in research productivity using our indicators of research activities. Regrettably, this was impossible because the two datasets had no common identifier.

Academic sector controls

The dataset used for the first article lacks disaggregated data by discipline, so we cannot control for variations of market supplements and CRC allocations by disciplines. We control for academic sector, but this certainly does not entirely account for gender differences in disciplinary affiliation. The sector variable includes a category for specialized medicine, but the departments of economics and computer science are attached to the social science/psychology sector of the Faculty of Arts and Sciences. The administrative data used in the second article shows that the proportions of professors who

benefit from market supplements or CRCs are the highest in economics, computer science and in some units of specialized medicine; between 75% and 88% of professors working in these units are recipients of one or the other. Women are underrepresented within these units, accounting for between 9% and 21% of the academic staff. Therefore, we likely overestimate the gender effect in the first article.

In our second article, the use of multilevel analysis where effects are partitioned between three levels of analysis addresses this problem. The first level accounts for within individual change over time on the outcomes. The second level accounts for differences between professors on the outcomes. Gender is modelized at this level. The third level accounts for differences between the 64 academic units on the outcomes. Therefore, all estimates at level 1 and 2, are to be interpreted as estimates *holding constant the impact of unit affiliation*. This means that the underrepresentation of women in some academic units where high proportions of faculty members receive market or chair supplements cannot account for our end result regarding gender. We find that controlling for year, rank, sector, unit affiliation and female representation within units, women are on average 1.6 times less likely than men of equivalent academic units to be recipients of market of chair supplements (see "Gender main effect only" model in the modified table 3, appendix 6). This estimate is the average effect of being female, and we find that it masks considerable within-gender variation. Indeed, when it is modelized using cross-level interactions, we find that the female disadvantage varies according to female representation within units and sector. Women in units where female representation is 40% or more are 2.3 times less likely to be recipients of market or chair supplements than women in units where 30% or less of professors are female. There are also variations by sector. Compared to women in Social science/psychology, those working in medicine are twice less likely to receive market or chair supplements and those in the sector "Other", 3.8 times less likely.

Controls for family constraints

In article 1, the two predictors of family constraints included in the analysis are unrelated to the receipt of market supplements, after controls for sector, research activity and career characteristics. We tested for the possibility that the effects of family constraints

appear in the indicators of research activity by running a model without these indicators. The results show that both indicators of family constraints remain non significant with the removal of all research activity variables (see the last column of the modified table 1, appendix 7).

Our test of the effect of family constraints is, however, limited to the receipt of a market supplement. Studies that have shown an impact of family constraints were analyzing other outcomes, i.e. salary (Toutkoushian, 1998) and promotion (Ginther & Hayes, 2001; Perna, 2005). We are unable to test for the possibility that family constraints influence promotion at the institution studied and account for part of the observed gender gap in access to the rank of full professor; therefore, this possibility cannot be excluded.

Controls for values and attitudes

In the first article, we test for the impact of values and attitudes towards pay. We find that the prioritization of salary scale improvements differs by gender and is associated with the receipt of a market supplement. However, the inclusion of this indicator in the analysis does not significantly alter the gender estimate; thus, we conclude that gender differences on the receipt of market supplements are not explained by divergent valuations of salary scale improvements.

However, we are unable to test for other possibly gendered attitudes, such as attitudes towards salary negotiation. Babcock and Laschever (2003) find that in general, women are less likely than men to negotiate their salaries. One of the administrators that we interviewed noticed that women made fewer requests for market supplements. Therefore, gender differences in propensity to negotiate may contribute to explain gender differences in the receipt of market supplements if it means that women make fewer requests. There are, of course, other plausible reasons why women would be less likely to request a supplement at this institution, such as a gendered access to information on the market supplements policy. In this respect, more information on faculty members' own experience with market supplements would have been welcome for this research. For instance, knowing not only who received market supplements, but also who did request them would

have allowed us to test whether gender differences in access to supplements may be related to differences in request or refusal rates.

Which estimate of the gender effect on access to market or chair supplements is most accurate?

Given the different estimates of the gender gap obtained in articles 1 and 2, one important question is "which is more accurate?" The articles differ in five important ways: the type of data used, the time period covered, the dependent variable definition, the independent variables used and the method.

The first article uses survey data while the second uses administrative data. A comparison of survey and administrative data led to the conclusion that there were little differences in the distribution of comparable variables. Yet, administrative data are necessarily more reliable given that they are taken from a population, that no data is missing and that they are not self-reported.

