Working from Home: Heterogeneous Effects on Hours Worked and Wages*

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Abstract

Working from home (WfH) has become much more common since the early 2000s. We exploit the German Socio-Economic Panel between 1997 and 2014 to investigate how such a work arrangement affects labour market outcomes, job and life satisfaction. We find that childless employees work an extra hour of unpaid overtime per week and report higher job satisfaction after taking up WfH. Among parents, WfH reduces the gender difference in working hours and monthly earnings, as contractual hours increase more among mothers. Hourly wages, however, increase with WfH take-up among fathers, but not among mothers unless they change employer.

JEL codes: J2, J31, O33

Keywords: working from home, working hours, wages, gender, flexible work arrangements.

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1 Introduction

Over the past two decades, progress in information and communication technologies (ICT) has made it easier to perform tasks outside of the workplace; in part due to better connectivity through broadband internet, as well as cheaper, more user-friendly computers. This made working from home (WfH) feasible for a wider range of tasks, and likely reduced the employer's costs of providing such arrangements (Vazquez and Winkler, 2017). Consequently, there has been a major expansion of WfH in many advanced economies such as the US, Nordic and Central European countries.[1] Among certain groups of workers, such as managers, WfH has already become a mainstream practice (Bloom et al., 2015), and with the current need for WfH practices induced by the Covid-19 pandemic, WfH is likely to become even more widespread over the next few years.

Yet, despite its growing relevance, little is known about how this work practice affects workers' wages, careers and well-being. The limited empirical evidence is mixed and has not fully taken into account that outcomes likely vary across workers with different private responsibilities. In general, more flexibility in where to work is expected to benefit primarily those who face private restrictions, such as mothers. This is why flexible working arrangements may help reduce gender gaps in the labour market, especially among parents. Yet, while this may be true for labour supply responses, the theoretical expectations are far from clear-cut when it comes to wages and other career prospects. On the one hand, WfH may improve wages and career prospects if it raises productivity due to a beneficial work environment at home, or due to workers' willingness to extend their availability beyond usual office hours. On the other hand, if WfH mainly serves to reconcile work and family responsibilities, it may give rise to a wage penalty if it is costly to employers.

This paper contributes to the limited and mixed evidence on labour market outcomes of WfH by providing new empirical evidence for Germany during a period of massive expansion of WfH practices. In particular, our analysis provides comprehensive insights on how the take-up of WfH affects a whole set of potential outcomes: namely, contractual hours, overtime hours, hourly wages, and monthly earnings. We also investigate the role of compensating wage differentials using information on job and life satisfaction, and take into account other schemes used to compensate overtime such as time off. In this way, we complement earlier studies that focus on responses in working hours and disregard compensations for increased working hours other than wages. Moreover, we study the case of employees working from home at least once a month, hence departing from the older

[1] Evidence on high and rising shares of employees working at home at least occasionally can be found for the U.S. (Lister and Harnish, 2011), and for Nordic and Central European countries (see Welz and Wolf, 2010; Brenke, 2014; Vilhelmson and Thulin, 2016, among others).

literature that focuses on the less common case of home being the only workplace (Edwards and Field-Hendrey, 2002; Oettinger, 2011).

As a second contribution, we examine the heterogeneity of these effects across groups of workers with a particular focus on differences between men and women, as well as parents and non-parents. The existing literature often fails to dig deeper into this heterogeneity, despite the fact that effects are likely to vary with opportunity costs of working and labour force attachment. By carving out the differences by gender and parental status, we contribute to the debate on the role of schedule constraints as a source of gender differences in working hours and wages (Goldin and Katz, 2011; Goldin, 2014; Cubas et al., 2019) and the role of flexible work arrangements and "family friendly" workplaces as a means of reconciling work and family responsibilities (see Allen et al., 2015; Hotz et al., 2017; Angelici and Profeta, 2020, among others) .

Thirdly, we reduce the potential endogeneity of WfH compared to previous studies that mostly use cross-sectional data only (Schroeder and Warren, 2004; Weeden, 2005; Gariety and Shaffer, 2007; Leslie et al., 2012). These studies likely suffer from a bias since WfH schemes are more frequently offered by high performing firms to workers who are positively selected among the firm's workforce (Osterman, 1995; Kelly and Kalev, 2006; Bloom and Van Reenen, 2006). We address these concerns by accounting for time-invariant unobserved individual heterogeneity in abilities, preferences and working attitudes, and by controlling for an extensive set of time-varying demographic and job-related variables. We also control for gender-specific industry and occupation fixed-effects to account for unobserved heterogeneity in the composition of the workforce across jobs. In order to address unobserved shocks that affect labour supply decisions as well as the decision to work from home, we also correct for sample selection biases due to changes in unobserved preferences or characteristics using a control function approach in a panel data setting.

