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Gender, Productivity and the Nature of Work and Pay: Evidence from the Late Nineteenth-Century Tobacco Industry

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Abstract
Women have, on average, been less well-paid than men throughout history. Prior to 1900, most economic historians see the gender wage gap as a reflection of men's greater strength and correspondingly higher productivity. This paper investigates the gender wage gap in cigar making around 1900. Strength was rarely an issue, but the gender wage gap was large. Two findings suggest that employers were not sexist. First, differences in earnings by gender for workers paid piece rates can be fully explained by differences in experience and other productivity-related characteristics. Second, conditioning on those characteristics, women were just as likely to be promoted to the better paying piece rate section. Neither finding is compatible with a simple model of sex-based discrimination. Instead, the gender wage gap can be decomposed into two components. First, women were typically less experienced, in an industry in which experience mattered. Second there were some jobs that required strength, for which men were better suited. Because strength was so valuable in the other jobs at this time, men commanded a wage premium in the general labour market, raising their reservation wage. Hiring a man required the firm to pay a 'man's wage'. This implies that firms that were slow to feminise their time rate workforce ended up with a higher cost structure than those that made the transition more quickly. We show that firms with a higher proportion of women in their workforce in 1863 were indeed more likely to survive 35 years later.

Keywords: gender, productivity, discrimination, piece-rates, time-rates, labour markets, firm survival
JEL Classifications: J16, J24, J71, J33, J40, L25

1.   Introduction

Whether men and women are paid the same wages for doing the same thing is a big question permeating time and space. In general they are not, raising the question of why this is so. Are women less good at the job, or is it discrimination? Economists often emphasize productivity differentials, while historians see a role for custom and gender ideology. Assessing gender wage gaps is complicated by the fact that men and women rarely do the same jobs, and often have different qualifications and labour market characteristics.[1]

Goldin has argued that before 1900 wages were more likely to be gender-neutral, since spot labour markets were common, work was simple and individual productivity easily measured.[2] Piece rates – which reduce the likelihood of gender discrimination – were common. In addition, goods were homogenous and for sale in a competitive market, limiting firms' ability to discriminate in ways that raised unit labour costs. Burnette's 2008 book supports this approach.[3] The twentieth century has seen the growth of professional and service work for which individual performance is difficult to assess. In this scenario firms wish to motivate workers to work hard and remain with the firm. They do so by offering 'internal labour markets': implicit or explicit long term labour contracts with delayed remuneration, such as a pension. Since men tend to work for a firm for longer, this raises male-to-female wages.[4] This is particularly true when firms operate marriage bars, requiring women to resign their position on marriage.

The best way to analyse and understand gender-differentiated earnings is to look within firms and compare individuals who do the same job. In this article we compare male and female cigar workers in Sweden in 1898. We do so for four reasons. First, the cigar industry is rare in employing large numbers of both men and women who, although segregated, were assigned the same jobs. Second, strength and technology were both unimportant, and the industry was not characterised by particular regulations concerning the use of male or female labour. Third, some workers were paid piece rates and some time rates, allowing us to investigate the effect of the payment system on gender differentials. Finally, the data are rich and very similar to modern datasets: a matched employer-employee dataset covering the

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[1] See e.g. Boot and Maindonald, 'New estimates'; Eichengreen, 'Experience'.

[2] Goldin, *Understanding the gender gap.*

[3] Burnette, *Gender, work and wages.*

[4] Goldin, 'Marriage bars', p. 527.

entire industry and containing data on individual hourly earnings, and information about both the worker (age, experience, as well as union membership, marital status, etc) and the firm (workforce composition, production quantities and values, for example).

We find that women are paid less, and that in aggregate this cannot be fully explained by differences in characteristics, such as experience, between male and female workers. There is evidence of discrimination. When we look at piece rate workers we find that although women were paid less than men, this difference can be fully explained, but that when we look at time rate workers, the difference cannot be fully explained. We deduce that employers were not sexist in the sense of having an ideological commitment to paying women less than men, but rather that men and women were in different labour markets outside of the cigar industry. This meant that when the cigar industry wanted to employ men, it had to pay them more, because they had more outside options, raising their reservation wage.

This conclusion is reinforced by our investigation of who was promoted to the piece rate section of the industry. This section paid better, and therefore all workers would want to work in it. There is no evidence that women were less likely to be promoted, given their characteristics. Again, this suggests that employers were not individually sexist, even if the final outcomes were differentiated by gender.

Finally, we link our data to the 1863 industrial census to look at whether firms that employed more women did better. Here the intuition is that, given that women were cheaper to employ in the time rate section, for any given level of experience, firms that employed more women would be more successful. We find that this is the case: those firms that had feminized their labour to a greater extent by 1863 were more likely to survive to 1898.

The article is organised as follows. Section 2 gives a more detailed background of previous research concentrating on the relationship between the gender wage gap on the one hand and productivity and discrimination on the other. Section 3 briefly describes the tobacco industry in the late nineteenth century and describes the dataset. Section 4 presents the results of the empirical investigation, which finds that there was no meaningful discrimination in the piece rate section but extensive discrimination in the time rate section. Section 5 explains why this difference was economically rational, by including firm survival in the analysis. Section 6 concludes.

