Gender Wage Gaps and Worker Mobility: Evidence from the Garment Sector in Bangladesh.

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Abstract: We use administrative data from 44 large garment factories in Bangladesh to examine pay differentials between female and male production workers. Minimum wage rates are assigned at the skill level and are largely binding. Nevertheless, we find that men are paid 5-8 percent more than women, largely the result of men being on average in positions associated with higher minimum wages. Using detailed skills assessments from a subset of 15 factories, we show that men have higher wages and grades even conditioning on skills. Only about one-third of the wage gap is explained by differences in skills. The fact that men have higher grades even conditional on skills focuses our attention on promotions. We find that factories promote men slightly more frequently, but the factory promotion gap is not enough to explain the wage gap. Rather, the data indicate that most promotions are "external promotions" that take place when workers leave one factory for a better paid position at another factory. Across their careers, males are more mobile, with average firm tenure rates that 25 percent shorter than those for females. We explore whether differential mobility is related to women facing higher costs of changing factories, or men receiving more benefits from moving. We find evidence that both of the channels play a role in the differential mobility rates.

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Pay differences between men and women in high-income countries have fallen in the past three decades, but a significant gap remains (Blau and Kahn, 2016). Much of the recent literature on the gender wage gap focuses on more precise measurement of differences in the marginal product of labor across gender, aiming to isolate differences in wages conditional on productivity differences.[1] The focus then turns to factors other than bias which rationalize gaps conditional on marginal products. For example, Goldin (2014) provides evidence that women have a stronger preference for flexible work schedules, and pay a price for this. Black (1995) and Manning (2013) show that when women are less likely to leave their current jobs, firms may optimally pay women less in a price-discrimination sense. Flory et al. (2015) provide experimental evidence that women are more reluctant to enter jobs that are framed as highly competitive. Blau and Kahn (2016) provide an excellent overview over this literature.

We follow the recent trend toward examining gaps in a narrow set of occupations by focusing on sewing workers in the garment sector in Bangladesh.[2] We use administrative records from 44 large garment factories in Bangladesh. Our data cover 55,000 production workers. The records include monthly salary sheets, on average for a period of 13 months from each factory, and, for a subset of the workers, surveys and internal skills assessments by the factories. The skills assessments are made at the level of the individual worker, and are detailed enough to measure the productivity of workers. They allow us to control for worker skill differences that remained unobservable in most previous studies on wage gaps. We use the skills assessments to decompose the overall wage gap into differences in skills and differences conditional on skills, and then to explore explanations for the conditional wage gap.

Wages of sewing workers in the garment sector in Bangladesh are subject to minimum-wage laws that are specific to the sector. Across the sector, workers are classified into a seven-point grade scale, from grade 7 for entry-level positions to grade 1 for workers in supervisor and management positions. The law proscribes a different minimum-wage for each grade, which increases as one progresses from grade 7 to grade 1. The factories in our sample are all direct suppliers to large European or North American brands, and the administrative records indicate that they comply with the minimum-wage law.[3]

In spite of the rigid wage-setting environment, we find that wages of male production workers are 5-8 percent higher than wages of females. Most of the gap owes to males

[1] For example, Bertrand et al (2010) use a sample of MBAs and include measures of MBA classes and grades, to control for possible unobservable skill levels. Similarly, Corcoran et al. (2005) document the evolution of the wage gap among cohorts of graduates from the University of Michigan Law School over time, being able to control for the performance during law school.

[2] See, for example, Bertrand et al. (2010) on MBAs and Corcoran et al. (2005) on lawyers.

[3] The minimum wage is fixed as the monthly wage for working six days per week, eight hours per day. Levels were last adjusted in December 2013 to a rate of roughly USD 66 for grade 7 and USD 85 for grade 3. Overtime beyond eight hours per day is paid at 150 percent of the hourly wage given by the minimum wage for regular work hours.

being more prevalent in the higher grades of sewing workers. Controlling for worker grade, the gap drops to 1.5-2 percent, though it remains statistically significant.

Detailed skills assessments allow us to examine whether males have higher wages and grades because they are more skilled, or whether instead they are paid more even conditional on skill levels. Many factories regularly test the production skills of their workers. For a subset of factories in our sample have data on worker skills that we can match with the worker information in our administrative data. Skills assessments conducted by industrial engineers in production conditions provide a measure of the efficiency and flexibility of each worker. We measure flexibility as the number of different machines or sewing processes, and the complexity of the processes the worker can do; efficiency is measured as the number of times a worker can do a given process in an hour, compared with a standard output for that process. We discuss these in more detail below, but we view them as unusually precise measures of worker productivity. We find that the skill level explains only about one-third of the wage gap, with two-thirds of the gap remaining after conditioning on skills.

From a different, randomly drawn subset of workers in our data, we have detailed demographic and socio-economic information from worker surveys conducted at all 44 factories in our sample. These data show that only a small part of the gender gap is explained by other background variables such as years of schooling or tenure in the sector, and that tenure and skills are correlated.

If the majority of the gap remains after controlling for skills and other demographics, then why do males have higher wages and grades? The monthly salary sheets allow us to observe promotions. We find that males are to a statistically significant degree more likely to be promoted by factories, but that the gap is too small to explain the overall grade gap we observe. We also find promotion rates in these factories are, in general, low: at the lowest grade levels (grades 7 through 5), the annual probability of promotion is around 10 percent; the rate drops to around 5 percent at higher grades (grade 4).[4] We estimate that between 60 and 80 percent of promotions occur when workers switch factories. The data show that men leave factories at higher rates than women. Retrospective labor histories from worker surveys corroborate this pattern, as men have shorter average tenures in factories in their careers as a whole. Thus, the majority of the grade gap is explained not by differences in internal promotion rates, but in differential mobility rates, with men more likely to move across factories, and, thus, to gain promotions in doing so.

Having traced a substantial part of the gender wage gap in this sector to differences in worker mobility, the question is then why men are more mobile than women. We divide explanations into two categories: those suggesting that women have higher costs of moving, for example due to additional responsibilities at home (Manning 2013) or due to higher risk aversion (Croson and Gneezy, 2009); and those suggesting that men have higher benefits of moving. We find some evidence supporting each of these channels. Women who are married, and those with older children, have longer tenure in their

[4] Promotion from grade 3 to higher grades implies a movement into supervisor roles. We have salary data for grades higher than grade 3 only for 27 of the 44 factories. However, at these factories, we find promotion rates at grade-3 and higher to be very rare, with less than 1 percent of grade 3 workers promoted in a year.

current factory and longer average tenure over their career. Women are more likely to arrive in a higher graded position from outside the factory in geographic regions where there is a higher density of factories. Consistent with career concerns, we find that female and male workers expressing an interest in promotion to supervisory positions move across factories more frequently. Because in our data 94 percent of supervisors at even the lowest supervisory level in the industry (grade 2) are male, men have stronger incentives to gain promotion at lower levels, and to move across factories to do so.[5]

While the gender wage gap has been the focus of much research in higher-income countries, there is much less work in low-income countries.[6] To the best of our knowledge, this is the first gender wage-gap study from a low-income country using employer administrative records. We believe the context is illuminating for other reasons as well. First, traditionally a large part of the literature on the gender wage gap emphasized differential attachments of men and women to the labor force. One reason given for the differential attachment is that women have increasingly entered sectors that traditionally evolved around a male workforce, and which are therefore marked by characteristics – such as high levels of competitiveness (Flory et al. 2015), or rewards for working long and inflexible hours (Goldin 2014) – that make it easier for men to excel than women. By contrast, the garment sector in Bangladesh has since its inception in the 1980s employed large numbers of female workers and thus is a "traditionally female" sector. Second, it has been argued that the lower prescribed attachment of women to the labor market causes lower investments into general and firm-specific human capital, and thus lower wages. The uniquely detailed skill data we collected in the sector allow us separate wage and promotion differences due to differing skill levels.

We begin by describing the data we use in the analysis in more detail. We next examine gender wage and grade gaps, first using the full administrative sample. We then use the skills data and the subsample for which we also have survey data allowing the inclusion of additional demographic controls. We then turn to data on promotion and mobility to determine the channels through which men end up in higher grades even conditional on skill levels. We then explore explanations for the higher cross-factory mobility we observe for males, and offer some concluding thoughts.

