Understanding the gender gap among turn-of-the-century Swedish compositors

by

Joyce Burnette
Wabash College

Maria Stanfors
Lund University

May 2017

Abstract

Women have always earned less than men, with men's greater strength explaining a large portion of the difference. This raises the question of why the gender gap did not disappear when the importance of strength waned with the emergence of the modern labor market. This paper explores the wage gap among Swedish compositors, an occupation featuring the main traits of modernity, circa 1900. We exploit matched employer-employee data with national coverage, and examine information on men and women holding the same jobs. On average, women's hourly wage was about seventy percent of men's. Individual characteristics explain much, but not all, of this gender gap. To explain the remainder of the gap we examine training and differences across firms. Our findings suggest that women received less training than men, and accounting for differences across firms explains the gender gap. We also find differences across firms by size and location. Smaller firms outside the major cities treated men and women fairly; it was the larger, firms in major cities that rewarded firm tenure and underpaid women, creating a gender gap. These results are consistent with the hypothesis that firms which set up internal labor markets treated men and women differently.

Keywords: Gender, earnings, manufacturing industry, firm-level data
JEL-codes: J16, J31

Table of contents

1 Introduction

Women have always earned less than men, with men's greater strength explaining a large portion of the difference. While industrialization in some cases increased the demand for strength (Samuel 1977, 1992), eventually machine power substituted for human strength and the rise of services demanded qualitatively different skills. This raises the question of why the gender gap did not disappear when the importance of strength waned with the emergence of the modern labor market. Wage discrimination appeared at a particular time in the development of the labor market, as has been shown for the U.S.; Goldin (1990, chapter 4) concludes that wage discrimination appeared there between 1890 and 1940. In the case of nineteenth-century manufacturing jobs, she finds that most of the wage gap was explained by differences in output. In the case of clerical work in the 1940s, however, the gender wage gap cannot be explained by economic factors. In a similar vein, Burnette (2015) finds that the wage ratio matched the productivity ratio for nineteenth-century manufacturing workers, but that female clerical workers in 1900 were underpaid.

There is little evidence of the causes of the shift to wage discrimination, but extant literature provides us with hypotheses. Goldin (1990) explains the rise of wage discrimination as the result of the shift from spot markets to internal labor markets. With the emergence of the modern labor market, women did not have access to the same job ladders as men, and thus did not have the same opportunities for improving their pay through training and career advancement. Owen (2001) suggests that firms offered men and women different incentives because male quits were more responsive to firm policies.

The timing is right for such an explanation. The transition from spot labor markets to internal labor markets occurred around the turn of the twentieth century, at the same time that gender wage discrimination emerged. During the nineteenth century most workers were hired in spot labor markets. Turnover was high, workers were paid their current marginal product, and wage discrimination was not widespread (Rosenbloom and Sundstrom 2009; Stanfors et al. 2014). The institutional infrastructure of modern labor markets was essentially nonexistent. Early in the twentieth century, firms sought to reduce turnover and developed internal labor markets (Jacoby 1985; Owen 1995). One method for reducing turnover was delayed compensation. Thus, wage profiles from the nineteenth and twentieth centuries look very different to each other. Nineteenth-century wage profiles increase rapidly during youth, but

are fairly flat for adults (Hatton 1997). In contrast, twentieth-century profiles rise continually until middle age (e.g. Murphy and Welch 1990). The turn of the twentieth century saw the transition between the two labor market regimes. Some aspects of internal labor markets, such as internal promotion and long-term employment, were already appearing in the late nineteenth century (Sundstrom 1988). Other characteristics, such as delayed compensation and personnel departments, did not appear until later, and this was particularly the case in certain industries consisting of large firms such as banking, and firms with monopoly/monopsony power such as railroads (Howlett 2004; Seltzer 2011).

With the rise of internal labor markets, firms offered different opportunities for advancement to men and women. Often men were offered jobs with delayed compensation while women were not. Goldin (1986) suggests that firms chose different incentive structures for men and women based on their expected careers. Based on their shorter expected careers, women were segregated into jobs with short learning periods that paid piece-rates while men, who had longer expected tenures, sorted into jobs where they were incentivized with on-the-job training and delayed compensation. Owen (2001, p. 63) suggests that men were the main beneficiaries of internal labor market policies instituted in the 1920s, and that: "men's greater access to internal labor markets…meant that women took on the status of residual workers." Thus, we expect to find that men were at an advantage compared to women when it comes to on-the-job learning and training, which affected their earnings positively. If this story is correct, we should see wage discrimination emerge at firms that adopted internal labor markets, and that these firms offered men delayed compensation, but offered women only limited training.

This narrative still needs to be tested, as it is based on a limited set of facts. For long there has been a lack of wage data linked to individual characteristics such as experience and tenure. Moreover, the availability of firm-level data has commonly been restricted to firm case studies, while data have not been generally available for whole industries. Further, the assessment of gender wage gaps has been complicated by the fact that men and women rarely do the same jobs. Although the literature on historical gender gaps in earnings is growing, we know little about the gender dimension of wage growth (see Burnette and Stanfors 2015 for an exception).

A positive association between firm size and workers' wages is well documented for modern contexts (e.g. Brown and Medoff 1989; Mellow 1982; Oi and Idson 1999; Evan and MacPherson 2012), indicating that small and large firms differ with respect to training, productivity and wage structure. Historically, large firms were more likely than small firms to adopt internal labor markets. There are a number of reasons why this might be so. First, the managers in smaller firms knew the workers personally and thus had less reason to use internal labor markets for career decisions and monitoring. Managers who have direct information about their workers do not need to use gender as a signal of type, and this should mean less statistical discrimination. Also, larger firms were better able to take advantage of the division of labor[1], which complemented internal labor markets. Moriguchi (2003, p. 636) suggests that large firms are more likely to establish internal labor markets because small firms find it harder to establish credible commitments to honor their side of the implicit contract, which became increasingly important with modern industries and production techniques. We explore the hypothesis that the practice of wage discrimination differed across firms, and emerged in larger firms.

In this paper, we investigate the gender gap among Swedish manufacturing workers in a time when the old labor market regime was being phased out and the new one was emerging. We expand the discussion on the emergence of wage discrimination, and its possible links to the modern labor market regime, to outside of the Anglo-Saxon countries, where most of the research on this transition has been located. Swedish labor markets, being part of the economic periphery, could have been quite different from those in the U.S. or Britain, but our research suggests that they were not. The industry in our study - the Swedish printing industry - featured wage profiles that become flat early in a worker's career, as do late nineteenth-century wage profiles in the U.S. and Britain (Hatton 1997; Boot and Maindonald 2008).

