Gender pay gap varies greatly by occupation

By Katharina Wrohlich and Aline Zucco

The German labor market is characterized by marked occupational segregation between women and men. The median earnings in female dominated occupations are lower than those in male dominated professions. This is one of the reasons for the gender pay gap. However, there are also large differences in earnings between men and women within occupations. These profession-specific gender pay gaps are smaller in professions with a high proportion of employees in the public sector. This finding indicates that more transparency with respect to earnings could reduce the gender pay gap in the private economy.

The discrepancy in pay between men and women has become a hotly debated topic in the political arena. The German Federal Statistical Office (*Statistische Bundesamt*) documented the extent of the "unadjusted" pay gap, which has hovered around 21 to 23 percent in the years 2006 to 2016.[1] The gender pay gap widens considerably over the course of professional careers, and for income over a lifetime the *gender lifetime earnings gap* is just under 50 percent.[2] After people retire, the difference in pay continues in the form of the *gender pension gap*, which measures the gender-specific difference in pension levels. Current calculations document that the gender pension gap is a major problem—particularly in Germany. In 2014, it was 42 percent in western Germany and 23 percent in eastern Germany.[3]

The "adjusted" pay gap is often a topic of discussion.[4] This term describes the unexplained portion of the gender pay gap and accounts for differences in characteristics in the earning estimate such as: professional experience, education, sector, profession, company size, number of hours worked, tasks, hierarchy level, and type of employment contract. According to the German Federal Statistical Office, the adjusted pay gap equals six percent.[5]

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1 German Federal Statistical Office, "Drei Viertel des Gender Pay Gaps lassen sich mit Strukturunterschieden erklären," (press release, German Statistical Office, Wiesbaden, March 14, 2017) (available online, accessed October 5, 2017. This also applies to all other online sources in this study, if not stated otherwise); and Christina Boll and Julian S. Leppin, "Die geschlechtsspezifische Lohnlücke in Deutschland: Umfang, Ursachen und Interpretation," *ZBW Wirtschaftsdienst* 2015/4 (2015): 249–254.

2 Christina Boll, et al., "Dauerhaft ungleich – berufsspezifische Lebenserwerbseinkommen von Frauen und Männern in Deutschland," *HWWI Policy Paper* 98 (2016).

3 Markus M. Grabka et al., "Der Gender Pension Gap verstärkt die Einkommensungleichheit von Männern und Frauen im Rentenalter," *DIW Wochenbericht* no. 5 (2016): 87–96 (available online). See also the article by Anna Hammerschmid, Peter Haan and Carla Rowold in this issue.

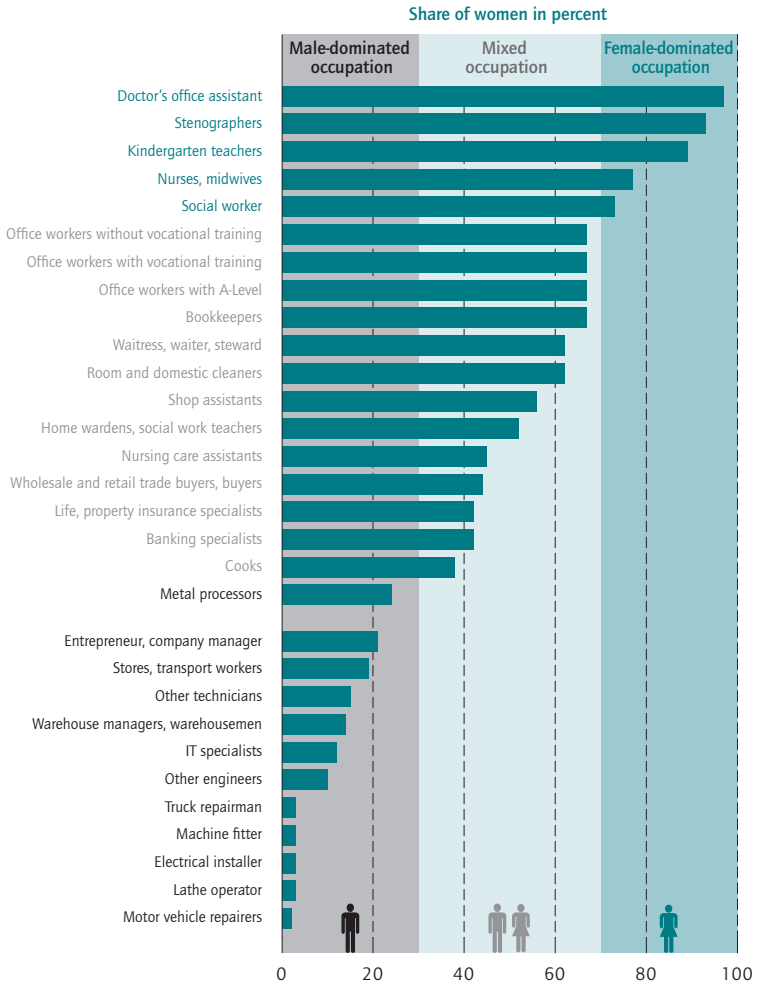
4 For a discussion of the terms "adjusted pay gap" and "unadjusted pay gap," see the term "gender pay gap" in the DIW Glossary (available online).