2.   Previous research and theoretical considerations

The gender wage gap refers to the difference between male and female earnings, and is one of the most enduring aspects of wage history. One of the earliest examples is found in *Leviticus* (27:1-7), in which the LORD tells Moses that the Israelites should value female servants at three-fifths the value of male servants. Differentials are known to have existed before industrialisation,[5] during industrialisation,[6] and thereafter.[7] Today women are still paid less than men in every country for which we have data.[8]

Market and custom constitute competing, although not necessarily contradictory, explanations of the persistent female to male wage gap.[9] Market explanations stress market mechanisms of supply and demand in a competitive environment, and their proponents argue that gender earnings differentials reflect productivity differentials. A firm which discriminated in the labour market would raise costs and reduce profits. From an economic point of view, it is perfectly legitimate and even necessary that those who are less productive earn less if they are to remain employed. Burnette finds evidence of this for the British Industrial Revolution, with greater strength generating higher rates of pay for men.[10] She argues that contemporary beliefs about men as the breadwinner, and women's dependence on men were not the causes of women's lower wages, but rather employers' way to obscure their real, economic, motivations.

This approach is compatible with human capital theory which posits that workers' earnings are a function of their human capital, and thus see some or all of the gender wage gap as caused by differential qualifications, skills, or experience.[11] Becker also suggests that women, due to specialization in caring for others, principally children, put less effort into paid work, which explains their lower earnings.[12] More recently, economists see women as shying

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[5] E.g. Kussmaul, *Servants*; Van Nederveen Meerkerk, 'Market wage'.

[6] E.g. Berg, *Women's work*, Burnette, *Gender, work and wages*; Simonton, *European women's work*.

[7] E.g. Goldin, *Understanding the gender gap*.

[8] Altonji and Blank, 'Race and gender'.

[9] Burnette, 'Female-male wage gap', *Gender, work and wages*; Cox and Nye, 'Male-female wage discrimination'; Goldin, *Understanding the gender gap*; Greenlees, 'Equal pay'.

[10] Burnette, *Gender, work and wages.*

[11] Mincer, *Schooling*; Mincer and Polachek, 'Family investments'; Polachek, 'Post-school investment'; see also Blau and Kahn, 'Gender differences'.

[12] Becker, 'Human capital'.

away from competition within the workplace - tournaments as well as variable payment schemes - therefore generating lower earnings and less successful careers.[13]

Against that, other researchers have ascribed the gender wage gap to established custom – that is, discrimination against women.[14] Implicit in this interpretation is that men and women are generally equally productive and therefore should receive equal wages. Customary wages meant that women's work was undervalued and that society deterred females from working by paying lower wages in order to prevent work leading women to lose their femininity, neglect their female duties, and break taboos that were set up in order to keep the sexes apart.[15] Male-dominated institutions such as unions and other professional organizations often blocked women's access to well-paid occupations and limited female skill formation in order to protect male members' interests.[16] Those interests included gender differentiated wages, but also maintaining a man's position within the family. From a theoretical point of view, discrimination by firms could occur either because of personal prejudice, or because of 'statistical discrimination'. In both cases employers prefer not to hire women but in the latter case this comes about because women are typically more likely to engage in cost raising behaviour, such as leaving the firm, say because of child rearing responsibilities.[17] Few studies have been able to adjudicate effectively in the debate between market and custom, because productivity is often difficult to measure and data are rarely available.

Wage mechanisms are designed to minimise unit costs by attracting, retaining and motivating good workers. One approach is to pay piece rates, that is payment according to production, as opposed to hourly wages independent of output. Piece rates are usually limited to sectors with individual and readily quantifiable output, and to processes with few unobservable quality issues. The tobacco industry, especially cigar making, is a case where the product manufactured is literally a piece: there is 'no clearer case of an individual who is paid her marginal product at every instant in time'.[18] Both present-day and historical estimates show that production workers on piece rates generally have higher earnings than time rate workers, either because they work harder, or because the best workers apply for piece rate

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[13] Dohmen and Falk, 'Multi-dimensional sorting'; Gneezy, Niederle and Rustichini, 'Performance'; Niederle and Vesterlund, 'Do women shy away?'.

[14] Berg, *Women's work*; Humphries, 'Lurking'; Johnson, 'Age'; Rose, *Limited livelihoods*.

[15] Humphries, 'The most free'; Simonton, *European women's work*.

[16] Hartmann, 'Capitalism'; Hartmann, 'Family'; Kessler-Harris, *Out to work*.

[17] Becker, *Economics of discrimination*; Phelps, 'Statistical theory'.

[18] Goldin, *Understanding the gender gap*, p. 114.

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jobs.[19] Piece rates were individual and gender neutral in the industry at the time. This allows us to construct a testable hypothesis, based on the notion that differences in piece rate earnings offer us a 'no-discrimination' gender wage gap benchmark. If wage differences reflect only productivity differences, then the gender gap will be constant, irrespective of the payment system. If there is wage discrimination, we would expect to find a larger gap among time rate workers than among piece rate workers.

