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Gender differences in career progression: Does the effect of children capture low work effort?

Astrid Kunze*

Abstract

This study exploits longitudinal employer-employee matched data to investigate gender differences in the probability to climb the job ladder with focus on the effect of children. We attempt to disentangle whether children directly affect promotions, or whether the effect of children is correlated with effort. We find that the probability to progress on the career ladder is decreased for women through children, but not for men. These effects are particularly strong at the lower and medium ranks. We explore whether the effect of children is correlated with several proxies of work effort including whether workers are highly attached or not, hours of work, and relative bonus payments. In promotion regressions controlling for these factors we find that the effects of children remain unchanged quantitatively as well qualitatively. If we compare workers with high effort levels above the 60th residual earnings percentile, we find large gender differences in promotion probabilities and it is men with 1-2 children who are most likely to climb the career ladder

JEL codes: J12, J16, J24, J62

Key words: Promotion, gender differences, number of children

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1 Introduction

The previous literature has found that women fall behind men in career progression because they are promoted less often (Blau and DeVaro (2007), McCue (1996) and Cobb-Clark (2001)) or gain relatively less from promotions within the same firm (Booth et al., 2003, Francesconi, 2001).¹ Studies both on male-female differentials in earnings (Bertrand et al, 2010; Ejrnæs and Kunze, 2013; Manning et al. 2007) and promotions (Cobb Clark, 2001) have shown that part of the male-female wage differentials accrues to the presence of children. Becker’s model argues that since child care is relatively more effort intensive than other household tasks, married women reduce effort on each hour of market work compared to married men working the same number of hours. This has implications for hourly wages, but also career progression in terms of moving up the job ladder in firm’s hierarchies. Many studies have tested whether effort of women with children does decline by calculating time in household production and market work from time use data, and have shown that these differences partly increase gender differentials in wages (Hersch and Stratton, 1995). Evidence also exists that children decrease women’s promotion probabilities relative to men. Booth et al. (2003) have used control variables for number and age of children which they interpret as proxy variables for effort, conditional on a large range of important determinants of promotions. Cobb-Clark et al (2001) found that infants relatively decrease women’s career progress.

In this study, we exploit longitudinal employer-employee matched data to investigate gender differences in the probability to climb the job ladder with focus on the effect of children. We attempt to disentangle whether children directly affect promotions, or whether the effect of children is correlated with effort. We estimate standard promotion regressions extended to within and between plant career progress. The data set is particularly suitable for this analysis: First, our data cover the private sector in Norway. Focus on the private sector where career progression is determined in a homogeneous way, by

¹For surveys of the literature, see Cobb-Clark (2001) and Blau and DeVaro (2007).

contrast to the public sector. We consider that human capital, worker and firm productivity related characteristics as well as factors derived from tournaments are important determinants of the probability to progress on the career ladder. Second, the data contains particularly detailed information on the worker's position in the hierarchies and allows us to follow the career progress for men and women during a period of 10 years, the late 1980s to late 1990s. Third, we can measure effort in several ways from these data supplementing measures based on time use data in the literature. We use detailed hours of work of contracted work as one indicator of career commitment which is strongly correlated with having children. Usually, women in Norway work full-time until the first child birth and switch for a period of time to part-time work. In addition we use de-meaned bonus payments as a proxy for effort. We construct individual bonus payments relative to industry-time means. Finally, we use as a proxy residual hourly earnings from regressions of wages on experience, education, tenure and year.

Fourth, the data sample is large so that we can select on highly attached workers that are more comparable in terms of careers than the average that includes careers with part-time spells or interruptions, for example, related to parental leave. Hence, among highly attached workers we can exclude explanations of lower career progression related to low working hours and long interruptions.² Core to this study is that career success can be measured as the move between a sequence of seven ranks that are consistently defined across plants and time.

The main findings are. First, on each rank, approximately a third, except on rank. On each rank women are two to three years younger at the mean than men, have equal or even higher numbers of years of education and are less likely parents. It documents that in fact low fractions of women are sitting in the pipelines for higher rank jobs.³ Second, within rank regression analyses show significant gender differences in the conditional probabilities to climb the

²Lundberg and Rose (2002) showed that children have no negative effects on wages for highly attached women.

³See e.g. Meyersson Milgrom et al. (2006) who label this frozen pipelines.

rank in the hierarchies even among highly attached workers. Third, we show that the rate of career progression is decreased through children particularly at the lower and medium ranks. Furthermore, on higher ranks the gender differences in the probability to climb rank among fathers and mothers of 1 or 2 children increases particularly above the 60th percentile in the residual earnings distribution. Hence, if we compare workers with high effort levels above the 60th percentile, then we still find large differences in promotion probabilities and it is men with 1-2 children who are most likely to be climb the career ladder.

The remainder of the paper is structured as follows. In Section 2, we describe the data. In Section 3, we present descriptive statistics on gender and rank. We also test the relation between children and effort. In Section 4, we present the mean regression results for the probability of moving up rank. In Section 5, we present results on residual earnings as a proxy for effort and its correlation with the probability of upward rank movement separately for men and women, with and without children. Section 6 summarises the results. Section 7 discusses policy implications in light of our results.

2 Data and sample selection

For the empirical analyses, we use the Norwegian matched employer-employee data for the population combined with information on ranks within the plant hierarchy. This particular variable was constructed from information in a plant level survey conducted by the NHO (Næringslivets Hovedorganisasjon - Confederation of Norwegian Enterprise) and is available for the population of employees within firms that are members of NHO. The members are in the private sector, including manufacturing, construction and machinery, oil, transport, and hotels and restaurants. The NHO data covers approximately 40 per cent of private sector employment. NHO firms tend to be larger and older than the average private sector firm in Norway. Employees tend to be more educated and hence earn on average more.⁴ In Appendix Table 2 the

⁴For more details see the Appendix A.

distribution of workers across sectors shows that almost 50 per cent are in manufacturing and 16 per cent in whole-and retail sale. Some private sectors are excluded from our data set such as banking.⁵ The data are yearly and the observation period is from 1987 until 1997 during which we follow workers born after 1936 and until 1969.⁶ In this data sample 41 per cent of observations are for women.

We select white-collar workers⁷ and workers highly attached to the labour market. The latter is to remove direct explanations of gender differences in career progression through low hours of work (i.e. part time), interruptions and lower career commitment.⁸ Particularly, job observations with less than 30 hours per week are removed from the data sample⁹ as well as individual records with gaps in their yearly earnings records. In effect, the sample of men (women) is reduced by 29.2 per cent (38.6 per cent). This selection rule also ensures that we can observe for every worker year-to-year changes in ranks and hence career progression.¹⁰

⁵Statistics Norway and the NHO as the primary employer association in Norway, compiled the data. The primary purpose for the data collection was to obtain an overview of earning levels and annual earnings growth among white-collar workers. See "Lønnsstatistikk for funksjonærer" (Income statistics for white collar workers), various years.

⁶For the main analysis we use the period for which all variables are available: before 1987, only limited register information is available; after 1997, the NHO ceased collecting the data. Statistics Norway then took over the running of a restricted survey which is not used in this study.