Finally, we provide novel insights into the channels underlying WfH effects by examining to what extent the take-up of WfH is accompanied by changing firm or job position within a firm. We are thus able to shed light on the role of such career events in explaining part of the WfH effects. If there is, for instance, a wage premium for WfH, it is informative to understand whether this applies only to workers with simultaneous career movements or whether it also applies to workers with otherwise unchanged jobs.

Our findings suggest that

(i) the incidence of WfH in Germany increased, on average, by about 50 percent between 1997 and 2014, but it almost tripled among mothers, suggesting that WfH is likely to be driven by both firms' demands as well as supply-side motives of reconciling family and work responsibilities;

(ii) addressing the endogeneity of WfH practices due to unobserved time-invariant characteristics is important, while controlling for selection into paid employment due to time-varying unobserved preferences or characteristics does not affect the magnitude of the effects;

(iii) among childless workers, WfH take-up leads to an expansion of overtime hours that raises job satisfaction, despite no compensation in terms of wages or time-off, suggesting that childless employees value the increased flexibility that WfH allows;[2]

(iv) among parents, WfH significantly contributes to reducing gender differences in contractual hours and monthly income;

(v) WfH has a positive effect on hourly wages for fathers but not for mothers unless they change employer, which points to a gender difference in bargaining power within established employer-employee relationships;

(vi) there is no evidence of a better work-life balance for parents with WfH despite positive labour market outcomes, indicating that related advantages may be counterbalanced by WfH-related conflicts between private and professional needs.

The rest of the paper is organized as follows. In section 2 we discuss the theoretical expectations regarding the effect of WfH on various outcomes and review existing findings. Section 3 describes the data and provides some facts and trends in WfH incidence and labour market outcomes across different groups of workers. We discuss the empirical strategy in section 4, and present the results in section 5. The last section concludes.

2 Labour Market Outcomes of WfH - a Review

2.1 Labour supply effects

From a theoretical perspective, there are two reasons why WfH may have positive effects on labour supply both at the extensive and intensive margin. Firstly, WfH can save on commuting time by avoiding daily commutes although the link between commuting time, WfH and labor supply appears to be weak.[3] What appears to be more important

[2]We use the term childless as a short way to designate individuals without dependent children under the age of 16. Parents, mothers and fathers refer in the text to individuals with children under the age of 16.

[3]Black et al. (2014) show that U.S. metropolitan areas with larger increases in average commuting time between 1980 and 2000 experienced slower growth in married women's labour force participation suggesting some impact of commuting distance on the extensive labour supply. Conditional on labour force participation, though, commuting time or distance do not have much of an effect on weekly working hours (Gutiérrez-i Puigarnau and van Ommeren, 2010; de Graaff and Rietveld, 2007).

is that WfH reduces schedule constraints that stem from private commitments, such as childcare, during standard working hours. With WfH, it may be possible to meet private needs during usual office hours and to also better synchronize work and leisure time within a couple (Bryan and Sevilla Sanz, 2014). In a standard labour supply framework, these advantages attached to WfH reduce the time cost of working, raise the utility level for a given number of working hours, and may thus result in positive labour supply responses both at the extensive and intensive margin (Cogan, 1981; Black et al., 2014). In particular, this should apply to employees with family responsibilities. Therefore, WfH is expected to be one potential means of narrowing the gender gap in working hours, including overtime, that has recently been considered a main source of the gender wage gap (Goldin, 2014; Cortes and Pan, 2019).

To the best of our knowledge, there are no empirical studies explicitly focusing on the effect of WfH on the extensive margin. However, Dettling (2017) demonstrates that access to broadband internet significantly increases female labour supply by about 4 percentage points on average, and by 8 percent among high-skilled mothers. She considers telework and time saved in home production to be the channels which likely explain how internet access encourages women with strong schedule constraints to enter the labour market.

Empirical evidence on the effect of WfH on the intensive labour supply is also quite limited, but tends to suggest a moderate extension effect of WfH on overtime rather than contractual hours. Evidence by Noonan and Glass (2012) point to a positive association between WfH and longer overtime hours in the US, although the use of cross-sectional analysis may give rise to an estimation bias, as workers who telecommute tend to be positively selected with regard to hours worked and other performance measures. Controlling for individual fixed effects, Possenriede et al. (2016), however, confirms an extension effect of teleworking on overtime hours for both men and women in the Netherlands, and a marginally significant increase in contractual hours for women only.

2.2 Wage effects

In contrast to the expected labour supply effects, the theoretical effects of WfH on wages are ambiguous, potentially giving rise to both a wage premium or a wage penalty depending on the relative strength of a hedonic effect, a productivity effect, as well as a signalling effect.