The administrative data covers the 1997-2006 period; it is more recent than the survey data, which is limited to the year 2002. However, the dependent variable used for the analysis of the survey data is retrospective; it captures the receipt of a market supplement since the beginning of each professor's appointment. Therefore, our first article gives an estimate of the gender gap in the receipt of market supplements up to 2002, when the changes brought about by the CRC program began taking effect. It likely captures some of these changes, i.e. part of the increase in market supplements allocations due to awards to some meritorious faculty members in response to the limited availability of CRCs. It does not capture the allocation of CRCs itself, because although the data included an indicator for being a CRC recipient, surveyed faculty members were not asked whether they had actually received a chair supplement. In addition, only 9 surveyed faculty members reported that they were CRC recipients at the time.

The dependent variable used for the analysis of the administrative data is longitudinal and includes both market and chair supplements. Therefore, it captures the full effect of the CRC program, i.e. the allocations of chair supplements and the increase in

market supplements allocations, as well as the effect of all market supplements allocations. Thus, it likely captures more accurately the potentially gendered impact of these two inter-related, discretionary awards.

The survey data contains a wider range of controls than the administrative data (sector, research activity, career stage, values and attitudes, family constraints). Yet, it lacks a precise measure of academic discipline; the administrative data includes such a measure, i.e. academic unit affiliation. The survey data is analyzed using logistic regression, while the administrative data is analyzed using multilevel longitudinal analysis; the latter is definitely superior to the former. Using multilevel longitudinal analysis enables us to address the clustering of the data, thus producing more accurate standard errors. It also allows us to test effects at separate levels, i.e professors and academic units; variance is partitioned between the two levels, which makes it possible to quantify the proportion of variation attributable to differences between professors and between academic units respectively. As mentioned previously, this partitioning of the effects allows for a gender estimate net of the influence of an important explanation of the gender gap in the receipt of market or chair supplements, i.e. gender differences in unit affiliations.

In sum, in the first article we estimate that after controls for sector, research activity, career stage and values and attitudes, in 2002 women were 2.9 times less likely than their male counterparts to declare that they had received a market supplement since the beginning of their appointments. In the second article, we find that controlling for year, rank, sector, unit affiliation and female representation within units, women were on average 1.6 times less likely than men of equivalent academic units to be recipients of market of chair supplements. Both estimates may be biased upwards because of insufficient controls for potential gender gaps in research productivity, but the latter likely suffers a larger bias in this regard because of the complete lack of controls for research productivity. However, in the end this latter estimate is likely the most accurate estimate of the actual gender difference in receipt of market supplements given that it was produced using more reliable and recent data, a more appropriate method given the nested structure of the data and

although the range of controls is more limited, this estimate is net of academic unit affiliation.

Directions for future research

Our findings suggest that some groups may be particularly disadvantaged regarding access to pay supplements. There are very few studies of these particular pay components, so more research is needed to determine how widespread differences between groups may be. Studies of other potentially disadvantaged groups, for instance groups based on ethnic origin, would likely add to our knowledge of labour market stratification.

Our results also suggest that analyses of how administrators make decisions pertaining to employees' work conditions may be a fruitful avenue for a better understanding of labor market stratification. In that respect, we urge researchers not to assume that administrators will refuse participating. We were able to obtain collaboration of most administrators who were solicited, even though the stated topic of the research – market supplements – was quite sensitive at this institution.

Finally, when data is available, multilevel research (preferably longitudinal) is likely to produce reliable and useful results. Indeed, the fact that we used a multilevel design enabled us to determine in which contexts the women studied were disadvantaged.

Practical implications

The broader goal pursued in our research was to produce findings that may be used to suggest concrete ways to reduce the gender differences on the labour market. Although they are based on limited evidence, our results suggest that access to information on actual work conditions, as opposed to strictly formalized aspects of work conditions, may be gendered in some workplaces. Therefore, it seems particularly important that female workers do not take for granted that they will be informed of all perks and advantages offered by their employers and keep an eye open for these. At the organizational level, employers, administrators, unions and other associations of workers ought to examine actual practices to detect the ones that may disadvantage female workers. In particular, our results suggest paying close attention to practices that lack transparency, for which there are

no pre-established criteria or for which a clear description is not available to all parties involved.

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Appendixes

Appendix 1. Survey questions used in article #1

Q13. Au cours de la dernière année académique, vous est-il arrivé d'accepter des contrats de recherche privés?

- ... Souvent 1
- ... À l'occasion 2
- ... Rarement 3
- ... Jamais 4

Q48. De façon générale, jusqu'à quel point êtes-vous satisfait(e) …

		Très satisfait(e)	*Assez satisfait(e)*	*Peu satisfait(e)*	*Pas du tout satisfait(e)*
Q48.1	• .. de votre rémunération actuelle?	1	2	3	4
Q48.2	• .. de l'allocation de dépenses reliées à la fonction?	1	2	3	4

Q49. En ce qui a trait à l'amélioration de la prochaine convention collective, quelle priorité accordez-vous aux éléments suivants :

		Très prioritaire	*Assez prioritaire*	*Peu prioritaire*	*Pas du tout prioritaire*
Q49.3	• ... Augmentation de l'allocation pour les dépenses reliées à la fonction	1	2	3	4
Q49.4	• ... Bonification de l'échelle salariale	1	2	3	4

Q57. Quel est votre rang?