Data

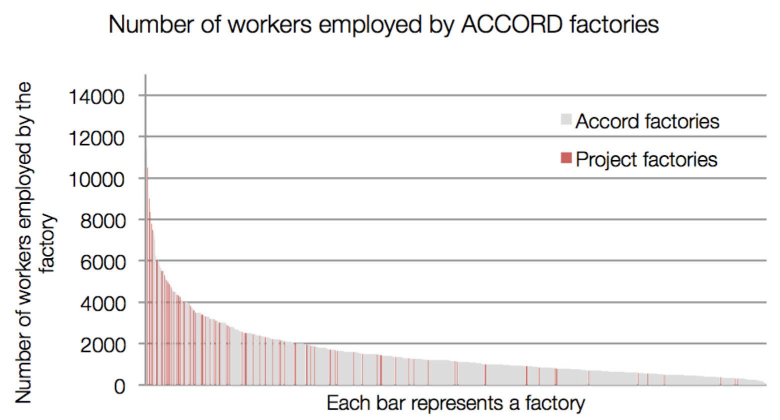
We study workers in a sample of 44 Bangladeshi garment factories located in and around Dhaka, the larger of two major production areas in Bangladesh. All of the factories

[5] The share of women among the workers in our sample drops from around 90 percent at grade 7 to around 65 percent at grade 3. However, the transition to supervisory ranks is still rare for women in the industry, with the share of supervisors of grade 2 being 6 percent and of grade 1 being 1 percent. Macchiavello et al. (2016) explores in more detail why so few women make the transition to supervisory ranks, while this paper focuses on promotion and wage gaps among the ranks of non-supervisor production workers in the industry, as captured by the grades 7 through 3.

[6] Several papers have examined wage gaps using household surveys in countries with large garment sectors. See Huynh (2016) for an analysis of nine Asian countries, including Bangladesh and Abras (2012) for an analysis of Bangladesh, India, Pakistan and Vietnam. Both Abras (2012) and Huynh (2016) find positive wage gaps for women in the sector. It is unclear why the household data should be so different from our factory data.

produce woven or light knit (e.g., t-shirts) garments, and are typically organized into three sections: cutting, sewing, and finishing.[7] The sewing sections typically employ around two-thirds of the workers in these factories, and we focus on workers in this section. Sewing sections are organized into parallel production lines, with the factories in our sample having anywhere from a dozen to more than 100 production lines, each with 20 to as many as 100 workers, depending on the complexity of the products being produced in the factories. Production is sequential, with each worker performing a single task. Thus, for example, a sewing machine operator will sew only the side seam of a shirt, and then pass the partially completed product on to the next operator to complete a different stitch. The garment moves down the line as each sewing process is completed, with the finished product exiting at the end of the line. Because the tasks to produce any single garment vary in difficulty and the time required to complete them, each line contains workers with a mixture of skills and experience levels.

Figure 1: Project factories among the distribution of Alliance and Accord Factories



	Project	All Accord
mean	2,913	1,587
median	2,413	1,140
max	10,500	15,000
min	313	65

Figure 1: Graph shows the distribution of number of workers per factory among the ca. 2000 factories organized in the buyer groups Alliance and Accord, with the 44 factories participating in the project marked in red.

The factories in our sample are all direct suppliers of major European and American brands. Though information on the full distribution of factories in Bangladesh is limited, Figure 1 above shows a comparison of data available from Accord and Alliance factories, indicating that our factories are mostly from the upper quartile of the distribution of Bangladeshi factories by both size and quality.[8] While the sample of factories is not representative of the full spectrum of firms in Bangladesh, our sample of workers has

[7] Some factories in our sample have further sections, such as knitting, dyeing, or embroidery.

[8] The Alliance for Bangladesh Worker Safety and the Accord on Fire and Building Safety in Bangladesh were both formed after the Rana Plaza factory collapse in 2013. These two organizations cover around 2,000 factories, roughly half of the factories active in the country, that are primary suppliers to Accord or Alliance buyers. Our sample factories are of a size that places them toward the upper part of the distribution of these lists.

characteristics very similar to those in the only large-scale representative sample of which we are aware (Haque et al, 2015).

Our data come from three main sources: detailed payroll records, surveys of randomly selected sewing machine operators, and skills assessments of sewing machine operators conducted by the industrial engineering departments of the factories. We will briefly discuss each of these three types of data in turn.

Payroll records

In a series of projects, we collected monthly payroll records from the factories. The data cover periods of at least six months, with the mean number of months 10.9 and the median 12.[9] The complete payroll records contain all workers employed by the factory at for at least one day of the given month, but the data we receive from some factories are limited to the sewing section and to non-supervisor workers (grades 7 through 3). The monthly payroll records usually contain the worker's name, an ID number, the date worker joined factory, the work designation, wages for regular hours, overtime earnings, some measure of absenteeism during the month, and sometimes further information which varies across factories. The mean size of the factories in our sample in terms of sewing workers employed and covered in our data is 1409 workers, while the median is 1187 workers. The smallest factory has 133 operators and the largest 3359.[10] In total, our data contains 122,379 individual workers with 837,685 observations at the worker-month level.[11] The sewing worker sample on which most of our analysis is based has 55,623 workers and 449,230 worker-month observations.

As previously mentioned, workers in the garment sector in Bangladesh are classified by grade. The lowest grade 7 is usually assigned to unskilled, entry-level, workers.[12] Sewing machine operators are assigned to grades 6 to 3, with 6 being the lowest-skilled operators and 3 being the most skilled operators. Sub line-level supervisors, quality supervisors, and other lower-level supervisory staff are grade 2, while higher-level line, floor, and factory managers are either assigned grade 1 or remain outside the grade scale. The distribution of worker grades in the sample is as follows: about 26 percent are grade 7; 18 percent are grade 6; 14 percent grade 5; 26 percent grade 4; and 16 percent grade 3.

[9] Four of the factories participated in more than one project, and hence we have data for these four for two spells of at least six months, with some break between. Thus we have at least six months of data at the factory-project level in 48 datasets representing 44 individual factories and four individual projects.

[10] The numbers we report for individual workers are based on repeated monthly staff lists collected from the factories. The factory level numbers are based on the median number of workers employed across the months for which we have data from the respective factory.

[11] Our data do not allow us to track workers across different factories in our sample. Thus, we cannot rule out that some of the 122,379 unique workers are indeed the same person working at different factories in our sample. But our factories are a very small part of the industry, so we expect this would be rare.

[12] The most common entry-level position for workers without any previous experience in the garment sector is a "helper" (or "assistant sewing operator"). In this position, the worker might cut thread, move garments along the sewing lines or do other supporting tasks. A common goal for these workers is learning the necessary skills to become sewing machine operators, which form the bulk of workers of grades 6 through 3. Workers may also enter the factory through other channels, including finishing assistants, input men, or iron men. Our data from some factories include these other workers, and we show the main results are robust to their inclusion where we have them.

In all of the analysis, we invert the factory grade scale so that higher grades represent more skilled workers.

The ability to track the same worker over the repeated rounds of staff lists – crucial for our analysis – requires a reliable worker identifier for the same worker within a factory. While all of our raw data contains worker ID numbers, we had to address two complications with the IDs. First, some factories re-use ID numbers from workers that have left the factory. Thus, more than one worker may have the same ID at different points in time. Second, some factories assign a new ID number when a worker is promoted. Thus, more than one ID can be assigned to the same worker. One or the other of these problems arose in around 20 of the 44 factories in our sample. For these factories, we used worker name – date-of-join combinations to assign a single unique identifier to each worker. In the very few (and arguably random) cases where this method yielded multiple workers with the same name and join-date in a factory, all observations with this name and join-date combination were dropped from the sample.

The administrative records typically do not include the gender of the worker, but do include the worker's name. Our local research field team assigned a gender to each name. Because some names may be either male or a female, we are not able to assign a gender to all of the workers. But we are able to assign a gender to 90 percent of all workers. We drop from the analysis those observations for which we are not able to designate a gender.

For certain factories, the grade variable required some cleaning. First, workers who were designated as supervisory staff in the data were sometimes listed as grade 3 rather than grade 2. In some instances, this clearly reflected records that had not yet been fully updated, because we observed that the grade was changed some months later. In other cases, the supervisors continued to be shown as grade 3 throughout. We re-classified all supervisors with a lower grade than 2 to grade 2. Second, some workers were classified as grade 8, which is meant to indicate a probationary worker. In theory, all workers should enter the factory as grade 8 and move to a regular grade at the end of the probationary period. Factories rarely use the grade 8 designation for new hires, and those that do use the designation, sometimes leave workers on that designation indefinitely. We therefore used the worker designation to re-grade the few grade-8 workers. Finally, we re-graded a small number of workers to grade 7 or grade 6 based on their designation (and wage rate), ensuring that all helpers were grade 7 and all other operators at least grade 6. However, the number of these adjustments is small and all our results are robust to leaving out these grade-cleaning operations.

We use the payroll data to define variables for promotion and exit from the factory. A worker is promoted if her/his grade number is lower in the present month compared with the previous month.[13] A worker is deemed to have exited if s/he disappears from the data before the last month for which we have factory data. By these definitions, we find that the monthly promotion probability is 0.62 percent, while the monthly exit

[13] We observe a small number of cases where a worker appears to be demoted. Most often, the worker soon reverts back to the previous grade. We assume in these cases that the initial demotion reflects a mistake by the factories. In the promotion analysis, we drop these few cases, though the results are not affected if we leave them in the data.

probability is 4.9 percent. The promotion rate implies workers are promoted one grade every 13.3 years, a rate of progression much lower than implied by survey data on sector experience and grade. We return to this issue below.