The hedonic wage effect reflects a worker's willingness to pay for being able to work from home or the need to be compensated for doing so. Workers for whom WfH raises utility due to reconciling schedule constraints or saving on commuting time might trade WfH not only for leisure, but also for wages, hence giving rise to a compensating wage

differential. By the same token, workers who prefer on-site work, but use WfH in response to employer needs may need to be compensated by higher wages. The hedonic effect can thus potentially go in both directions. Evidence from an experimental study that offered random job attributes to potential job applicants suggests that, on average, both men and women attach a positive value to working from home. Yet, women's willingness to pay for WfH exceeds that of men, especially among parents with young children, suggesting that WfH might actually increase the gender wage gap (Mas and Pallais, 2017). In line with this, a recent study by Lott and Chung (2016) finds that flexible work schedules result in increased overtime for both men and women that is compensated by higher annual earnings only for men; hence reinforcing gender earnings gaps.

Moreover, WfH may also transmit a signal regarding a workers' job attachment. An experimental study by Leslie et al. (2012), for instance, demonstrates that WfH may induce career premia or penalties depending on whether managers attribute the use of such arrangements to private or job-related needs. To the extent that managers consider that women use WfH for private needs but men do so for business needs, such perceptions may increase gender wage gaps.

In addition, WfH may increase worker productivity if it raises motivation or provides a more productive work environment, at least for certain tasks (Dutcher, 2012). On the other hand, workers may get interrupted by family members or other private responsibilities, hence giving rise to shirking which is costly to monitor at home. Empirical evidence more often suggests positive ratehr than negative productivity effects (Gajendran and Harrison, 2007). In an experimental setting, Bloom et al. (2015) find a 13 percent performance increase among call center employees that were allowed to work from home. Moreover, the productivity effect may to some extent depend on available technologies. Angelici and Profeta (2020) also find that flexibility in the time and place of work increases employees' productivity in a large Italian company of the multi-utility sector. In a competitive labour market, such productivity effects would be reflected in a worker's wage level. de Graaff and Rietveld (2007) present evidence for the Netherlands that a wage penalty of 19 percent for working at home is almost reduced to zero once workers have access to the internet. Similarly, Oettinger (2011) shows that the expansion of home-based work was strongest in occupations with a greater growth in IT use and that this expansion was accompanied by a declining wage penalty for home-based work.

Hence, WfH arrangements may theoretically give rise to both a wage premium and a wage penalty. Reflecting this ambiguity, empirical studies have found mixed evidence. While some studies suggest a wage penalty for working from home (Glass, 2004), others suggest positive wage effects (Schroeder and Warren, 2004; Weeden, 2005; Gariety and

Shaffer, 2007; Leslie et al., 2012). Yet, most of these studies use cross-sectional data only and may thus be upwardly biased if the positive selection of WfH practices at the level of firms and workers is not taken into account. As an exception, Glass and Noonan (2016) exploit US individual panel data to control for individual fixed effects, as well as information on firms' characteristics, and find a wage penalty for WfH during overtime but not during contractual hours. These average effects, however, may hide heterogeneous responses across groups with different private constraints.

2.3 Job and life satisfaction

Since WfH reduces schedule constraints and potentially lowers the fixed costs of working due to reduced commuting costs, WfH should raise the utility associated with a given level of hours and wages. This should be reflected in a higher job satisfaction among those working from home than among otherwise comparable workers without WfH arrangements. Indeed, studies from the sociological or management literature support the view that an increased autonomy over when and where to work raises job satisfaction (Kröll and Nüesch, 2017; De Menezes and Kelliher, 2017; Wheatley, 2017). However, the value attached to flexible work arrangements such as WfH may differ across workers. This may be particularly pronounced among women whose willingness to pay for such arrangements has been shown to exceed men's (Mas and Pallais, 2017), or among parents whose schedule constraints are tighter (Angelici and Profeta, 2020). Since the utility gain derived from flexible arrangements may also be traded against lower wages or increased hours, simultaneous wage and hours adjustments need to be taken into account in order to assess the uncompensated value that workers attach to such work practices. If wage and hours adjustments fully compensate for the utility gains, WfH need not raise job satisfaction.

Life satisfaction depends on both the satisfaction derived from the job and the private domain. Hence, life satisfaction may rise with improved job satisfaction. However, WfH may exert additional positive or negative effects on the private domain. This is because WfH may facilitate the reconciliation of family and job needs, but at the same time generate new sources of conflict and stress at home (Baines and Gelder, 2003; Sullivan, 2012; Song and Gao, 2018). Hence, WfH could be more or less favorable to overall life satisfaction depending on the interactions between private life and work. These interactions are likely to differ by gender and parental status, as illustrated by the paradox of the decline in female happiness (Stevenson and Wolfers, 2009). In spite of better access to the labour market and better control on family formation, women report lower well-being, both in absolute terms and relative to men, than four decades ago. Hence, it is unclear whether WfH will translate into greater life satisfaction or may even be detrimental due to new

expectations and more pressure.