⁷Mostly men go into blue-collar jobs.

⁸A disadvantage of this selection rule is that we also exclude workers who move sector or to plants not members of the NHO. It is not obvious that this will create a bias in our estimations of gender differences. Generally, this rule may exclude very successful workers who receive outside offers, but also unsuccessful ones.

⁹Hence, we ensure that switches to part-time work do not affect career progression as this is beyond the scope of this paper. However, individuals working four days a week are still included. As the pay for these workers may be less than that of an equivalent full-time worker, we include a dummy variable for part-time work in the earnings regressions. The restriction on hours of work leads to the exclusion of 4 per cent of all observations in the male sample and approximately 10 per cent in the female sample.

¹⁰Note that mothers on parental leave would still be included, unless they have taken unpaid leave for a whole year. During the observation window, paid parental leave varied

In regression analysis career progression probabilities are estimated, that is upward changes in rank, conditional on the observed characteristics gender and number of children. In order to focus on couples and intact families, we exclude divorced workers and hence single mothers. This is the main group we can identify where we expect adjustments in child care arrangements and possibly effort. For divorced workers we exclude their records from divorce onwards which leads to exclusion of 10 per cent (18 per cent) of observations for men (women). The final sample contains for individuals between 18 and 60 years old approximately 407,000 (136,000) observations for males (females) for approximately 82,000 (32,000) male (female) individuals. In the final analysis sample 39 per cent of individuals are female.

We distinguish seven ranks in hierarchies of plants. The highest rank includes technical directors and leading positions. The lowest rank is defined to include unskilled, more routine tasks. The variable is constructed from information on the occupational groups and hierarchical ranks in the NHO data.¹¹ Workers are assigned one of six occupational groups which are technical white-collar, supervisor, administrative, task in shop, in storage and others. Within each occupational group, seven task levels (ranks) are distinguished. In the Table 1 we show the construction of ranks and what occupation groups are included.

Table 1 here

In the empirical analysis of career progression we will entirely focus on ranks, not using controls for occupation. In terms of gender differences and segregation, ranks will measure vertical segregation while occupations will measure both horizontal and vertical segregation. The focus here is on vertical segregation, but we acknowledge that career progression partly captures occupation between 18 and 42 weeks at full pay; see Appendix C for details. Since the rank within the hierarchy and the moves between ranks are only observed within the sectors covered by the NHO data, we cannot fill gaps from other register data as we could only do so for annual earnings.

¹¹For more details, see Lønnsstatistikk for funksjonærer - Norsk arbeidsgiverforening, 1987–1997.

pational mobility. Since men and women typically segregate in different types of occupations potentially our results partly reflect segregation and that occupations vary in the potential for career progression. For illustration in our data we observe that men are more likely in technical occupations, which is group A occupations in the data, while women are more likely in clerical occupations which are in group C. It has been documented with Swedish data that are very similarly constructed to the NHO data, that workers holding technical occupations are more likely to get into leading positions than others, but this tendency has decreased over time (see Meyersson-Milgrom and Pedersen, 2006).

An advantage of our data is that the seven ranks are consistently defined across plants and time within plants.¹² We define moves up the ranks as year-to-year increases in the rank variable, and staying on a rank and declines in the rank accordingly. Note that we will include in the regressions a control for plant change distinguishing between workers moving up the ranks in the same plant and those moving up the ranks in connection with a change of plant.¹³ Note that not all plants have jobs on all seven ranks and hence plant mobility in connection with career progression may partly reflect differences in organizations. To a large extent this effect will be controlled for by variables for plant size. We cannot measure career progression if workers move to a plant outside the NHO sample of plants, or to non-employment which is mostly extended parental leave since unemployment longer than a year is rare in our data. This limits our sample, but arguably still reflects representative hierarchies and movements of men and women on those.

Additional variables that we use in the analyses are individual characteristics, age and educational attainment in years, civil status, and the number and age of children, bonus payments, monthly earnings, plant identifier and plant characteristics such as sector and plant size.

¹²Other studies, such as in the field of personnel economics, usually have such information only for a single (large) plant. Further, while studies using representative surveys, like the British Household Panel Survey (BHPS), rely on multiple firm data, they often observe only one worker for every firm. See, for example, Francesconi (2001) and Booth et al. (2003).

¹³We also observe demotions within plant, i.e. downward moves, but these are rare.

The earnings per hour variable is constructed from information in the register data on monthly earnings and from the survey on normal hours of work. The normal hours of work exclude overtime hours, and earnings are from work and benefit claims, but exclude overtime payments. Additional lump sum pay and performance pay is subsumed in the variable bonus and are reported separately in the survey. Note that overtime in these sectors is usually not paid, which is why this information was not collected. Education is defined as the years of education. The number of children is generated from the birth register where for every individual in Norway all births are recorded. We define the remaining variables as standard with the summary statistics detailed in Table 2 in Appendix C. In Table 3, Appendix C, the distribution of children for our sample is shown.

3 Descriptive statistics on rank and gender

The distribution of positions across ranks reflects typical hierarchies with many workers at the lower ranks (Ranks 1 to 4) and very few at the higher ranks (Ranks 5 to 7). Few workers are recruited into higher ranks in their first job. At entry at Rank 1, the proportion of women is 76 per cent, but at Rank 2, it is 22 per cent, 31 per cent at Rank 3, 21 per cent at Rank 4, 9 per cent at Rank 5, and 17 per cent at Rank 6. Hence, except for the lowest rank, men occupy around two-thirds of the positions within all ranks.

Table 2 here

In Table 2, the distribution of men and women across ranks in their first job is respectively reported as the proportion of all men or all women. Women enter most likely ranks one and three, while men enter ranks three and four. Approximately 8 per cent of men enter ranks 5 and 6. A negligible fraction of women enter these ranks as their first job. Women enter at lower ranks which however is also reflected by their levels of education measured in years. Within rank the raw gender earnings gap ranges between 0.1 and 0.15 and is significant except for on rank 6, because of the limited cell size. Table 2

also provides the means of core characteristics for men and women within the first job rank. This reveals that women are around 0.5 to 1.5 years less formally educated. Regarding family status the data show that women are less likely to have children at entry than men; less than 6 per cent of women have children. One explanation why this percentage is very low might be related to the selection of workers; that is these are women highly attached to the labour market throughout the consequent years as they are observed in the data. If this selection excludes those with low opportunity costs of having children, we might expect this finding.

Table 3 here

Table 3 reports the overall distribution (for all person-year observations) showing that the likelihood for a woman to hold a job at the three highest ranks is also overall very low, approximately 2.5 per cent, compared with men, for whom the probability is 13.5 per cent. The distribution of men and women in all career stages across ranks is surprisingly similar to the one in entry jobs. Some changes however are noticeable with respect to gender differences in age and years of education within ranks. On every rank, women are at the mean 2 to 3 years younger than men. Compared to entry jobs the age differences hence seem to increase within rank; it could be that relatively more younger women, or older men are entering the ranks over time since entry - or older women and younger men are exiting. Education levels are higher for the younger cohorts which might help women to get into higher ranks but is of less importance for men. This might be an explanation why within rank five women are more highly educated in the overall distribution. With respect to the likelihood to have children it is interesting that men are more likely to have children than women also following entry, using these broad averages. While around 55 percent of men within rank have children at some point during the period until 1997, among women only 45 per cent do so. This might reflect that still it is more difficult for women to combine family and career, particularly a career continuously working more than 30 hours per week. This is however not excluding that in the data some women have paid parental leave following births as it is granted in Norway.