5 The adjusted gender pay gap of six percent refers to 2014, the last year in which the Pay Structure Survey was conducted. The survey was the basis for calculating the adjusted gender pay gap. See German Federal Statistical Office, "Drei Viertel des Gender Pay Gaps"; and Claudia Finke, "Verdienstunterschiede zwischen Männern und Frauen. Eine Ursachenanalyse auf Grundlage der Verdienststrukturerhebung 2006," *Wirtschaft und Statistik* 1 (2011): 36–48.

Figure 1

Share of women in occupations

Distribution of the 30 most frequent occupations in male dominated, mixed and female dominated occupations (share of women in percent)



Note: The calculations are solely based on full-time employed persons. The assignment to the respective occupations is based on the KldB 88. The translation of the German professional titles refers to the BiBB.

Source: Authors' own calculations based on the SIAB data for 2014.

The labor market in Germany is very sex segregated. Only 13 of the most frequent occupations are mixed occupations.

The characteristics of number of hours worked, profession, and vertical segregation explain the pay gap to a large extent. This fact is often used to argue that the pay gap between men and women stems from different sets of decisions and is therefore possibly driven by different preferences. However, choice of profession and number of hours worked are not only expressions of preference. They are also the consequences of societal and institutional norms and restrictions.[6]

German labor market shows marked professional segregation between men and women

The German labor market is heavily segregated by gender. As a study of the Institute for Employment Research (IAB) of the Federal Employment Agency documented,[7] in 2010 a total of 60 percent of women worked in female dominated, 29 percent in mixed gender, and 11 percent in male dominated occupations. "Female dominated occupations" refer to those in which the proportion of women is over 70 percent, and "male dominated occupations" refer to those with a proportion of women of less than 30 percent. All other occupations are defined as mixed gender professions.

In total, 69 percent of men work in male dominated occupations, 20 percent in mixed gender occupations, and 11 percent in female dominated occupations. The IAB study also showed that there was virtually no change in the distribution of women and men among female dominated, male dominated and gender mixed professions between 1976 and 2010 in western Germany. Further studies document a similar relationship nationwide between 1993 and 2010.[8]

A current evaluation of the sample of the 2014 IAB data, Sample of Integrated Labour Market Biographies (SIAB) (Box), showed that not even half (13) of the 30 most frequently cited professions[9] are mixed gender professions (Figure 1). With a proportion of women of more than 80 percent, stenographers, kindergarten teachers, and doctor's office assistants are among the typical women's professions. Lathe operator, electrical installer, and truck repairman are all professions with an average proportion

6 See for example Christina Klenner, "Gender Pay Gap – die geschlechtsspezifische Lohnlücke und ihre Ursachen," *Policy Brief* WSI 07/2016 (2016).