3.   The cigar industry in 1898

Prior to the widespread adoption of the Bonsack cigarette-making machine around the time of the First World War, cigar making was the most important part of the tobacco industry in almost every country.[20] Cigar making is a three stage process: preparation work, rolling, and sorting and packaging. Preparation involved handling the raw tobacco, fermentation, moistening and removing stems. Rolling is undertaken either by hand or with the help of a wooden mould. Finally, the cigars were sorted by quality, dried and packed. Rolling and sorting were generally considered to be more highly skilled work: rolling required dexterity while sorters needed experience to grade by quality.[21]

By 1898 Swedish cigar production, which accounted for 70 per cent of total tobacco employment, was factory based, but relatively un-mechanised by international standards.[22] Although cigar makers and sorters traditionally trained for at least two years, rises in output and the introduction of cigar making moulds shortened the learning process considerably.[23] As in other countries, women entered the Swedish cigar making industry in the mid-nineteenth century and by 1898,[24] 70 per cent of cigar workers were female, working side by

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[19] Booth and Frank, 'Earnings'; Busch, 'Incentive pay'; Goldin, 'Monitoring costs'; Lazear, 'Performance pay'; Petersen, Snartland and Milgrom, 'Female workers'; Scranton, *Figured tapestry*.

[20] Hannah, 'American tobacco'.

[21] Cooper, *Cigar maker*; Prus, 'Mechanisation'.

[22] Cox, 'Tobacco industry', p. 124; Elmquist, *Undersökning*, p. 64.

[23] Elmquist, *Undersökning*, pp. 96–8; Oakeshott, 'Women', p. 565.

[24] Abbott, 'Employment'; Elmquist, *Undersökning*; Gálvez Muñoz, 'Engendering wages'; Murray and Keith, 'Earnings differentials'.

side with men within individual factories.[25] Cigar making thus represents a good industry to investigate for our purposes: men and women worked together, doing jobs that did not require strength, with some workers paid piece rates and some on time wages.

Concern about economic issues, including gender issues, led US and European governments to undertake a range of surveys and censuses from around 1880. The *Swedish Board of Commerce* instigated statistical surveys of a number of industries, including tobacco in 1898. Statistician Henning Elmquist, and three travelling agents, asked detailed questions of 104 employers and 4,336 employees, which we link together.

We restrict our analysis to adult cigar workers, excluding apprentices and foremen, for whom we have data on all variables of interest. We include only establishments with a gender mixed workforce consisting of at least ten employees and at least five cigar workers. This leaves a sample of 1,914 individuals, 612 men and 1,302 women.

Employers supplied information on the number of employees, their earnings, machinery, working hours, employment contracts and regulations, fringe benefits (which were trivial), experiences of strikes and lock-outs. Workers were asked about the date and location of birth, parents' occupation, civil status, number of children, health status, present occupation, year of entering the industry as well as when they began their present occupation, year when employment at the present factory began, weekly income, wage form, and whether they were union members or subscribers to a benefit society. Since workers report both weekly earnings and hours worked we are able to use hourly earnings throughout, which is rare but highly important from a gender perspective since the danger of using weekly wages is that women may be paid less because they work shorter hours. Descriptive statistics for the variables of interest are shown in Table 1.

We can see from the first row that female workers earned 36 per cent less per hour than male workers. At first sight this would seem to be *prima facie* evidence of extensive discrimination. However, the table shows that men were more likely to have characteristics that we might imagine are associated, causally or by proxy, with higher productivity. Male workers were almost twice as experienced, and only 10 per cent of male workers, compared with a quarter of female workers, had been in the industry for two years or less. There was

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[25] Collet, 'Leeds', p. 473; Lindbom and Kuhm, *Tobaksarbetarnas*, p. 38; Webb, 'Alleged differences', p. 639

thus a much larger group of female workers who were probably still learning on the job. The difference in experience is reflected in the occupational distribution: 91 per cent of men were in skilled occupations (cigar makers and sorters), compared with 54 per cent of women. In addition, men were more likely to report that they were in good health, more likely to be married, and to have children at home. Women, on the other hand, were more likely to have had a career break longer than six months, often relating to childbirth. Family responsibilities do not increase men's productivity directly, but they can increase the individual's incentive to work hard and can lead to employers perceiving them as reliable, in line with the traditional male breadwinner norm. For women, on the other hand, they may be associated with more of a workload at home that reduces productivity at the workplace.[26]

4.   Why women earned less than men: a quantitative analysis

There is historical evidence that men were paid more than women in industries in which strength was an important determining characteristic of productivity. In addition, there is evidence that in the twentieth century men have been paid more than women in industries with clearly defined career structures. Neither of these descriptions characterises cigar making in 1898. We have noted that this is an industry in which within any given factory, men and women frequently worked side by side, doing the same job, and yet men earned more than women. Neither strength your career structures can explain this.

We now look at whether we can explain the difference in earnings between men and women. We begin by asking whether the differences in gross earnings can be explained by factors, including gender, that we might expect to be correlated with productivity. The first stage, therefore, is to calculate standardised earnings gaps, using regression analysis. We estimate an OLS earnings model where the natural logarithm of gross hourly earnings is modelled as a function of gender, age, and other personal characteristics, experience, tenure, work interruptions, occupation, and union status, as well as factory fixed effects. As we are interested in an unbiased estimation of individual specific variables, we control for the chance that there may be unobserved heterogeneity with respect to the labour force between firms, such as may arise from the recruitment of different kinds of labour. The R-squared 'within'

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[26] Becker, 'Human capital'.

gives us an indication of how well our model explains variation in outcome between individuals in a particular establishment. The model we estimate is:

$$\ln E_i = \alpha_0 + \beta_1 X_i + \beta_2 Z_i + G_{ij} + \varepsilon_i \tag{1}$$

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 denotes occupation; and G is the unobserved group fixed effect for individuals working in the firm j.