Since relatively more young women seem to get into higher ranks, a question is whether those women who choose a highly attached career - like other men - do even relatively better in terms of career progression. These effects may vary with number of children and rank since those may reflect different cost-benefit trade offs. Ranks reflect earnings but also obligations and tasks. While higher earnings may make it easier to raise children, more tasks and obligations may constrain time and flexibility which makes it more costly. The male-female earnings differences are remarkably similar on ranks one to three to those estimated at entry. At ranks five and seven earnings differences are much smaller, but still significant.

Table 4 here

To give an overview of variation in career progression on the job ladder, that is including both moves within plant and related to a plant change, we split the pooled sample of men and women into those staying at a rank or changing rank. A summary of the probabilities is presented in Table 4. As shown, 80 to 91 per cent remain at the same rank for two periods. If climbing the ladder, individuals are mostly climbing one or two ranks. While declines in rank are rare, they mostly involve change in just one to two ranks. Probabilities to move up the rank also decline from the bottom of the hierarchy towards the top.

These simple means give the impression that the male-female differences are in fact small. Men are somewhat more likely to move up one to two ranks than women. Women are also more likely to be decreasing in rank. The gender differences in the likelihood to move upward is slightly larger. Overall, the means in gender differences appear remarkably small when we consider the changes across two sequential periods for all workers pooled across the different stages of their careers. In the estimations we will also take into account whether rank changes are within or between plant. In addition, we will investigate career progression on average as well as during the early career.

4 Regression analysis

In the following, we present the estimation results from regression analysis. Particularly, we are interested in the relation between career success and two observable characteristics gender and having children. While we control for a lot of heterogeneity by controlling for a rich set of observed characteristics in the regressions and by conducting within rank estimation, we do not interpret the effects as necessarily causal. We interpret them as the differences in career success given the set of observable characteristics. This includes the distribution of children. The effect may differ from those if children were randomly distributed. In other words, the effects partly show outcomes related to sorting and selection.

We use three sets of control variables. A vector of individual (base) characteristics contains dummy variables for age, years of education, years of tenure and its squared term, dummy variables for year, dummy variable for 30–37 hours part-time work, and dummy variables for being married. A vector of effort variables includes controls for various mechanisms that can explain moves up the rank, or promotions as widely used in the literature (see Francesconi (2001) for an overview). Tenure is included to measure specific human capital as an important determinant of internal promotions. Following tournament theory, we control for effects through effort on promotions by including variables for the hours of work (as we do not have overtime hours, this is the best measure available for these data)¹⁴ and bonus payments. To control for factors in the external market on moves up the rank, we include variables that can potentially be observed by other employers, such as years of education and age. A vector for firm fixed specific effects includes variables for plant size and dummy variables for sector. To account for any additional heterogeneity across individuals, we apply fixed effects estimation to the linear probability model. The latter however do not allow to identify the coefficient of gender and hence is only useful for the marginal effects of children interacted with

¹⁴Alternatively, we also specified the deviation from mean hours. Results not reported here.

gender.

Table 5 here

In the upper panel of Table 5 we report the raw gender difference, that is the coefficient on being female from a simple linear probability model estimated within each rank separately.¹⁵ These show that women are less likely to move up the ladder from every rank, but the differences are only significant at ranks one to four. In the second panel the coefficient on being female is shown from a regression within rank including the full set of control variables for individual, effort and plant characteristics. This specification does not control for number of children and is provided a base estimate. We see that at the lowest rank, in which the majority are women, the probability of a woman is 7.1 percentage point lower than for a comparable men. Note that men and women in all estimates are comparable with respect to standard individual characteristics, including years of education, age and tenure, effort and plant characteristics. The gender difference is lower but also significant at rank three and four. In ranks two and five the point estimate of the differences is also negative but not significantly different from zero. At rank 6 there is no difference. Note that in all estimations we drop those on rank 7 since those by definition can only remain or decline in rank. Overall the pattern is that the gender difference declines from the lowest to the highest rank. Rank 2 is an exception.

In the lower panel we interacted the female dummy variable with the number of children. We still find the same pattern in the coefficients of the female dummy variable that measures now the marginal effect of women without children. The marginal effect is always negative except for on rank 6. The coefficients are slightly lower in size than in the second panel. The coefficients of the female dummy variables interacted with number of children are mostly negative but only partly significant. Most notable are the negative and significant coefficients for two and three children on ranks one and two, and for two children on rank 4. The marginal effects for women turn the sign to positive on the highest ranks, for rank 6 and for 1 to 2 children on rank 5.

¹⁵We estimated all of the models also by probit and find that overall the marginal effects evaluated at the mean are very close to the estimates from simple OLS.

Hence, we find that women with two to three children have relatively worse chances of climbing the ranks than comparable men with two to three children but only on rank one, which is a very female dominated rank, and the middle ranks, ranks 3 and 4. Interestingly for the top ranks five and six gender differences are not significant though point estimates are negative on rank 5; that is among women without children and with children.

The results regarding marginal effects for women with children are also confirmed if we re-estimate the marginal effects of having children and being female by (individual) fixed effects estimation. Fixed effects controls for those unobserved or omitted factors that remain constant over time. That includes rank of entry, and entry conditions more broadly, as well as ability or preferences. On ranks one, three and four the coefficients are larger and strongly significant. Also the marginal effects of being a women with one child become now negative and significant. That is compared to men with one child. This is partly also so for the effect of having four children for women.

Question: Are the gender differences in career progression directly related to children or effort? As the comparison of table 5 and 6 shows the marginal effects of children on the probability to climb the rank, within rank, is unaffected whether we include part time workers, which are mostly women, and workers with more interruptive careers. Hence, if children have an effect it seems unrelated to effort measured by hours of work. Hence, children must affect career progression through other factors.

Table 6 here

These estimation results use the entire sample of men and women for which the distribution and mean characteristics across ranks were shown in Table 3. We saw from the comparison of Table 2 and 3 that men and women are much more similar in terms of age at entry than overall in the sample. The comparison also suggested that those we follow since entry are also more highly educated and have (still) less children. In Table 7 we show the estimation results from the same regressions as estimated on the entire sample, only on those followed during the early career since the first job in the labour market.

Table 5: Move up regression results: OLS, by rank						
Highly attached workers						
	Rank1	Rank2	Rank 3	Rank 4	Rank 5	Rank 6
Specification allowing for differences in gender and children						
female	-0.067***	-0.005	-0.034***	-0.011**	-0.021	0.000
female with one child	-0.023	-0.006	-0.006	-0.010	0.023	0.000
female with 2 children	-0.030*	0.000	-0.011**	-0.018**	0.006	0.003
female with 3 children	-0.046*	0.005	-0.015*	-0.007	-0.001	0.010
female with 4 children	0.008	-0.022	-0.002	-0.046	-0.009	0.078
female with more than 4	-0.116		-0.010	-0.041		
N	32229	68551	137783	112722	27923	44985
r2	0.033	0.053	0.056	0.036	0.035	0.011

The dependent variable in all regression is 1 if $(rank_{t+1} - rank_t > 0)$, 0 otherwise.