One potential issue with both of these measures is that we lack data on supervisors in 17 of the 44 factories. In these factories, workers promoted from lower grades to grade 2 or 1 will disappear from our dataset and will be recorded as having exited the factory rather than being promoted. In aggregate, we view it as a minor issue because promotion above grade 3 is a rare event. In the 27 factories for which we have supervisory data, only 46 (3 percent) of the 1,403 promotions end with the worker in a supervisory grade or higher. Given this, any overstatement of exit rates or understatement of promotion rates will be slight.

The salary records provide us with both wage and grade data, and we use both of these in the analysis. However, we note that wage and grade are not entirely independent of one another. A common practice is for the production staff, industrial engineers in particular, to determine an appropriate wage and then for the human resources staff to set an appropriate grade conditional on that wage. We find it convenient to focus on wages and wage gaps for part of the analysis and on grades and grade gaps for another part. But the two should be viewed as co-determined.

Skills assessments

Production in all of our factories is organized on production lines, with each worker performing a single stitch in the sequential production process. Almost all of the factories in our data employ industrial engineers who set an hourly target for each process (for example, a stitch or seam) required to complete the product. Each process is assigned a "Standard Minute Value" (SMV) which represents the number of minutes (or portion of a minute) a fully skilled and fully efficient worker would take to complete the task. The SMVs are usually based on international standards, but adjusted for factory conditions. For example, the SMV may be adjusted for the presence or absence of a helper, characteristics of the fabric (e.g., solid vs. striped) or quality of the machine (e.g., automatic thread cutting or not), and it may be re-scaled to reflect the output of the most skilled workers in the factory. Multiplying the inverse of the SMV by 60 gives the hourly target output for the given process. The efficiency of a given sewing operator can then be measured as the number of times she completes the process divided by the target for that process. The efficiency is one measure of worker skill that factories care about.

Some processes are more difficult or "critical" than others, and some require more physical strength than others. A worker's ability to perform more critical or physically demanding skills is also valuable to the factory. Finally, factories report that they value flexibility of an operator, that is, the number of processes or machines on which a given operator is skilled. For example, more flexible workers are able to step in to a wider variety of roles when workers are absent.

Some factories conduct regular skills assessments of operators, and we have collected those assessments where they are available to us.[14] We use the skills assessments to calculate four measures for each worker. First, we record the number of sewing processes on which a worker is tested as a measure of flexibility. Second, we measure the average efficiency of the worker on all skills tested. Third, an industrial engineer with substantial industry experience working for our project team coded the "criticality" of each process on a scale of one to seven.[15] We create a variable which indicates the level of the most critical process on which the operator is tested. Last, our industrial engineer also flagged the processes that require physical strength to complete. We create a variable indicating the worker is tested on at least one process requiring a high level of physical strength.

These four skills measures are, according to factories, highly correlated with the productivity of workers. The skills map more closely to the value of marginal product of a given worker than measures more commonly available in data, making this a particularly interesting setting to examine gender wage gaps.

Survey data

In addition to the salary records and skills measures, we have survey data from a sample of randomly selected sewing machine operators in each of the factories. The surveys were conducted to support other projects. We collected both the worker name and the factory ID number for each respondent, and are able to match the majority of them (around 70 percent) to their payroll records. This yields a sample of 1,766 workers. The surveys contain additional variables useful in our analysis. In particular, there are data on tenure in the garment sector, the number of factories the respondent has worked in, and basic demographics such as age, years of schooling and marital status. This allows us to test whether gender wage gaps we find in the administrative data are explained by differences across gender in this additional set of variables.

The sample we use is always from operators randomly selected from given production lines. However, the production lines from which the operators are sampled are not random, but selected by the factory to participate in a particular intervention. Nevertheless, we don't see significant differences in the administrative variables between the subsample of workers for whom we have survey data and the much larger sample of workers not surveyed, so we believe they can be viewed as a random sample of factory workers.

[14] Most of these are from factories participating in a project implementing a consulting intervention which includes training on conducting regular skills assessments.

[15] Some factories record processes as "A" (most critical), "B", or "C" (least critical). Our IE separated the A ratings into high-A, middle-A and low-A, and created similar tiers for the B ratings. In his judgement, the C-rated processes were all of the same level of difficulty. This measure is highly negatively correlated with the target for the process, indicating that processes rated as more critical are more complex and take longer to complete.

Summary Statistics

The top panel of Table 1 shows factory-level summary statistics for the sample. That is, we take averages of key variables at the factory level, and then take median, mean, minimum and maximum values across the 44 factories (not weighting by factory size), to gauge the variation of the averages across the factories in our sample. The number of (non-supervisory) sewing workers at the factories ranges from 133 to 2,653, with an average of 1,192. An average of 81 percent of sewing workers are female, but the share of women ranges from 54 percent to 98 percent. There is similarly substantial variation across factories in the promotion and exit rates: the monthly promotion rate varies between zero and 5.9 percent, with a mean of 0.8 percent, the monthly exit rates varies between 0.5 percent and 12.3 percent, with a mean of 5.1 percent on the factory level.

The second panel of Table 1 shows similar summary statistics at the level of individual workers in the sample. We restrict the sample of workers to those present in the first round of data collected from each of the 44 factories, so that the sample is not weighted toward workers who just arrived in the factory. The share of female workers in the pooled sample across the 44 factories is still 81 percent. The average worker has worked in the factory for 1.86 years, with the median being 1.15 years. The promotion rates remain low: Only 4.2 percent of workers appearing in the first salary sheet we have for the factory are promoted at least one grade level during the period we observe them. Given that we have on average 0.82 years of data per factory (weighted by number of workers), this implies an annual promotion rate of around 5.1 percent. Exit rates, on the other hand, are high, though perhaps not by standards of developing-country manufacturing.[16] The typical factory loses one-quarter of its workers over the time covered by the data. Since we cannot trace workers across factories, we do not know the proportion of these workers who move to another factory, and what proportion exit the industry.

The bottom panel of Table 1 shows summary data on the worker-month level, which are largely in line with the numbers on the worker level. The share of females drops slightly to 78 percent. Though not shown on the table, the average tenure among females is slightly higher than among males (1.86 vs. 1.72 years), indicating that women are less likely to exit the factory. The average base wage (without overtime payments) amounts to around 5600 Bangladeshi Taka, which is roughly USD 70 at the time the data was collected. Monthly turnover is 4.9 percent, which drops from 6.1 percent for workers on grade 7 to 3.9 percent for workers on grade 3. Monthly promotion rates remain low at 0.62 percent, which also drop from 0.93 percent for grade 7 to 0.36 percent for grade 4, and 0.02 percent for grade 3.[17]

[16] In an experiment among five Ethiopian factories, Blattman and Dercon (2016) find that 77 percent of new hires in unskilled factory jobs leave the factories again within one year of employment. A series of reports by the garment sector consultancy Impactt reports monthly exit rates of garment workers of 7-12 percent in Chinese, Bangladeshi and Indian factories (Impactt 2011, 2012, 2013). Further research by consultancies indicates monthly turnover rates of 15 percent and higher in Chinese export oriented electronics factories (AT Kearney 2014, KPMG 2013), while the Wall Street Journal (2013) reports that toy factories in the Pearl River Delta in China routinely lose 10-30 percent of their workforce over the Chinese New Year break.

[17] The 0.02 percent promotion rate for grade 3 is from the subsample of 27 factories for which we have also have workers of grade 2 and 1 in the sample. Thus, a worker who would obtain a promotion from grade 3 to grade 2 would not drop out of the sample among these factories. This very low promotion rate first of all reflects

Gender Wage Gaps

We follow the empirical approach that is standard in the literature on gender wage gaps, running a basic regression of the form:

$$LnWage_{ifm} = \alpha Female_i + \beta Tenure_{im} + \gamma Tenure^{\wedge}2_{im} + \delta_m + \delta_f + \epsilon_{ifm}$$

where *Female* is a dummy variable indicating the worker *i* is female and *Tenure* is the number of days (measured in years) between the date the worker joined the factory and the first of the month for which the data applies. We include fixed effects for month *m* and factory *f* and cluster standard errors at the factory level.

We start on Table 2 with a sample of workers at all levels, including managers. We have data for upper level managers (beyond sewing line supervisors) in only 21 factories, so we limit the regression in the first column to these 21 factories. The variable of interest is Female, which takes a value of one for women and zero for men. We find a large negative gap, with women paid almost 20 log points less than men. We present this result for the purposes of comparison with the gaps we find among sewing workers, which is our focus and a place where our data are complete enough to be representative of the full set of factories. In Column 2, we limit the sample to sewing workers who enter our data as either helpers or sewing machine operators of grades 7 to 3. We continue to find that women have lower earnings then men, though the gap falls to 8.8 log points.