3 Data and descriptive statistics

3.1 The German Socio-Economic Panel

The German Socio-Economic Panel (SOEP) is a panel dataset for the years 1984-2014 consisting of around 20,000 individuals living in Germany.[4] It includes detailed individual and household-level characteristics and also provides information on working from home in five waves (1997, 1999, 2002, 2009 and 2014). In these waves, individuals were asked whether they sometimes work from home and, if so, whether they do it on a daily, weekly or monthly basis. Note that this information does not capture the actual intensity of WfH, as we do not have any information on the number of hours worked at home or whether WfH takes place during normal office hours or during overtime. We construct a dummy variable equal to one if the individual works from home at least once a month and test for the robustness of the results when using weekly WfH instead. Among those working from home at least once a month, 14% do it every day, 45% do it at least once a week, and 41% do it once every two to four weeks. Hence, we focus on occasional home-based work. Moreover, note that we exclude those whose main place of work is their home. We thus focus on WfH as a complement to on-site work.[5]

Concerning working hours, the data allows us to distinguish between contractually agreed weekly working hours and actual weekly working hours (i.e. the number of hours generally worked every week). Overtime hours are calculated as the difference between actual working hours and contractually agreed working hours. We trim overtime hours by excluding the 1st and the 99th percentile, which implies excluding observations with negative overtime hours and more than 23 overtime hours per week. Hourly wages are measured through the self-reported monthly gross earnings divided by actual monthly working hours. We calculate real wages based on the CPI deflator using 2010 as the base year. In order to ensure that outliers are not driving the wage results, we also trim hourly wages excluding the 1st and the 99th percentile (individuals receiving an hourly wage lower than EUR 4 or higher than EUR 50 in 2010 value) and we employ the standard logarithmic form for the wage regressions. Job and life satisfaction are measured on an 11-point Likert scale.

We use a sample of employees between 20 and 65 years old, for whom we have information on whether or not they work from home in at least two waves. We exclude

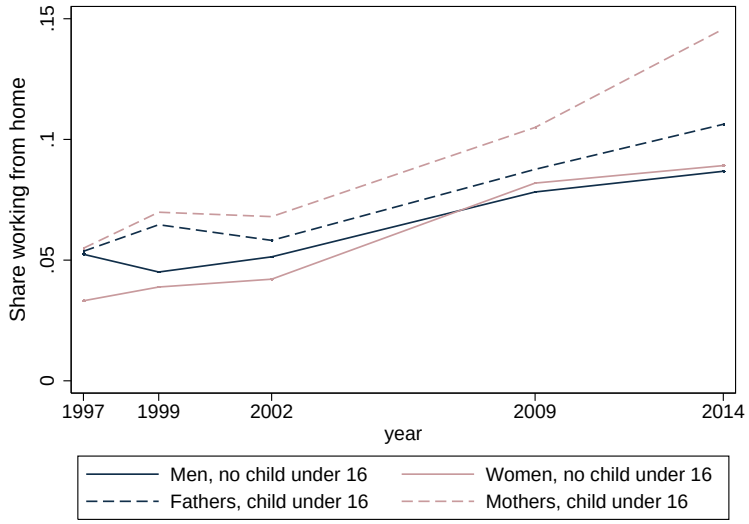
[4] See SOEP (2013) and Wagner et al. (2007) for details on the SOEP data set.

[5] Besides, we do not identify telecommuting or teleworking, nor a broader definition of remote work.

self-employed individuals, individuals whose main place of work is their home, students, individuals in training, and individuals in marginal employment (i.e. those earning less than 400-450 euros per month). The resulting sample consists of 8,143 employed workers (23,092 observations) for the four waves.

Based on this sample, Figure 1 shows that the share of individuals working from home has increased in Germany over the past 20 years, consistent with what has been reported from other advanced economies. Moreover, the increase in WfH has been strongest among mothers. This suggests that the WfH decision is likely to be driven, at least in part, by supply-side motives of reconciling family and work responsibilities and not by employers' needs alone.

Figure 1: Trends in working-from-home by gender and parenthood in Germany



Source: SOEP. 1997, 1999, 2002, 2009 and 2014 waves. Individuals working from home at least once a month. In 2014, the share of female and male employees with a child under 16 years old are 14% and 17% respectively. The share of female and male employees without a child under 16 years old are 36% and 33%.

