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Abstract
This paper investigates the gender earnings gap, adjusted for key determinants, for individuals employed in clerical and professional level information systems positions for the period from 1991 through 2008. It explores changes in the earnings gap for IS workers, and specifically examines changes which occurred relative to the so-called internet “bubble” observed during the late 1990s. Empirical analysis of the wage gap is based on data from the Current Population Survey (CPS). Examination of these data suggests that the gender earnings gap is persistent, despite frequent claims to the contrary from industry surveys. It is narrower for professional level positions. Furthermore, the data suggest that professional level female IS workers may have indeed experienced a beneficial effect from the internet “bubble” of the late 1990s, but it is unknown whether or not that effect may be fading in the internet “bust” of the early 21st century.

1. Introduction

A robust gender-based difference in earnings persists in the U.S. labor force, spanning industries, occupations, job levels, and economic climates. In spite of decades of legislation, diversity initiatives, significant public awareness, support networks, and individual strategies, women have not made significant progress towards achieving salary parity with men. Researchers in a variety of academic disciplines have attempted to understand this phenomenon, in the hopes of contributing to the development of change strategies for public policy, educational institutions, business organizations, and individual women. These theoretical explanations have primarily emerged from the disciplinary frameworks of economics, sociology and social/cognitive psychology [3] [44].

Over the last half century, a rapidly expanding and dynamic occupational sector has emerged in Information Systems. The growth of this sector has spawned a powerful mythology of a kind of sub-culture within the world of work. These well-documented [44] beliefs comprise a self-depicted saga of meritocracy, innovation, and individualism, largely freed from the baggage of the industrial heritage of the 20th Century. It has long been argued that IS professionals are a different breed [13], and that traditional rules do not apply. For decades, it has been asserted that IS jobs are somehow different [20], and that IS professionals possess uniquely transferable job skills, which can be applied across a very broad range of organizations and industries. It is also suggested that the gender wage discrepancies that persist in the US economy at large, do not appear, or are vastly diminished, between men and women who work in IS.

The purposes of the current study are to track the gender wage gap among IS workers since 1991, using data from the Current Population Survey (CPS), with particular emphasis on the period commonly referred to as the “Internet Bubble” of the late 20th century. A previous study [22] investigated the gender wage gap using CPS data at five year intervals from 1975 through 1990, inclusive. The analysis here is conducted in greater detail, and begins where that study left off. This study is designed to discover whether an enduring and significant wage gap actually remains, even after the typical sociological explanations (e.g., occupational segregation into "hard" and "soft" subfields) and economic explanations (e.g. differential human capital inputs) are accounted for, and how, if at all, the nature of that gap might have changed during a period of unprecedented demand for information technology professionals.
This research considers the following questions:

- Have IS occupations exhibited a diminishing gender wage gap since 1990?
- Did the “internet bubble” result in a smaller gender wage gap – suggesting that organizations might alter or abandon discriminatory practices when facing a relative scarcity of skilled IS workers?
- Did the collapse of the internet bubble have a disproportionate affect on female knowledge workers? As the so-called “new economy” contracted, was there a return to a higher level of gender wage inequity in IS occupations?

2. Theoretical Foundation

Numerous studies have demonstrated the existence and persistence of the gender wage gap in the general US economy. Isaacs [26] cites a finding from American Demographics that women employed full-time with two years or less experience earn 72% of the level for their male peers. A Wall Street Journal study of corporate managers found that women with the same credentials as their male peers earned approximately 82% of the wages for their male counterparts. Other studies (e.g. [31]) have found that after adjusting for college majors, starting salaries for male and female college graduates are approximately equivalent. It may appear that while both men and women begin their careers on equal footing, the gender wage gap can develop very quickly.