7 Ann-Christin Hausmann and Corinna Kleinert, "Männer- und Frauendomänen kaum verändert," *IAB Kurzbericht* no. 9 (2014).

8 See for example Anne Busch, *Die berufliche Geschlechtersegregation in Deutschland*, (Wiesbaden: VS Verlag für Sozialwissenschaften, 2013); German Federal Statistical Office, "Frauen arbeiten selten in Männerberufen – und umgekehrt," (press release, German Federal Statistical Office, Wiesbaden, December 22, 2010) (available online).

9 Civil servants and the self-employed were excluded from our analyses.

of women of less than three percent, making them men's professions. Nursing care assistants, shop assistants, and office workers[10] are all typical mixed gender professions.

Gross wages in male dominated occupations are significantly higher than in female dominated occupations

Based on the SIAB data, we were able to calculate the median wages paid within individual professions. The median wage is the wage in the 50th percentile of the wage distribution: it is the value with the same number of people with a higher and a lower wage. There is a difference between median wage and average wage, the former being more robust against outliers. Since wages at the upper end of the distribution have to be estimated,[11] the median wage is preferable to the average wage. In order to compare the difference in earnings among and within occupations, we use the median wage in our analyses.[12]

In general, professions with a higher proportion of women have lower median wages than professions with a lower proportion of women (Figure 2).[13] The five professions with the highest median wages are all men's professions: entrepreneur, company manager, engineer, IT specialists, and banking and insurance specialists. Ranking the 30 most common professions according to median earnings, the best-paid women's profession is number 14 (nurse, midwife), followed by stenographer

Box

Sample of Integrated Labour Market Biographies (SIAB)

The SIAB sample is an administrative data set provided by the Institute for Employment Research (IAB) of the Federal Employment Agency. It is a two-percent sample drawn from the Integrated Employment Biographies population, which contains the complete employment history of more than 1.75 million individuals.

The size of the SIAB sample gives it a key advantage in comparison to other data sets: for 2014 alone, the data set contained more than 764,000 observations. As a result of the administrative data collection process, the data set has no missing values, and its information on gross pay is accurate to the day. However, the SIAB does not record working hours, which means that part-time employees must be excluded from the comparison of daily pay in order to avoid distorting the results. And due to the administrative data collection process, the data set does not contain any information outside employer reports (no family status, number of children, or partner's pay, for example).

Definition: Profession

We based our definition of "profession" on the 3-digit level of *Klassifikation der Berufe 1988* (KldB 88), a scheme for classifying professions in which they are allocated to groups based on the knowledge, skills, and experience required. For example, the system differentiates between human and veterinary medicine but not between surgeons and pediatricians. In effect, the classification makes it possible to differentiate between professions requiring different skill levels. This is important when comparing the pay in heterogeneous professions.

On the other hand, the classification cannot be used to examine how genders are divided into subgroups of professions. This means, for example, that within the profession of human medicine, we could not observe whether men and women segregate themselves into different areas of specialization. That means the gender pay gap within a profession can be traced to two factors, but differentiation is not possible. Men and women may work in subgroups of a profession that are paid differently; then again this could involve discrimination.

10 A problem with KldB 88, the official classification of all professions, is that the industrial professions are intricately subdivided, while many different service and administrative professions are grouped into one three-digit level. See Britta Matthes, Carola Burkert, and Wolfgang Biersack, "Berufssegmente – eine empirisch fundierte Neuabgrenzung vergleichbarer beruflicher Einheiten," *IAB Discussion Paper* 35 (2008). To counteract the problem, the profession of office assistant has been subdivided according to educational level (as per Ann-Christin Hausmann et al., "Männer- und Frauendomänen."). However, based on the data at hand, the proportion of women can only be calculated for the overall profession.

11 The SIAB data are based on reports from employers that report wages only up to the contribution assessment ceiling. See Manfred Antoni, Andreas Ganzer, and Philipp vom Berge, "Sample of Integrated Labour Market Biographies (SIAB) 1975–2014," *FDZ-Datenreport* 04/2016 (2016). We imputed the wages above the ceiling.