In addition, the ability to use WfH arrangements is also strongly related to job characteristics. Table A.1 in the appendix shows that the share of employees who sometimes work from home in 2014 differs greatly across industries. While 15% of employees in the services sector use WfH, no one in the mining or energy sectors brings work home, and very few do so in the trade sector. Table A.2 shows that the share of employees who sometimes work from home varies also greatly across occupations, tasks or work tool intensities. Teachers are different from all other employees as 65% of them report working from home in 2014, a share well above the average. After teachers, managers, consultants, accountants and IT specialists are those who work from home more often, unlike manufacturing blue collar workers and cleaners who never work from home. The likelihood of WfH increases with the

level of autonomy at work. It also increases with an occupation's share of analytical tasks. Finally, in occupations in the top quarter of personal computer use, 11% of employees work sometimes from home while 3% of employees do it in occupations where PCs are less common. Hence, the pattern of WfH incidence seems to resemble what has been found in other countries.

3.2 Determinants of WfH take-up

For taking a closer look at the determinants of working from home, and the subsequent analysis of its impact on various outcome measure, we further exclude individuals after they have dropped out of WfH (i.e. we drop 945 year-individual observations from 254 individuals after they have stopped working from home). The reason for this is that the effects of take-up and drop-outs are asymmetric.[6] In particular, the take-up decision is more likely to be driven by factors exogenous to the firm and the individual, such as the extended availability of broadband internet, whereas the drop-out decision is more likely to be driven by firm and individual-specific unobservable factors that are related to the quality of the work arrangement. Moreover, due to rigidities, it is unlikely that wage gains during WfH practices are taken away after dropout at least in the short to medium run.

The final sample is thus composed of individuals never WfH, always WfH and individuals who switch from not using WfH to using WfH later on. Hence, we estimate the effect of working from home by exploiting the take-up decisions only. In addition, we exclude teaching and religious occupations from the sample, since the majority of individuals in these occupations have always been working from home.[7] We end up with an unbalanced panel of 7,602 individuals (21,392 observations), 46 percent of whom are women, who we observe for 2 to 5 waves over the period 1997-2014.

Table 1 provides summary statistics by gender and WfH status. It shows that individuals working from home differ from individuals working on-site only. Employees working from home earn higher wages and work longer overtime hours than employees working in the office only. On average, employees working from home are older, are more likely to have a university degree and are less likely to have a migration background (i.e. have migrated to Germany or have parents who migrated). When it comes to the household context, they are more likely to live as a couple and to have an employed partner with relatively high earnings. Individuals working from home also tend to commute longer distances, which confirms that WfH may be used to save on commuting costs. Moreover, a higher fraction

[6] Results available upon request.

[7] The main results are similar in magnitude when including these occupations in the analysis, but the estimates are less precise.

of individuals working from home have children under age 16 compared to pure on-site workers, particularly among women. This fact is consistent with the idea that WfH may be used to better combine work and family responsibilities. Turning to job characteristics, WfH is much more common in larger firms while firm tenure is not related to the WfH status.

Table 1: Summary statistics by working from home status and gender

	Female				**Male**			
	WfH	No WfH	Difference (t-stat.)		WfH	No WfH	Difference (t-stat.)	
Panel A: Outcome variables								
Actual working hours per week	36.06	35.13	0.94*	(1.66)	46.97	42.43	4.54***	(17.06)
Contracted working hours per week	31.66	32.82	-1.15**	(-2.31)	38.99	38.76	0.23	(1.54)
Overtime hours per week	4.40	2.31	2.09***	(10.43)	7.98	3.67	4.31***	(20.15)
Gross hourly real wages	18.47	13.48	4.99***	(16.43)	21.94	16.31	5.63***	(19.47)
Panel B: Main explanatory variables								
Migration background	0.15	0.19	-0.04*	(-1.79)	0.11	0.22	-0.11***	(-5.77)
Married (or cohabitating)	0.86	0.76	0.10***	(4.04)	0.88	0.81	0.07***	(3.84)
Age	43.51	42.30	1.21**	(2.05)	44.32	42.29	2.02***	(4.41)
Child aged 0-2	0.05	0.02	0.03***	(3.44)	0.08	0.09	-0.01	(-0.80)
Child aged 3-5	0.12	0.05	0.07***	(5.31)	0.10	0.08	0.02	(1.54)
Child aged 6-15	0.28	0.23	0.05*	(1.95)	0.28	0.24	0.04**	(2.13)
Child older than 15	0.31	0.40	-0.09***	(-3.05)	0.21	0.21	-0.01	(-0.30)
Partner in paid employment	0.86	0.83	0.03	(1.10)	0.67	0.61	0.06**	(2.43)
Partner's earnings	4824.89	2915.43	1909.45***	(11.89)	2057.67	1598.92	458.75***	(7.01)
Tertiary education degree	0.48	0.19	0.29***	(12.66)	0.56	0.17	0.40***	(22.72)
Vocational qualification	0.47	0.68	-0.21***	(-7.75)	0.39	0.71	-0.32***	(-15.53)
Part-time work experience (in years)	5.19	4.88	0.31	(0.79)	0.92	0.39	0.53***	(7.45)
Full-time work experience (in years)	14.02	13.84	0.19	(0.32)	19.61	20.20	-0.59	(-1.23)
Urban region	0.70	0.66	0.05*	(1.72)	0.75	0.66	0.09***	(4.02)
Commuting distance (in km)	28.78	14.59	14.20***	(7.48)	44.26	24.00	20.27***	(7.27)
Civil servant	0.31	0.35	-0.04	(-1.50)	0.27	0.22	0.04**	(2.33)
Large firm (>200 empl.)	0.58	0.47	0.10***	(3.58)	0.67	0.53	0.14***	(6.21)
Small firm (<20 empl.)	0.24	0.23	0.01	(0.51)	0.10	0.17	-0.07***	(-3.84)
Firm tenure (in years)	11.37	10.72	0.66	(1.23)	12.42	12.64	-0.22	(-0.45)
Observations	309	9,601			498	11,026		