Many researchers distinguish among three explanatory frameworks - psychological, sociological, and economic - to provide an understanding of the persistence of this gender gap. A psychological framework may include actual individual differences in cognitive aptitude [8] but primarily considers stereotypes, expectations, and preferences of employers. It is also important to distinguish between a blatant bias that prevents equitable selection and compensation of women because of employers’ distastes for hiring them, and a more subtle "statistical discrimination", in which employers act upon expectations of productivity differentials [35]. The latter generates group discrimination through self-fulfilling prophecies, and lower payment of high-performing group members based on an assumed lower average productivity of that group. There is a widely held belief that men are better at negotiations, better understanding the process, and are able to bring greater aggressiveness and confidence to the salary negotiating table [15]. This suggests that women may tend to believe this is the “male way”, recognizing inherent gender differences in negotiating behavior.

In typically male-dominated disciplines, such as science and engineering, research has pointed to conflicts between stereotypes of women and cultural stereotypes of professional success [21]. A great deal of social/cognitive psychological research has looked at mechanisms such as implicit theories, perceptions of similarity and attraction, and schematic in-group/out-group categorization as explanations of barriers to mentoring and advancement for women.

The sociological framework explains the gap as primarily deriving from institutional barriers to full participation. This perspective maintains that women face substantial barriers to acceptance and success. As an example, in academic institutions, women have been denied a level playing field due to such factors as issues in early education (inhibiting women from entering undergraduate programs in those fields), college and post-graduate education [28], lack of role models and mentors, inequitable distribution of resources and opportunities to women faculty, male-dominated cultures that perpetuate stereotypes, difficulty gaining credibility, and lack of institutional support for efforts to balance career and family demands [39].

On a more macro level, the sociological perspective points to differences in industrial sectors, occupational categories, and types of firms to which men and women tend to be attracted [3]. It is suggested that women are more often concentrated in lower-paying support and service occupations, and even when they hold line and management positions, these tend to be in lower paying, female-dominated industries [1]. After nearly two decades of movement toward managerial integration, there remains no conclusive evidence that the entry of some women into the managerial ranks has brought material benefits to the majority who remain below [9].

The human capital framework holds that wages are largely determined by employees' long-term inputs into the labor process. Factors such as education, work experience, and job tenure explain much of the difference between men's and women's pay for nominally similar work. Specifically, human capital theory would predict that women would earn less than men, due to interrupted patterns of employment which result in less investment in training, education, or continuous job tenure [3] [25] [38]. The contention is that wage differences would disappear when human capital factors are held constant [3]. Conversely, if the wage differences remain after controlling for human capital variables, one could conclude that investments in training, education, and experience yield different returns for men than for women [25]. Despite an apparent difference in education, women are able to
better overcome this deficit, and maintain comparable productivity to men [7].

One study [34] did find that the salary gap was smaller for women who successfully completed an MBA than for matched peers who were accepted into MBA programs but chose not to enter or dropped out of the programs. The wage gap among matched non-MBAs was 14%, and 9% among MBAs. However, studies have also found significant wage gaps in advanced careers, including attorneys [36], Ph.D. economists [41], and Ph.D. computer scientists [26].

3. The Current Study

The current study is based on the approach described in [22], to test a human capital theory explanation for the gender wage gap among IS workers over time. According to human capital theory [3] [18] [22] [25], true gender discrimination is demonstrated only if all variables other than gender which influence wages (that is, the human capital inputs) are controlled for. While it is unlikely that a study can control for all such variables, the current study follows the choice of human capital and demographic variables that have been frequently cited in the literature (education, experience, marital status, race, job type, industrial sector, urban density, and geographic region). Wages of men and women in the IS related professions, controlled for these human capital and demographic variables, are tracked annually for the period of interest.

3.1 Methodology

Data are drawn from the database of the Current Population Survey (CPS), a monthly survey which has been conducted for over 50 years by the U.S. Bureau of Labor Statistics and the Bureau of the Census [14]. CPS data are the undisputed “gold standard” of data in demographic research. Each month, over 50,000 households are scientifically sampled and interviewed, providing employment data used by policymakers, legislators, academics, the press, and the general public. The CPS is widely regarded as a representative sample of the general population for research purposes. Data are accessed by use of Ferret (Federal Electronic Research and Review Extraction Tool), a web-based statistical and database extraction tool developed explicitly for this system by the Bureau of Labor Statistics and the Census Bureau [17].