Controls are included. Highly attached workers born between 1936 and 1969.

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

Table 6: Move up regression results: OLS, by rank						
All workers including part-time workers						
	Rank1	Rank2	Rank 3	Rank 4	Rank 5	Rank 6
Specification allowing for differences in gender and children						
female	-0.060***	-0.004	-0.032***	-0.010***	-0.021	-0.001
female with one child	-0.026*	-0.010	-0.012***	-0.010*	0.027	0.002
female with 2 children	-0.020	-0.003	-0.015***	-0.015**	-0.008	-0.001
female with 3 children	-0.042*	-0.008	-0.021***	0.007	0.011	0.003
female with 4 children	0.010	-0.020	0.002	-0.060*	0.039	0.059*
female with more than 4	-0.084	0.007	-0.034	-0.053		0.002
N	54377	98077	189139	153700	38649	64086
r2	0.032	0.053	0.053	0.033	0.033	0.010

The dependent variable in all regression is 1 if $(rank_{t+1} - rank_t > 0)$, 0 otherwise.

Controls are included. All workers born between 1936 and 1969.

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

Table 7

The estimation results for the early career are reported in Table 7 and similarly organized as Table 5. The raw gender differences during the early career is somewhat larger than the overall mean, particularly at ranks one, and two to five. The raw gender difference is declining in rank. However it is not significant at rank two, and the highest ranks five and six. The conditional estimates are reported in the lower panel of Table 7. The marginal effect of being female without children reveals the same pattern as the overall gender difference. However, at the middle ranks, ranks 3 and 4, the marginal effect of being female without children is now lower than the raw difference. Hence, at those ranks differences in characteristics partly explain the size of the coefficient. Looking at the marginal effect of having children for women, we see that only the effect of two children on the middle ranks is significant and ranges between 2.1 percentage points and 4.1 percentage points. Most of the other coefficients of children on ranks one to four are negative, but mostly not significant. We find no significant gender differences on ranks five and six but interestingly the marginal effects of having children for women are almost all positive, but not significant.

Since during the early career women are younger, have less children the effects of three children are less precisely estimated. However, one child does not either give significant differences, and only two children do for women during the early career. For completeness, fixed effects estimates as presented in Table 8 but they lead to very similar findings as in the total sample which we would expect since fixed effects is identified because of new births in year to year comparison.

Table 8 here

In summary, we find negative effects for being a woman on the overall probability to be moving up the rank, within and between plant, but they are not significant across all ranks. The negative and significant marginal effect is most pronounced at the lowest rank and ranks three and four. Negative effects for women through children are only found on ranks one, three and four. The

effects are strongest at the lowest rank which is also a rank dominated by women. The effect through children on woman is only significant for two and three children from OLS. (Fixed effects suggests also negative effects for one child.) At the ranks five and six, we also find that the effects through gender and children are zero and can be even positive.

These results may be consistent with two explanations. First, results may reflect matching issues when it comes to combining family and career. At lowest levels in hierarchies as we have used them responsibility and leadership requirements are low but at the middle ranks these substantially increase. This may make it difficult either to actually combine the two, if children require more flexibility and time, or it makes it more difficult for the firm to evaluate workers ignoring these potential challenges. Note that from our sample divorced (and as a result single mothers) are excluded, and workers with low hours as well. Hence related differences cannot explain our findings directly. Second, that we do not find any significant gender differences at the highest ranks might reflect non-random selection, that is the ‘super moms. As we see from Table 2 and 3, some women on these ranks do have children. Hence these women who made it quite high on the career ladder have both children and career success. Noteworthy, however these women are less likely to have children than men on the same rank (see Table 2 and 3). This may proxy that women devote relatively more time to their career than they would do if they were to have children. Alternatively, they may be positively selected on some to us unobservable characteristics. In the next section we use the residual earnings distribution to investigate further gender differences in career success.

5 Distributional analysis

Since we have information both on ranks and earnings, we can also investigate to what extent the position in the earnings distribution is related to the likelihood to be moving up the rank, and whether this relationship varies by gender and parental status. For this comparison, we generate the residual earnings distribution. In order to make workers comparable, we run pooled

earnings regressions that include controls on age, years of education, tenure and year. Then we predict the residuals, \hat{e} , and determine their rank in the pooled distribution, $F(\hat{e})$. Then we determine the percentile rank, $F^{-1}(\hat{e})$, which is denoted on the x -axis of the graphs. The probability of moving up the job ladder, $\Delta rank$, is then determined for each group separately at every percentile as $E(\Delta rank | F^{-1}(\hat{e}), group)$, where the groups are males without children, males with children, females without children and females with children. We then split the probability distribution into 100 percentile points. That is, we count the number of person-year observations in percentile x for which a move up the rank is reported and divide this by the total number of person-year observations in percentile x . To smooth the graphs, we apply locally weighted regressions. The bandwidth is set to 0.8. Figure 1 plots the probability of moving up the job ladder against the position in the residual earnings distribution for women and men with no children and one to two children.

Figure 1 here

For men with one or two children, we find an almost linearly increasing probability of moving up the job ladder. Above the 10th percentile, this is also the group with the highest probability. By comparison, men with no children also have an increasing probability, but starting at a lower point, and the progression is less steep. This leads to an increasing differential as we move up the distribution. Hence, men without children do not do as well as men with children in terms of career progression.

Women with one or two children are also more likely to be promoted than women without children, but only in the lowest part of the distribution. In the range between the 30th percentile and 60th percentile, women without children are more likely to move up the job ladder than women with children. However, these differences are very small.

Regarding the gender differences, it is noteworthy that the curves for women lie everywhere below those for men; this is equally true for mothers

as well as women without children.¹⁶ Additionally, the difference when compared with both men without children as well as with children is increasing when we move up in the residual earnings distribution.

In order to reveal the potential differences in male–female differences in career progression, we next present the corresponding graphs distinguishing low (Ranks 1 to 4) and high (Ranks 5 to 7) in the ranks for workers with children (Figure 2) and for those without children (Figure 3). As hierarchies have many positions at the lower end and fewer towards the top, the average in Figure 1 may not be very detailed. That is, more opportunities for career progression exist at the bottom of the career ladder than at the top. Given that more women are at the bottom of the hierarchies than at the top, gender differences may then be understated with respect to career progression.

Figures 2 and 3 here

Figure 2 shows that when men and women are both on lower ranks and parents, women are less likely to move up the rank than men. This difference is first increasing and then decreasing, beyond the 60th percentile, when we move up the residual earnings distribution. The reason is that for low rank men, the probability curve is concave. This may be because some are not moving up rank, but are given instead increases in earnings. Those climbing the ladder are not from the highest percentile ranks.