Given the highly-structured minimum-wage rates in the industry, this gap is notable, especially because the majority of workers are paid at or near the minimum-wage for their grade. For example, in August 2015, 80 percent of helpers are paid less than 105 percent of the minimum-wage. We should therefore expect that much of the wage gap will reflect differences in worker grade rather than wage differences within grade. We examine this in the regression in column 3, which adds worker grade fixed effects to the wage regression. We see that indeed, most of the wage gap is across rather than within grades. The within-grade gap drops to 1.7 log points. The within-gap differences are not affected by interacting the factory and grade fixed effects. In Column 4, we explore this issue further by making worker grade the dependent variable. We find that women are in positions which are on average 0.88 grades lower than men. Recall that the sample here is limited to grade 7 to 3, helpers and the four grades of operators.

In the following sections, we study which share of the wage and grade gap is explained by other explanatory variables, such as skills, experience, or age. These variables are either only measured (e.g., sewing skills) or only available for workers of grades 6 to 3 (the sewing operators). Therefore, columns 5-7 of Table 2 repeat columns 2-4 of the same table, using only the sample of operators of grades 6 to 3. We can see that the wage gap unconditional on grade drops by roughly one half to 3.8 log-points (column 5), while the

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the fact that there is a lower need for workers of grade 2 than of workers with lower grades; at those factories where we do have the grade 2 and 1 workers in the sample, workers of these grades make up only 4.4 percent of all workers, while grade 7 and 4 each make up about 25 percent of all workers, and grades 6,5, and 3 each around 15 percent. Furthermore, when splitting this promotion likelihood along gender lines, the promotion rates are 0.033 percent for men and 0.008 percent for women.

wage-gap conditional on grade fixed effects remains largely unchanged at 1.6 log-points (column 6). The grade gap also drops from 0.88 to 0.38 (column 7). Thus, building on the insight from the previous paragraph that the bulk of the gender wage gap is explained by women achieving on average lower grades, we can see that about half of the wage gap is explained by women being less likely to reach above grade 7. Since the larger overall wage gap, and the smaller gap among the sewing machine operators both largely owe to differences in grade, we expect that the insights from the narrower sample of operators applies to the broader sample of sewing floor workers as well.

Does the grade gap reflect a skills gap?

One possible explanation for men having higher wages and grades is that they have higher skill levels. One of the strengths of our data is the very good measures of worker skills. For 15 factories that are part of a consulting intervention project, we have detailed skills assessments conducted by the factories for some or all of their workers, as described above.

Written promotion policies available from several factories indicate that efficiency captured by one or more of these measures is the most often mentioned criterion for promotion. In the few factories that assign weights to the criteria, these account for half or more of the weight. The promotion policies also routinely mention factory tenure and attendance. We control for tenure in all of the analysis, and return to attendance later.

Our first objective is to test whether skills are positively associated with wages. We begin on Table 3 by presenting the basic wage-gap regressions for this subsample of factories for which we have skills data. In the first column of Table 3, we repeat column 5 of Table 2, the unconditional wage gap among workers of grades 6 to 3, on the sample of workers for which we have skills data. We see that the skills sample has a similar wage gap, with both measured at 0.038. The appendix shows similar results for salary conditional on grade. In column 2 we ask whether and how strongly the skills measures are associated with wages. We find that all four skills measures are strongly and positively correlated with the operator's wage. With regard to wages, the magnitude of the implied changes is modest, consistent with the low levels of variation in wages. A one standard deviation change in the average efficiency (15 percentage points) is associated with a movement of 0.9 log points in wages. Changes of a similar magnitude in the number of processes (4.4 processes) and the most critical process (2.4) have effects of 1.3 and 1.4 log points, respectively. Finally, a standard-deviation change in being skilled in at least one physical process (0.48) has a 0.6 log point effect on wages.

We next ask how much of the gender gap is accounted for by differences in skills. We add gender to the regression including the measures of skills in column 3. Comparing columns 1 and 3, we see that the inclusion of skills reduces the gender wage gap by 1.2 log points, or around 30 percent. That is, more than two-thirds of the gender gap survives the inclusion of these skills measures. In Column 4, we include a series of dummy variables indicating the types of machines the worker is skilled in using. The inclusion of controls for machine type increases the wage gap marginally. Finally, in columns 5-8, we decompose the skills gap by examining gender differences in each of the skills. We find no difference between women and men in the average efficiency or the number of

processes tested. We find a significant male advantage in the most critical skill tested and in skills requiring physical strength. These two skills explain most of the wage gap that is explained by skills. Multiplying these skill gaps by the coefficient indicates that 0.6 log points of the gap can be explained by differences in the ability to perform more critical processes, and 0.4 log points of the gap can be explained by the ability to perform skills requiring physical strength.[18]

Other than these skills, most factories also list attendance and factory tenure as criteria. We have measures of these as well, and we control for factory tenure in all of the regressions. Workmanship quality and the recommendation of the line supervisor or line chief are also frequently mentioned, however there are no written records of either of these available in any of the factories.[19]

The salary data show measures of absenteeism and overtime hours. Table A.1 in the Appendix shows the results of regressing these data on a gender-dummy and the usual factory and month fixed effects. We find that women miss somewhat fewer days of work, an effect that is stronger when we exclude a very small number of observations in which women miss more than 15 days in a month (columns 1-3). Most factories in Bangladesh pay monthly bonuses when workers are present every day or miss no more than one day of work in a month. Women earn this bonus unambiguously more often, a difference that is highly statistically significant (column 4). On the other hand, men work more overtime hours (column 5). As shown in Table A.2 in the Appendix, we find that there is a positive correlation between both attendance bonuses earned and days missed on the monthly *base* wage (before adjustment for overtime or missing days). On the other hand, overtime worked is negatively correlated with the wage, an effect driven by entry level workers (grade 7 helpers) having on average more overtime than workers of the remaining grades. This effect disappears when we include grade FE. Finally, measures of absenteeism and overtime do not have any effect on the gender wage gap when they are included as controls in a wage regression. Our overall conclusion, then, is that differences in absenteeism and overtime do not explain any part of the wage gap.

Survey data

The administrative data have the advantage of providing a very large sample of workers but, aside from the measures of skills, with a limited set of variables. Actual labor market experience is one factor that the literature has found to be important but which is not available from the factory records. From various projects, we have survey data from random sub-samples of sewing machine operators of grade 6 to 3 from all factories in our sample. The surveys contain measures of tenure in the garment sector, along with education, age and marital status. The survey data indicate that men have more

[18] There is weak evidence that the returns to skills are lower for females. In a regression of wages on skills which includes skills interacted with gender, all four measures of skills * female are negative, though none is significant at the 10 percent level. Allowing only interaction in the two skills for which there is a gender gap – criticality and physicality – yields a significant negative interaction of physicality, indicating that women who are able to do processes involving physical strength are not compensated for that.

[19] Quality is available at the production line level, but the factories do not formally measure or record quality data at the worker level.

experience working in the sector (6.8 years vs. 5.7 years), and also more schooling (6.2 years vs. 5.7 years). Women are more likely to be married (82 percent vs. 67 percent), and there is no difference in the average age of women and men. On Table 4, we examine the effect on the measured wage gap of including these additional controls.

In columns 1 and 2 of Table 4, we reproduce the basic regressions on the wage and grade gap in the sample of workers for which we have survey data. We again find only modest differences from the full administrative sample, with an unconditional wage gap of 3.8 log points (identical to the full administrative sample) and a grade gap of 0.42 (compared with 0.38 in the full sample). With these results as a comparison, we next add the additional demographic controls in columns 3 and 4. We see that experience in the garment sector has a significant effect on both unconditional salary and on the operator grade. Since men have an average tenure of about one year longer, we should expect the inclusion of this control to reduce the gender gaps, and it does. Both the salary and the grade gap fall by about a quarter to 2.8 log points and 0.31, respectively. Nevertheless, these gaps remain both statistically and economically important.

In sum, the data show that female production workers earn significantly less than males. The gap narrows to roughly half the size when the sample is limited to sewing machine operators. We focus on this sample because we have more detailed skills and demographic data for them. Both the wage gap and the gap in worker grade are robust to controls for industry experience, years of schooling, and other standard controls. We have a sample of 151 workers for whom we have both skills assessments and survey data. Within this sample, tenure in the sector is positively correlated with higher output relative to targets – efficiency increase by approximately 1 percentage point per year – and with being able to perform more complex tasks – with each year associated with a 0.2 point increase in complexity of tasks. These correlations suggest that the 30 percent of the wage gap explained by skills overlaps with the 25 percent that is explained by tenure in the sector. If that is the case, then something less than half of the gap is explained by measured skill differences, while more than half is unexplained by skill differences.[20] We therefore turn to data on promotion in search of explanations for the remaining gap.