We examine compositing, which was the main occupation of the printing industry. This occupation was neither a typical manufacturing job nor a white-collar job; it was a skilled blue-collar job. Compositors were regarded as part of the 'labor aristocracy' and were, in Sweden and elsewhere, among the very first to form trade unions (Wessel 1937; Schmick 2017). The turn of the twentieth century was a time of technological change in the printing industry, affecting typesetting in particular. The linotype machine was new, and some of the

[1] Toman (2005) suggests that the ability to assign workers tasks appropriate to their comparative advantage increased productivity on farms using gang labor.

firms in our study adopted the new machine, while most of the work in the industry continued to be done on the traditional letterpress. Typesetting in Sweden was gender-mixed but male-dominated. There were no rules preventing female employment or union membership, though the compositors' union was strong and known to be male-biased (Karlsson and Stanfors 2017). In other contexts, such as Britain, where the compositors' union was similarly strong and biased (Webb 1891, p. 646), wage standards and union norms implied that few women worked in the industry.

Using a rich employer-employee matched data set with national coverage, we examine information on men and women in the same trade and even holding the same jobs; such data are rare but important for understanding gender gaps. We are able to explain the gender gap in compositing using individual and firm characteristics. Women's hourly wage was about seventy percent of men's. Individual characteristics explain much of this raw gap, but not all of it. To explain the remainder of the wage gap we examine training and differences across firms. Wage profiles indicate that women had a slightly higher average wage for six of the first seven years, but after seven years men's wages gained a substantial advantage over women's wages. We find that when we control for unobserved heterogeneity across firms, there is no longer a significant wage penalty for female workers. We also find that part of the firm fixed effect relates to the fact that large firms and small firms behaved differently. While we can completely explain the wage gap in small firms located outside the principal cities, a portion of the wage gap remains unexplained in larger firms and those located in the major cities. Consistent with the hypothesis that the larger firms introduced internal labor markets, we find that men were rewarded for staying with the same firm at larger firms in cities, but not at smaller firms or outside the major cities. We also find evidence that women were treated differently, as women were not rewarded for staying with the same firm. Apprenticeship patterns also differed by type of firm. Large firms and those in the principal cities apprenticed women for shorter periods than men. For small firms outside the major cities, however, apprenticeship patterns were the same for men and women. We conclude that there was no gender discrimination at small firms outside the main cities, but that there is some evidence that large firms in major cities treated men and women differently. Our results are consistent with the story that wage discrimination emerged as some firms offered men and women different opportunities for training and different wage profiles.

2 Understanding the gender gap in past and present times

The gender wage gap, which is often defined as the differential between the male and female average wage, is an important indicator regarding the economic status of women. However, this standard of measurement is problematic if one only compares average wages without taking into account the actual differentials existing between the groups. One must standardize the wage gap so that it takes into account differences in personal characteristics such as age, education, work experience, etc. The more factors taken into account in the calculations, the narrower the gender wage gap. This is essential if we are to understand the reasons for gender earnings differentials – not least in terms of whether or not they are the result of discrimination.

Earnings differentials can be structural and straightforward, made up of observable factors affecting wage, such as age, education, and work experience that differ between genders. Earnings differentials can thus arise from differences in human capital but also from differences in wages between typical female and typical male occupations. Finally, there are unexplained earnings differentials – that which is left after having taken into account the structural differentials. These might arise from lack of data on relevant characteristics and occupation/job, but they might also be the result of discrimination.

Therefore, although gender earnings differentials exist, it is not certain that these are due to unequal treatment in the labor market, i.e. discrimination. They might also be due to productivity differentials, in that men and women possess different qualifications or experience of relevance for performance on the job. Becker (1962) developed a formal model of human capital investment with respect to different returns to different levels of education. In Becker's original formulation, if workers are free to change employers and move between firms, as is the case in a spot market, and general skills increase their productivity (and earnings) at many workplaces, no single employer would be willing to pay for this training since and the acquisition of general skills since no firm can protect its investment and recoup the cost of training through higher worker productivity. The end result is that firms provide training that leads to general skills only if the workers bear the cost of training, typically by accepting lower (training) wages. When it comes to firm-specific skills, the employer may be willing to pay (at least part of) the training cost since the skills acquired are not transferable to other firms. This may result in the firm paying for the training and recouping the costs through future increases in labor productivity. There is always a risk that the worker will

leave the firm, and the employer loses the investment, but this risk can be mediated. For example, the firm can try to influence worker turnover by offering higher wages than elsewhere.

Historical evidence indicates that firm-specific skills were not very important among nineteenth-century workers. Many workers were unskilled, and most skilled workers had craft skills that could easily be transferred from one firm to another. Turnover was extremely high, partly because workers found it easy to find new employment after they quit (Hareven 1982, pp. 77, 130). Slichter (1919, pp. 18-19, 34) reports turnover rates of 72 percent at a steel mill, a staggering 232 percent in the clothing industry, and 370 percent at Ford. Carter and Savoca (1990), on the other hand, suggest, based on a survey of several thousand workers in 1892 San Francisco, that job attachment, in fact, was far greater than labor historians suggest, and not much different from findings for the post-WWII period (cf. Hall 1972), though their results have been debated (Jacoby and Sharma 1992). James (1994), however, finds support for a reconciliation of the two extremes with higher turnover then than now, especially for young workers; proposing that the end of the nineteenth-century labor market was half-way in between spot market and the modern labor market. In the early decades of the twentieth century, things changed when firms instituted various policies designed to reduce turnover, a move that Owen (1995) suggests was due to the increase in firm-specific human capital. Our results suggest that firm-specific skills were not important among compositors, because there was no return to tenure, after controlling for experience, at small firms and at firms outside big cities, and because we observe workers paying for their own training in the form of lower wages during apprenticeship.