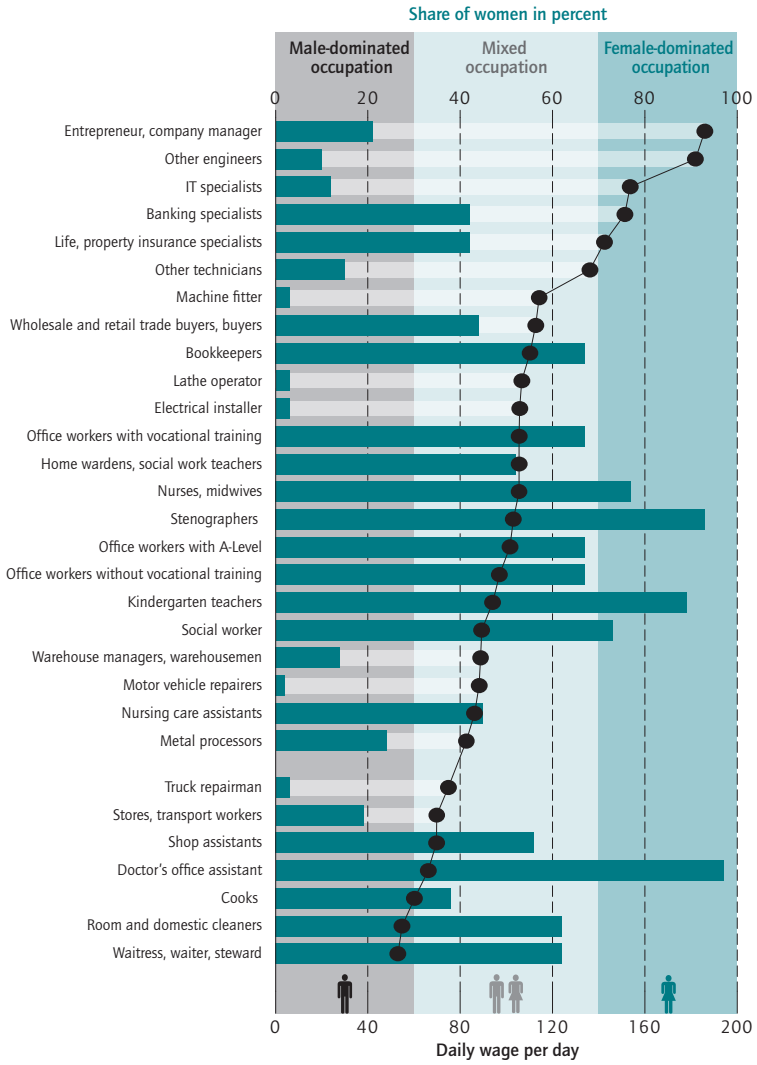
12 Each of the median wages refers to a daily wage. The SIAB data used here do not provide information about hours worked. They only indicate whether the person worked full- or part-time. For this reason, we could only calculate daily wages and not hourly ones. To be able to ensure that the wages are nevertheless comparable, people who work part-time were excluded from the analysis (see box).

13 Also see previous evaluations by the German Institute for Economic Research (DIW Berlin) based on data from the Socio-Economic Panel (SOEP). DIW Berlin, "Brutto-Stundenverdienste in typischen Frauenberufen 2014 im Schnitt um acht Euro – oder 39 Prozent – niedriger als in typischen Männerberufen," (Press release, German Institute for Economic Research, Berlin, March 11, 2016) (available online). The increase in the proportion of women in a profession leads to a drop in the wage level. Above all, this is based on the increase in women who receive lower pay than men. See Ann-Christin Hausmann, Corinna Kleinert, and Kathrin Leuze, "Entwertung von Frauenberufen oder Entwertung von Frauen im Beruf?" *Kölner Zeitschrift für Soziologie und Sozialpsychologie* 67 (2) (2015): 217–242.

Figure 2

Share of women and median wage in the 30 most frequent occupations

Share of women in percent, daily wage (median) in euro per day



Note: The calculations are solely based on full-time employed persons. The assignment to the respective occupations is based on the KldB 88. The translation of the German professional titles refers to the BiBB.