Promotion Patterns

Men have higher salaries and grades even conditional on very finely measured skills. This raises the issue of differences in promotion rates by gender. As we saw in the summary statistics on Table 1, promotion rates are low, varying between around 0.8-1.0 percent for workers currently on grades 7 to 5, to 0.35 percent for workers on grade 4, and less than 0.1 percent for workers on grade 3. We begin by exploring two questions around these promotion rates. First, do promotion rates differ between men and women, and is the difference sufficient to explain the observed gender grade gap? Second, are these promotion rates high enough to explain the observed levels of career progression that we observe in the survey data? From the survey responses, we calculate the ratio of the number of years the respondent has worked in the industry and the number of grades

[20] Since we do not have independently administered skills assessments, we cannot rule out the possibility that the skills tests themselves are implemented in a biased fashion.

she has "gained". For the latter, we assume that all workers started at grade 7 in the industry.[21] The discrepancy between the overall career progression and the rate of internal promotion can be attributed promotions occurring when workers switch factories.. We refer to these as "external promotions".

We begin by exploring whether the internal promotion rates differ enough between men and women to generate the grade gap that we observe in the data. The regression in the first column of Table 5 reports an OLS regression which uses worker-month level data for operators and helpers (grades 7 through 3). As with all similar regressions, we add month and factory fixed effects, and cluster standard errors at the factory level. The results indicate that, indeed, promotions are statistically less likely for women than men. However, the effect is very small, 0.28 percentage points per month, or roughly 3.5 percent per year. While we define the promotion variable as 0/1, in some cases promotion involves a jump of more than a single grade. The data indicate that for a women the average promotion increases the grade by 1.08 levels on average, while for a men the average promotion is 1.18 grades. Combining the difference in promotion rates and the difference in grade per promotion, men will advance by 0.037 grades faster per year than women. The survey data indicate that males have an average tenure in the sector of about 6.74 years, while females have an average tenure of 5.84 years. If all promotions were internal (while allowing for switching factories without a change in grade), these differential promotion patterns would explain, at average tenure, a grade gap of 0.31, or 35 percent of the overall grade gap of 0.88.

Arguably, promotion should be thought of as a hazard, and in column 2, we collapse the data to the individual level and run a Cox hazard regression. We find results very similar to the OLS regressions, with women being 44 percent less likely to be promoted. Thus, while we do find that men are more likely to be promoted within the factory, the incremental promotion rates explain only a modest share of the observed gender grade gap.

We next turn to the question of whether the internal promotion rates are sufficiently high to generate the career trajectories we observe in the survey data. Our ability to provide a precise answer to this question is limited by the fact that we do not observe workers who have exited the industry. Indeed, we have no way of estimating the industry exit rate. But through a variety of means, we estimate that internal promotions can account for at most half, and more likely account for less than one-third, of promotions. One estimate of the overall promotion rate comes from survey questions that ask operators how long they have worked in the garment sector, how long they have worked as a sewing machine operator, how many factories they have worked in, and what their initial position in the industry was. On average, the 1.766 respondents report they were a helper for 14 months. Among those working at the entry operator grade (6), 38 percent of females and 37 percent of males report that their current factory is their first. This provides one estimated lower bound for the ratio of helpers that switch to the next higher grade through internal promotions.

[21] Of all workers surveyed, 91 percent report to have started their career as helper, which typically has grade 7 assigned to it.

Alternatively, we can look at the average number of years a respondent reports being an operator relative to the number of promotions they have received. Focusing on grade 4 workers, the most common grade, the average (median) time reported working as an operator is 5.4 years (4.9 years). Grade 4 operators are two levels above the entry-operator grade, implying a promotion every 2.7 years. Combined with one-year average tenure as a helper, this suggests an average period of between two and two and a half years per promotion, meaning that 40 to 50 percent of workers are promoted each year.[22] Since internal promotion rates are around 10 percent, this implies that only 20 to 25 percent of promotions occur when workers are promoted within the factory.

If internal promotions only explain a part of the observed career progression gradient in the survey data, the remaining part must then be due to promotions obtained when workers change factories and enter the new factory at a higher grade. We don't directly track workers across factories. But we can estimate the frequency of cross-factory promotions by looking at observations in the administrative data where we observe an operator for the first time at a grade which is above entry level. For example, consider a worker observed as a senior operator (grade 3) for the first time. There are two possibilities. One is that we observed that worker in the same factory in a previous month working at a lower grade, and that she or he has been promoted internally. The other is that the worker is new to the sample. If the worker is new to the sample, she may have worked at either the same level or a lower level at a different factory, since all senior operators have previous experience working as lower-level operators somewhere. For any individual worker, we do not know whether or not the entry into the factory coincides with a promotion. But we know that internal promotion rates (at a rate of one grade every 10 years) are not high enough to explain normal career progression or the gender grade gap.

We exclude the first month of data for each factory, since all workers are observed for the first time in that month. We then calculate a lower bound on the proportion of internal promotions by asking what proportion of these new worker-grade observations are workers previously observed in the factory. Given the high rate of exit in the sector, we have very large samples of workers observed for the first time even after the first month of data. The ratio of those previously observed in the factory to those not observed in the factory is informative about the frequency of the cross-factory promotions.

The data tell us that 85 percent of movements into higher-grade operator positions come from workers moving across factories rather than from promotions within factories. Of 4,662 workers observed as junior operators of grade 6 for the first time, only 868 (19 percent) were previously observed in the factory at a lower grade level, and this represents the highest share for any grade. The lowest share can be found among workers of grade 4 (10 percent).

[22] An alternative approach is to regress grade on the tenure as a line operator. When we do this for those in the first three quartiles of reported tenure, we find that workers are promoted every five years. We suspect that the tenure coefficient is attenuated, as tenure is likely to be measured with significant noise. Finally, in five factories where we have information on date of birth, the median age of grade-3 workers is 27 and the 90th percentile is 33. Given 4 promotions and an average start age of 18, this implies an average of three years at the median and five years at the 90th percentile.

Is there a gender difference in the frequency of within-factory vs. across-factory promotion? To explore this, we start by looking at gender differences in exit rates. In column 3 of Table 5, we see that women are a half percentage point less likely to exit the factory in any month. The Cox hazard regression for exit (column 5) shows a similar result, with women 13 percent less likely to leave. Column 5 limits the sample to workers with less than one year of tenure in the factory, and shows that men are particularly more likely to leave during their first year, when the exit gap is a full percentage point.

Men are more likely to be promoted internally, and also more likely to exit factories. Which of these two channels to promotion is the more important? We examine this by taking the ratio of internal and external arrivals in a more senior grade for men and for women. In the regression reported in column 6 of Table 5, we show that the gap in cross-firm promotions explains a larger share of the gap than the gap in internal promotions. Women are almost 5 percentage points less likely than men to arrive in a new grade from outside the company.

Our survey data provide us with another angle on this question. We ask respondents how long they have worked in the garment sector, and how many factories they have worked in. We use these two responses to calculate an average tenure for each surveyed worker over her/his career. The last column of Table 5 shows that women have significantly longer average tenures – that is, they change factories less often than men. The gap is 0.60 years, about 25 percent of the sample mean tenure of 2.6 years per factory.

The data, then, tell a fairly clear story. Women are paid less than men, even in the context of a highly regulated wage environment. Most or all of the pay gap comes from women working at lower grades, and only about a third of the wage and grade gaps are explained by the detailed measures of worker skills. The lower grades, in turn, come in a small part from lower promotion rates by factories, but in a larger part from the fact that most promotions occur across rather than within factories, and women are less likely to move across factories. The question which we explore in the next section is: Why do women move across factories less often than men?.

Why are women less likely to move across factories?

The data suggest that men move across factories more frequently than women. The literature suggests several possible explanations for this pattern. We divide them into those grounded in higher costs of moving for women and those grounded in higher benefits of moving for men. Women may face higher costs of moving because they have more household responsibilities than men (Manning, 2013). Perhaps related to this, women are found to be more risk averse than men, and thus may be less willing to take the risk of moving across factories (Croson and Gneezy, 2013). On the other hand, the higher frequency of movement by men may reflect added benefits of moving. Women might shy away from, or be disadvantaged in, bargaining situations compared to men, and hence may capture less gains immediately upon moving (Mazei et al. 2014, Bowles et al. 2007, Babcock and Laschever 2003, Leibhardt and List 2014). Our data shows that less than 6 percent of even the lowest supervisor positions above the ranks of ordinary worker are filled by women in this sector. If promotion through the operator grades is a

step toward promotion to supervisor, and if supervisory jobs are not available to women, then these career concerns will provide an additional incentive for men to move.

Is the cost of moving an issue?