Among parents on high ranks, we also see that men progress faster than women do. Overall, the probabilities of climbing up are low for mothers, however, slightly increasing as we move up the residual earnings distribution. At lower percentiles, the gender differences are close to zero. However, as the curve for high rank fathers is convex, the gender differences increase from 0.02 at the median to 0.06 at the 90th percentile.¹⁷ Hence, fathers are three times as likely as comparable mothers to have successful careers at the higher end of

¹⁶Only below the 10th percentile women with one or two children are more likely to be moving up the ladder.

¹⁷We tried other specifications where we included an indicator for part-time work, but this did not affect the results. We also added plant-level characteristics in order to exclude any between-plant differences, but this likewise did not alter the results.

the residual earnings distribution.¹⁸

Figure 3 depicts the corresponding graphs for men and women without children. Together these show that women both with and without children on lower and higher ranks are less likely to climb the ladder than men. Note that variation in the probabilities is quite low among those without children, compared with those with children. However, the pattern is the same. Figure 3 also shows that on higher ranks the gender difference is substantially increasing as we move up the residual earnings distribution.

The distributional results show patterns in gender differences in career success rates across the residual earnings distribution. There are several interpretations for the distribution of residual earnings. First, residual earnings measure unexplained earnings variation after removing (exogenous) individual differences.¹⁹ Hence, we can compare workers with high and low residual earnings with other characteristics held constant. High (low) residual earnings capture unobserved factors, including high (low) unobserved individual characteristics or the choice of sectors or firms that pay high (low) productivity wages. The gender difference then reflects that despite some women climbing high up the residual earnings distribution, they have less chance to climb into the highest ranks than men with comparable residual earnings. A similar pattern in the gender gap in earnings data has been labelled the glass ceiling.²⁰ It has been shown that gender differences in residual earnings increase above the median and are largest at the top 20–30 percentiles in the distribution. We use year-to-year moves up the job ladder as a measure of career progression and gender differences are increasing in the upper part of the residual earnings

¹⁸The graphs for parents with three and more children would, however, show that parents of three and more children do relatively worse overall, and worse than men and women without children.

¹⁹Note that the means of residual earnings are lower for women than for men in every rank, but the variation of residual earnings within ranks and by gender is almost constant. These statistics are not shown in the paper.

²⁰The glass ceiling has also been investigated in the sociology literature, which uses measures other than earnings or promotions. For example, Wright et al. (1995) use data on authority and Storvik and Schøne (2008) analyse survey data on motivation and job applications).

distribution. This suggests that part of the difference is that women do not manage to gain the highest paid positions on the highest ranks, which is why they still fall behind in terms of earnings.

Second, if both men and women have the same ability distribution and sort into high and low-paying plants similarly as may be the case for white-collar workers²¹ we may interpret residual earnings as a broad measure of effort. High effort workers will then sort into plants that can pay high earnings and invest high work effort, etc. Following this interpretation of residual earnings, then any difference in a given percentile can be interpreted as showing the difference in the probability of moving up the ladder at the same effort level, among otherwise comparable workers. This leads to the interpretation that women have to be better, or invest a great deal more effort, than otherwise similar men in order to be promoted to higher rank jobs.²²

6 Summary of the results

This paper shows new evidence on hierarchies and the distribution of women across those in comparison to men. To make job positions in the hierarchies and career progress more homogenous particular attention is given to highly attached workers, that is workers with earnings in consequent years and always holding a job with at least 30 hours per week. Using these data for the period 1987-1987 on white collar private sector workers it is shown that very few women are on high ranks. That is 2.3 per cent of women and 14.5 per cent of men are on the highest three ranks (out of 7 ranks). The fraction of women relative to the fraction of men on each rank is declining as we go from rank 1 to rank 7. Women are 2 to 3 years younger at the mean but are equally or higher educated than men on the same ranks. But among these highly attached workers women are also less likely to have children than men on the same career rank. This demonstrates one source for why so few women are on

²¹The summary statistics in Table 1 in Appendix C show at the very least that the proportion of male and female white-collar workers are very similar within each sector.

²²See e.g. Lazear and Rosen (1990) model.

the highest ranks which is that there are still less women in starting positions to top jobs.

Our evidence also shows that given the distribution of women across ranks, women are also less likely to climb the ladder. The overall gender differences, conditional on a large range of individual, effort and plant specific variables, is largest at the lowest ranks and declining as we move up the ranks. The differences are not significant at rank 2, and the highest ranks 6 and 7. Taking these numbers into account the expected gender difference in the probability to climb to the top is lower if women start at the lowest ranks, and is relatively lower starting at higher ranks.

Decomposing the overall gender differences into effects through the observed characteristics gender and number of children shows that the gender difference is increased through children at the lower to medium ranks, ranks 1 to 4. The effects are strongest for women with two and three children, when looking at simple OLS estimates. Taken OLS and fixed effects estimates together it seems that differences through gender and children are strongest on rank 1, followed by the medium ranks, three and four. Hence, it seems that observed characteristics, that is gender and number of children, capture important channels at lower and medium ranks.

Looking at the probability to climb the ladder across the residual earnings distribution we find that on higher ranks, ranks 5 to 7, women with and without children are less likely to move up the rank at any percentile rank in the residual earnings distribution. The residual earnings distribution may be interpreted as unobserved earnings variation, or a broad measure of effort. Hence, we find that unobserved factors contribute to gender differences in the upper part of the distribution within higher ranks. Furthermore, for employees with children it is found that the gender gap in the probability to move up rank is increasing as we move from low levels of residual earnings to high levels. This we interpret as the glass ceiling.

7 Discussion and policy implications

This evidence shows three sources for why there are so few women at highest ranks: First, we show short supply, frozen pipelines. This imbalance is not only existent at top ranks but also at the middle ranks which are the main pool of candidates to fill the top ranks in the future. Second, we show that screening probabilities are higher for women than for men which is why less women climb from within these sectors the ladder. These differences are negatively related to the observed characteristics, gender and having children, particularly at lower and medium ranks. Third, we show a new aspect of the glass ceiling which is that women are less likely to be moving up the ranks than men at comparable characteristics and residual earnings. We also show that this difference is dramatically increasing as we climb the residual earnings distribution.

The evidence is based on data for Norway during the 1980s and 1990s a period where gender equality and family policies have started to be established at a much lower level than they exist today in Norway. At the time paid parental leave was relatively new and granted only for 22 weeks after births during the late 1980s and expanded to durations of 42 weeks in 1993 (or 52 weeks at 80 percent pay). At the same time public child care provision was in place but only then coverage rates started to grow beyond 10 percent among 1-2 years old children, and coverage rates ranged between 40 to 50 percent for 3 to 7 year old children. Hence institutions were much more similar to those in place in many European today, such as the U.K. Hence, while for within Norway it would be interesting to follow the development further on, for cross-country comparison these findings may suit as benchmark numbers.

Main policies to integrate more women into labour markets have been parental leave policies and introduction of high child care coverage provision. These policies hope to reduce the opportunity costs of working in order to combine work and family life. It is still an open question to what extent these policies have helped to increase the fraction of women in highly attached careers that are regarded comparable by employers to men's highly attached careers. This study shows evidence for this selected group and shows that they do not

perform equally. Questions arise what the observed characteristic gender and number of children capture and whether they capture effects through parental leaves. In that case women who continuously work and only take usual parental leave are not regarded equally qualified to men also continuously working, but without leave periods related to children.