For the current study, data are taken from the March Annual Demographic Supplements (ADS) of the CPS for the years from 1991 to 2008. Samples are restricted to full-year, full-time, private sector workers in IS related occupations. Sample sizes for each year range from approximately 1,000 to 2,600 persons.

The samples are divided into cohorts based on gender and occupational class (professional or clerical). A major change in CPS occupational data classifications occurred in 2003, greatly expanding the number of IS-related positions.

Analysis is conducted both on a combined sample of IS workers (both professional and clerical), and separately for the professional occupations cohort. Specifically, regression analysis is used to construct profiles and to compare the relative earnings of men and women in both classes combined, as described in section 3.2.

The occupations that make up the clerical and professional sub-groups are as follows:

CPS Occupational Categories 1991 – 2002

Professional Cohort
- Systems Analysts
- Computer Programmers

Clerical Cohort
- Computer Equipment Operators
- Peripheral Equipment Operators
- Data Entry Clerks

CPS Occupational Categories 2003 – present

Professional Cohort
- IS Managers
- Systems Analysts
- Computer Programmers
- Computer Engineers
- Database Administrators
- Support Specialists
- Network Administrators
- Network Analysts
- Hardware Engineers

Clerical Cohort
- Computer Operators
- Data Key System Operators
- Word Processor Operators
- Desktop Publishing Equipment Operators
- Computer Repairers

3.2 Analysis

Analysis of the data is based on a technique known as the Oaxaca decomposition [37], which has been widely used by labor economists (e.g., [34] [35]) to compare groups known to be subject to different regimes. The fact that men and women are subject to
different earnings regimes is very well established in the literature.

The authors acknowledge, however, that Oaxaca’s technique is not without potential shortcomings. Discussion of two of the more commonly suggested issues with the method appear in [6] and [11]. Specifically, there are persistent questions about wage differentials based on demand v. supply side factors in the labor market, which Oaxaca’s methodology does not distinguish between. Another challenge results from the fact that the assortment of human capital variables used in the research may not represent ALL of the relevant factors. This type of analysis is based on otherwise unexplained residuals, so any inability to account for a significant source of variance would clearly be an issue of concern. However, this research specifically extends the work began in [22] and as a result, the variables chosen are the same set as employed in prior research to allow for comparison of results across these studies.

Regression analysis is used to estimate coefficients for the human capital and other demographic factors cited above, to predict earnings for men and women. While standard statistical (e.g. Chow) tests can assess the significance of the differences between cohorts, Oaxaca's technique allows for the consideration of questions that are much more interesting, such as: "How would men have fared if they had been treated the same way as women"? An illustration follows.

The present research recognizes that men and women are subject to different earnings regimes. Consider a standard regression model,

\[ D = A + ax1 + bx2 + cx3 + \ldots + e \]

in which D is the dependent variable, the natural log of annual earnings as reported by the participants in the CPS. Although this measure may be limited, (e.g. quality of work and quality of life issues may be excluded), the variables chosen and analyses described here are typical throughout the labor economics and Human Resources literature (e.g., [6] [8] [11] [34]).

This research seeks to establish a basis for future comparisons between IS professions and other occupations. The measurements chosen also provide consistent estimates across the time period, which is a primary focus of the research. A is the constant term, \( x_1 \ldots x_n \) are the independent variables. In this research, these will include traditional factors such as age, education, gender, marital status, experience, type of job, industry grouping, geographical category, etc. Finally, e is the error term. All of the coefficient values are estimates, of course. It is well known that the coefficient estimates for male and female cohorts are often significantly different. Thus, dividing the sample into cohorts by gender yields the following two equations:

\[ D_m = A_m + a_m x_{1m} + b_m x_{2m} + c_m x_{3m} + \ldots + e_m \]
\[ D_f = A_f + a_f x_{1f} + b_f x_{2f} + c_f x_{3f} + \ldots + e_f \]

with the m and f suffixes referring to the male and female cohorts. The underlying assumption is that \( A_m \) is potentially different from \( A_f \), etc. The difference \((D_m - D_f)\) provides us with one estimate of the earnings gap, but it is more interesting to see how men would have fared if they were subject to the same earnings regime as women. Consequently, we consider:

\[ D_{mf} = A_f + a_f x_{1m} + b_f x_{2m} + c_f x_{3m} + \ldots + e_f \]
\[ D_{fm} = A_m + a_m x_{1f} + b_m x_{2f} + c_m x_{3f} + \ldots + e_m \]

which suggests how women would have fared if they were subject to the male earnings regime. From this, it is possible to construct two estimates of the gender gap:

\[ D_m - D_{mf} \]
\[ D_f - D_{fm} \]

The following example applies the technique with sample data. Consider the group of men and women in the Professional jobs cohort for 1999. Male average (log) earnings are 10.8396. Female average earnings are 10.6454. The simple estimate of the earnings gap would be 10.8396 – 10.6454; approximately .194 (19.4%). However, if males are treated according to the female earnings regime, estimated male log earnings fall to 10.6538, and if females are treated according to the male earnings regime, estimated female log earnings rise to 10.8119. So, when females are treated according to the male earnings regime, the estimated wage gap is 10.8396 – 10.8119; approximately 0.028 (2.8%). Correspondingly, when males are treated according to the female earnings regime, the estimate of the gap is 10.6538 – 10.6454; approximately 0.08 (0.8%).

These alternatives may be of far greater use than the simple comparison of the differences between male and female earnings, which will tend to exaggerate the extent of the gender earnings gap. It is also important to distinguish between occupational cohorts, as women represent a greater proportion of the typically lower paying clerical group, and men a greater proportion of the higher paying professional group.
Using this approach, it is possible to more closely control for human capital and other demographic factors and produce more realistic estimates of the extent of the gender earnings gap.

4. Data Analysis & Interpretation

This section presents an abbreviated summary of the analysis of data. A complete exploration of all the permutations of possible analysis is far beyond the scope of this work, since space is limited.

The data consist of a typical range of human capital factors for full-year, full-time, private-sector workers earning between 5,000 and 250,000 dollars and working at least 40 weeks in the year for which the earnings data pertain (to filter outliers due to coding anomalies in the data and to maintain consistency with data collected for a larger future study) in IS related occupations, as listed below:

Dependent Variable
- Annual Earnings (natural log)

Independent Variables
- Age
- Education
- Experience
- Gender
- Marital Status
- Race
- Occupation
- Industry Group
- Population Density
- Region

Occupations, industry groups, regions and population density are coded as series of categorical (dummy) variables. Experience is a proxy derived from age and educational attainment and assumes that individuals have been continuously employed (in the categories specified) throughout the period of study. While the authors readily acknowledge the potential shortcoming of this assumption, there are no data available upon which to propose a more credible alternative.

It is also readily acknowledged that effects of experience in the workforce are traditionally different for males and females. Women, historically, have tended to take greater and longer absences from the workplace for family-related reasons. There is a small but growing percentage of males who are beginning to assume what have traditionally been female roles [42]. Official estimates of the “stay at home Dad” population begin at roughly 2.7 percent of the stay-at-home workforce. Anecdotal evidence suggests this may actually be as high as 20 percent, but while this is a compelling topic for future discussion, the restriction of the data sampling to full-year, full-time, private sector workers removes most if not all of these individuals from the sample populations regardless of gender.

Briefly, some of these factors have persistent and significant effects, while others have little to none. Age, education, experience and gender are invariably significant across all years and cohorts. Marital status and race are not. Occupation has more of an effect in the combined samples, and less once the distinction is made between the professional and clerical cohorts – as would be expected. Industry groups are occasionally significant, but clearly this interacts with other variables. In a given year, it might seem to matter if an individual worked in manufacturing or professional services, but in other years this factor would be statistically insignificant. Population density and region exhibit similar intermittent and inconsistent individual effects. In some years, it might be worth noting if an individual is from a large urban area, or from the northeast rather than the Midwest, etc., but these effects are also sporadic.