Source: SOEP, sample of 7,602 employed workers (21,392 observations) from the 1997, 1999, 2002, 2009 and 2014 waves. Note: The table displays summary statistics on the main control variables by WfH status. The information on commuting distance is available only for a subset of 19,952 observations. The information on partner's employment and earnings is available only for a subset of 15,988 observations.

To better document how WfH may be related to simultaneous life and career events, we describe in Table 2 how WfH *take-up* coincides with having a child or a career change. In fact, individuals might start working for another employer in order to get access to WfH practices, thus selecting into certain types of firms. Or, individuals might start WfH as they have their first child. In order to shed some light on such simultaneities, Table 2 shows the share of individuals who i) have their first child, ii) change employer, iii) change position within a firm among those who take up WfH (columns (1) and (4)) compared to those who don't (columns (2) and (5)). Indeed, WfH take-up is often related to having a first child. Women taking-up WfH are 15 percentage points more likely to have their first child around that time compared to women who do not change WfH status. The difference is much smaller among men. Also, the share of employees who change employer

is significantly higher among those with a WfH take-up in the same period. This also holds for career changes within the same firm. Again, the likelihood of a career change increases more for women than for men with WfH take-up.

Table 2: Simultaneity of working from home take-up with family and job changes

	Female				**Male**			
	(1) WfH takeup	(2) No change	(3) Difference	(t-stat.)	(4) WfH takeup	(5) No change	(6) Difference	(t-stat.)
First child	0.20	0.05	0.15***	(8.41)	0.10	0.06	0.04**	(2.29)
New employer	0.24	0.15	0.09***	(3.10)	0.23	0.15	0.07***	(2.99)
New position within firm	0.10	0.03	0.07***	(5.46)	0.09	0.02	0.06***	(5.68)
Observations	164	6,132			234	7,260		

Note: The table displays the mean of the variables for the population of women taking up WfH in column (1), women not changing WfH status in column (2), men taking up WfH in column (4), and men not changing WfH status in column (5). For example, column (1) shows that 20% of women taking up WfH got their first child in the same period. Changes in WfH status and first child are computed using information from the previous wave. Changes in employer and position are self-reported variables. All waves are pooled which amounts to 13,790 observations for 7,602 individuals.

Table 3 documents how individual and job characteristics, as well as these career and life events, are related to the probability of working from home using a multivariate analysis based on the described sample excluding WfH dropouts.[8] The results from a linear probability model with OLS in columns (1) and (4) for women and men, respectively, confirm the findings from Table 1. When investigating the determinants of WfH take-up by adding individual fixed effects in column (2) for women and column (5) for men, most of the characteristics turn out to be insignificant. However, women with children under 16 are significantly more likely to start working from home than other women. As for fathers, they are more likely to start working from home than childless men only if the children are of school age, and the impact is smaller than for women. Moreover, women are more likely to work from home when they get married or move in with their partner, and when they move to a more rural area. The fact that couples tend to make their location decisions based on the male breadwinner's job could explain the latter result. Females might thus need to start working from home because they are bound to their partner's choice of location.

When further adding fixed effects for occupation, occupational status and industry affiliation, see columns (3) and (6), these results do not change much.[9] Moreover, simultaneous events such as having a first child, changing employer or changing position are not related to WfH take-up, suggesting that observable characteristics explain the simultaneity between WfH take-up and these events as shown in Table 2. Hence, individuals seem to change employer and job positions for other reasons than for taking up WfH. Still, we will

[8]The main insights are unaltered when including these dropouts.

[9]Similarly, changes in commuting distances are not related to WfH take-up, even though the correlation between WfH and commuting distances is strong in the cross-section. Results available upon request.