This enables us to interpret a gender coefficient as the cost of being female. Table 2 presents the results, for all workers, and separately for those on piece and time rates. (Gender specific regression results are reported in Appendix A1.) Columns one and two show the results from a pooled regression. The returns (estimated coefficients) for the two sub-samples of workers on time rate wages and piece rates are displayed in columns three to four and five to six, respectively. The main results are in line with expectations. Occupation was by far the most important determinant of hourly earnings within firms. We find that when we take into account all of the characteristics that might influence productivity, and for which we have data, the dummy variable on gender is still significant. In comparison to the raw gender earnings gap of 36 per cent, the adjusted gender gap for all workers is 21.2 log points, with the equivalent figures being 36.3 and 18.4 for time rate and piece rate workers, respectively.

We need to interpret these coefficients with care. Female workers were less experienced than male workers. The correlation between these two right hand variables means that their coefficients are biased, and some part of the cost of being less experienced will be attributed to the gender dummy variable. The same is true for age, skills, and so on. Even if there was no discrimination, we would expect the dummy variable for 'woman' to be negative and perhaps statistically significant, since it will be acting as a proxy for being younger, having less experience, and so on. Thus, the coefficient on gender in the regressions in Table 2 must be seen as an upper bound on the extent of wage discrimination.

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For that reason we use the standard methodology originally proposed by Oaxaca and Blinder.[27] The Oaxaca-Blinder method decomposes the difference in male to female earnings into two parts, the part which can be explained by differences in the levels of the characteristics relevant to earnings, and the part that cannot. In essence the procedure works out what women should have been paid, given their characteristics, were they to have been paid the same as men for those characteristics, and compares this with what they were actually paid. The difference is taken to be discrimination, although of course it could be that there are other unexplained differences between men and women that affected productivity and so pay.

The Oaxaca-Blinder decomposition is a two-stage process. As a first stage, we estimate gender specific earnings regressions in line with equation (1). Dropping the subscripts in equation (1) gives us the following gender specific equations:

$$\ln E_m = \alpha_m + \beta_{\mathrm{m}} X_m + \varepsilon \tag{2}$$
$$\ln E_f = \alpha_f + \beta_{\mathrm{f}} X_f + \varepsilon \tag{3}$$

Where E is the natural log of hourly earnings, X is a vector of factors that are causally or by proxy determinants of wages, β the coefficients, x the set of factors that are causally or by proxy determinants of wages (age, experience, etc), ε is an error term, and the subscripts m and f denote male and female, respectively. The results are given in appendix table A1.

Assuming the average values of the variables in the two groups, the gender earnings difference can be decomposed as follows:

$$\ln E_m - \ln E_f = \alpha_m + \beta_{\mathrm{m}} X_m - \alpha_f - \beta_{\mathrm{f}} X_f$$
$$= (\alpha_m - \alpha_f) + (\beta_{\mathrm{m}} - \beta_{\mathrm{f}}) X_f + \beta_{\mathrm{m}} (X_m - X_f) \tag{4}$$

where the notation follows equations (2) and (3) above.

The difference in wages is decomposed into the amount by which we would expect women to be paid less, given their different characteristics in relation to men, $\beta_{\mathrm{m}} (X_m - X_f)$, and the amount explained by women having lower returns to characteristics, $(\beta_{\mathrm{m}} - \beta_{\mathrm{f}}) X_f$. It is

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[27] Oaxaca, 'Male-female wage differentials'; Blinder, 'Wage discrimination'.

this second factor that economists usually describe as wage discrimination. Since we believe that the results may be different for those paid by the piece from those paid by the hour, we undertake the decomposition exercise for each payment types.

Table 3 contains three panels, covering all workers, time rate workers and piece rate workers respectively. In the case of all workers, we find that men had better individual characteristics (worth 16.6 wage log points) and better jobs (giving a 14.7 log point advantage). Together these imply that men should earn 31.3 log points more than women, but in fact we find that they earn 46.0 log points more. Thus we can explain 68 per cent of the actual difference, leaving 32 per cent unexplained. In the case of time rate and piece rate workers, differences in characteristics and occupations explain 46 per cent and 116 per cent of the raw difference in earnings respectively. This is a huge difference, and demonstrates the importance of looking separately at workers paid by the piece, and at workers paid by the hour. For piece rate workers there was no discrimination against women, indeed there was some discrimination in their favour (116 per cent exceeds 100 per cent), whereas over half of the gender gap in the earnings of time rate workers cannot be explained.

That women paid piece rates are discriminated in favour of is a remarkable result. Men appear to have reason to grumble, but since these are piece rate earnings it is most likely that men did produce less relative to their characteristics than did women. It could be that men were lazier than they might have been, or it could be that the returns to labour market characteristics such as experience are more complex than the simple approach used here. In any case, our basic assumption that women were not discriminated against when being paid piece rates is born out. Women earned less per hour than men because they produced less, and they produced less because they had different labour market characteristics.