R-Squared values for the individual regression models are in the range of 45-55% for the combined samples and fall to 15 – 25% when the samples are confined to the professional occupation cohorts. Space limitations once again restrict the full discussion of these factors in this paper, and readers are encouraged to contact the authors for more information. In essence, the estimation of the gender earnings gap is based on the unexplained residuals.

4.1 Combined Samples Data

Interpretation of the results begins with an assessment of the overall extent of the gender earnings gap. Three estimates of the gap are available from the data used. The data are presented in Table 1 and Figure 1 that follow.

The first, which might be termed the “traditional” estimate, is obtained by taking the difference between men’s and women’s earnings for each of the years in question. The second, which is referred to as “male based”, is computed based on the difference between men’s earnings and the estimate of what men’s earnings would have been had men been treated according to the female earnings regime. Finally, the “female based” estimate considers the converse scenario of the difference between women’s earnings and the estimate of what women would have earned if treated according to the male earnings regime.
Table 1 – Gender Wage Gap Estimates 1991-2008 (Combined Cohorts)

<table>
<thead>
<tr>
<th>Year</th>
<th>Traditional Male-based</th>
<th>Female-based</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>42.6%</td>
<td>22.8%</td>
</tr>
<tr>
<td>1992</td>
<td>42.7%</td>
<td>29.9%</td>
</tr>
<tr>
<td>1993</td>
<td>44.7%</td>
<td>24.3%</td>
</tr>
<tr>
<td>1994</td>
<td>46.1%</td>
<td>23.3%</td>
</tr>
<tr>
<td>1995</td>
<td>46.2%</td>
<td>28.4%</td>
</tr>
<tr>
<td>1996</td>
<td>45.6%</td>
<td>38.1%</td>
</tr>
<tr>
<td>1997</td>
<td>45.2%</td>
<td>17.3%</td>
</tr>
<tr>
<td>1998</td>
<td>40.3%</td>
<td>24.3%</td>
</tr>
<tr>
<td>1999</td>
<td>51.5%</td>
<td>30.8%</td>
</tr>
<tr>
<td>2000</td>
<td>40.0%</td>
<td>24.6%</td>
</tr>
<tr>
<td>2001</td>
<td>44.7%</td>
<td>32.4%</td>
</tr>
<tr>
<td>2002</td>
<td>44.1%</td>
<td>31.8%</td>
</tr>
<tr>
<td>2003</td>
<td>67.3%</td>
<td>57.5%</td>
</tr>
<tr>
<td>2004</td>
<td>76.9%</td>
<td>56.8%</td>
</tr>
<tr>
<td>2005</td>
<td>61.2%</td>
<td>46.3%</td>
</tr>
<tr>
<td>2006</td>
<td>52.4%</td>
<td>37.6%</td>
</tr>
<tr>
<td>2007</td>
<td>46.4%</td>
<td>24.9%</td>
</tr>
<tr>
<td>2008</td>
<td>69.8%</td>
<td>54.3%</td>
</tr>
</tbody>
</table>