According to human capital theory, differences in men's and women's education and work experience are key determinants of the gender earnings gap. Sex differences in experience and tenure with the same employer are large because women have more intermittent careers due to family responsibilities (Becker 1981).[2] It is possible that women voluntarily chose different levels of training than men. Individuals who expect to spend less time in the workforce would choose jobs with higher starting salaries and lower wage growth compared to individuals who

[2] Gary Becker (1985) also argued that specialization within the household means that women, by way of their reproductive responsibility for the home and children, have less energy to devote to paid work and therefore earn less.

expect to spend more time in the labor force (Polachek 1981).[3] In line with such economic arguments, it was rational for women at the turn of last century - when most women left their job in connection with marriage - to be in occupations where training was task-specific and learning on the job was brief (Eichengreen 1984, p. 822). Firms' expectations that women were workers only for a limited period of their lives made them restrict training opportunities for women in order to minimize costs. This resonates with accounts of women's work and wages from contemporary observers (Abbott and Breckinridge 1906; Abbott 1910). Among our Swedish workers, low-experience women earned slightly higher wages than men, but male wages quickly surpassed female wages, so there is some possibility that women chose lower amounts of training because they expected to leave the occupation before the training paid off.

In order to better understand the historical gender gap, we need to establish how extensive discrimination based on gender was in the past and when it emerged. This implies taking individual experience and tenure into consideration, generally but also within industries and firms.

3 Data

3.1 Sample

Our data serve our research purpose very well. They come from a survey of the printing industry in 1902/03, conducted by The *Swedish Board of Commerce* (Kommerskollegium). The industry was surveyed in its entirety with one set of questions for employers, and another for employees. The ambition was to collect data from all workers employed at the point in time when the agents visited the factory. In total, the agents managed to collect answers from 7,855 workers in the printing industry - a number which is very close to that reported by the employers in the official industrial statistics the same years. While all workers in the industry were included in the survey, we confine our analysis to compositors, as theirs was the most common and the key occupation within the industry. We know the hourly wage, experience in the occupation, and tenure with the present employer for every worker. Since workers are connected to firms, we are able to match the two, and examine whether firm characteristics

[3] While Polachek (1981) suggests that women choose occupations where the skill depreciation resulting from time out of the labor force is relatively small, England (1982) questions this, showing that predominantly female occupations do not have smaller penalties for time out of the workforce than predominantly male occupations. This suggests that women are not choosing occupations for their low rates of skill depreciation.

such as size and location, and group dynamics at the firm-level, mattered for the gender gap and individual wage profiles.

We restrict our analysis to adult compositors (age 15 and above) for whom we have data on all variables of interest, excluding foremen. Our main sample consists of 2,590 individuals, 2,247 men and 343 women.[4] In our sensitivity analysis we restrict our sample to only include workers in gender-mixed firms; this sample consists of 1,072 compositors, 771 men and 301 women. Though substantially smaller, the sample of gender-mixed firms gives essentially the same results as the full sample.

Compositing at the time of the survey

Compositing, or typesetting, was the most common occupational specialty in the printing industry, accounting for 36 percent of total employment. Typesetting is the composition of text by means of types. It requires the prior process of designing a font (*sort)* which is stored in some manner. During the letterpress era, moveable type was composed by hand for each page. Cast metal *sorts* were composited into words and lines of text and bound together to make up a page image called a *forme*, with all letter faces exactly the same height to form an even surface of type, which was then mounted in a press, inked, and pressed on paper.[5] Hand compositing was rendered obsolete by continuous casting or *hot-metal* typesetting machines such as the linotype machine and monotype at the end of the nineteenth century. The linotype enabled one machine operator to do the work of ten hand compositors by automating the selection, use and replacement of sorts, with a keyboard as input. This revolutionized typesetting as well as printing - before the invention of the linotype, no newspaper in the world had more than eight pages. Typesetting was especially important in newspaper and book printing but also in factories producing other printed matters. It was skilled work with some compositors working by hand and some by machines, where work by machines was considered more challenging than work by hand. In our data most of the typesetting was done by hand, but there are a few compositors who worked using the linotype machine. Machine compositors earned about twice as much as hand compositors (see Table 1).

[4] From a sample of 2,692 compositors with full information on variables of interest, we excluded 67 foremen and 35 individuals under the age of 15, leaving us with a sample of 2,590 workers for analysis.
[5] Sometimes copies of *formes* were cast when subsequent printings of a text were anticipated, freeing the type for other work. This process was called stereotyping.

Typesetting required some formal skills, as workers had to have above-average literacy at the turn of the century and even be proficient at mirror-image reading. Typesetting as a trade was growing, with formal apprenticeship providing for rejuvenation. There were 40-45 apprentices per every 100 skilled compositors, depending on specialty (Elmquist 1909).[6] Compositors worked with formatting and setting text and tables, but they also worked with typesetting sheet music and ads, etc.

In 1903, 13 percent of the compositors were women, which was less than the 25 percent prevailing in the printing industry.[7] Women were less likely to be among the most skilled compositors operating a machine, and were more likely to work by hand. Nevertheless, men and women with similar skills worked side by side within individual factories (Elmquist 1909). Women could join the compositors' unions, but fewer women than men chose to do so.

3.2 Variables of interest

Because workers reported both weekly earnings and hours worked, we are able to use hourly earnings as our dependent variable (i.e. the natural logarithm of weekly earnings divided by hours worked during a normal working week).[8] This is particularly useful in the case of gender analysis, since the danger of using weekly wages is that women may have been paid less because they worked shorter hours. Earnings refer to wage earnings and do not include the value of fringe benefits; to control for differences in earnings arising from fringe benefits, we include a variable indicating for the free housing benefit received by some compositors. We also control for whether the individual worked night shifts or Sundays, which may have factored into his/her earnings.

Our data contain direct measures of experience in the trade, which is unusual. Typically labor economists follow Mincer (1974), who defined experience as the number of years since leaving school (age - years of schooling - 6). Instead, we have a direct measure of experience in the occupation. This is a better measure of experience because it is specific to the occupation. We also know how many years the worker was at the same firm, i.e. tenure with

[6] This refers to the industry in full. After we limit the data set to compositors, the percentage of apprentices is smaller.
[7] The printing industry was segregated, with women dominating in book binding and men dominating in other occupations, such as compositing.
[8] The hourly wage is expressed in ore, which is one hundredth of a Swedish krona. We primarily use the workers' own statements of hours worked and income for a normal working week.

the current employer. In the context we study, it would be misleading to assume that a worker's education was equal to age minus years in the occupation minus six.[9] Though we have information on education (notably whether the individuals had any secondary, technical, or other education beyond primary) in our data, we do not use this to calculate experience because the survey asked workers which year they started to work in the trade.