We can see the ultimate expression of this finding when we restrict our attention to workers rolling cigars using a mould. The mould was a wooden device that ensured that workers produce cigars of a consistent size and shape. It also reduced the skill level needed to produce a cigar that was well-shaped. We know for sure that mould workers did exactly the same task and for this group we also have information on the actual piece rates they were paid. Piece rates in the cigar industry were individual and gender neutral, which make them perfect for accounting for individual productivity. When we perform regression analysis on the 312 mould workers, taking individual characteristics into account, we find that the gender

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dummy is insignificant, and at less than 0.1 log points, so small as to be completely irrelevant. The results for mould are shown in Table 4.

5.   Why women were paid less than men: a qualitative analysis

We have found that women were discriminated against in the time rate section of the industry, but not in the piece rate section. The easy explanation would be to claim that bosses – who were, in this industry, uniformly male – were biased, and were able to express that bias in the time rate section. Women were paid less because bosses conform to a stereotypical image of a patriarchal society, in which men wish to keep women in their place, and do so partly by paying them less. The primary data, in the form of notes made by the interviewers, provide some evidence of this kind of discrimination. For example, in one factory in Lund, the interviewer noted that 'the boys and the women had to stay behind for up to an hour and a half on Saturday evenings in order to clean the factory'.[28] The women's situation was further aggravated by having to sit close to a stamping machine that gave of a foul smell that caused headaches and nausea. Against that, only one worker (a man) of all those surveyed, complained of wage differentiation. Blatant discrimination seems to have been the exception rather than the rule. Indeed, the existence of a piece rate section, in which both men and women worked side by side, and in which both were paid according to their productivity and their characteristics, tells us that discrimination was not universal. Had society and industry as a whole been consistently sexist, these better paid jobs would have been reserved for men.

Instead we need to think of other explanations as to why women on time rates were paid less, while accepting that companies paid productivity related, gender-neutral, wages to a

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[28] The primary material is found in the National Archives (*Riksarkivet*) in Stockholm. The *Special Investigations of the Tobacco Industry in 1898 [Specialundersökningar Tobaksindustrien 1898]* is part of the Archive of the Swedish Board of Commerce [Kommerskollegiets arkiv], and the box in question is labeled Statistiska avdelningen, HIII b:1.

significant proportion of their workforce. This is best understood in the context of competitive markets and profit maximising firms. We know that there were about 50 firms producing cigars at this point. Although this is not the infinite number formally needed to declare an industry perfectly competitive, it is clearly a competitive sector rather than a monopolistic one. Cigars are easy to transport, and local monopolies were not an issue. Even in the absence of significant levels of imports, firms in this industry were price takers, not price setters. In this context, profits per cigar are equal to the price, which is exogenous, minus costs. In short, subject to maintaining quality, profit-maximisation is equal to cost-minimisation.

Let us think further about the costs faced by the industry. The raw material, tobacco, is overwhelmingly imported. Individual cigar makers do not own their own plantations, and purchase the material on the open market, at a common price dictated by global supply and demand. Other than a requirement to be diligent, the purchase of tobacco is not a source of profitability for any given firm. The same is true for capital equipment: this is a low capital industry, almost devoid of specialist equipment. Prior to the widespread adoption of the Bonsack machine, capital consisted of general physical capital – a building, containers for material, and work benches at which workers perform their duties. There is no meaningful source of enhanced profitability here. In contrast, the level of labour costs was important. Provided that neither productivity nor quality suffers, a firm that cuts wages will raise profits. In this case the quest for profit maximisation becomes a quest to reduce wages.

In the long run wages in one industry are decided by competitive pressures across all industries, taking into account any particularly pleasant or unpleasant aspects of the work. Workers always demand high wages, but their ability to do so relates essentially to their outside options – if someone else will pay them a high wage then in essence their current employer must do so, or lose them. The *de facto* wage negotiations between firms and workers in the tobacco industry in this era need to be seen in this context.

ike many other jobs in manufacturing, cigar making in 1898 was not pleasant or stimulating work. Many workers suffered from work-related health problems such as respiratory diseases. But cigar makers nevertheless belonged to the 'labour aristocracy', were respected for their skills, and had relatively good prospects of earning good wages.[29] As we have noted, cigar making divides into two types of work: those for which individual productivity can be assessed, and those for which it cannot. In the former, the firm's profit maximising strategy is to pay piece rates. This ensures that productivity is high, and since

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[29] Carlsson, *Svensk ståndscirkulation*.

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poor quality can be easily detected, this strategy dominates all others. Furthermore, the profit maximising strategy is to pay men and women equal amounts per piece produced: those who profit maximise care about output, not gender. This is exactly what we find.

For those jobs for which individual output is not readily measurable, the profit maximising strategy is more complex. Piece rates are not an option, since output cannot be measured. The firm is therefore forced to pay by the hour. Although few of the jobs in the cigar factory require strength, most men are stronger than most women, and as such men had outside options that were not available to women. This means that, economy-wide, men had higher equilibrium wages than women, and as a result employers had to pay men more than women, even taking into account characteristics such as experience within the tobacco industry.

This has three implications. The first is that a profit-maximising firm would want to employ as many women as possible in the time rate section, since women are cheaper to employ than men. The gender division of labour, in which women enter predominantly lower paid work, has its roots in the greater availability of outside options for men, and this is no exception. Women are to a larger extent priced into tobacco jobs by their absence of other, better-paid opportunities. We see this happening in the greater feminisation of the tobacco workforce over time: in 1863 22 per cent of workers were women, rising steadily to about 60 per cent by 1898.[30] Competition at the product market level was not harsh enough that firms had to fire all men and replace them with women immediately, but it was sufficient to ensure the steady feminisation of the labour force over time.