- ... Adjoint(e) 1
- ... Agrégé(e) 2
- ... Titulaire 3

Q58. Combien d'années d'exercice comptez-vous à votre rang actuel? __ __ années d'exercice

Q59. Au moment de votre nomination à [Nom de l'université], combien aviez-vous d'années d'expérience de travail à titre professionnel? _ _ années d'expérience ➢ Si 0, PASSEZ À LA Q61

Q60. De quel type était surtout cette expérience antérieure à votre nomination comme professeur(e) ou chercheur(e) à [Nom de l'université]?

- .. Enseignement 1
- .. Recherche 2
- .. Gestion 3
- .. Autre 8

Q61. Depuis votre nomination, bénéficiez-vous ou avez-vous bénéficié …

	Oui	*Non*
• …d'une prime de marché?	1	2
• …d'une prime de fonction liée à des responsabilités administratives?	1	2
• …d'un autre type de prime?	1	2

Q62. Combien d'années d'ancienneté avez-vous cumulées depuis votre nomination à [Nom de l'université]? __ __ années d'ancienneté

➢ Si moins de 6 années, PASSEZ À LA Q71

Q73. À quelle faculté êtes-vous actuellement rattaché(e)?
(Si vous êtes rattaché(e) à la F.A.S., indiquez dans quel secteur : sciences sociales, sciences pures ou lettres et sciences humaines)

Aucune : 0
Aménagement :1
Droit : 2
Médecine : 3
Médecine dentaire : 4
Médecine vétérinaire : 5
Musique : 6
Pharmacie : 7
Sciences infirmières : 8
Sciences de l'éducation : 9
FAS : 10
FAS – sciences pures :11
FAS – sciences sociales et psycho. : 12
FAS – lettres et sciences humaines : 13
Théologie : 14
Optométrie : 15
Éducation physique (kinésiologie) : 16
Autres : 17

Q74. Vivez-vous présentement avec un(e) conjoint(e)?

• …Oui 1
• …Non ..... 2 ➢ PASSEZ À LA Q76

Q75. Quelle est la principale occupation de votre conjoint(e)?

• …Professeur(e) d'université 1
• …Enseignement (non-universitaire) 2
• …Autre emploi professionnel 3
• …Emploi non professionnel 4
• …Sans emploi 5
• …À la retraite 6
• …Étudiant(e) 7
• …Autre 8

Q76. Actuellement, combien avez-vous d'enfants qui vivent avec vous au moins la moitié du temps?

- .. Q76.1 : De moins de 6 ans? __
- .. Q76.2 : De 6 à 12 ans ? __
- .. Q76.3 : De 13 à 17 ans? __
- .. Q76.4 : De 18 ans ou plus? __

Q77. Jusqu'à quel point est-il difficile pour vous de concilier vos obligations comme professeur(e)ou chercheur(e) et vos obligations familiales? C'est …

- .. Souvent difficile 1
- .. Parfois difficile 2
- .. Rarement difficile.....3
- .. Jamais difficile ou presque 4

Q78. Au cours des deux dernières années académiques, avez-vous dû assumer des charges familiales lourdes?
(parent handicapé, en perte d'autonomie, demandant des soins importants)

- .. Oui.....1
- .. Non.....2

Q79. Quelle est votre année de naissance?

19 _ _

Q80. Quel est votre sexe?

- .. Homme 1
- .. Femme 2

Appendix 2. Thematic outline for semi-directed interviews (article #3)

Thèmes à aborder	Indicateurs
Règles qui encadrent la prise de décision en ce qui a trait à l'octroi des primes de marché et aux montants à verser.	• Présence de règles • Contenu des règles • "Provenance" des règles (établies par le directeur ou provenant d'autres instances) • Appréciation de la facilité/difficulté d'application des règles
Processus de décision en place pour l'octroi des primes de marché et la détermination de leurs montants.	• Comment on en vient à la décision de verser une prime à un professeur nouvellement embauché. • Comment on en vient à la décision de verser une prime à un professeur en cours de carrière. • Comment on détermine le montant de la prime à verser • Description de cas-types • Fréquence à laquelle les primes sont octroyées sous l'initiative du département ou en réaction à une offre salariale faite à un professeur par un employeur potentiel • Rôle et pouvoir de la faculté dans l'attribution des primes
Informations fournies sur les primes aux directeurs de départements et aux professeurs	• Nature des informations • Disponibilité des informations
Changements dans l'usage des primes durant les dernières années.	• Chronologie des changements • Nature des changements (règles, leur application, etc.) • Contexte des changements
Critiques par les professeurs du département de la pratique de versement de primes de marché.	• Nature des critiques • Circonstances des critiques

Appendix 3. Consent form #1

(Used for all adminisrators but a Vice-president and the President)

FORMULAIRE DE CONSENTEMENT

Titre de la recherche : Étude des modes de rémunération des professeurs d'université : le cas des primes de marché à [Nom de l'Université].