Table 2 - Sample Population Sizes from CPS Data 1991 - 2008

<table>
<thead>
<tr>
<th>Year</th>
<th>Male</th>
<th>Prof %</th>
<th>Fem</th>
<th>Prof %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>453</td>
<td>329</td>
<td>73</td>
<td>543</td>
</tr>
<tr>
<td>1992</td>
<td>481</td>
<td>360</td>
<td>75</td>
<td>507</td>
</tr>
<tr>
<td>1993</td>
<td>524</td>
<td>363</td>
<td>69</td>
<td>545</td>
</tr>
<tr>
<td>1994</td>
<td>499</td>
<td>378</td>
<td>76</td>
<td>398</td>
</tr>
<tr>
<td>1995</td>
<td>506</td>
<td>394</td>
<td>78</td>
<td>412</td>
</tr>
<tr>
<td>1996</td>
<td>434</td>
<td>358</td>
<td>82</td>
<td>366</td>
</tr>
<tr>
<td>1997</td>
<td>512</td>
<td>419</td>
<td>82</td>
<td>359</td>
</tr>
<tr>
<td>1998</td>
<td>589</td>
<td>472</td>
<td>80</td>
<td>410</td>
</tr>
<tr>
<td>1999</td>
<td>614</td>
<td>530</td>
<td>86</td>
<td>469</td>
</tr>
<tr>
<td>2000</td>
<td>672</td>
<td>578</td>
<td>86</td>
<td>460</td>
</tr>
<tr>
<td>2001</td>
<td>936</td>
<td>815</td>
<td>87</td>
<td>514</td>
</tr>
<tr>
<td>2002</td>
<td>965</td>
<td>838</td>
<td>87</td>
<td>550</td>
</tr>
<tr>
<td>2003</td>
<td>1362</td>
<td>1192</td>
<td>88</td>
<td>771</td>
</tr>
<tr>
<td>2004</td>
<td>1275</td>
<td>1167</td>
<td>92</td>
<td>688</td>
</tr>
<tr>
<td>2005</td>
<td>1439</td>
<td>1188</td>
<td>83</td>
<td>734</td>
</tr>
<tr>
<td>2006</td>
<td>1534</td>
<td>1268</td>
<td>83</td>
<td>713</td>
</tr>
<tr>
<td>2007</td>
<td>1512</td>
<td>1281</td>
<td>85</td>
<td>710</td>
</tr>
<tr>
<td>2008</td>
<td>1668</td>
<td>1458</td>
<td>87</td>
<td>680</td>
</tr>
</tbody>
</table>

Figure 1 – Gender Wage Gap Estimates 1991-2008 (Combined Cohorts)

Although it would be appealing to jump to the conclusion that there was a dramatic increase in the size of the wage gap in 2003, the reader is reminded that there was a significant change in the recording of occupational category data within the CPS, as well as a dramatic increase in the size of the sample populations, as shown in Table 2.

The sizes and composition of the sample groups, as shown in Table 2, provide a great deal of insight into the difficulty of accurately assessing the gender earnings gap. It is clear that, in terms of sheer numbers, males dominate the (higher paying) professional cohorts to a greater extent, without exception [24] [43]. However, there is a steady increase in the proportion of females in professional level positions, reflecting changes in the nature of IS occupations on a general level, and the role of women in the field as well. Conversely, the lower paying clerical occupations, which are diminishing over time, are female dominated. Keeping in mind that the CPS is designed to try and reflect these demographic properties, if males dominate higher paying jobs, it is important to distinguish between a more legitimate wage differential between occupations v. a wage differential within occupations. While the existence of either type of differential might suggest discriminatory practices, the latter makes a far more compelling case when the argument concerns equal pay for equal work.

4.2 Earnings Gaps in Professional Cohorts

Consistent with prior research and expectations, the picture is different in the professional cohorts when they are considered separately. Although an earnings
differential exists and is persistent over time, it is considerably smaller. Once again, there is a sharp drop-off in female earnings in 2003, concurrent with the change in occupation coding, and therefore it is difficult to consider causality. There is also a second peculiar and seemingly inconsistent set of values for female earnings for 2008, and the unknown reasons for this are under investigation at the time of this writing.

However, once again, there is little evidence under the traditional model to support a contention that the earnings gap diminished during the internet bubble, or that it has increased in the recent past, unless the 2008 data are interpreted as a departure point for a new trend. Of greater interest is the relationship of the adjusted earnings curves, as shown in Figure 2.

![Figure 2 – Gender Wage Gap Estimates 1991-2008 (Professional Cohorts)](image)

In the combined samples, the adjusted earnings were closer to their original values, while in the professional cohorts, adjusted earnings are closer to the alternative groups. For example, when women are treated according to the male regime, in professional cohorts, the adjusted earnings are closer to men’s earnings v. the combined samples, where they would be closer to women’s. One hypothesis is that there may be a greater degree of gender wage discrimination in the clerical level positions.

These data suggest that in the professional occupations cohorts, the gender wage gap may be much narrower than is often asserted by those who adopt the traditional view. Some studies have even reported a differential that might be the inverse [29], although at some point it is important to note that some degree of statistical variance is inevitable. Parity does not need to imply perfect equality.