We can demonstrate this effect formally. We have firm specific data for the proportion of workers who were female in 1863. We can therefore test whether firms that had more female workers in 1863 were more likely to survive to 1898, in line with our prediction. We run a probit regression to test this intuition, and find that it holds. The results are given in Table 5. This is an important result, because it explicitly links the survival of the firm with the gender make up of its workforce. We should not see the proportion of the workforce that were of either gender, or the relative pay of men and women, as being decisions which the firm could take without regard to the market. Instead, we should see the firm has constrained in its labour market choices by only by the labour market itself, but also by the product market. Conditions in both the labour market and the product market change over time, so that the

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[30] Swedish Board of Commerce [Kommerskollegii], *Bidrag till Sveriges officiella statistik. S, Fabriker och manufakturer 1863.*

decision as to who to employee is one that involves in a dynamic setting over time.

The second apparent implication is that women appear to have had a much greater incentive than men to enter the piece rate section of the industry, since this allowed them to escape the wage discrimination faced by female time rate workers. In fact both genders have an incentive to become paid by the piece, since both genders receive a pay rise on doing so. Notice too that the firm has no preference for the gender of the staff who are given piece rate responsibilities – in equilibrium any worker transferred from the time rate section will be replaced by another worker of the same gender. Women will be replaced by women because women are cheaper to hire. The decision as to whether to replace men with men is slightly more complex. In equilibria, men will be replaced by men, since men will only be employed in positions that require specific attributes unique to men. In the dynamic period characterised by the feminisation of the workforce, men will be replaced by women wherever possible.

Both men and women are better paid when on piece rates, and therefore we would expect to see both seek to work in that section. The only exception would be if women steered clear of piece rates as being too 'competitive', in line with some recent suggestions about gender differences in approaches to the labour market. We use a probit regression to test this proposition. The model specification is given by:

$$\text{Prob } (Y_i = 1) = F\,(\hat{a}_1\,X_i + \hat{a}_2\,G_{ij}), \tag{5}$$

where as before X is a vector of individual and human capital related characteristics; and G is the unobserved group fixed effect for individuals working in firm j.

The results are reported in table 6, and show that women were not less likely to work on piece rates than men. Given their characteristics, they were actually more likely, so we find no evidence that they were shying away from competition. Firms simply picked people they thought had aptitude, which is unobservable to us, and the workers they picked will almost certainly accept the offer to move to the piece rate section, given the increasing pay that this involved.

The final implication is most important. Individual firms do not exist in a vacuum, but

need to be seen in the context of the economy as a whole. In competitive markets firms are forced to act in cost-minimising ways. Let us imagine a firm that decided that it would ensure that men and women would earn, on average, the same amount. Even if that firm excluded managerial and supervisory workers from the calculation, it would struggle to stay in business. If the firm paid all workers 'male' wages, its cost level would be too high, and it would be driven out of business by a lack of customers. If the firm paid all workers 'female' wages, it would not secure men for roles for which strength was important. If it paid the weighted average of male and female workers it will face the same effect: the men will leave. This would not be a problem in the piece rate section, where men can be replaced by women without any change in unit labour costs. But it is a problem in the time rate section, where the firm had previously hired men at higher rates of pay than women because they had found that there were some jobs for which men, who typically have greater strength, had a greater aptitude that outweighed the difference in wages. An equal wage firm cannot survive and make a profit.

If, then, we are to understand male-female wage differentials in any one sector of the economy we need to understand them in all sectors. The differences in earnings in the cigar industry do not come about simply because of the attitudes of employers or workers in this particular industry, but because of the competitive equilibria for male and female workers that exists across a country at a given point in time. Here, two things stand out. First, strength is an important labour market attribute, particularly although not exclusively in the past. Men are usually stronger than women and as a result men will be paid more than women. This applies not only to jobs that require strength, but to any jobs whose employees could obtain a job requiring strength, or who have some other attribute that precludes them being replaced by women. You do not have to use your strength to get the strength premium, you simply have to have some strength that you could put to use in the labour market.

Second, both individuals and society have expectations as to who cares for children and the elderly. It is not clear to what extent societal expectations are simply the aggregate of individual preferences, and to what extent individual preferences are moulded by society's expectations. But the fact remains that societies expected and expect women to provide the overwhelming majority of care for those who cannot care for themselves.[31] Women have an outside option that is not as available to men: becoming mothers. Of course, for those who are poor, being a mother is generally an additional burden to paid work, not a replacement. But

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[31] Stanfors, *Education*.

for most women, motherhood can be an attractive option when compared with factory labour. Working in a cigar factory, a cotton mill or a glue plant was not an appealing way to spend 60 hours a week, on a year round basis, for pretty much all your adult life. Having the potential to be a mother and to take care of your family was therefore both a burden and a blessing. Caring activities reduce earnings, both directly because you typically have less experience, and indirectly, in that many people perceive you to have less experience, be less likely to gain experience, or to lack commitment more generally. But equally, becoming a mother may well have been a more enjoyable and rewarding experience for many women than working in a factory.