Source: Authors' own calculations based on the SIAB data for 2014.

Median wages are in general higher in male-dominated than in female dominated occupations.

at number 15. The other women's professions are numbers 18 (kindergarten teacher), 19 (social worker), and 27 (doctor's office assistant).

In summary, we can state than in the upper part of the pay distribution, male dominated professions predominate while female dominated professions are found in the lower half of the distribution. The professions with the lowest wages (waitress, waiter, steward, room and domestic cleaners, and cooks) are mixed gender professions.

Many studies have examined the causes of the systematically lower pay observed in women's professions in comparison to men's. The devaluation hypothesis rests on the assumption that society attributes different competencies to women and men. According to this hypothesis, women are ascribed to have strengths in housework and family duties, while men are ascribed to be more productive in gainful employment. For this reason, women and the professions in which most of them work have a lower status and are thus poorly paid.[14] Further, inequality of pay between men's and women's professions can arise as a result of differences in human resources requirements. For example, the theory of compensating differentials claims that lower wages compensate for better possibilities to reconcile work and family duties in female dominated professions.[15] The theory also suggests that fewer specific human resources are required in female dominated occupations professions than in those that are male dominated. This specialization leads to higher pay in the latter occupations.[16]

14 Anne Busch and Elke Holst, "Geschlechtsspezifische Verdienstunterschiede bei Führungskräften und sonstigen Angestellten in Deutschland: Welche Relevanz hat der Frauenanteil im Beruf?" *Zeitschrift für Soziologie* 42 (4) (2013): 315–336; Paula England, *Comparable Worth. Theories and Evidence,* (Hawthorne: Aldine de Gruyter, 1992). However, the theory could not be confirmed for Germany. See Ann-Christin Hausmann et al., "Entwertung von Frauenberufen."

15 Anne Busch and Elke Holst, "Geschlechtsspezifische Verdienstunterschiede."; and Solomon W. Polachek, "Occupational Self-Selection: A Human Capital Approach to Sex Differences in Occupational Structure," *Review of Income and Statistics* 63 (1) (1981): 60-69. However, this theory could neither be confirmed in Germany nor the US. See Paula England, "The Failure of Human Capital Theory to Explain Occupational Sex Segregation," *The Journal of Human Resources* 17 (3) (1982): 358–370; and Juliane Achatz, Hermann Gartner, and Timea Glück, "Bonus oder Bias? Mechanismen geschlechtsspezifischer Entlohnung," *Kölner Zeitschrift für Soziologie und Sozialpsychologie* 57 (3) (2005): 466–493.

16 Tony Tam, "Sex Segregation and Occupational Gender Inequality in the United States: Devaluation or Specialized Training?" *American Journal of Sociology* 102 (6) (1977): 1652–1692; and Anne Busch and Elke Holst "Geschlechtsspezifische Verdienstunterschiede."

Gender pay gap also evident within professions

The previous analyses showed that in general, the pay in typical male dominated occupations is higher than that in female dominated occupations: part of the gender pay gap is due to the gender differences in occupational "choice". However, we also find that gender pay gaps exist within occupations (Figure 3).[17]