Table 3: Determinants of working from home

	Female			Male		
	OLS	Fixed effects		OLS	Fixed effects	
	(1)	(2)	(3)	(4)	(5)	(6)
Migration background	-0.007	0.000	0.000	-0.024***	0.000	0.000
Married (or cohabitating)	0.014***	0.017**	0.017***	0.013**	0.003	-0.000
Age	0.003*	0.003	0.004	0.003	-0.014	-0.016
Child aged 0-2	0.020	0.077**	0.071**	-0.009	0.014	0.013
Child aged 3-5	0.023*	0.087***	0.085***	0.008	0.023	0.022
Child aged 6-15	0.006	0.092***	0.091***	0.007	0.030	0.029
Child older than 15	-0.008	0.101***	0.100***	-0.006	0.020	0.020
Tertiary education degree	0.061***	0.043	0.033	0.089***	0.031	0.026
Vocational qualification	0.005	-0.009	-0.011	-0.003	-0.000	0.000
Part-time work experience	0.000	0.002	0.003	0.002	0.005	0.003
Full-time work experience	0.000	0.003	0.004	-0.002*	0.008***	0.006**
Urban region	-0.002	-0.068***	-0.063***	0.013**	0.032	0.028
Civil servant	-0.012**	-0.014*	-0.012	-0.007	-0.007	-0.005
Large firm (>200 empl.)	0.016***	0.000	0.001	0.013**	-0.005	-0.004
Small firm (<20 empl.)	0.013**	0.008	0.006	0.001	0.005	0.002
Firm tenure	0.001	-0.000	-0.000	0.000	-0.000	-0.000
First child	0.059***	-0.005	-0.002	0.014	-0.001	0.000
New employer	0.001	0.008	0.007	0.001	-0.002	-0.004
New position within firm	0.035*	0.013	0.007	0.068***	0.039*	0.033
Occupation fixed effects	No	No	Yes	No	No	Yes
Occupational status FE	No	No	Yes	No	No	Yes
Industry FE	No	No	Yes	No	No	Yes
Observations	9880	9880	9880	11512	11512	11512
R-squared	0.048	0.672	0.680	0.062	0.708	0.714

Note: Linear probability model estimates with WfH at least once a month as the dependent variable. All equations include year fixed effects, federal state fixed effects, as well as age and tenure squared as further control variables. Standard errors are clustered at the individual level, $*p < 0.10, **p < 0.05, ***p < 0.01$.

shed light on the impact of these parallel career shifts on the estimated effects of WfH take-up on hours and wages. Moreover, as parents of young children are more likely to start WfH, and also differ in other aspects from childless employees, we will estimate the WfH effects separately for childless individuals, parents and individuals having a first child.

4 Empirical strategy

The take-up of working from home is determined by the employee's and the employer's willingness to use this arrangement and the state of the technology that makes it feasible. While advances in technologies are exogenous to individual outcomes, employees' and firms' characteristics that determine WfH take-up may generate endogeneity biases. In order to identify the effects of WfH on hours worked and wages, we estimate the following regression

on the pooled sample of men and women:

$$Y_{it} = \alpha + \beta_1 WfH_{it} \times Male_i + \beta_2 WfH_{it} \times Female_i + X'_{it}\lambda + \theta_t + \theta_{tf} + \theta_o + \theta_{of} + \theta_i + \mu_{it} \quad (1)$$

where the individual labour market outcome Y_{it} is the number of actual hours worked, the number of contractual hours and the logarithm of the wage of individual i at time t. WfH_{it} is a dummy variable indicating whether individual i works from home at least once every month in year t. X_{it} is a vector that includes individual time-varying characteristics such as education, actual experience, number of children in different age groups and the marital status, as well as job characteristics such as firm tenure, firm size, whether it is a public sector job, the region of work, the industry affiliation. These characteristics are interacted with a female dummy to allow for gender differences in the returns to individual characteristics. Gender-specific year fixed effects θ_t and θ_{tf} are included. We also estimate equation (1) with gender-specific occupation fixed-effects θ_o and θ_{of} and exploit changes in individual WfH status within occupation only. μ_{it} is an unobserved and time-invariant individual specific effect.

Since the effect of WfH likely differs across groups of workers with different motives for taking up WfH, we will split the sample into more homogeneous sub-groups regarding potential reasons for WfH take-up and conduct separate estimations for these groups. In particular, we differentiate between people with and without children under age 16 and further disaggregate the group of women who had their first child. In this way, we take into account that men's and women's career paths are affected differently by childbirth (Kleven et al., 2018 and references therein) and that these differences may interact with WfH take up.