A more recent policy targets the low fraction of women in top jobs, the gender equality on the board policy introduced first in Norway. While since 2008 Norway has a law stating that all public limited companies with boards of directors greater than 9 members have to have at least 40 percent women, this policy was first announced in 1999 and introduced as voluntary compliance law already in 2005. The goal of this law was to achieve increased representation of women on the boards, which it has achieved in Norway as recent figures show. The further goal implicitly is increased representation of women's managers voice shaping the Norwegian economy. The evidence in this study demonstrates that it demands more women from external entering these plants and entering those at higher ranks in order to increase the representation of women in the private sector. Arguably previous family policies have not achieved these goals, nor targeted women in top rank jobs. It remains to be seen whether quotas will make a change. Other countries have copied the Norwegian law or are in the process of discussing such a law which shows at least large interest.

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Table 1: Construction of the rank variable

Rank	Occupational Group	Description/Examples
7 (top)	A0	Technical director
	C0	Assistant director, Director in the sales/accounting etc. department
6	A1	Chief engineer, Plant manager Production manager, Chief Researcher
	B1	Chief work leader, e.g. plant leader, production leader,
	C1	Head of department
5	A2	Chief of specific department (construction, laboratory, ...)
4	A31/A32	administrator, engineer, etc.
	B2	foreman
	C2	accountant, shipper
3	A41, A42	craftsman
	B3	foreman, shift foreman, controller,
	C3	skilled, accounting clerk, logistics manager
	D1	Shop manager
	E1	store manager
2	A5	technician
	D2	shop cashier, sales assistant
	E2	storeman, bookkeeper
	F	various
1 (bottom)	A6	(technical) unskilled
	C4	(clerical) unskilled

Note: See NHO publications Lønnsstatistikk for funksjonærer various years.

Table 2: Rank and mean characteristics of entry job during 1980-1997, by gender

Rank	m	w	Means and s.e. for men (m) women (w)							
	%	%	m	w	m	w	m	w	m	w
			age		yrs of edu		fraction with children		log earnings	
1	3.84	38.81	22.03	21.32	12.16	11.99	0.04	0.04	4.35	4.25
			(0.11)	(0.04)	(0.10)	(0.03)	(0.02)	(0.01)	(0.01)	(0.00)
2	19.31	10.99	23.42	22.97	13.64	12.87	0.10	0.05	4.49	4.38
			(0.07)	(0.11)	(0.08)	(0.14)	(0.01)	(0.01)	(0.00)	(0.01)
3	41.50	37.80	25.09	23.50	15.58	13.42	0.11	0.04	4.60	4.45
			(0.04)	(0.06)	(0.05)	(0.08)	(0.01)	(0.01)	(0.00)	(0.00)
4	25.77	12.03	25.89	25.32	16.41	15.88	0.16	0.06	4.74	4.64
			(0.04)	(0.08)	(0.06)	(0.14)	(0.02)	(0.02)	(0.00)	(0.01)
5	3.07	0.20	26.52	25.50	17.00	17.00	0.67	0.00	5.00	4.88
			(0.23)	(0.65)	(0.23)	(0.00)	(0.21)	(0.00)	(0.01)	(0.05)
6	5.80	0.18	25.43	.	16.00	.	0.00	.	4.96	4.82
			(0.30)	.	(0.58)	.	(0.00)	.	(0.01)	(0.08)
Total	100	100								
obs	7,502	3,950								

Data source: NHO data, 1980-1997. Highly attached workers born between 1936 and 1969.

Reported are means and standard errors in parentheses.

Entry jobs are those where age: $(7 + \text{years of education}) < \text{age} \leq (7 + \text{years of education} + 3)$.

Table 3: Rank during 1987-1997, by gender

Rank	m	w	Means* for men (m) women (w)							
	%	%	m	w	m	w	m	w	m	w
			age		yrs of edu		fraction with children		log earnings	
1	3.3	29.7	37.3	35.8	10.9	10.8	.54	.50	4.48	4.38
			[-11.5]		[-3.9]		[-6.3]		[-63.5]	
2	24.6	17.1	39.1	37.0	11.2	11.4	.67	.50	4.59	4.49
			[-20.6]		[9.9]		[-38.]		[-47.6]	
3	34.9	37.5	39.6	37.9	11.6	11.4	.65	.50	4.66	4.53
			[-32.5]		[-9.6]		[-53.6]		[-157.7]	
4	23.3	13.1	40.3	37.5	13.1	13.2	.71	.49	4.86	4.76
			[-41.3]		[-.7]		[-57.4]		[-67.1]	
5	4.4	0.4	42.5	37.5	14.6	16.2	.80	.61	5.07	5.06
			[-25.5]		[23.8]		[-17.1]		[-2.24]	
6	8.9	1.9	43.7	40.3	14.1	13.9	.82	.59	5.14	5.06
			[-25.5]		[-3.9]		[-30.7]		[-22.4]	
7	1.2	0.06	45.1	42.8	15	15	.84	.73	5.38	5.33
			[-3.7]		[0.3]		[-2.9]		[-2.9]	

Data source: NHO data, 1980-1997. Highly attached workers born between 1936 and 1969.

*Reported are means and t-test in squared parentheses.

Table 4: Probability of staying and changing rank between t and t+1

Rank at entry	Means in t+1 for men				Means in t+1 for women			
	minus	stay	plus	plus	minus	stay	plus	plus
			1-2	3 plus			1-2	3 plus
Men and women without children								
1	0.00	0.81	0.18	0.01	0.00	0.85	0.15	0.01
2	0.01	0.88	0.11	0.01	0.04	0.85	0.11	0.00
3	0.03	0.88	0.09	0.00	0.05	0.89	0.05	0.00
4	0.00	0.89	0.05	0.00	0.09	0.87	0.04	0.00
5	0.06	0.87	0.07	0.00	0.06	0.88	0.05	0.00
6	0.08	0.91	0.01	0.00	0.11	0.89	0.01	0.00
7	0.11	0.89	0.00	0.00	0.13	0.87	0.00	0.00
Obs.	82091				43943			
Men and women with children								
1	0.00	0.81	0.18	0.01	0.00	0.85	0.14	0.01
2	0.01	0.88	0.10	0.01	0.03	0.88	0.09	0.00
3	0.03	0.89	0.08	0.00	0.05	0.90	0.04	0.00
4	0.05	0.88	0.07	0.00	0.09	0.86	0.05	0.00
5	0.05	0.86	0.08	0.00	0.06	0.86	0.08	0.00
6	0.06	0.92	0.02	0.00	0.09	0.90	0.01	0.00
7	0.13	0.87	0.00	0.00	0.10	0.90	0.00	0.00
Obs.	209518				44966			

Data source: NHO data, 1987-1997.

Highly attached workers born between 1936 and 1969.