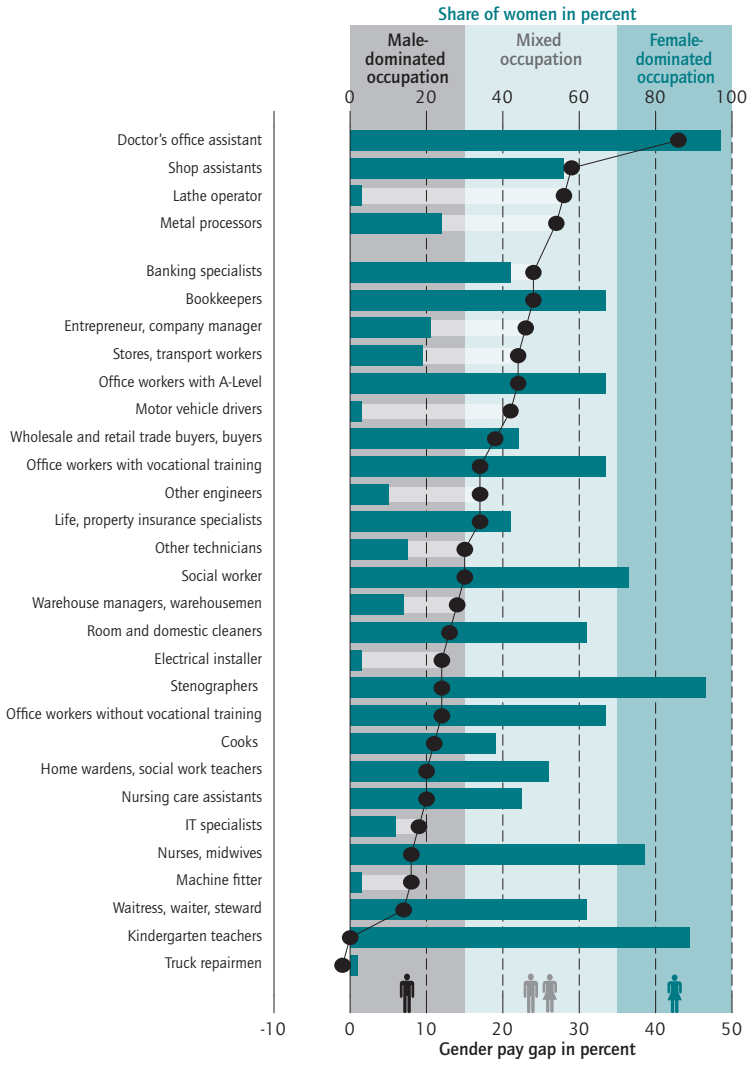
Indeed, nine professions show a pay gap that is greater than the average unadjusted pay gap of 22 percent. These nine professions include male and female dominated as well as gender mixed occupations. For example, at 43 percent, the profession with the highest proportion of women (doctor's office assistant) has the highest gender pay gap among the 30 most common professions. But even some male dominated professions show a very wide gender pay gap, for example, lathe operators and metal processors (28 percent each). The same applies to mixed professions. The pay structures of some also exhibit above-average gender pay gaps: salesperson (29 percent), banking specialists (25 percent), and bookkeepers (24 percent). The gender pay gap in the best-paid profession (entrepreneur, company manager) is 23 percent, which is also slightly above the average. This confirms the findings of current studies showing that overall the gender pay gap is significantly larger in the upper part of the income distribution than in the middle and lower parts.[18] Further, earlier studies have found that the unexplained portion of the gender pay gap is increasing in the upper income range, which can be interpreted as a greater level of discrimination (glass ceiling).[19]

Some professions have a very low gender pay gap or none at all. This is the case in the male dominated occupation truck repairman, and in the female dominated occupation kindergarten teacher. In the mixed gender profession waitress, waiter, steward, the female dominated occupation nurse or midwife, and the male dominated occupations machine fitter and IT specialist, the gender pay gap is below ten percent.

Figure 3

Gender Pay Gap and share of women in the 30 most frequent occupations

In percent



Note: The calculations are solely based on full-time employed persons. The assignment to the respective occupations is based on the KldB 88. The translation of the German professional titles refers to the BiBB. The Gender Pay Gap corresponds to the difference between the median wages of men and women in relation to the median wage of men.

Source: Authors' own calculations based on the SIAB data for 2014.

The Gender Pay Gap varies strongly between occupations.

17 Previous Analysis of the Federal Statistical Office on the basis of data from the quarterly earnings survey 2006 has shown similar results, see Claudia Finke (2010): Verdienstunterschiede zwischen Männer und Frauen. Wiesbaden: Statistisches Bundesamt.