### Table 3 – Gender Wage Gap Estimates 1991-2008 (Professional Cohorts)

<table>
<thead>
<tr>
<th>Year</th>
<th>Traditional</th>
<th>Male based</th>
<th>Female based</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>18.9%</td>
<td>16.9%</td>
<td>13.3%</td>
</tr>
<tr>
<td>1992</td>
<td>11.2%</td>
<td>1.7%</td>
<td>2.5%</td>
</tr>
<tr>
<td>1993</td>
<td>13.4%</td>
<td>6.7%</td>
<td>5.3%</td>
</tr>
<tr>
<td>1994</td>
<td>22.1%</td>
<td>7.6%</td>
<td>3.5%</td>
</tr>
<tr>
<td>1995</td>
<td>17.1%</td>
<td>3.5%</td>
<td>1.2%</td>
</tr>
<tr>
<td>1996</td>
<td>12.9%</td>
<td>3.0%</td>
<td>0.9%</td>
</tr>
<tr>
<td>1997</td>
<td>15.5%</td>
<td>1.5%</td>
<td>-1.5%</td>
</tr>
<tr>
<td>1998</td>
<td>17.8%</td>
<td>4.1%</td>
<td>0.3%</td>
</tr>
<tr>
<td>1999</td>
<td>19.4%</td>
<td>2.8%</td>
<td>0.8%</td>
</tr>
<tr>
<td>2000</td>
<td>8.3%</td>
<td>0.1%</td>
<td>-0.4%</td>
</tr>
<tr>
<td>2001</td>
<td>14.4%</td>
<td>0.5%</td>
<td>3.5%</td>
</tr>
<tr>
<td>2002</td>
<td>14.0%</td>
<td>0.0%</td>
<td>2.7%</td>
</tr>
<tr>
<td>2003</td>
<td>21.6%</td>
<td>7.2%</td>
<td>13.2%</td>
</tr>
<tr>
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<td>30.1%</td>
<td>8.0%</td>
<td>9.0%</td>
</tr>
<tr>
<td>2005</td>
<td>24.0%</td>
<td>2.7%</td>
<td>12.5%</td>
</tr>
<tr>
<td>2006</td>
<td>28.9%</td>
<td>13.0%</td>
<td>15.0%</td>
</tr>
<tr>
<td>2007</td>
<td>10.6%</td>
<td>-2.8%</td>
<td>3.0%</td>
</tr>
<tr>
<td>2008</td>
<td>49.2%</td>
<td>33.5%</td>
<td>31.0%</td>
</tr>
</tbody>
</table>

The visual evidence, shown in Figure 1, clearly suggests that some form of persistent gender wage gap exists, that it has certainly not diminished to any great extent over the period of this study. The professional cohort, shown in Figure 2 and Table 3, does show a diminished earnings gap during the internet “bubble” years, but it may be returning in full force.

### 5. Conclusions

This study provides a significant contrast to prior studies of wage differences among IS workers that have relied primarily on self-report surveys, and are typically limited to single samples in single time periods, often conducted by trade organizations and journals. (e.g., [2] [3] [4] [5] [10] [12] [19] [26] [30] [32] [33]). There is no lack of interest in the issue of why women may or may not choose to enter the IS profession, but this study focuses exclusively on what happens to those who do.

Specifically, this research has considered three issues related to the gender wage gap. The first issue is whether or not IS occupations have exhibited a diminishing gender wage gap since 1990. There is some limited evidence to suggest that the wage gap might have diminished over this period, but to the authors it seems far from compelling. However, there
does seem to be a significantly narrower wage gap in the professional level occupations.

The second topic of interest concerns the so-called Internet “bubble” period of the late 1990’s through the early 21st century. While it does not appear that the overall estimates of the wage gap are significantly narrower for these years than for the preceding years, professional level occupations do show a narrowing of the gap. This may be attributable to the higher total level of demand for IS professionals during that period, and is theoretically consistent with the notion that demand inelasticity in a labor market will inversely affect the ability of employers to discriminate [23] [27].