6.   Conclusion

This paper has looked for discrimination in Swedish cigar making. We looked at the differences in earnings by gender among workers paid piece rates and time rates. We found that, as we might expect, there is no evidence of discrimination in the piece rate section even though men were paid much more than women on average. The difference in earnings can be explained entirely by the differences in characteristics of men and women employed. But when we looked at workers paid by the hour we find that less than half of the difference in earnings can be explained by characteristics such as experience and age. In this case, men appear to have been paid more than women simply because they were men.

We argue that it is unlikely that firms were ideologically schizophrenic when it came to the treatment of gender: favouring equality for some work, and highly discriminatory for others. Instead we show that equality in one section and discrimination in the other was likely to be a profitable strategy in a reasonably competitive sector in which output could be accurately assessed for some jobs, and in which strength was important for a limited range of jobs. Firms paid by the piece whenever possible because it was profit maximising, and they paid market wages otherwise. Since women were paid less than men in general, they employed women when they could, and the labour force became gradually more and more feminised. We find that firms that feminised their labour force earlier were more likely to survive. Outside options explain the differences in time rate earnings: men could get jobs that required strength in a way than women generally could not, and as a result any firm wanting

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to employ men was forced to pay higher wages. The classic outside option for women was motherhood, which while unremunerated has rewards as well as costs, and most women made this choice at some point. As a result women in the paid labour force were generally less experienced, which, combined with lower strength meant that the equilibrium wage for women was significantly lower for women than for men.

The twentieth century saw a fall in the labour market returns to strength, to the advantage of women relative to men. But it also saw a rise in the returns to experience, as human capital, including on the job learning, became more important. This, clearly, was to women's detriment, since women are still responsible for the majority of care provided for the young, the old, and for others who cannot care for themselves. Until that changes, there is little chance of men and women being paid the same.

Table 1. Means and distributions of variables used in the analysis of gender earnings differentials among cigar workers, standard deviations within parentheses.

Variable	Type	Definition	Men	Women
Earnings	Continuous	Hourly earnings (SEK)	0.262	0.167
			(.08)	(.06)
Age	Continuous	Age when survey was	36.5	30.5
		carried out	(13.84)	(12.43)
Health status	Dummy	Good health	78.4	70.0
Migrant	Dummy	Migrant	58.2	40.6
Civil status	Dummy	Single	45.6	71.5
		Married	48.0	19.9
		Previously married	6.4	8.6
Kids at home	Dummy	Kids at home	47.9	32.9
Career break	Dummy	Have had career break	2.5	8.5
Wage form	Dummy	Piece rates	92.8	83.8
Occupation	Dummy	Preparation worker	4.3	29.8
		Bunch-maker	4.9	15.8
		Cigar maker	82.4	43.6
		Sorter	8.5	10.8
Experience	Continuous	Years in tobacco	22.2	11.7
		industry	(14.92)	(10.59)
Tenure	Continuous	Years with present	8.7	6.1
		employer	(11.10)	(7.54)
Union member	Dummy	Member	80.0	37.7
Subscriber to benefit society	Dummy	Member	72.4	55.5
Workplace location	Dummy	Big city	62.4	76.1
Workplace size	Dummy	1–49 workers	14.4	9.2
		50–99 workers	43.1	39.9
		> 100 workers	42.5	50.9
Share women	Continuous	Women's share of the	54.5	73.3
		labour force at	(.21)	(.15)
		workplace		

Table 2. Determinants of log hourly earnings: estimated coefficients and probability values from fixed effects-regressions with robust variance estimates.[32]

	All cigar workers		Cigar workers on time rates		Cigar workers on piece rates	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
Woman	-0.212	0.000	-0.363	0.000	-0.184	0.000
Age	0.025	0.000	0.039	0.000	0.018	0.000
Age square x 10	-0.004	0.000	-0.004	0.002	-0.003	0.000
Married	0.030	0.104	0.152	0.018	0.017	0.362
Previously married	0.004	0.872	-0.078	0.378	0.017	0.511
Bunch-maker	0.049	0.028	-0.051	0.351	0.103	0.000
Cigar maker	0.425	0.000	0.832	0.000	0.491	0.000
Sorter	0.571	0.000	0.367	0.000	0.650	0.000
Experience	0.010	0.000	0.004	0.569	0.011	0.000
Experience square x 10	-0.001	0.009	0.000	0.872	-0.002	0.002
Tenure	0.006	0.007	0.019	0.032	0.003	0.139
Tenure square x 10	-0.001	0.039	-0.005	0.038	0.000	0.443
Constant	2.029	0.000	1.862	0.000	2.105	0.000
No of obs	1,914		255		1,659	
No of factories	42		39		42	
F-statistics	249.56		18.10		207.18	
Prob (F-stat)	0.000		0.000		0.000	
R-squared	0.692		0.508		0.696	
R-squared: within	0.708		0.622		0.700	
R-squared: between	0.497		0.232		0.585	

Note: We also control for health status, whether the person had migrated, dependent children at home, career interruptions longer than six months, union membership, and whether the individual subscribed to a benefit organization.

The reference category is a single man working as a preparation worker

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[32] All results are estimated with heteroscedasticity corrected standard errors, using the Huber-White sandwich estimator.

Table 3. Oaxaca-Blinder decompositions of the gender earnings gap by payment system.