18 Francine D. Blau and Lawrence M. Kahn, "The Gender Wage Gap: Extent, Trends, and Explanations," *Journal of Economic Literature* 2017 55 (3) (2017): 789-865; and Wiji Arulampalam, Alison L. Booth, and Mark L. Bryan, "Is there a glass ceiling over Europe? Exploring the gender pay gap across the wage distribution," *ILR Review* 60.2 (2007): 163–186.

19 For example Francine D. Blau and Lawrence M. Kahn, "The Gender Wage Gap."

Table

Linear regression of occupational characteristics on the Gender Pay Gap within occupations

	regression coefficient
Daily wage (Median)	−0.00
Average age	0.018*
Average firm size	0.000
Education (Reference: Share with vocational training and without A-Level)	
Share without vocational training and without A-Level	0.027
Share with A-Level	0.418
Share with higher education	0.029
Industry (Reference: Share of manufacturing)	
Share of agriculture/mining	0.192
Share of construction	0.125
Share of trade/traffic /storage/hotel and restaurants/ communication	0.038
Share of economical service	0.117
Share of administration/education/social services/entertainment	−0.026
Share of personalized service	−0.021
Share without assignment to an industry	0.668
Share of part-time employed	0.018
Share of women	−0.064
Constant	−0.436
Number of occupations	90
R^2	0.181

*Note: The calculations are solely based on full-time employed persons. Levels of significance: ***p<0.01 **p<0.05 *p<0.1. The assignment to the respective occupations is based on the KldB 88. The Gender Pay Gap corresponds to the difference between the median wages of men and women in relation to the median wage of men. Reading aid: A positive coefficient indicates an increase of the Gender Pay Gap within occupations if the respective characteristic rises. Thus, this occupational property has a positive effect on the Gender Pay Gap if it is statically significant.*

Source: Authors' own calculations based on the Occupational Panel (OccPan) 2010.

Only the average age within an occupation correlates with the Gender Pay Gap within an occupation. The higher the average age within an occupation, the higher is the Gender Pay Gap.

Gender pay gap level unrelated to proportion of women in professions

Overall, we found that median pay has a negative correlation with the proportion of women in a profession but the gender pay gap does not. We ran a simple linear regression[20] to relate the gender pay gap within a profession to factors such as the proportion of women in the profession, the proportion of employees in various sectors, and qualification levels, which confirmed the finding (Table). It reveals that neither the proportion of women among the employees in a profession, nor the proportion of part-time employees, nor median pay had a statistically significant relationship to the gender pay gap within a profession.[21] We were unable to confirm a statistically significant relationship between this variable and the formal education of employees within a profession, the proportion of employees in a profession in various industries, or the average size of the company. Only the average age of the employees in a profession was correlated with the gender pay gap: The higher the average age of the employees, the wider the gender pay gap within a profession. This matches the empirical finding that in general the gender pay gap increases with age.[22]

We were not able to include some of the factors of influence that seem to cause differences in the gender pay gap in individual professions due to a lack of information. For example, previous analyses of the German Federal Statistical Office have shown that in occupations in which the proportion of employees in the public sector is very high, the gender pay gap is much lower than in professions that are primarily practiced in the private sector.[23] This could explain the large difference in gender pay gaps between doctor's office assistants (43 percent) and kindergarten teachers (0 percent). The proportion of kindergarten teachers who are civil servants was around 63 percent in 2014, while only nine percent of doctor's office assistants were civil servants.[24]

The *gender leadership gap* is the difference in the proportion of women among total employees and the proportion of women in high management positions in a specific profession. The relationship can also be used to establish the existence of a gender pay gap within a profession. The present analysis based on the SIAB data was able to show that the profession of banking specialist has an above-average gender pay gap of 24 percent, for example (Figure 3). Earlier analyses conducted by DIW Berlin documented the existence of a particularly wide gender leadership gap in the financial sector.[25] This can be an explanation of why the pay gap between men and women among banking specialists is higher than average.

20 The regression refers to employees with an obligation to pay social security contributions in western Germany in 2010. See Ann-Christin Hausmann, Aline Zucco, and Corinna Kleinert, "Berufspanel für Westdeutschland 1976-2010 (OccPan)," *FDZ-Methodenreport* 09/2015 (2015).