Chercheure *: Christine Doucet, étudiante au doctorat en sociologie, Université de Montréal*

Directeur de recherche : *Claire Durand, professeur titulaire au département de sociologie, Université de Montréal*

Co-directeur de recherche : *Michael Smith, professeur titulaire au département de sociologie de l'Université McGill*

A) RENSEIGNEMENTS AUX PARTICIPANTS

1. Objectifs de la recherche.

Ce projet de recherche vise à mieux comprendre la pratique de versement de primes de marché aux professeurs de [Nom de l'Université].

2. Participation à la recherche

Votre participation à cette recherche consiste à rencontrer la chercheure pour un entretien d'une durée d'environ 45 minutes où vous ferez part de vos connaissances concernant la pratique de versement de primes de marché qui avait cours alors que vous occupiez un poste de direction dans un department ou une faculté à [Nom de l'Université] entre 2000 et 2005. Votre contribution viendra complémenter les résultats obtenus à l'aide de données institutionnelles. Si vous y consentez, l'entretien sera enregistré sur enregistreur numérique.

3. Confidentialité

Seule la chercheure aura accès aux enregistrements des entretiens. De plus, chaque participant à la recherche se verra attribuer un numéro et seule la chercheure aura la liste des participants et des numéros qui leur auront été attribués. Les données seront conservées dans un classeur sous clé situé dans un bureau fermé. Toutes les données seront détruites 7 ans après la fin du projet. Aucune information permettant de vous identifier d'une façon ou d'une autre ne sera publiée.

4. Avantages et inconvénients

En participant à cette recherche, vous pourrez contribuer à l'avancement des connaissances sur les modes de rémunération des professeurs d'université. Ce projet ne comporte ni inconvénient ni bénéfice personnel pour les participants.

5. Droit de retrait

Votre participation est entièrement volontaire. Vous êtes libre de vous retirer en tout temps par avis verbal, sans préjudice et sans devoir justifier votre décision. Si vous décidez de vous retirer de la recherche, vous pouvez communiquer avec la chercheure, au numéro de téléphone indiqué à la dernière page de ce document. Si vous vous retirez de la recherche, les renseignements qui auront été recueillis au moment de votre retrait seront détruits.

B) CONSENTEMENT

Je déclare avoir pris connaissance des informations ci-dessus, avoir obtenu les réponses à mes questions sur ma participation à la recherche et comprendre le but, la nature, les avantages, les risques et les inconvénients de cette recherche.

Après réflexion et un délai raisonnable, je consens librement à prendre part à cette recherche. Je sais que je peux me retirer en tout temps sans préjudice et sans devoir justifier ma décision.

Signature : _____ Date : _____

Nom : _____ Prénom : _____

Je déclare avoir expliqué le but, la nature, les avantages, les risques et les inconvénients de l'étude et avoir répondu au meilleur de ma connaissance aux questions posées.

Signature de la chercheure_____ Date : _____
(ou de son représentant)

Nom : _____ Prénom : _____

Pour toute question relative à la recherche, ou pour vous retirer de la recherche, vous pouvez communiquer avec Christine Doucet, étudiante au doctorat en sociologie à l'Université de Montréal, au numéro de téléphone suivant : (514) 343-6111, poste 3910, ou à l'adresse courriel suivante : **********.

Toute plainte relative à votre participation à cette recherche peut être adressée à l'ombudsman de l'Université de Montréal, au numéro de téléphone (514) 343-2100 ou à l'adresse courriel **********. **(L'ombudsman accepte les appels à frais virés).**

Un exemplaire du formulaire de consentement signé doit être remis au participant

Appendix 4. Consent form #2

(Used for Vice-president and President)

FORMULAIRE DE CONSENTEMENT

Titre de la recherche : Étude des modes de rémunération des professeurs d'université : le cas des primes de marché à [Nom de l'Université]..