Information on the firm allows us to construct a number of firm-level indicators that reflect firm types of potential relevance for the gender gap. These variables are specific to the firm in which the individual worked, rather than to the individual. Some of them are straightforward firm characteristics (such as location and size) while others (such as share women and unionization) reflect workforce characteristics and group dynamics at the workplace level. When calculating average characteristics of the firm workforce, we exclude the worker whose wage is being explained from the calculation of those averages, to avoid feedback effects. The variable *Firm in big city* indicates that a firm was located in one of the three largest industrial towns: Stockholm, Gothenburg, or Malmo. The variable *Firm size* measures the total workforce of the firm (including workers who were not compositors). Table 1 reveals that men were more likely to work in larger firms.

Table 1 about here

Table 1 shows averages by gender for the variables used in this study. The raw gender gap among compositors was about 70 percent, though substantially smaller among those who worked by the machine and among apprentices. Women partly earned less than men because they were younger and had less experience. Women were also less likely than men to be a member of a union or a mutual aid society. The majority of workers were single; women were far less likely to be married and/or with children then men, which was not always the case in manufacturing (Karlsson and Stanfors 2017). In line with extensive internal migration in Sweden at this time, a large share of workers was not born in the same location as the current workplace. Men were far more likely than women to have some secondary (including post-primary technical) education. At this time six years of schooling was compulsory for all Swedes, but secondary education was rare. Even though only 16 percent of male compositors

[9] The average age of starting in the trade was 14.7 for men and 16.7 for women. This does not, however, imply that women had on average two more years of schooling, but may rather indicate different inroads into manufacturing industry according to gender. On the contrary, men were much more likely to have some secondary education.

had any secondary education this was well above the national average (Orring 1967). Women were more likely to be apprentices (due to their relative youth), but men were more likely to work night shifts and Sundays, which affected their earnings positively.

4 Results

This section presents the results from the empirical analysis. We begin by discussing the gender earnings gap – its size and determinants – among compositors in 1902/03. Then we move on to examine the role of training more specifically. Finally, we investigate what were the important factors at the firm-level affecting the gender gap among compositors.

4.1 The wage gap

On average, female compositors earned 71 percent as much per hour worked as did male compositors (see Table 1). Among the apprenticed, who earned less, the raw wage gap was much smaller, with female apprentices earning 95 percent as much as male apprentices. Among hand compositors, the wage gap was 26 percent, but among machine compositors, handling the new technology, women actually earned 81 percent as much as men. Women were, however, less likely to work with the machine. The gender gaps were consistently smaller in gender-mixed firms compared to among all firms (of which some were single-sex). Table 1 also suggests some potential explanations for the wage gap. On average the female compositors were younger than the men, and had less experience in the industry. Women were less likely to have family responsibilities, secondary education, to be union members, or to work nights or Sundays.

To examine how much of the wage gap can be explained by individual characteristics that we might expect to be correlated with productivity, we calculate standardized wage gaps, by estimating OLS earnings models where the natural logarithm of gross hourly earnings is modeled as a function of gender, age, and other personal characteristics, experience, tenure, union status, and job characteristics, as well as factory fixed effects. The latter are important as we are interested in an unbiased estimation of individual-specific variables, and thus we control for the chance that there may be unobserved heterogeneity with respect to the labor force between firms, such as may arise from the recruitment of different kinds of labor. There may also be unobserved practices regarding management, including hiring/firing, and training

between firms, affecting men's and women's earnings. We introduce explanatory variables in a stepwise manner. The full model we estimate is:

$$\ln E_i = \alpha_0 + \beta_1 \mathbf{X}_i + \beta_2 \mathbf{Z}_j + \mathrm{G}_j + \varepsilon_i$$

where ln E_i is the natural log of hourly earnings for individual i; **X** is a vector of individual and human capital-related characteristics; **Z** is a vector of firm-related characteristics; and G is the unobserved group fixed effect for individuals working in the firm j.[10] Explanatory variables are added to the models in a stepwise manner. This enables us to interpret the gender coefficients as the cost of being female, net of other factors. Table 2 shows the results.[11]

The first regression model estimates the raw gender gap, which was 34 log points, and the second model adjusts for working as a machine compositor, who earned significantly more than a compositor working by hand. Controlling for work with the new technology reduces the gender gap to about 30 log points. Model 3 estimates the within-firm gender gap, only adjusting for machine work, which is substantially reduced to 11 log points, indicating that the gender gap was largely due to sorting of men and women across firms that paid differently.

The fourth model does not include firm fixed effects, but introduces controls for age at start of work, experience, and tenure. These individual characteristics explain about half of the gender gap. Instead of including age, which is highly correlated with experience, we control for the age at which the worker started in the trade. The age of starting work has a small positive effect on wages (for everyone starting before age 38). We use a quadratic spline as the functional form for experience because this captures the shape of the profile better than a simple quadratic (Burnette and Stanfors, 2015).[12] Because the functional form is not linear, the best way to present the relationship between wage and experience is graphically. We first estimate separate regressions for men and women (presented in Table A2). We then graph

[10] Z includes a number of characteristics that vary by firm such as size and location, but also characteristics of the workforce such as the share of female workers, union density, and the share of workers who had secondary education. Due to collinearity Z and G cannot be estimated in the same model.

[11] Results for the limited data set of gender-mixed firms are reported in Table A1. The results hold up for this sample too, though the raw gender gap was slightly smaller in gender-mixed firms.

[12] The spline variable is max{0, age-k} where k is the break point. We determine the break point by estimating functions with a wide range of k's and choosing the break point that gives the highest R-squared. Burnette and Stanfors (2015) conclude that using a quadratic instead of a quadratic spline leads to underestimation of the wage gap for workers in their 20s.

predicted wages against experience for men and women, for an individual who begins work at age 16 (Figure 1). The figure graphs both a profile for movers (which assumes tenure is always zero) and a profile for stayers (which assumes tenure is equal to experience) for each gender. The mover and stayer profiles are indistinguishable, suggesting that firm tenure was not important in the labor market.[13] There is, however, a difference between the male and female profiles after six years of experience. The wage-experience profiles are similar to those observed by Hatton (1997) in that they are steep for a few years, and then suddenly become quite flat.