If women bear the burden of household responsibilities, they may be reluctant to change factories, especially when doing so requires either that they move their household or increase their commuting time. We examine this in two ways. First, we consider how exit rates for women vary with the density of factories in the areas where they work. Those in more factory-dense areas are more likely to be able to move without moving home or without increasing their commuting time substantially.[23] Moreover, in the event that the new factory does not work out, they are more likely to be able to move again in the same area. We have the address of most of the 2000 factories that are suppliers for buyers who signed either the Accord or the Alliance agreements. We use these data to measure the number of factories in each Zip Code.[24] We find that the wage gap is insignificantly higher in denser areas and, indeed, marginally significantly higher when we control for worker grade. There is no difference in the exit rates of men and women, but women are significantly more likely to arrive in a higher grade from outside the factory in denser areas, compared with men (Table 6, column 4). This last result provides some evidence consistent with women making more strategic movements across factories in denser areas.

A second source of variance in the cost of mobility comes from comparing women without and with children. We have data on children in the workers' households from the surveys of randomly selected operators from only one of the projects. We have a sample of 666 women with data on children. We use the data to examine both tenure at the current factory and average tenure across their career. If either household responsibilities or risk aversion are driving the lower rate of movement, we should see that the average tenure of women with children is lower than those without children. We might also expect that married women face greater frictions than single women. The regressions reported in columns 4 and 5 provide evidence for this pattern. Taking single women as the base group, we define three categorical variables: married women with no children, married women whose youngest child is under 5 years of age, and married women whose youngest child is older than 5 years of age. We find that married women have longer average tenure per factory, and that women with children all age 6 or older have both longer tenure in their current factory (column 4) and longer average tenure (column 5). There is no significant difference between single women and women whose youngest child is under five years of age.[25] Taken together, we view these results as providing evidence that higher costs of moving are one potential cause of lower mobility of women.

An alternative explanation is that men realize higher benefits from moving. One reason offered by the literature to explain why men may gain more is that they have an

[23] The garment sector in Bangladesh is clustered to a varying degree. In the most densely clustered areas, where a number of our sample factories are located, factories are often located next to one another. Thus, workers, who often live in walking distance from the factories, can in these areas switch employer with little increase in commuting time. Anecdotal evidence from factory managers suggests that they often do so.

[24] We are presently geocoding all of the factories to obtain more precise measures of factory density.

[25] Some of these patterns are doubtless caused by women leaving work immediately after children are born.

advantage in negotiation situations. We test this by looking at differences between the initial wage earned by women and men when they first enter a factory, controlling for grade. We find that in the first month at the factory, women earn 1.9 percent less than men on average, controlling for the grade at which they enter. This gap is, if anything, larger than the overall unexplained wage gap (controlling for grade) in the data. This is corroborated by the fact that the unexplained wage gap is significantly decreasing with tenure in the factory, at least in the first five years of tenure (results on request from authors).[26]

A second channel through which men may realize higher gains from mobility is that moving to the upper operator grades makes it more likely they will be promoted further. While almost 80 percent of operators are women, around 95 percent of supervisors are men. By gaining a promotion, women gain additional wages; men gain the additional wages and also move a step closer to being promoted to supervisor. In several surveys, we asked operators whether they would accept a promotion to supervisor if offered one. Sixty percent of males and 40 percent of females said they would. Those who say yes have changed factories more often than those saying no. Their average tenure is 2.4 years compared with 3.0 years for those saying they would decline the promotion. As the regression in Column 6 of Table 6 indicates, among all workers saying they would accept a promotion to supervisor, there is no difference in the average tenure per factory.

We read the evidence as providing some support for both the higher costs and higher benefits channels. To the extent that the higher benefits men obtain from being promoted drive the gap might be reduced if and when women see more opportunity for advancement into supervisory positions. It is also possible that the additional career opportunities available to men lead to men making greater investment in skills, though we are not able to provide corroboration of this give the data available.

Discussion and conclusion

The gap between female and male wages has fallen in recent decades in many places, but a significant gap remains. We find that women earn lower wages in export-oriented garment factories in Bangladesh, even in a context where minimum-wage s are very close to binding. The measured gaps in our data are very similar to those reported by Blau and Kahn (2016), both with and without controls for occupation. Our data include very good measures of skills, which allow us to control for worker productivity much more precisely than is typically possible. About two-thirds of the wage gap remains even after controlling for these skills measures. We trace the root cause of this unexplained wage gap to higher mobility of male workers. Factory promotion rates are low, and most promotions occur when workers move across factories. Males have higher exit rates, and higher wages conditional on grades when they enter new factories.

The data on why women are less mobile provide some support for women facing higher mobility frictions and for men having stronger incentives to move. However, while much

[26] Also the wage gap before controlling for grade fixed effects declines with tenure in the factory at a similar speed. However, this decline is not statistically significant at conventional levels.

of the literature has moved toward a finding that flexibility is the key to the remaining wage gap (e.g., Goldin 2014), our data suggest that flexibility is less important than frictions in mobility across factories and more traditional glass ceiling effects. Indeed, none of the jobs are particularly flexible in this sector, where the typical work week is six days of at least ten hours each. And promotion within operator ranks does not change the flexibility of the work. In that sense, we clearly have a sample selected from women with a high tolerance for inflexible working conditions. Instead, the data point toward constraints of movement by women into management. While the lack of women in supervisory roles may reflect a desire to maintain some degree of flexibility, Macchiavello et al (2015) point to cultural constraints that appear to make this transition difficult.

Most of the high-quality administrative data providing evidence on wage gaps and, indeed, on determinants of wages more generally come from high-income countries. By organizing administrative records from a substantial number of very large garment factories in Bangladesh, we contribute to the breadth of the evidence on determinants of wages. In that regard, although we find evidence of wage gaps unexplained by differences in skills, the data do indicate that wages more generally do respond to skills, even among female workers in the sample – though there is weak evidence that the returns to skills are lower for females.

References

Abras, A.L.G. 2012. “Success and upgrading after the end of the MFA”, in G. Lopez-Acevedo and R. Robertson (eds): Sewing success? Employment, wages, and poverty following the end of the Multi-fibre Arrangement (Washington, DC, World Bank), pp. 87–135.

AT Kearney. 2014. “Get Ready for China’s Manufacturing Comeback”, atkearney.cz/documents

Babcock, Linda and Sara Laschever. 2003. *Women Don’t Ask: Negotiation and the Gender Divide*. Princeton: Princeton University Press.

Bertrand, Marianne, Claudia Goldin, and Lawrence F. Katz. 2010. “Dynamics of the Gender Gap for Young Professionals in the Financial and Corporate Sectors.” *American Economic Journal: Applied Economics* 2 (3): 228–55,

Bertrand, Marianne, Emir Kamenica, and Jessica Pan. 2015. “Gender Identity and Relative Income within Households.” *Quarterly Journal of Economics* 130 (2): 571-614.

Blattman, Christopher, and Stefan Dercon. 2016. “Occupational choice in early industrializing societies: Experimental evidence on the income and health effects of industrial and entrepreneurial work”, mimeo, University of Chicago

Blau, Francine, and Lawrence Khan. 2016: “The Gender Wage Gap: Extent, Trends, and Explanations.” IZA Discussion Paper No. 9656

Bowles, Hannah R., Linda Babcock and Lei Lai. 2007. “Social Incentives for Sex Differences in the Propensity to Initiate Negotiation: Sometimes It Does Hurt to Ask.” *Organzational Behavior and Human Decision Processes* 103 (1): 84–103.

Corcoran, Mary E., Paul Courant, and Mary C. Noonan. 2005. “Pay Differences among the Highly Trained: Cohort Differences in the Sex Gap in Lawyers’ Earnings.” *Social Forces* 84 (2): 853–72.

Croson, Rachel and Uri Gneezy. 2009. “Gender Differences in Preferences.” *Journal of Economic Literature* 47 (2): 448-474.

Flory, Jeffrey A., Andreas Leibbrandt and John A. List, “Do Competitive Work Places Deter Female Workers? A Large-Scale Natural Field Experiment on Gender Differences in Job-Entry Decisions," *Review of Economic Studies*, (2015), 82(1), 122-155.

Goldin, Claudia. 2014. "A Grand Convergence: Its Last Chapter." *American Economic Review* 104 (4): 1091-1119.

Haque, A.K. Enamel, 2015. Garment Workers in Bangladesh: Social Impact of the Industry. Dhaka: Asian Center for Development

Huynh, Phu, 2016, "Assessing the gender pay gap in Asia's garment sector," ILO Asia-Pacific working paper series.

Impactt. 2011. "Finding the Sweet Spot: Smarter ethical trade that delivers more for all", https://impacttlimited.squarespace.com

-----. 2012. "Nice Work? Are workers taking the strain in the economic downturn? 2006-2012", https://impacttlimited.squarespace.com

-----. 2013. "Nicer Work? Impactt's Benefits for Business and Workers Programme 2011-2013", https://impacttlimited.squarespace.com

KPMG. 2013. "Business Case Analysis for Responsible Electronics Manufacturing" kpmg.com/TW/zh/Documents

Leibhardt, Andreas, John A. List. 2014: "Do Women Avoid Salary Negotiations? Evidence from a Large-Scale Natural Field Experiment," Management Science 61(9): 2016-2024

Macchiavello, Rocco, Andreas Menzel, and Christopher M. Woodruff. 2016. "Challenges of Change: An Experiment Training Women to Manage in the Bangladeshi Garment Sector", mimeo, University of Warwick.