Chercheure *: Christine Doucet, étudiante au doctorat en sociologie, Université de Montréal*

Directeur de recherche : *Claire Durand, professeur titulaire au département de sociologie, Université de Montréal*

Co-directeur de recherche : *Michael Smith, professeur titulaire au département de sociologie de l'Université McGill*

A) RENSEIGNEMENTS AUX PARTICIPANTS

1. Objectifs de la recherche.

Ce projet de recherche vise à mieux comprendre la pratique de versement de primes de marché aux professeurs de [Nom de l'Université].

2. Participation à la recherche

Votre participation à cette recherche consiste à rencontrer la chercheure pour un entretien d'une durée d'environ 45 minutes où vous ferez part de vos connaissances concernant la pratique de versement de primes de marché qui avait cours alors que vous occupiez un poste au rectorat de [Nom de l'Université] entre 2000 et 2005. Votre contribution viendra complémenter les résultats obtenus à l'aide de données institutionnelles. Si vous y consentez, l'entretien sera enregistré sur enregistreur numérique.

3. Confidentialité

Seule la chercheure aura accès aux enregistrements des entretiens. De plus, chaque participant à la recherche se verra attribuer un numéro et seule la chercheure aura la liste des participants et des numéros qui leur auront été attribués. Les données seront conservées dans un classeur sous clé situé dans un bureau fermé. Toutes les données seront détruites 7 ans après la fin du projet. Si votre nom ou des extraits de l'entrevue permettant de vous identifier devaient apparaître dans une publication quelle qu'elle soit, la chercheure vous transmettrait au préalable ces informations et vous demanderait si vous acceptez qu'elles soient publiées. Vous pourriez alors prendre

connaissance du texte et les informations permettant de vous identifier ne seraient publiées que si vous donniez votre consentement écrit. Vous pourriez, à la même occasion, indiquer si vous acceptez ou non que votre nom apparaisse à la section des remerciements aux différentes personnes ayant contribué à la recherche. Vous êtes tout à fait libre de consentir ou non à la publication de ces informations.

4. Avantages et inconvénients

En participant à cette recherche, vous pourrez contribuer à l'avancement des connaissances sur les modes de rémunération des professeurs d'université. Ce projet ne comporte ni inconvénient ni bénéfice personnel pour les participants.

5. Droit de retrait

Votre participation est entièrement volontaire. Vous êtes libre de vous retirer en tout temps par avis verbal, sans préjudice et sans devoir justifier votre décision. Si vous décidez de vous retirer de la recherche, vous pouvez communiquer avec la chercheure, au numéro de téléphone indiqué à la dernière page de ce document. Si vous vous retirez de la recherche, les renseignements qui auront été recueillis au moment de votre retrait seront détruits.

B) CONSENTEMENT

Je déclare avoir pris connaissance des informations ci-dessus, avoir obtenu les réponses à mes questions sur ma participation à la recherche et comprendre le but, la nature, les avantages, les risques et les inconvénients de cette recherche.

Après réflexion et un délai raisonnable, je consens librement à prendre part à cette recherche. Je sais que je peux me retirer en tout temps sans préjudice et sans devoir justifier ma décision.

Signature : _____ Date : _____

Nom : _____ Prénom : _____

Je déclare avoir expliqué le but, la nature, les avantages, les risques et les inconvénients de l'étude et avoir répondu au meilleur de ma connaissance aux questions posées.

Signature de la chercheure_____ Date : _____
(ou de son représentant)

Nom : _____ Prénom : _____

Pour toute question relative à la recherche, ou pour vous retirer de la recherche, vous pouvez communiquer avec Christine Doucet, étudiante au doctorat en sociologie à l'Université de Montréal, au numéro de téléphone suivant : (514) 343-6111, poste 3910, ou à l'adresse courriel suivante : **********.

Toute plainte relative à votre participation à cette recherche peut être adressée à l'ombudsman de l'Université de Montréal, au numéro de téléphone (514) 343-2100 ou à l'adresse courriel **********. **(L'ombudsman accepte les appels à frais virés).**

Un exemplaire du formulaire de consentement signé doit être remis au participant

Appendix 5. Authorizations of co-authors and journal editor

Université de Montréal Faculté des études supérieures et postdoctorales

ACCORD DES COAUTEURS D'UN ARTICLE INCLUS DANS UN MÉMOIRE DE MAÎTRISE OU UNE THÈSE DE DOCTORAT

Lorsqu'un étudiant n'est pas le seul auteur d'un article qu'il veut inclure dans son mémoire ou dans sa thèse, il doit obtenir l'accord de tous les coauteurs. De plus, le nom de tous les coauteurs doit apparaître dans le manuscrit pour chacun des articles. Enfin, une déclaration distincte doit être complétée et ce, également pour chacun des articles inclus dans le mémoire ou la thèse.