Figure 1 about here

Model 5 in Table 2 adds variables for family status, education, and migration experience. Family responsibilities affected earnings positively; married workers earned more than unmarried workers, which can be explained by human capital theory (i.e. that marriage makes men more productive) but also by selection (that men who marry are more productive) or positive discrimination (by employers who benefit men with breadwinning responsibilities regardless of productivity). The fact that previously married compositors also earned a similar premium suggests that this was not a treatment effect but rather a result of married workers being able to accumulate human capital when married, or that selection may explain the marriage premium observed.[14] Workers with some secondary education earned more, but this variable mattered little for earnings and the gender gap, indicating that substantial human capital accumulation of relevance for productivity took place on the job rather than in school. Model 6 adds more controls that may have impacted earnings, for example whether the worker was a union member or a member of a mutual aid society. Membership in these organizations was probably an indicator of commitment to the occupation or low discount rates, and was more common among men. Apprentices, of which a larger share was female, earned less than other workers because they were undergoing training and still learning. There was a compensating differential for working at night or on Sunday, which more men did.[15] Model 7 adds firm characteristics relating to size and location with potential relevance for earnings while column 8 adds a firm fixed effect to the full model and assesses the gender gap

[13] Table A2 shows that the tenure variables are individually insignificant. We also use F-test to test whether tenure and tenure squared are jointly significant. Tenure is never statistically significant at small firms or at firms outside the major cities.
[14] The presence of children had no effect on wages.
[15] The effect of free housing is negative, which is consistent with the hypothesis that this fringe benefit was given in place of a portion of the wage, but the coefficient is not statistically significant.

among workers in the same establishment. Firms in the major cities paid more, which could be compensation for a higher cost of living. Controlling for location, wages declined with firm size. The addition of controls for firm size and location increases the gender gap to 8.5 log points. Firms in major cities, which paid more, also hired more women, so women's average wages were slightly higher due to their location; controlling for location thus increases the wage gap. The fixed-effect estimates indicate that, within firms, there was not really any gender earnings gap among compositors at the turn of the last century, which is unexpected. Our results show that the firm mattered a lot for the gender gap, a result which has not been thoroughly explored before for historical contexts. The results from models 7 and 8 indicate that the gender gap cannot be fully explained by characteristics of the firm that we can easily observe, such as location or size; but that the gender gap is rather due to other, potentially unobservable, aspects of the firm, such as management practices and group dynamics, which calls for further investigation.

Table 2 about here

In order to disentangle what were the important factors at the firm-level, captured by the firm fixed effect, we constructed a number of variables of potential relevance for group dynamics and earnings. We calculate the share which had secondary education, the average experience of compositors at the firm, union density, and how large share of the workforce was female. To make sure there were at least two co-workers, we limit the data set used in Table 3 to firms with at least three compositors. Then we ran regressions along the lines of Model 6 in Table 2 to see how various firm-level factors independently affected the gender gap among compositors (see Table 3). Both easily observable firm characteristics such as size and location and characteristics of the firm's labor force mattered for the gender gap. As in Table 2, we find that firms in the major cities paid more. If we do not control for location, firm size has a positive effect on wage. This is different from the result in Table 2 where, controlling for location, firm size had a negative effect on the wage, suggesting that firm size and location are correlated enough that it is difficult to disentangle the two effects.[16] Firms with a more educated workforce and more experienced workers paid more. Working at a firm with high union density increased the wage and was associated with a smaller gender wage gap. It is highly likely that the experience and union density measures capture similar processes at the

[16] The correlation between firm size and city location is 0.42.

workplace. We also find that wages are in general lower at firms hiring more women. Controlling for this factor makes the gender earnings gap disappear.

Table 3 about here

By including firm characteristics we are able to fully explain the gender wage gap. Table 4 presents estimates of the wage gap with individual controls only, with the addition of measurable firm characteristics, and with firm fixed effects for all firms and for firms with a gender-mixed workforce. With no firm-level controls the wage gap is about 7 log points and it is statistically significant irrespective of sample. Including all six firm characteristics from Table 3 reduces the gap to about 2 log points, yet the gap is no longer statistically significant. The resulting gap is similar to that of the regression with firm fixed effects, suggesting that our variables capture the most important differences across firms. Controlling for other firm characteristics, the share of workers with some secondary education, and union density no longer matter for the gender gap in the full sample.[17] As in Table 2, firms in big cities pay more, and controlling for location, larger firms pay less. Workers in firms with more female workers earn less. The full sample estimates are quite similar to the estimates based on gender-mixed firms. Firm size becomes insignificant when we limit the data to gender-mixed firms and so does average experience and union density. The two firm characteristics that seem to matter most robustly are location in a major city and share of women in the workforce. Obviously firms were different when it comes to the recruitment and retention of women, with implications for gender differences in earnings, which makes us ask through what processes this was channeled at the individual level.

Table 4 about here

4.2 Training

One possible reason why women might have earned less than men with the same experience level is that they spent less of their work time investing in training. Human capital theory suggests that workers can give up some current output in order to invest in human capital that pays off later in their career, and that individuals who expect to spend less time in the workforce tend to choose jobs with higher starting salaries and lower wage growth compared

[17] Among the gender-mixed firms, the average experience of the workforce also is statistically insignificant.

to individuals who expect to spend more time in the labor force. Thus, those who expect to spend more time in the labor force invest more in on-the-job training and have higher returns to labor market experience. Such expectations are not always correct; Sandell and Shapiro (1980) find, based on NLSY data, that white women, who were 14-24 years in 1968, underestimated their future participation rates, perhaps because there was rapid change in female labor force participation rates during this time period.

Differences in training may have been formal or informal. While we do not have information on informal training, we have some measures of formal training because we know which workers were apprentices at the time of the survey. Unfortunately we don't know whether workers had been apprenticed in the past. Our data, though limited, suggest that women received less formal training than men. At the time of the survey a greater percentage of the female workforce were apprentices (32 percent of women and 24 percent of men). However, this apparent female advantage results from the fact that women in compositing were concentrated at low levels of experience. If we divide the workforce into experience groups, each group contains a smaller percentage of female apprentices. Among compositors with up to five years of experience, 73 percent of women and 83 percent of men were apprentices. Among compositors with six to ten years of experience, seven percent of women and ten percent of men were apprentices. Thus, women were more likely to be apprentices at the time of the survey only because of their lower levels of experience. If we control for experience, women were less likely than men to be apprentices.

Women also seem to have been apprenticed for shorter periods. To demonstrate this, we look at how the likelihood of being an apprentice changed with experience. Figure 2 shows the percentage of workers who were apprentices at each level of experience. The increase in the percentage apprenticed in the first year is consistent either with women working for a time before starting their apprenticeship or with the presence of casual workers who very soon exited the industry and were never apprenticed. Such a pattern could have resulted from the common practice of trying out a job before starting a career (Schulz 2013). Women were nearly as likely as men to be apprentices after one, two, or three years of experience. However, for workers with four to six years of experience, women were less likely than men to be apprentices. At five years of experience, 64 percent of men were apprentices while only 28 percent of women were apprenticed. Figure 2 suggests that on average female compositors

had shorter apprenticeships than male compositors, which could help to explain women's lower wages.