Sample	Endowments	Coeffs.	Raw gap	Adj. gap	Explained (%)	Unexplained (%)
All workers						
Individual and human capital characteristics	16.6	7.9				
Occupation	14.7	-14.1				
Total	31.3	-6.2	46.0	14.7	68	32
Time rate workers						
Individual and human capital characteristics	-1.0	75.4				
Occupation	11.8	3.0				
Total	10.8	78.4	23.3	12.5	46	54
Piece rate workers						
Individual and human capital characteristics	14.3	-25.9				
Occupation	36.7	63.6				
Total	51.0	37.7	44.0	-7.0	116	-16

A positive number in the endowments column indicates that men were better positioned

Table 4. Determinants of log hourly earnings among mould workers: estimated coefficients and probability values from fixed effects-regressions with robust variance estimates.[33]

	Coeff.	p-value
Woman	0.0008	0.994
Age	0.031	0.002
Age square x 10	-0.005	0.000
Married	-0.005	0.894
Previously married	0.055	0.293
Experience	0.002	0.834
Experience square x 10	0.000	0.973
Tenure	0.005	0.579
Tenure square x 10	-0.001	0.683
Piecerate	0.030	0.001
Constant	2.062	0.000
No of obs	312	
No of groups	26	
F-statistics	8.25	
Prob (F-stat)	0.000	
R-squared	0.340	
R-squared: within	0.329	
R-squared: between	0.295	

Note: See Table 2.

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[33] All results are estimated with heteroscedasticity corrected standard errors, using the Huber-White sandwich estimator.

Table 5. Determinants of firm survival using probit regression with robust variance estimates for firms producing cigars, standard error in parentheses

	Model2B
Share Women	2.195**
	(0.786)
Total Production	0.004
	(0.003)
Share Cigar	-0.216
	(1.478)
Constant	-0.630
	(1.592)
N	50
chi2	14.427
p	0.002

*p<0.05, **p<0.01, ***p<0.001

Table 6. Determinants of working under piece rates for all workers age 15 and over, directly involved in cigar making, and by sex. Coefficients and probability values from a probit regression with robust variance estimates.

	Coeff.	p-value
Woman	0.698	0.000
Age	-0.079	0.009
Age square x 10	0.011	0.003
Married	0.442	0.023
Previously married	-0.422	0.067
Experience	0.071	0.001
Experience square x 10	-0.017	0.000
Tenure	-0.068	0.001
Tenure square x 10	0.011	0.017
Bunch-maker	1.101	0.000
Cigar maker	3.500	0.000
Sorter	1.241	0.000
No of obs	1,757	
Log pseudolikelihood	-380.2	
Prob > chi2	0.000	
Pseudo R2	0.449	

Note: See Table 2. We also include firm-specific controls for workplace location, size, revenue, and share of women at the workplace.

Table A1. Determinants of log hourly earnings: estimated coefficients and probability values by gender from fixed effects-regressions with robust variance estimates.[34]

| | All cigar workers, fixed effects | | | | Time rates, fixed effects | | | | Piece rates, fixed effects | | | |
| | Men | | Women | | Men | | Women | | Men | | Women | |
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
Age	0.031	0.007	0.024	0.000	0.093	0.159	0.037	0.000	0.001	0.890	0.017	0.000
Age square x 10	-0.004	0.004	-0.004	0.000	-0.006	0.456	-0.004	0.002	0.000	0.554	-0.003	0.000
Married	0.073	0.066	0.018	0.390	0.864	0.042	-0.015	0.811	0.058	0.083	0.019	0.394
Previously married	-0.027	0.598	0.019	0.501	n.a.	n.a.	-0.031	0.710	-0.008	0.859	0.025	0.411
Bunch-maker	-0.383	0.000	0.111	0.000	0.195	0.063	0.047	0.459	0.553	0.000	0.120	0.000
Cigar maker	0.300	0.000	0.431	0.000	1.358	0.001	n.a.	n.a.	1.338	0.000	0.447	0.000
Sorter	0.492	0.000	0.549	0.000	0.483	0.063	0.308	0.000	1.497	0.000	0.602	0.000
Experience	-0.001	0.856	0.016	0.000	0.005	0.889	0.009	0.288	0.012	0.046	0.018	0.000
Experience square x 10	0.000	0.732	-0.003	0.000	-0.002	0.768	-0.003	0.145	-0.002	0.083	-0.004	0.000
Tenure	-0.003	0.732	0.007	0.045	0.021	0.678	0.014	0.169	-0.002	0.409	0.004	0.223
Tenure square	0.000	0.446	0.000	0.619	-0.024	0.450	-0.001	0.634	0.000	0.282	0.000	0.922
Constant	2.055	0.000	1.845	0.000	0.934	0.248	1.593	0.000	1.517	0.000	1.964	0.000
No of obs	612		1,302		44		211		568		1,091	
No of groups	42		42		18		39		41		38	
F-statistics	54.86		131.37		34.80		8.40		54.60		113.76	
Prob (F-stat)	0.000		0.000		0.000		0.000		0.000		0.000	
R-squared	0.589		0.642		0.645		0.446		0.587		0.643	
R-squared: within	0.628		0.642		0.979		0.463		0.645		0.651	
R-squared: between	0.510		0.634		0.368		0.393		0.406		0.728	

Note: See Table 2, n.a. – not applicable due to lack of observations.

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[34] All results are estimated with heteroscedasticity corrected standard errors, using the Huber-White sandwich estimator.

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