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1. Identification

Nom	Prénom	Code permanent
Doucet	Christine	[redacted]
Grade	**Programme**	
Ph.D.	Doctorat en sociologie	

2. Description de l'article

Auteurs
Christine Doucet, Claire Durand et Michael Smith

Titre Who Gets Market Supplements? Gender Differences within a Large Canadian University

État actuel de l'article ☑ publié ☐ soumis pour publication ☐ en préparation

Revue / journal *
Canadian Journal of Higher Education, Vol. 38, No. 1 (2008), pp. 67-103.

** Si l'article est en phase finale de préparation ou a été soumis pour publication, veuillez fournir tous les détails disponibles.*

3. Déclaration de tous les coauteurs autres que l'étudiant

À titre de coauteur de l'article identifié ci-dessus, j'autorise : **Christine Doucet**
à inclure cet article dans ☐ son mémoire de maîtrise ☑ sa thèse de doctorat
qui a pour titre *Gender differences in pay among faculty members of a large Canadian research university: the role of individual and organizational determinants*

Claire Durand	[redacted]	2 novembre 2010
Coauteur	Signature	Date
Michael Smith	[redacted]	2 novembre 2010
Coauteur	Signature	Date
Coauteur	Signature	Date
Coauteur	Signature	Date

FESP / formulaire accord des coauteurs mémoire ou thèse par articles / août 2009

Imprimer [redacted]

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Lorsqu'un étudiant n'est pas le seul auteur d'un article qu'il veut inclure dans son mémoire ou dans sa thèse, il doit obtenir l'accord de tous les coauteurs. De plus, le nom de tous les coauteurs doit apparaître dans le manuscrit pour chacun des articles. Enfin, une déclaration distincte doit être complétée et ce, également pour chacun des articles inclus dans le mémoire ou la thèse.

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1. Identification

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Doucet	Christine	[redacted]
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Auteurs
Christine Doucet, Claire Durand et Michael Smith

Titre Who Gets Market Supplements? Gender Differences within a Large Canadian University

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Claire Durand	[redacted]	2 novembre 2010
Coauteur	Signature	Date
Michael Smith	[redacted]	2 novembre 2010
Coauteur	Signature	Date
Coauteur	Signature	Date
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Lesley Andres

Department of Educational Studies, Faculty of Education, University of British Columbia

2125 Main Mall, Vancouver, B.C. V6T 1Z4

3. Identification de l'article

Auteur(s) : Christine Doucet, Claire Durand, Michael Smith

Titre : *Who Gets Market Supplements? Gender Differences within a Large Canadian University.*

N° de la revue, page initiale et finale et date de publication :

Vol. 38, No. 1, pp. 67-103, 2008

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Dear Christine,

I apologize for the late response as I just returned from Africa.

Consider this email as permission to reproduce your article in the CJHE in your dissertation.
Please acknowledge the journal in your dissertation.

Best wishes,

Lesley

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academic web site: http://www.edst.educ.ubc.ca/faculty/andres.html

research web site: http://www.edst.educ.ubc.ca/paths/paths.htm

New book:

Andres, Lesley & Wyn, Johanna (2010). The making of a generation: Children of the 1970s in adulthood. Toronto: University of Toronto Press.

http://edst.educ.ubc.ca/sites/edst.educ.ubc.ca/files/faculty_uploads/u20/AndresMakingofaGenerationFlyer.pdf

On 2010-11-03, at 7:43 PM, Doucet Christine wrote:

Dear Mrs. Andres,

I am one of the co-authors of an article published in the CJHE in 2008. This article is part of my doctoral research. I will be submitting my doctoral dissertation soon and I need the authorization from the journal's editor to include the article in it (evidently, with proper reference to the journal). Would it be possible to

email me this authorization? Here is the complete reference:

Doucet, Christine, Claire Durand, and Michael Smith. 2008. "Who Gets Market Supplements? Gender Differences within a Large Canadian University." *Canadian Journal of Higher Education*, Vol. 38, No. 1, pp. 67-103.

Best regards,

Christine Doucet
Candidate au doctorat
Département de sociologie
Université de Montréal
(514) 343-6111 poste 3910

Appendix 6. Table 3 (modified). Multilevel logistic regressions of the presence of market supplements and CRCs (Article #2)

Table 3 (modified). Multilevel logistic regressions of the presence of market supplements and CRCs (Article #2)