Figure 2 about here

If women did invest less in training, was this a voluntary choice or were they offered different options than men? It is possible that women chose to invest less in training because they expected to have a short working life. If the working life a woman expected was short enough, it may have been rational for her to choose the "female" profile rather than the "male" profile. We explore this possibility by examining which profile women would have preferred.

Table 5 examines whether a woman would have preferred the male or the female earnings profile in Figure 1. We annualize predicted earnings by assuming 57 hours per week and 50 weeks per year.[18] Up to six years of experience earnings were quite similar among men and women. Men earned slightly more than women upon starting and at one year of experience, and women earned slightly more than men at two to six years of experience. Starting at seven years of experience, the male earnings profile gives substantially higher earnings. Which earnings profile was more remunerative overall depended on how long the worker expected to stay in the industry. Assuming a discount rate of five percent, a worker planning to stay in the industry four to seven years preferred the female earnings profile, while a worker planning to stay in the industry less than four years or more than seven years preferred the male earnings profile.[19]

Table 5 about here

The average experience of female compositors in our sample was ten years (see Table 1), and the median experience was seven years. Since we have cross-sectional data, this estimate of time in the industry is biased in two ways. First, observed median experience is an

[18] The standard working was 60 hours. The actual working week among the workers included in our sample was about 57 hours, actually marginally higher among women than among men. We thus assume 57 hours per week because, i.e. the sample average in the calculations presented in Table 5. For robustness, we also did the same calculations for 60 hours (see Table A5). This makes the level of earnings change, but the pattern stays the same because it is just a matter of multiplying everything by a constant.

[19] This result is not sensitive to the discount rate. Any discount rate between 3 percent and 31 percent will give the same result.

underestimate of median experience because we observed uncompleted spells, and most of the women we observed would continue to work and acquire experience. That said, we are less likely at any point in time to encounter a given short spell than a given long spell. If we randomly choose a date during a twenty-year period we are sure to encounter a worker who worked the whole twenty years, but we have only a five percent chance of encountering a worker who worked only one year. This means we would underestimate the number of short spells. These biases work in opposite directions but do not necessarily cancel each other out. As a result, we cannot accurately measure median completed tenure from our cross-sectional data.

An alternative estimate of how long a woman would expect to be in the labor market is the typical window between start of work and marriage. Our data suggest that on average women started in the compositing industry at age 16.7. The average age at marriage in 1900 was 26.4 in the east and 27.8 in the west, so a woman who was average in both regards and quit at marriage would spend approximately 10 or 11 years in the industry. If a woman did expect to spend this long as a compositor, she would have preferred the male profile to the female profile. While it is possible that women chose the low-training wage profiles because they expected to spend only four to seven years in the industry, it is also possible that women did not have the option of choosing the same training as men.

4.3 Firm size and location

Next we look for differences in the wage gap across types of firm. Since size and location were highly correlated, we divided firms by both size and by location and find similar results for large firms and for firms in the major cities. We define a large printing firm as one hiring at least 50 workers. These firms make up the employers for about 30 percent of our sample. Table 6 shows the female wage penalty from wage regressions on different subsamples of the data. Models 1-6 correspond to the models in Table 2 and include the same set of control variables. For all subsamples there is a large and statistically significant wage gap. Adding firm fixed effects (column 3) fully explains the gender wage gap at small firms, and at firms outside the major cities. By contrast, large firms and firms in the larger cities have a significant gender gap even after controlling for firm fixed effects. At small firms fixed effects explain 78 percent of the wage gap, while at large firms they explain only 27 percent. Similarly, the individual and firm characteristics included in column 6 explain the gender

wage gap at small firms outside major cities, but at large firms in big cities the gender gap remains significant. For small firms these characteristics explain 87 percent of the gender wage gap, while for large firms they explain only 62 percent. For firms outside the major cities we explain 86 percent of the wage gap, but for big city firms we explain only 71 percent. We conclude that men and women were treated more equally in smaller firms outside of the major cities, and that differences in opportunities for men and women were beginning to emerge in large firms in the major cities.

Table 6 about here

To examine what is the reason behind this difference in outcome by type of firm, we examine apprenticeship patterns by type of firm. Figure 3 shows apprenticeship rates by experience level, for small and large firms, and for firms in and outside of the major cities. These figures reveal that the differences in apprenticeship patterns observed in Figure 2 are entirely due to large firms in big cities. At small firms and at firms outside the big cities, men and women had nearly identical apprenticeship patterns. At large firms and firms in big cities, by contrast, women did not become apprentice immediately upon starting work, and women were much less likely than men to be apprentices if they had four or five years of experience.[20]

Figure 3 about here

The fact that the gender gap in apprenticeship appears only among certain types of firms casts doubt on the hypothesis that women chose less training. If the gap were entirely due to choice, then women at small firms outside big cities would only choose more training if they expected longer working lives than women at other firms. It is possible that women sorted across firms and thus women at small firms would have made different choices, but it is also possible that large firms in big cities treated men and women differently. One clear difference is among women with zero experience. At smaller firms, women who had just started in compositing were all apprentices. At large firms, none of them were. It would seem that the large firms did not start women on apprenticeships immediately.

[20] At both large firms and firms in the large cities there are *no* female apprentices at zero years of experience, which suggests that heterogeneity is not the explanation.

One common characteristics of internal labor markets is delayed compensation. Firms encourage hard work and discourage quits by underpaying young workers and overpaying older workers (Lazear 1979; Kotlikoff and Gokhale 1992). Goldin (1986) suggests that men were offered delayed compensation and women were not, and that as a result men earned more. Do we observe such patterns among compositors? Figure 1 suggests that wages did not respond to firm tenure, which suggests there was no delayed compensation. However, if we divide firms by size and location we find a different story. Figure 4 presents wage-experience profiles by gender for movers (who always have zero tenure) and stayers (whose tenure is equal to experience). These graphs suggest that some workers were rewarded for tenure. We also use F-tests to determine if the quadratic function of tenure contributes significantly to estimating the wage (see Table A6). Using a 5% level of significance, tenure is never significant at small firms or firms outside big cities. At large firms, tenure is significant for men but not for women. At firms in big cities, tenure is always significant for men, and is significant for women when controlling for all individual characteristics. Our explanation for these patterns is that large firms started to offer delayed compensation schemes to men keep them as workers but did not treat women the same way, while market forces in line with the old labor market regime and spot labor market prevailed at small firms, which benefited women through fairer wages. While it is possible that firm-specific skills were important at large firms and not small firms, if male compositors but not female compositors benefited from firm-specific skills this still implies some sort of discriminatory treatment. While small firms outside of large cities treated men and women similarly, large firms in big cities seem to have treated them differently. At these firms, men were apprenticed for longer periods than women, and were rewarded for firm tenure.