Manning, Alan. 2013. "Monopsony in Motion: Imperfect Competition in Labor Markets." Princeton: Princeton University Press.

Mazei, Jens, Joachim Hüffmeier, Philipp Alexander Freund, Alice F. Stuhlmacher, Lena Bilke, and Guido Hertel. 2015. "A Meta-Analysis on Gender Differences in Negotiation Outcomes and Their Moderators." *Psychological Bulletin* 141 (1): 85-104.

WSJ. 2013. "Companies Seek to Avoid China New Year Hangover". wsj.com/articles/SB10001424127887323864304578315872427597756 .

Table 1: Summary Statistics

Panel 1: Factory Level Statistics

Variable	N	median	mean	min	max
Factory Size	44	1187	1409	133	3359
Factory Size, Sewing Sample	44	1048	1192	133	2653
Share Female Worker	44	0.808	0.806	0.544	0.984
Average Tenure (years)	44	1.907	2.028	0.813	5.600
Monthly Promotion rate (Not demoted)	44	0.004	0.008	0.000	0.060
Monthly Exit rate	44	0.049	0.051	0.005	0.128

Panel 2: Individual Level Statistics, those present in first round of data

Sewing section production workers	Workers	median	mean	min	max
Sewing section	55,623				
Sample with non-missing gender, grade and pay:					
Female	49,446		81%	0	1
Tenure (years)	49,446	1.15	1.86	0	29.8
Wage	49,446	5755	5590	752	15350
Exit	49,446		25.1%	0	1
Promoted (Not demoted)	49,419		4.2%	0	1

Panel 3: Worker-Month Level Statistics

Sewing section production workers	Workers	median	mean	min	max
Sewing section	449,230				
Sample with non-missing gender, grade and pay:					
Female	399,463		78%	0	1
Tenure (years)	399,463	1.24	1.87	0	30.15
Wage	399,463	5,678	5509	266	15350
Monthly Exit rate	371,044		4.9%	0	1
Monthly Promotion rate (not demoted)	368,938		0.6%	0	1

Table 2: General Gender Wage- and Grade Gaps

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Mgmt. Fact.s All Sample	| - - - Operators + Helpers - - - |			| - - - - - Operators - - - - - |		
VARIABLES	| - - - - L o g W a g e - - - - |			Grade	| - - L o g W a g e - - |		Grade
Female	-0.197***	-0.088***	-0.017**	-0.880***	-0.038***	-0.016**	-0.384***
	(0.014)	(0.008)	(0.007)	(0.076)	(0.009)	(0.007)	(0.071)
Tenure	0.033***	0.026***	0.008***	0.214***	0.009***	0.004**	0.095*
	(0.003)	(0.003)	(0.002)	(0.036)	(0.002)	(0.002)	(0.050)
Tenure^2	-0.000	-0.001***	-0.000***	-0.006**	-0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.002)
Constant	8.410***	8.292***	8.414***	3.182***	8.364***	8.436***	3.707***
	(0.008)	(0.012)	(0.012)	(0.073)	(0.009)	(0.009)	(0.071)
Observations	268,696	401,447	401,447	401,965	296,522	296,522	296,850
R-squared	0.444	0.716	0.909	0.226	0.827	0.898	0.369
Factory-FE	YES	YES	YES	YES	YES	YES	YES
Month FE	YES	YES	YES	YES	YES	YES	YES
Grade FE	NO	NO	YES	-	NO	YES	-

Notes: Samples: Column 1 21 factories with information on workers at all levels, including management positions; Columns 2-4 all sewing section production workers grade 7-3 in 44 factories; columns 5-7, sewing machine operators grade 6-3 in 44 factories. The dependent variable in columns 1-3 and 5-6 is the monthly wage for six 8-hour days, in BDT. Overtime pay is not included. The dependent variable in columns 4 and 7 is the operator grade. Grades are inverted from the normal factory scale, so that grade 3 is the entry operator grade and grade is a multi-skilled, senior operator. Tenure is the number of years since the date the worker joined the factory, based on the recorded date of joining the factoring reported in the administrative records. Asterisks indicate significance at the .10 (*), .05 (**), and .01 (***) levels.

Table 3: Wage Gaps Controlling for Skills, Grade 6-3

VARIABLES	(1)	(2)	(3)	(4)	(5) Average efficiency	(6) #Processes	(7) Highest skill	(8) Physical operation
	| - - - -	S a l a r y	- - - -	|				
Female	-0.038***		-0.026***	-0.027***	0.001	-0.484*	-0.980***	-0.339***
	(0.009)		(0.008)	(0.007)	(0.014)	(0.241)	(0.095)	(0.036)
Average efficiency, tested processes		0.063***	0.062***	0.055***				
		(0.013)	(0.013)	(0.014)				
# Processes tested		0.003***	0.003***	0.003***				
		(0.000)	(0.000)	(0.000)				
Most complex process tested		0.006***	0.006***	0.005***				
		(0.001)	(0.001)	(0.001)				
Tested on process involving physical strength		0.013***	0.011**	0.017***				
		(0.003)	(0.004)	(0.004)				
Factory tenure	0.023*	0.022*	0.022*	0.022	-0.003	0.212*	0.019	0.013
	(0.013)	(0.013)	(0.013)	(0.013)	(0.005)	(0.114)	(0.038)	(0.011)
Factory tenure squared	-0.001	-0.001	-0.001	-0.001	0.001	-0.015	-0.004*	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.009)	(0.002)	(0.001)
Observations	11,783	11,783	11,783	11,268	3,031	3,205	3,096	3,205
R-squared	0.206	0.278	0.283	0.289	0.174	0.342	0.103	0.238
Factory-Month FE	YES	YES	YES	YES	YES	YES	YES	YES
Grade FE	NO	NO	NO	NO	NO	NO	NO	NO
Machine FE				YES				

Notes: Standard errors are clustered at the factory level. The sample is grade 3 to 6 operators in 15 factories for whom a recent skills assessment is available. Gross pay is the log monthly basic wage for six 8-hour days, without overtime. Tenure is the number of years since the date the worker joined the factory. Skills are measures by the number of sewing processes on which the operator is tested, and by the average percentage efficiency (0-100%) of the skills on which the operator is tested, the most complex or "critical" process on which the operator is tested, and whether the operator is tested on any process requiring physical strength. The regressions in Columns 1 through 5 use monthly data with multiple observations per operator. The regressions in Columns 6 through 9 use data from only a single month per operator. Asterisks indicate significance at the .10 (*), .05 (**), and .01 (***) levels.

Table 4: Wage Gaps with Demographic Controls, Grade 6-3

	(1)	(3)	(4)	(6)
VARIABLES	Wage gap	Grade Gap	Wage gap	Grade Gap
Female	-0.038***	-0.423***	-0.028***	-0.280***
	(0.007)	(0.077)	(0.007)	(0.052)
Tenure in factory	0.016***	0.106**	0.014***	0.066
	(0.004)	(0.047)	(0.003)	(0.046)
Tenure in factory^2	-0.0002	0.00001	-0.000	0.002
	(0.0003)	(0.001)	(0.000)	(0.002)
Tenure, RMG sector			0.015***	0.212***
			(0.001)	(0.025)
Tenure, RMG Sector^2			-0.000***	-0.007***
			(0.000)	(0.001)
Years schooling			-0.000	0.007
			(0.001)	(0.008)
Age			-0.001	0.001
			(0.001)	(0.005)
Married			-0.003	0.027
			(0.004)	(0.058)
Months per factory, career			-0.005***	-0.071***
			(0.002)	(0.022)
Constant	8.538***	3.753***	8.497***	2.893***
	(0.056)	(0.225)	(0.063)	(0.312)
Observations	14,352	12,837	14,317	12,806
R-squared	0.675	0.356	0.698	0.450
Factory-FE	YES	YES	YES	YES
Month FE	YES	YES	YES	YES
Grade FE	NO	NO	NO	NO

Notes: Samples: operators surveyed and matched to adminstrative records. The dependent variable is the monthly wage for six 8-hour days, in BDT. Overtime pay is not included. Tenure is the number of years since the date the worker joined the factory, based on the recorded date of joining the factoring reported in the adminstrative records. Tenure in the RMG sector is in years as reported by workers in surveys. Years of scholling, years of age and number of other factories in which the worker has worked are as reported by workers in surveys. Asterisks indicate significance at the .10 (*), .05 (**), and .01 (***) levels.