	Model 0		Model 1		Model 2		Model 3		Model 4		Model 5		Gender main effect only	
Intercept model	β	Exp(β)	β	Exp(β)	β	Exp(β)	β	Exp(β)	β	Exp(β)	β	Exp(β)	β	Exp(β)
Intercept	-1.24***	0.29	-1.17***	0.31	-1.00***	0.37	-0.77**	0.46	-1.26***	0.28	-1.16***	0.31	-0.97***	0.38
Academic sector on intercept														
Social science/psychology									ref		ref		ref	
Pure/applied science									0.31	1.36	0.22	1.25	0.11	1.11
Humanities									-0.59*	0.55	-0.44+	0.64	-0.59*	0.56
Medicine									-0.39+	0.68	-0.43+	0.65	-0.65**	0.52
Specialized medicine									1.78***	5.93	1.75***	5.76	1.66***	5.25
Nursing/education									-0.41	0.67	-0.34	0.71	-0.32	0.72
Econ., law, computer sc.									1.88***	6.55	1.90***	6.69	1.85***	6.38
Others									-0.19	0.83	-0.21	0.81	-0.51*	0.60
Female represent. on intercept														
0-29%							ref				ref		ref	
30-39%							-0.53*	0.59			-0.34	0.71	-0.42	0.66
40%+							-0.71*	0.49			-0.13	0.88	-0.44*	0.64
Female on intercept			-0.28*	0.76	-0.33**	0.72	-0.11	0.89	-0.30	0.74	0.17	1.19	-0.44**	0.64
Acad. sector on female														
Social science/psychology									ref		ref			
Pure/applied science									0.36	1.44	-0.09	0.91		
Humanities									-0.28	0.76	-0.32	0.73		
Medicine									-0.57	0.56	-0.71*	0.49		
Specialized medicine									0.11	1.12	-0.24	0.79		
Nursing/education									-0.02	0.98	0.02	1.02		
Econ., law, computer sc.									0.28	1.32	0.14	1.15		
Others									-1.14**	0.32	-1.34**	0.26		

	Model 0		Model 1		Model 2		Model 3		Model 4		Model 5		Gender main effect only	
Intercept model	β	Exp(β)	β	Exp(β)	β	Exp(β)	β	Exp(β)	β	Exp(β)	β	Exp(β)	β	Exp(β)
Female represent. on female														
0-29%							ref				ref			
30-39%							-0.24	0.79			-0.45	0.64		
40%+							-0.77*	0.46			-0.82*	0.44		
Change model														
Year	0.08***	1.08	0.08***	1.08	0.09***	1.09	0.09***	1.09	0.11***	1.11	0.11***	1.11	0.11***	1.11
Associate professor					-0.20*	0.82	-0.20*	0.82	-0.23*	0.79	-0.23*	0.80	-0.24*	0.79
Full professor					-0.27*	0.76	-0.26*	0.77	-0.28*	0.75	-0.27*	0.76	-0.29*	0.75
Variance components														
Between person: intercept	7.104***		7.081***		7.153***		7.172***		7.201***		7.227***		7.213***	
Between units : intercept	3.370***		3.236***		3.261***		2.751***		0.668***		0.540***		0.561***	
N at level 1 (within-person)	11 170		11 170		11 170		11 170		11 170		11 170		11 170	
N at level 2 (individuals)	1 882		1 882		1 882		1 882		1 882		1 882		1 882	
N at level 3 (units)	64		64		64		64		64		64		64	

Estimation using full Penalized Quasi-Likelihood (PQL) with Bernoulli distribution at level-1. Parameter estimates are reported from the population-average model. p<,001*** p<,01** p<,05* p<,10 +

Appendix 7. Table 1 (modified). Hierarchical logistic regression of the presence of market supplements (Article #1)

Table 1 (modified). Hierarchical logistic regression of the presence of market supplements (Article #1)