5 Conclusion

We find that the gender gap, at least in the case of smaller firms outside of the larger cities, can be entirely explained by observable characteristics, if we include firm characteristics as well as worker characteristics. We also find that men and women had identical apprenticeship patterns at these firms. For large firms in the big cities, observable characteristics explain most of the gender gap but there remains a statistically significant one. We also find evidence that apprenticeship patterns differed for men and women, and that men were rewarded for firm tenure, at large firms in big cities. Our results show that the firm mattered a lot for

understanding the gender gap that many others have observed on group level. We cannot say whether these differences were due to choice or discrimination, but our results are consistent with the hypothesis that discrimination was emerging in large firms in big cities because these offered different job ladders to men and women.

The patterns we observe are consistent with changes in the US labor market, where the nineteenth century was characterized by spot labor markets without wage discrimination, but wage discrimination appeared around the beginning of the twentieth century in white-collar occupations, probably because of the rise of internal labor markets in which men and women were not offered the same career ladders. Previous studies of the US labor market have found no wage discrimination among manufacturing production workers in the 19th century, but have found wage discrimination among clerical workers in the early twentieth century (Goldin 1990; Burnette 2015). The current study holds occupation and time constant, but finds a difference between large and small firms. While internal labor markets became more popular over time, the earliest adopters were larger firms (Howlett 2004; Seltzer 2011), so in 1902/03 larger firms were more likely to have adopted internal labor markets than smaller firms. Thus larger firms, which had adopted internal labor markets, treated men and women differently, while smaller firms did not. We also find that, consistent with Goldin (1986) and Owen (2001), men but not women were rewarded for firm tenure at large firms.

Our results strengthen our conviction that, to understand the gender wage gap, it is essential to understand internal labor markets. Gender gaps cannot be explained or understood by examining only the workers; we must examine the firms where they worked, i.e. the context for production and wage setting, and relationships between firms and their workers. When firms have different expectations for male and female employees, they offer sex-specific contracts for training and compensation, leading to systematic differences in wage by gender. These are the patterns that must be addressed if we wish to eliminate gender wage discrimination.

6 References

Abbott, E. (1910), *Women in Industry.* New York: Appleton.

Abbott, E. and S. Breckinridge (1906), "Employment of Women in Industries-Twelfth Census Statistics", *Journal of Political Economy,* 14: 14-40.

Becker, G.S. (1962), *Human Capital.* Chicago: Chicago University Press.

Becker, G.S. (1981), *A Treatise on the Family.* Cambridge: Harvard University Press.

Becker, G.S. (1985), "Human Capital, Effort and the Sexual Division of Labor", *Journal of Labor Economics,* 3: S33-S58.

Boot, H.M and J.H. Maindonald (2008), "New Estimates of Age- and Sex-Specific Earnings and the Male-Female Earnings Gap in the British Cotton Industry, 1833-1906", *Economic History Review*, 61: 380-408.

Brown, C. and J. Medoff (1989), "The Employer Size Wage Effect", *Journal of Political Economy*, 97: 1029-1057.

Burnette, J. (2015), "The Paradox of Progress: The Emergence of Wage Discrimination", *European Review of Economic History*, 19: 128-148.

Burnette, J. and M. Stanfors (2015), "Estimating Historical Wage Profiles", *Historical Methods: A Journal of Quantitative and Interdisciplinary History*, 48: 35-51.

Carter, S.B. and E. Savoca (1990), "Labor Mobility and Lengthy Jobs in Nineteenth-Century America", *Journal of Economic History*, 50: 1-16.

Elmquist, H. (1909), *Undersökning af tryckerier och därmed förenad handtering i Sverige.* Stockholm: Kommerskollegium.

Eichengreen, B. (1984), "Experience and the Male-Female Earnings Gap in the 1890s", *Journal of Economic History*, 44: 822-834.

England, P. (1982), "The Failure of Human Capital Theory to Explain Occupational Sex Segregation", *Journal of Human Resources*, 17: 358-370.

Evan, W. and D. MacPherson (2012), "Is Bigger Better? The Decline of the Wage Premium at Large Firms", *Southern Economic Journal*, 78: 1181-1201.

Goldin, C. (1986), "Monitoring Costs and Occupational Segregation by Sex: A Historical Analysis", *Journal of Labor Economics,* 4: 1-27.

Goldin, C. (1990), *Understanding the Gender Gap.* New York: Oxford University Press.

Hall, R. (1972), "Turnover in the Labor Force", *Brookings Papers No* 3.

Hatton, T. (1997), "The Immigration Assimilation Puzzle in Late Nineteenth-Century America", *Journal of Economic History*, 57: 34-62.

Hareven, T.K. (1982), *Family Time and Industrial Time: The Relationship Between the Family and Work in a New England Industrial Community*. New York: Cambridge University Press.

Howlett, P. (2004), "The Internal Labour Dynamics of the Great Eastern Railway Company, 1870-1913", *Economic History Review*, 57: 396-422.

Jacoby, S. (1985), *Employing Bureaucracy: Managers, Unions, and the Transformation of Work in American Industry, 1900-1945*. New York: Columbia University Press.

Jacoby, S. and S. Sharma (1992), "Employment Duration and Industrial labor Mobility in the United States 1880-1980", *Journal of Economic History,* 52: 161-179.

James, J. (1994), "Job Tenure in the Gilded Age," in George Grantham and Mary MacKinnon, eds, *Labour Market Evolution.* London: Routledge.

Karlsson, T. and M. Stanfors (2017), "Risk preference and gender differences in union membership in late nineteenth-century manufacturing", forthcoming in *Feminist Economics*.

Kotlikoff, L. and J. Gokhale (1992), "Estimating a Firm's Age-Productivity Profile Using the Present Value of Workers' Earnings," *Quarterly Journal of Economics*, 107: 1215-1242.