21 Previous analyses of the Federal Statistical Office did not find a significant correlation between the gender pay gap and the share of women working in an industry (see Claudia Finke (2010): a. a. O.).

22 Also see Walter Joachimiak, "Frauenverdienste – Männerverdienste: Wie groß ist der Abstand wirklich?" (Web page, German Federal Statistical Office, Wiesbaden, 2013) (available online).

23 Claudia Finke (2010): a. a. O.

24 These numbers are based on a weighted evaluation of the Socio-Economic Panel (SOEP) v32, 2014.

25 See Elke Holst and Martin Friedrich, "Women's likelihood of holding a senior management position is considerably lower than men's—especially in the financial sector," *DIW Wochenbericht* no. 37 (2016): 827–838 (available online).

It has been shown previously for the US that occupations in which working hours can be flexibly designed have smaller gender pay gaps than less flexible professions in which compulsory presence plays a greater role.[26] However, when flexibility is mapped as the proportion of part-time employees, this relationship cannot be conclusively established for Germany (Table).

Conclusions

In the highly gender segregated German labor market, employees in female dominated occupations receive lower median pay than those in male dominated occupations. Therefore, choice of occupation is an important factor in explaining the gender pay gap. Based on the SIAB data of the IAB, DIW Berlin's analyses, however, also show that in some cases there are very wide gender gaps within professions. However, in our initial analyses, we were unable to find a correlation between the proportion of women in a profession and the gender pay gap. There are above-average gender pay gaps across the board: in male dominated, female dominated, and mixed professions.

The data also showed that in general, professions with a high proportion of employees in civil service have smaller gender pay gaps. This is probably due to the tariff-based contracts in civil service, which leave less leeway for negotiation than in the private sector. Numerous behavioral economics studies have shown that women make fewer demands during negotiations than men.[27] Social norms regarding the gendered expectations of men and women were identified as the cause of the discrepancy.[28]

Based on data for the US, it has been shown that the gender pay gap is particularly low in professions in which flexible working hours are possible. Using the proportion of part-time employees as a measure of flexibility, we were unable to find a correlation with the gender pay gap in Germany. However, it must be noted that the proportion of part-time employment in a profession is not necessarily an indication of employees' time sovereignty or the extent to which management positions can be held without compulsory presence. For example, earlier studies in the US identified the financial sector as one with a very large gender pay gap and at the same time, a lower likelihood of women holding management positions. With regard to that sector, the same holds true for Germany.

Our findings indicate a need for more research into the causes of the different levels of the gender pay gap within individual professions in Germany. Although many studies have analyzed the causes of lower pay in female dominated in comparison to male dominated occupations, little research has been done to answer the question of why the gender pay gap is much higher in some professions than in others.

The results suggest that more transparency in wage negotiations would lead to lower differences in pay between men and women.[29] The Remuneration Transparency Act (*Entgelttransparenzgesetz*, EntgTranspG) can be viewed as a step in that direction.[30] And a change in corporate culture—away from overtime and compulsory presence to more employee control over working hours and flexible career models—could lead to more equal opportunity for men and women in the labor market, closing the gender pay gap in the process.

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

27 For example, see Linda Babcock and Sara Laschever, *Women Don't Ask: The High Cost of Avoiding Negotiation—and Positive Strategies for Change*, (London: Bantam Press, 2003).

28 For an overview, see Mario Macis and Mirco Tonin, "Gender Differences in Earnings and Leadership: Recent Evidence on Causes and Consequences," *ifo DICE Report* 2/2017 (2017): 18–21.

29 Linda Babcock and Sara Laschever, *Women Don't Ask*.

30 The German Women Lawyers Association initiated a series of proposals for improving the Remuneration Transparency Act with the goal of actually implementing a legal right to equal pay for women and men for the same or similar work. See German Women Lawyers Association, "Stellungnahme des Deutschen Juristinnenbundes," (Web page, German Women Lawyers Association, Berlin, March 6, 2017) (available online).

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