Table 5: Exit and Promotions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	----- Promotion	-----	--------	Exit from Factory	--------	External	Survey
				Exit in first year		Arrivals	Years/factory
VARIABLES	OLS	Cox Hazard	OLS	OLS	Cox Hazard	OLS	OLS
Female	-0.291***	-0.469***	-0.005**	-0.012***	-0.113**	-0.048***	0.60***
	(0.100)	(0.132)	(0.003)	(0.004)	(0.053)	(0.014)	(0.10)
Tenure in factory	0.010	0.911***	-0.019***	-0.102***	-0.339***		
	(0.047)	(0.177)	(0.002)	(0.023)	(0.025)		
Tenure in factory'	-0.001	-0.134***	0.001***	0.031	0.015***		
	(0.004)	(0.040)	(0.000)	(0.021)	(0.002)		
Tenure, RMG sector							0.25**
							(0.10)
Tenure, RMG Sector^2							0.00
							(0.01)
Constant	1.786***		0.128***	0.163***		0.859***	-1.30
	(0.295)		(0.003)	(0.006)		(0.076)	(0.83)
Observations	369,437	66,958	371,561	161,680	63,800	14,242	1,766
R-squared	0.028		0.027	0.030		0.366	0.411
Factory FE	YES	YES	YES	YES	YES	YES	YES
Month FE	YES	-	YES	YES	-	YES	YES
Grade FE	YES	YES	YES	YES	YES	YES	NO

Notes: Sample is grade 3-7 operators in 48 factories. The dependent variable in columns 1-2 is 100 if the worker is in a higher grade compared with the previous month, and zero otherwise. The dependent variable in columns 3-5 is 1 isf the worker exists the sample in a given month, and zero otherwise. The sample for the regression in column 6 is the set of workers arriving in a new factory/grade combination in a given month. This includes both workers promoted within the factory and workers arriving at a factory in grades above entry level in the factory. The dependent variable is 1 if the worker is new to the factory, and 0 otherwise (i.e., is 0 if the worker is promoted internally). The first month for which we have data for the factory is excluded from the regressions in columns 3-6. Tenure is the number of years since the date the worker joined the factory, and Tenure, RMG sector is the number of years the worker reports working in the RMG sector. This is available only in the sample of workers for whom we have survey data. Asterisks indicate significance at the .10 (*), .05 (**), and .01 (***) levels.

Table 6: Exploring Reasons for Differential Mobility Rates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	Wage Gap	Wage Gap	Exit - First yr.	xternal Arriva	Tenure @ fac	Years/factory	Years/factory
Female	-0.089***	-0.020***	-0.017***	-0.0574***			0.62***
	(0.008)	(0.006)	(0.0034)	(0.0128)			(0.11)
Number other factories in zip code*female	-0.005	-0.015*	-0.0008	0.0410***			
	(0.010)	(0.008)	(0.0023)	(0.0119)			
Tenure in factory	0.026***		-0.0946***				
	(0.003)		(0.0217)				
Tenure in factory^2	-0.001***		0.0300				
	(0.000)		(0.0200)				
Tenure, RMG sector					0.10	0.46***	0.26**
					(0.10)	(0.09)	(0.10)
Tenure, RMG Sector^2					0.01	-0.01	0.00
					(0.01)	(0.01)	(0.01)
Married							0.09
							(0.07)
Married, no children					0.06	0.32*	
					(0.24)	(0.18)	
Married, has child age 5 or younger					-0.22	0.18	
					(0.27)	(0.18)	
Married, all children age 6 or older					0.57*	0.55***	
					(0.30)	(0.17)	
SV trainee							0.20
							(0.28)
SV Trainee * Female							-0.79*
							(0.42)
Observations	391,449	391,449	170,110	13,837	666	666	1,823
R-squared	0.715	0.909	0.029	0.375	0.387	0.452	0.405
Factory-FE	YES	YES	YES	YES	YES	YES	YES
Month FE	YES	YES	YES	YES	YES	YES	YES
Grade FE	NO	YES	YES	YES	NO	NO	NO

The sample in columns 5 and 6 is limited to female operators. The number of factories in the post code is based on factories that are suppliers of signatories of the Accord and Alliance. Variables are as defined in Table 5, with additional variables indicting women with children, at least one of which is five years old or younger, and women with children, all of which are six or older. SV Trainee indicates a participant in a program to train operators to be line supervisors.

Appendix

Table A.1: Gender Differences in Absenteeism and Overtime:

	(1)	(2)	(3)	(4)	(5)
	| - - - - Absent Days	- - - - |		Attendance	Overtime
VARIABLES		< 16 days	< 13 days	Bonus	Hours
Female	0.0023	-0.0143*	-0.0157*	11.1886***	-2.0249***
	(0.0118)	(0.0084)	(0.0082)	(3.7194)	(0.4876)
Tenure	-0.0734***	-0.0767***	-0.0745***	8.6586***	0.5552***
	(0.0177)	(0.0169)	(0.0170)	(1.2795)	(0.1779)
Tenure^2	0.0031***	0.0034***	0.0032***	-0.4654***	-0.0140
	(0.0008)	(0.0008)	(0.0009)	(0.0992)	(0.0145)
Constant	0.9946***	0.9930***	0.9980***	93.3146***	30.3074***
	(0.0427)	(0.0398)	(0.0405)	(12.5671)	(2.9519)
Observations	183,543	183,351	183,198	234,361	144,471
R-squared	0.072	0.078	0.080	0.451	0.599
Factory-FE	YES	YES	YES	YES	YES
Month FE	YES	YES	YES	YES	YES
Grade FE	YES	YES	YES	YES	YES

Notes: Regression of Number of days worker was absent on dummy variable for female worker and tenure in factory in Column 1, with sample restricted in Column 2 and 3 to observations where workers missed less than 16 and 13 days during the month, respectively. Column 4 shows regression of earned Attendance bonuses (in BDT) by workers, while column 5 of total overtime hours worked by worker during month on the same right hand side variables. Standard errors clustered on the factory level: Asterisks indicate significance at the .10 (*), .05 (**), and .01 (***) levels

Table A.2: Absenteeism, Overtime, and the Gender Wage Gap

	(1)	(2)	(3)	(4)	(5)
VARIABLES	| - - - - - - - - - - - -	-	W a g e	- - - - - - - - - - - -	|
Female	-0.064***	-0.063***	-0.064***	-0.063***	-0.006
	(0.007)	(0.007)	(0.007)	(0.007)	(0.003)
Absent Days/1000	0.157			3.235***	0.562*
	(0.749)			(0.880)	(0.293)
Tenure	0.037***	0.034***	0.038***	0.035***	0.014***
	(0.008)	(0.007)	(0.008)	(0.007)	(0.004)
Tenure^2	-0.002***	-0.002***	-0.002***	-0.002***	-0.001**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)
Att. Bonus/1000		0.123***		0.156***	0.011
		(0.018)		(0.023)	(0.009)
Overt.Hours/1000			-0.243**	-0.426***	-0.033
			(0.097)	(0.134)	(0.053)
Constant	8.447***	8.423***	8.460***	8.433***	8.565***
	(0.009)	(0.008)	(0.013)	(0.011)	(0.013)
Observations	104,529	104,529	104,529	104,529	104,529
R-squared	0.729	0.737	0.729	0.739	0.946
Factory-FE	YES	YES	YES	YES	YES
Month FE	YES	YES	YES	YES	YES
Grade FE	NO	NO	NO	NO	YES

Notes: Regression of log base wage on a dummy indicating female workers, tenure in factory, number of days worker missed in a given month, the amount of Attendance Bonuses earned (in BDT) and the number of overtime hours worked in the month. Standard errors clustered on the factory level: Asterisks indicate significance at the .10 (*), .05 (**), and .01 (***) levels

Table A.3: Minimum-wage s in the Bangladeshi Garment Sector:

Bangladesh Garment Industry Minimum Wage 2013

Sl. No.	Grade and Description of Position	Basic Salary in BDT	Yearly Rate of Basic Salary Increase	House Rent in BDT	Medical Allowance in BDT	Transport Allowance in BDT	Food Allowance in BDT	Gross Salary in BDT	% Increase of Gross Salary from the 7th Grade	% Increase of Gross Salary from Minimum Wage 2010	% Increase of Basic Salary from 7th Grade	% Increase of Basic Salary from Minimum Wage 2010
1	Grade 1	8500	5%	3400	250	200	650	13000	145.28%	39.78%	183.33%	23.53%
2	Grade 2	7000	5%	2800	250	200	650	10900	105.66%	51.39%	133.33%	28.57%
3	Grade 3	4075	5%	1630	250	200	650	6805	28.40%	61.33%	35.83%	29.57%
4	Grade 4	3800	5%	1520	250	200	650	6420	21.13%	66.28%	26.67%	31.18%
5	Grade 5	3530	5%	1412	250	200	650	6042	14.00%	70.05%	17.67%	32.15%
6	Grade 6	3270	5%	1308	250	200	650	5678	7.13%	70.92%	9.00%	31.80%
7	Grade 7	3000	5%	1200	250	200	650	5300	n/a	76.67%	n/a	33.33%
8	Probationary Period	2200	5%	880	250	200	650	4180	-21.13%	67.20%	-26.67%	no basic in 2010

RISE