Lazear, E. (1979), "Why is there Mandatory Retirement?", *Journal of Political Economy*, 87: 1261-1284.

Mellow, W. (1982), "Employer Size and Wages", *Review of Economics and Statistics*, 64: 495-501.

Mincer, J. (1974), *Schooling, Experience, and Earnings.* New York: Columbia University Press.

Moriguchi, C. (2003), "Implicit Contracts, the Great Depression, and Institutional Change: A Comparative Analysis of US and Japanese Employment Relations, 1920-1940", *Journal of Economic History*, 63: 625-665.

Murphy, K. and Welch, F. (1990), "Empirical Age-Earnings Profiles", *Journal of Labor Economics*, 8: 202-229.

Oi, W.Y. and T.L. Idson (1999), "Firm-Size and Wages", in Orly Ashenfelter and David Card, eds, *Handbook of Labor Economics 3.* Amsterdam: North Holland.

Orring, J. (1967), *Skolan i Sverige*. Stockholm: Seelig.

Owen, L. (1995), "Worker Turnover in the 1920s: The Role of Changing Employment Policies", *Industrial and Corporate Change*, 4: 499-530.

Owen, L. (2001), "Gender Differences in Labor Turnover and the Development of Internal Labor Markets in the United States during the 1920s", *Enterprise & Society,* 2: 41-71.

Polachek, S.W. (1981), "Occupational Self-Selection: A Human Capital Approach to Sex Differences in Occupational Structure", *Review of Economics and Statistics*, 63: 60-69.

Rosenbloom, J. and W. Sundstrom (2009), "Labor-Market Regimes in US Economic History", *NBER Working Paper No 15055*.

Samuel, R. (1977), "Workshop of the World: Steam Power and Hand Technology in mid-Victorian Britain", *History Workshop*, 3: 6-72.

Samuel, R. (1992), "Mechanization and Hand Labour in Industrializing Britain" in Lenard R. Berlanstein, ed, *The Industrial Revolution and Work in Nineteenth-Century Europe*. London: Routledge.

Sandell, S. and D. Shapiro (1980), "Work Expectations, Human Capital Accumulation, and the Wages of Young Women", *Journal of Human Resources*, 15: 335-353.

Schmick, E. (2017), "Collective Action and Origins of the American Labor Movement", unpublished paper retrieved at http://www.pitt.edu/~ejs83/Labor%20Unions.pdf

Schulz, W. (2013), *Careers of men and women in the 19th and 20th centuries.* Dissertation, Department of Sociology, Utrecht University.

Seltzer, A. (2011), "Female Salaries and Careers in the British Banking Industry, 1915–1941", *Explorations in Economic History,* 48: 461-477.

Slichter, S. (1919), *The Turnover of Factory Labor.* New York: D. Appleton and Co.

Stanfors, M., T. Leunig, B. Eriksson and T. Karlsson (2014), "Gender, Productivity and the Nature of Work and Pay: Evidence from the Late Nineteenth-Century Tobacco Industry", *Economic History Review,* 67: 48-65.

Sundstrom, W. (1988), "Internal Labor Markets before World War I: One-the-Job Training and Employee Promotion", *Explorations in Economic History*, 25: 424-445.

Toman, J.T. (2005), "The Gang System and Comparative Advantage", *Explorations in Economic History*, 42: 310-323.

Webb, S. (1891), "The Alleged Differences in the Wages Paid to Men and Women for Similar Work", *Economic Journal*, 1: 635-662.

Wessel, N. (1937), *Svenska typografförbundet 1887-1936: ett svenskt fackförbunds historia*. Stockholm.

Table 1. Descriptive statistics: shares (in percent) and means of variables used in analysis.

	Compositors			Compositors in gender-mixed firms		
	All	Men	Women	All	Men	Women
Hourly earnings (ore)	36.8 (19.58)	38.2 (19.91)	27.0 (13.73)	35.3 (17.39)	38.0 (17.91)	28.3 (13.68)
Hourly earnings if work by hand	34.4 (17.44)	35.7 (17.71)	26.3 (13.04)	34.0 (16.42)	36.6 (16.96)	27.5 (12.95)
Hourly earnings if work by machine	67.5 (20.15)	68.0 (20.27)	55.4 (12.82)	57.9 (18.14)	58.3 (18.91)	55.4 (12.82)
Hourly earnings if apprentice	14.5 (6.54)	14.6 (6.54)	13.9 (6.53)	14.3 (6.19)	14.2 (5.82)	14.6 (6.79)
Woman	13.2			28.0		
Age (years)	28.9 (11.40)	29.2 (11.61)	27.2 (9.71)	29.2 (11.38)	29.9 (11.91)	27.6 (9.73)
Age of starting work in industry	15.0 (3.44)	14.7 (3.38)	16.7 (3.37)	15.5 (4.08)	15.1 (4.23)	16.7 (3.41)
Experience (years)	13.9 (11.26)	14.4 (11.42)	10.5 (9.49)	13.7 (11.14)	14.8 (11.55)	10.9 (9.46)
Tenure (years)	7.1 (8.02)	7.2 (8.16)	6.0 (6.94)	6.4 (7.61)	6.5 (7.82)	6.2 (7.06)
Married	34.7	38.8	7.9	28.5	36.5	8.3
Children at home	28.5	31.8	6.7	24.1	30.8	7.0
Any secondary education	14.9	16.4	0.5	16.3	20.9	4.7
Not born in the same location as workplace	51.2	52.3	42.9	54.0	58.0	43.9
Union member	82.6	86.5	56.9	79.8	86.5	62.5
Member of mutual aid society	71.3	71.9	67.1	75.5	77.0	71.4
Machine compositor	7.1	7.8	2.3	5.5	6.6	2.7
Apprentice	23.8	22.6	32.1	22.4	19.3	30.2
Night work	4.4	4.8	1.5	2.6	3.0	1.7
Sunday work	3.0	3.4	0.5	2.5	3.2	0.7
Firm size (number of workers)	67 (110.74)	70 (115.01)	47 (74.08)	119 (154.68)	146 (168.59)	48 (70.48)
Firm in big city	47.0	46.6	49.9	58.8	61.3	51.6
N	2,590	2,247	343	1,072	771	301

Note: Standard deviations in parentheses.
Source: Undersökning av tryckerier mm 1903, Avdelningen för arbetsstatistik, HII a:1 vol 1-6 samt HII a:2 vol 1-12*,* Kommerskollegiets arkiv, National Archives (*Riksarkivet*), Stockholm.