Table 5: Move up regression results: OLS, by rank

	Rank1	Rank2	Rank 3	Rank 4	Rank 5	Rank 6
Specification allowing for gender differences without controls						
fem	-0.049*** (0.005)	-0.015*** (0.003)	-0.038*** (0.001)	-0.018*** (0.002)	-0.005 (0.007)	-0.004 (0.003)
N	32229	68550	137782	112722	27923	44985
r2	0.003	0.000	0.005	0.001	0.000	0.000
Specification allowing for gender differences						
female	-0.071*** (0.008)	-0.006 (0.005)	-0.036*** (0.003)	-0.013*** (0.003)	-0.018 (0.014)	0.000 (0.006)
N	32229	68550	137782	112722	27923	44985
r2	0.032	0.053	0.056	0.036	0.035	0.011
Specification allowing for differences in gender and children						
female	-0.067*** (0.008)	-0.005 (0.005)	-0.034*** (0.003)	-0.011** (0.004)	-0.021 (0.015)	0.000 (0.006)
female with one child	-0.023 (0.013)	-0.006 (0.008)	-0.006 (0.004)	-0.010 (0.005)	0.023 (0.022)	0.000 (0.007)
female with 2 children	-0.030* (0.014)	0.000 (0.009)	-0.011** (0.004)	-0.018** (0.006)	0.006 (0.021)	0.003 (0.007)
female with 3 children	-0.046* (0.021)	0.005 (0.015)	-0.015* (0.008)	-0.007 (0.011)	-0.001 (0.030)	0.010 (0.011)
female with 4 children	0.008 (0.058)	-0.022 (0.036)	-0.002 (0.025)	-0.046 (0.033)	-0.009 (0.123)	0.078 (0.042)
female with more than 4	-0.116 (0.130)		-0.010 (0.074)	-0.041 (0.079)		
N	32229	68551	137783	112722	27923	44985
r2	0.033	0.053	0.056	0.036	0.035	0.011

The dependent variable in all regression is the $rank_{t+1} - rank_t$.

All explanatory variables are measured in period t .

In the regression the following controls are included: dummy variables for age, years of education, years of tenure and its squared term, dummy variables for year, dummy variable for 30–37 hours part-time work, and dummy variables for being married, bonus payments, dummy variables for plant size and sector.

Standard errors in parentheses

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

Table 6: Move up regression results: Linear Individual fixed effects, by rank

	Rank1	Rank2	Rank 3	Rank 4	Rank 5	Rank 6
female with	-0.073*	-0.008	-0.066***	-0.066***	0.022	-0.023
one child	(0.032)	(0.019)	(0.009)	(0.012)	(0.043)	(0.020)
female with	-0.190***	-0.015	-0.136***	-0.105***	0.015	-0.034
two children	(0.044)	(0.028)	(0.013)	(0.016)	(0.056)	(0.026)
female with	-0.321***	-0.024	-0.194***	-0.130***	0.001	-0.047
3 children	(0.076)	(0.062)	(0.027)	(0.029)	(0.092)	(0.053)
female with	-0.085	-0.223	-0.192*	-0.160*		-0.069
4 children	(0.218)	(0.136)	(0.088)	(0.076)		(0.078)
N	32229	68551	137783	112722	27923	44985
r2	0.070	0.055	0.047	0.037	0.052	0.011

The dependent variable in all regression is the $rank_{t+1} - rank_t$.

All explanatory variables are measured in period t .

In the regression the following controls are included: dummy variables for age, years of education, years of tenure and its squared term, dummy variables for year, dummy variable for 30–37 hours part-time work, and dummy variables for being married, bonus payments, dummy variables for plant size and sector.

Standard errors in parentheses

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

Table 7: Early career and OLS move up regression results, by rank

	Rank1	Rank2	Rank 3	Rank 4	Rank 5	Rank 6
Specification allowing for gender differences without controls						
fem	-0.071*** (0.007)	-0.002 (0.005)	-0.065*** (0.003)	-0.022*** (0.003)	-0.016 (0.011)	-0.005 (0.005)
N	15671	25980	53419	42804	8646	10419
r2	0.006	0.000	0.011	0.001	0.000	0.000
Specification allowing for differences in gender and children						
female	-0.076*** (0.010)	-0.003 (0.007)	-0.041*** (0.004)	-0.011* (0.005)	-0.027 (0.021)	-0.001 (0.009)
female with one child	-0.026 (0.021)	-0.013 (0.013)	-0.011 (0.007)	-0.017 (0.009)	0.023 (0.032)	0.017 (0.014)
female with two children	-0.042 (0.025)	0.003 (0.017)	-0.021* (0.009)	-0.041*** (0.011)	0.019 (0.033)	0.017 (0.014)
female with 3 children	0.000 (0.052)	0.072 (0.043)	-0.031 (0.020)	-0.008 (0.024)	0.004 (0.062)	0.028 (0.023)
female with 4 children	0.171 (0.200)	-0.053 (0.146)	0.014 (0.079)	-0.034 (0.067)		-0.004 (0.102)
N	15671	25981	53419	42804	8646	10419
r2	0.038	0.070	0.066	0.045	0.038	0.017

The dependent variable in all regression is the $rank_{t+1} - rank_t$.

All explanatory variables are measured in period t .

In the regression the following controls are included: dummy variables for age, years of education, years of tenure and its squared term, dummy variables for year, dummy variable for 30–37 hours part-time work, and dummy variables for being married, bonus payments, dummy variables for plant size and sector.

Standard errors in parentheses

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

Table 8: Early career and FE move up regression results, by rank

	Rank1	Rank2	Rank 3	Rank 4	Rank 5	Rank 6
female with	-0.082*	-0.007	-0.063***	-0.066***	0.024	-0.003
one child	(0.035)	(0.022)	(0.012)	(0.014)	(0.055)	(0.026)
female with	-0.203***	-0.024	-0.142***	-0.112***	0.004	-0.026
two children	(0.051)	(0.033)	(0.017)	(0.019)	(0.070)	(0.032)
female with	-0.230*	0.057	-0.219***	-0.142***	0.038	-0.030
3children	(0.094)	(0.089)	(0.035)	(0.040)	(0.125)	(0.082)
female with	-0.131	0.009	-0.135	-0.152		
4 children	(0.309)	(0.259)	(0.158)	(0.107)		
N	15671	25981	53419	42804	8646	10419
r2	0.086	0.070	0.075	0.057	0.083	0.026

The dependent variable in all regression is the $rank_{t+1} - rank_t$.

All explanatory variables are measured in period t .

In the regression the following controls are included: dummy variables for age, years of education, years of tenure and its squared term, dummy variables for year, dummy variable for 30–37 hours part-time work, and dummy variables for being married, bonus payments, dummy variables for plant size and sector.

Standard errors in parentheses

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

Appendix

Appendix A: NHO Data

The matched employer-employee data used in the analyses were collected from individual-level records that the establishments collected and that were compiled by the Norwegian Central Bureau of Statistics and the main employer's association in Norway, the Confederation of Business and Employers (NHO). The purpose for data collection was to get an overview of wage levels and annual wage growth among white collar workers. The data could be supplemented by information on blue collar workers within those establishments, which have not exploited though in this study.