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Family /no research	
Variables in analysis	ß	exp ß	ß	exp ß	ß	exp ß	ß	exp ß	ß	exp ß	ß	exp ß	ß	exp ß
Gender	W: 11.77 p=0.001		W: 6.82 p=0.009		W:6.50 p=0.011		W: 10.20 p=0.001		W: 10.88 p=0.001		W: 12.41 p=0.000		W: 9.87 p=0.002	
Women	-0.88**	0.42	-0.74**	0.48	-0.73*	0.48	-1.00**	0.37	-1.08**	0.34	-1.05***	0.35	-0.91**	0.40
Sector (ref.: humanities)			W: 52.34 p=0.000		W: 49.13 p=0.000		W: 44.31 p=0.000		W : 45.46 p=0.000		W: 54.91 p=0.000		W: 55.36 p=0.000	
Pure and applied science			2.63***	13.88	2.57***	13.08	2.82***	16.73	2.92***	18.48	2.41***	11.18	2.37***	10.72
Social science/psychology			1.82**	6.15	1.74**	5.70	1.77**	5.88	1.83**	6.21	1.36*	3.89	1.52**	4.58
Medicine			0.83	2.28	0..77	2.15	0.82	2.28	0.91	2.49	0.10	1.10	0.41	1.51
Specialized medicine			3.25***	25.73	3.14***	23.08	3.13***	22.76	3.27***	26.41	2.67***	14.49	2.65***	14.15
Nursing/education			1.48*	4.41	1.47*	4.34	1.33	3.80	1.46	4.30	0.98	2.65	0.98	2.67
Other sector			1.78**	5.91	1.82**	6.14	1.81**	6.09	1.89**	6.59	1.45**	4.27	1.39*	4.02
Frequency of research contracts (ref. : never)			W: 8.38 p=0.015		W: 6.58 p=0.037		W: 5.96 p=0.051		W: 5.72 p=0.057		W: 8.02 p=0.018			
Often or occasionally			0.82**	2.28	0.74*	2.10	0.77*	2.16	0.76*	2.14	0.84**	2.31		
Rarely			0.49	1.64	0.43	1.54	0.39	1.48	0.43	1.54	0.35	1.41		
Award of Canada Research Chair			W: 3.82 p=0.051		W: 3.68 p=0.055		W: 3.10 p=0.078		W: 2.97 p=.085					
Yes			2.07+	7.93	2.21+	9.10	2.05+	7.73	2.04+	7.68				
Research assistants			W: 0.93 p=0.335		W: 0.89 p=0.34		W: 2.926 p=0.087		W: 3.37 p=.066		W: 2.28 p=0.131			
Yes			0.25	1.28	0.25	1.28	0.48+	1.62	0.53+	1.70	0.40	1.49		
Post-doctoral fellows			W: 1.38 p=0.240		W: 1.58 p=0.208		W: 0.54 p=0.464		W: 0.40 p=0.526					
Yes			-0.35	0.71	-0.38	0.69	-0.25	0.78	-0.22	0.80				
Priority: improv. of salary (ref.: low/not a priority)					W: 7.28 p=0.026		W: 7.20 p=0.027		W: 7.50 p=0.023		W: 7.62 p=0.022		W: 8.77 p=0.012	
High priority					1.03*	2.80	1.00*	2.71	1.03*	2.80	0.87*	2.38	1.09*	2.98
Medium priority					0.53	1.71	0.42	1.53	0.43	1.54	0.27	1.31	0.57	1.77
Seniority within rank (ref.: assistant prof.)							W: 17.14 p=0.002		W: 18.00 p=0.001		W: 19.79 p=0.001		W: 16.19 p=0.003	
Associate prof. 6 years -							-0.28	0.76	-0.28	0.76	-0.20	0.82	-0.11*	0.90
Associate prof. 7 years +							-0.90*	0.41	-1.01*	0.36	-0.97*	0.38	-0.89*	0.41
Full professor 6 years -							-1.28**	0.28	-1.33**	0.27	-1.10**	0.33	-0.75*	0.47
Full professor 7 years +							-1.48***	0.23	-1.63***	0.20	-1.52***	0.22	-1.38***	0.25

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Family /no research	
Variables in analysis	ß	exp ß	ß	exp ß	ß	exp ß	ß	exp ß	ß	exp ß	ß	exp ß	ß	exp ß
Age at appointment (ref.: under 30)							W: 2.35 p=0.504		W: 2.13 p=0.546					
31-35 years old							0.07	1.07	0.07	1.07				
36-40 years old							-0.40	0.67	-0.40	0.67				
41 years old +							0.19	1.21	0.14	1.16				
Nb. years of prior experience (ref.: None)							W: 2.28 p=0.516		W: 2.30 p=0.513					
1-4 years							0.69	1.99	0.68	1.97				
5-9 years							0.58	1.79	0.57	1.77				
10 years+							0.70	2.10	0.73	2.07				
Type of experience (ref.: teaching)							W:0.19 p=0.91		W:0.21 p=0.90					
Research							-0.05	0.95	-0.05	0.95				
Other							0.12	1.13	0.13	1.14				
Receipt of administrative stipends							W: 2.77 p=0.096		W: 2.82 p=0.093		W=3.13 p=0.077		W: 4.49 p=0.034	
Yes							0.61+	1.83	0.62+	1.85	0.60+	1.82	0.68*	1.97
Presence of children									W: 0.88 p=0.349				W: 2.00 p=0.157	
Yes									-0.28	0.76			0.37	1.45
Spouse main occupation (ref.: univ. prof.)									W: 1.16 p=0.762				W: 1.86 p=0.602	
Other profes. occupation									-0.34	0.71			-0.39	0.68
Other occupation									-0.10	0.91			-0.12	0.89
No spouse									-0.05	0.95			-0.45	0.64
Nagelkerke R2	0.039		0.261		0.281		0.339		0.345		0.317		0.284	
-2Log likelihood	528.290		446.217		438.452		414.132		411.512		458.003		484.89	
df	1		12		14		27		31		17		18	