Finally, the data are analyzed to consider whether or not the collapse of the internet bubble had a disproportionate affect on female knowledge workers. Once again, the data suggest that overall gender wage inequity remained somewhat consistent over the period of interest, economic conditions notwithstanding, and that if women in professional level IS occupations enjoyed a narrowing of the wage gap during the Internet bubble years, the collapse of the bubble has been accompanied by a return to higher levels of wage differentials. This observation is also consistent with the theoretical relationship between demand elasticity and gender wage discrimination. As demand has fallen, the gender wage gap has increased.

Many claims of gender-based wage differentials will depend on how one chooses to estimate them. By applying an acknowledged unbiased data source that has employed consistent data collection techniques over several decades, many of the challenges of self-reporting bias, generalizability of results, and short-term effects are avoided. A well-recognized statistical technique for assessing differences between groups known to be subject to different regimes is employed, and three estimates of the gender wage gap have been constructed. The traditional estimate looks at differences between male and female earnings but does not factor in structural issues, such as the relative proportions of males and females in professional and clerical level positions. As such, it may provide a useful measure of structural differences in the economy at large, but is of less value when examining differences within occupational categories.

The Oaxaca Decomposition technique was applied to the data to estimate how male and female earnings might have been affected if males and females were subject to their respective alternative earnings regimes. This approach suggests that if males were subject to the female earnings regime, or vice versa, the resulting estimates of the wage differential would be more appropriate than the traditional estimate. Still, it seems to be a man’s world when it comes to the bottom line of compensation.

The data clearly suggest that there is a persistent earnings differential between men and women for the period from 1991 through 2008, as reported by CPS data. This differential is noticeably smaller in professional level occupations.

6. Implications for Future Research

One of the frequent counter arguments to the traditional view is that the gender earnings gap is in large measure a statistical aberration [40]. Women are clearly subject to a different set of criteria when assessing their career choices and outcomes. Many women deliberately choose alternative lifestyles and career paths. Women frequently take protracted amounts of time away from their career paths for family issues, etc. While changes in the economy, the workforce, and job roles are causing a growing percentage of males to pursue these non-traditional (for males) career paths [42] there are not yet sufficient numbers of individuals in the sample populations nor available data to provide a basis for a quantitatively meaningful analysis. It may well be that, when these factors are taken into account, the nature and extent of gender based wage discrimination is far less than is typically argued. Still, the authors contend that ANY level of artificial wage discrimination is not desirable.

There has been a relentless demand for qualified IS professionals, and IS positions usually rank at or near the top of the list in occupational studies for the economy at large. Given the perpetually high level of demand and the chronic relative scarcity of qualified individuals, it is a simple application of economics to assert that significant discrimination against half of the population is not going to be well tolerated, and the data from this study support that notion. It would appear that, at least at the professional level, one interpretation of the data is that women in IS positions enjoy less gender-based inequity than women in other occupational categories. The gender gap has not been eliminated, but at the least it appears to be diminished. One intriguing implication of this is the potential for greater numbers of women to be drawn to IS careers if there is widespread awareness of the fact that the gender wage gap is lower in IS than for other professions.

Also of future interest is a comparison of the domestic IS job market with that of other countries – such as in the European Union or the Pacific Rim. There would be significant cultural differences to be considered, and the availability of data is unknown.
The demographic profiles of IS careers in the domestic market often exhibit a significant presence of imported labor. It is also a very popular practice to outsource systems development and support activities to offshore vendors. A compelling future research topic is consideration of the extent to which this offshoring outside the domestic labor market might be affecting returns to human capital investments within it.

This study has continued the research from [22], and while the methodologies are similar, the data from the two studies have not been formally linked at the time of this writing. The previous work suggested a more significant earnings gap than was found in this research. One of the long-term goals of this project is to create a data set appropriate for a wide range of possible longitudinal studies for the period from 1975 to the present. This will also require additional data collection for the years not included in [22], where data were observed at five-year intervals. The 2003 changes in CPS occupational classification coding pose a significant but not insurmountable challenge to that goal.

7. Acknowledgement

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8. References