The empirical analyses matched employer-employee data cover the entire populations of white-collar employees in central sectors of the Norwegian economy in the period 1987 to 1997.¹ These data have been matched to register data on fertility histories (number and age of children), household characteristics (civil status) and individual characteristics (educational attainment). The main advantage of these data compared to other register data are that they include information on individuals hours of work and earnings, and a specific variable on job characteristic, that is the rank within a establishment's hierarchy. The latter allows to observe promotions within establishments and moves between ranks between establishments. Finally, the data includes establishment characteristics such as measures on establishment size and sectors.

The data are collected through a questionnaire that was sent out to all members of the employer association that have at least 5 employees. Members are in central sectors of the private sector. These include are the manufacturing sector, construction and machinery, oil sector, transport, hotel and restaurant. Largest subsectors in manufacturing are food and nutrition, wood, graphics, chemical, mechanical, and car sector. Information on all occupation groups is included except for CEO (administrative directors), editors in newspapers, secretary to the editor of newspapers and journalists.

¹To trace entry earnings we have extended the data back to 1980.

Questionnaires were sent out to all members and response rates are 80 to 85 per cent. In 1987 questionnaires were sent to 3973 establishments (that had at least 5 employees). The response rate was high. 81 per cent of establishments responded. Response rates are also very stable across the period 1987 to 1997. In 1997, for example, 4084 establishments were contacted and 83 per cent of establishments that employ 94 per cent of employees.

Since the data source is the survey run by the employer association clearly we have a selective sample of the economy. In another study we have compared the composition of the sample with respect to sector to the whole population of male workers in the register data. For illustration, we selected two years 1987 and 1997. Looking at the distribution of log wages we see that mean wages in our sample are higher, 30-40 percent, than in the population which is because they are more highly educated and older than workers in the population, i.e. the population including low wage earners and public sector workers, and compared to workers in the manufacturing sector per, i.e. including blue collar workers. The differential is also related to the fact that older and larger establishments tend to be more likely a member of an employer association. Hence, arguably we do not cover the lower part of the wage distribution. Variation in log wages does not look very different.

The NHO data includes all member plants in the private sectors.² Unique information in the NHO data is used to construct a well-defined variable for rank within the hierarchy of a plant following Hunnes, Møen and Salvanes (2008). The highest rank includes technical directors and leading positions. The lowest rank is defined to include unskilled, more routine tasks. The variable is constructed from information on the occupational groups and hierarchical ranks in the NHO data, where each worker is assigned one of six groups. The occupational groups are technical white-collar, supervisor, administrative, task in shop, in storage and others. Within each occupational group, seven task levels (ranks) are distinguished.

Plants were given tables with occupational codes and descriptions that

²For more details, see Lønnsstatistikk for funksjonærer - Norsk arbeidsgiverforening, 1987-1997.

included aspects of type of work as well as work and responsibility tasks. Additionally, plants were asked to give information about the rank of the job in the plant hierarchy with respect to superior and inferior jobs. Ranks are defined in the range 1 to 7; however, not all groups have used all seven ranks. Detailed descriptions of the ranks within occupational groups were provided. For example, for technical white-collar workers, ranks range from level A0 of a technical director or a comparable position down to A6 that includes positions with more routine tasks following instructions or sketches, or well-established routines. A5, by comparison, would include corresponding technical jobs for skilled workers. Codes for occupational groups and ranks were created by NHO for wage bargaining purposes and as such they are comparable across plants and sectors. To create a consistent rank measure across plants and years, the occupational group codes and rank codes were combined into 22 occupational positions. These were then harmonized to the seven ranks we use in the data analysis. The harmonization carefully used the detailed job descriptions provided by NHO. See for details in Table 1.

Appendix B: Institutional Background

Table 1: Parental leave legislation and child care, 1977-1994 in Norway

Year	Parental leave after birth in weeks*	wage replacement in per cent	father** quota in weeks	other rules	% kids in child care 1-2 3-7 years old	
since 1977	18			full-time leave	2 ¹ 2 ¹	8 ¹ 8 ¹
since 1978		100			5 ²	27 ²
since 1987	20				6 ³	43 ³
since 1988	22				11 ⁴	44 ⁴
since 1993	42 (52)	80 (100)	4		21 ⁵	47 ⁵
since 1994				39 weeks can be part-time	21 ⁵	47 ⁵

Note: *3 weeks before birth and 6 weeks after birth must be taken by the mother

** The father quota is a period of the total parental leave reserved to the father.

Figures are for ¹: 1975, ²: 1980, ³: 1985, ⁴: 1990, ⁵: 1995.

Appendix C: Tables

Table 2: Sample means, by gender and family status

	Men			Women		
	All	kids>0	kids=0	All	kids>0	kids=0
log(earnings)	4.81	4.74	4.84	4.55	4.55	4.57
married	.78	.42	.92	.62	.37	.85
age	40.63	38.81	41.37	37.38	35.50	39.09
years education	12.62	12.68	12.59	11.79	11.95	11.64
years tenure	7.63	6.81	7.96	6.54	6.22	6.84
work hours	37.69	37.68	37.70	37.20	37.50	36.92
1 if part time*	0.068	0.075	0.065	.157	.188	.123
1 if move up rank	.066	.061	.068	.065	.063	.059
1 if bonus**	.057	.056	.058	.037	.037	.036
Bonus (Nkr)	93,249	83,427	97,247	31,886	31,209	32,505
Plant size	433	440	430	403	423	386
Real profits	93768	94377	93523	76529	78583	74799
Fraction in						
Agriculture	0.19	0.14	0.21	0.16	0.14	0.19
Mining (incl. oil)	9.83	8.06	10.55	11.17	10.48	11.80
manufacturing	49.11	48.80	49.24	43.21	41.60	44.68
Energy	0.81	0.73	0.84	0.66	0.55	0.77
Construction	7.77	7.04	8.07	4.81	4.96	4.68
Wholesale, retail, hotels	15.13	16.01	14.78	16.67	18.48	15.02
Transport and communication	5.04	5.74	4.76	9.49	10.29	8.75
Finance, insurance, real estate	4.82	5.87	4.39	5.06	5.39	4.76
Public administration and service	6.59	6.85	6.48	8.15	7.41	8.82
Observations	407130	117770	289360	135962	64874	71088

Data source: NHO data, 1987-1997.

Highly attached workers born between 1936 and 1969. * part time is 30-36 hours.

Table 3: Distribution of total number of children*, by gender

	Men	Women
	mean	mean
no children	28.04	41.95
one child	21.61	25.71
two children	34.21	26.27
three children	13.44	5.53
four children	2.24	0.49
more than four	0.46	0.04
no child less than 6 yrs old	67.01	72.37
one child less than 6 yrs old	19.49	18.82
two children less than 6 yrs old	11.84	8.32
three children less than 6 yrs old	1.58	0.47
more than three children less than 6 yrs old	0.08	0.01
Individuals	82,161	32,459

Data source: NHO data, 1987-1997.

Highly attached workers born between 1936 and 1969.

* Total number of children is measured at the last spell for each individuals during 1987-1997.