Our estimation strategy addresses a number of potential threats to identification. In particular, we control for a rich set of time-varying observables such as couple formation, childbirth or job-related characteristics that may confound the effect of WfH. Our baseline specification further eliminates any endogeneity problem operating through the individual fixed-effects θ_i like time-invariant preferences and ability. Hence, we identify the effect of WfH by exploiting WfH take-up, rather than WfH status. Our estimates could still be biased if individuals select into occupations with a high or low incidence of WfH for unobserved reasons that are also correlated with the outcomes. To tackle this issue, we condition on gender-specific occupation fixed-effects (using 86 groups). Thus, related biases should be minimized as the identification stems from those taking up WfH while remaining in the same occupation. Moreover, occupational choice is likely to be driven by time-constant preferences and attitudes which we take into account by including individual fixed-effects.

For the main estimates in section 5.1, we assume WfH to be strictly exogenous in the above specification. However, section 5.2 relaxes this assumption in several ways and addresses a number of potential concerns. In particular, we test the robustness of the results to additional controls including occupational characteristics, such as task composition and computer use, individuals' commuting distances, and more detailed information on the household structure using partner's characteristics as there may be interaction effects between partners. Moreover, we explore whether a selection bias due to unobserved shocks to individuals' decision to (re)enter paid employment affects WfH estimates using a control function approach adapted to the panel data setting.

Aside from any endogenous selection into paid employment, the choice of the specific employer may also be endogenous if individuals select into certain firms to get access to WfH amenities that also differ with respect to other outcome-relevant aspects. Since we have only few employer-specific characteristics that we can control for, we later condition on remaining with the same employer before and after WfH take-up as a robustness check, thus tackling potentially endogenous selection into certain types of firms. By doing so, we exploit variation in WfH that is likely driven by an exogenous shock to a firm's costs of offering WfH due to, for instance, computer-related technological progress and better Internet connectivity. The remaining threats to identification are related to unobserved firm-level changes that could be correlated to working hours and wages such as a change in manager and human resources practices. Finally, climbing up the career ladder may simultaneously increase working hours, the demand for availability outside usual office hours, and wages. This would induce an upward bias for the effect of WfH on our outcome measures. We investigate the role of such simultaneous change in job position by comparing our baseline estimates with WfH estimates on a sample of individuals who stay with the same employer and experience no job change.

5 Results

5.1 Effect of working from home on hours worked and wages

In this section, we present the results on the effect of working from home at least once a month on actual hours, contractual and overtime hours, and hourly and monthly wages. We look at the results for the overall sample first, before running estimations for sub-groups by parental status. In all estimations, we allow for a different impact of WfH for men and women, as shown in equation 1, and compare OLS and FE estimates.

All employees. According to OLS estimates in Table 4, men with WfH arrangements work 3.7 hours a week more than men without WfH arrangements. For women, WfH is associated with 1.3 additional hours per week (column 1). When controlling for unobserved time-invariant characteristics by using a fixed-effects (FE) approach, column (2) shows that the hour-premium associated with WfH is strongly reduced to about one hour a week for men and turns statistically insignificant for women. The difference between OLS and FE results indicates that individuals selecting into WfH work longer hours anyhow such that OLS estimates are upward biased. Controlling for occupational status does not reduce this bias much (column (3) vs. column (4)).

Table 4: Effect of WfH on hours worked, all employees

	Actual hours				Contracted hours		Overtime hours	
	(1) OLS	(2) FE	(3) OLS	(4) FE	(5) OLS	(6) FE	(7) OLS	(8) FE
WfH (Male)	3.734***	1.085***	3.069***	0.913**	0.168	0.232	2.901***	0.681**
	(0.389)	(0.373)	(0.370)	(0.372)	(0.194)	(0.153)	(0.322)	(0.334)
WfH (Female)	1.284**	0.814	0.628	0.655	-0.890*	-0.385	1.518***	1.040***
	(0.573)	(0.653)	(0.565)	(0.645)	(0.463)	(0.567)	(0.294)	(0.388)
Occupation FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupational status	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Observations	21392	21392	21392	21392	21392	21392	21392	21392
R-squared	0.499	0.832	0.515	0.834	0.549	0.852	0.182	0.673

Note: The table shows the estimates of OLS regressions and fixed effects regressions based on equation (1). The dependent variables are actual, contractually agreed and overtime weekly working hours. Control variables included are year fixed effects, demographic controls (age, age squared, migration background, marital status, children for four age-groups), human capital controls (highest qualification and actual work experience), job characteristics (tenure, tenure squared, public sector dummy, firm size, employer and position change), federal state and urban area dummies, 1-digit industry dummies, occupation fixed effects (95 dummies), occupational status fixed effects (15 dummies). All control variables are gender-specific (also interacted with a gender dummy). Standard errors are clustered at the individual level, $*p < 0.10, **p < 0.05, ***p < 0.01$.

The changes in actual hours in columns (3) and (4) are the sum of the changes in contractual and in overtime hours shown in columns (5) to (8). The increase in actual hours comes from extended overtime hours rather than increased contractual hours, a result that holds for both men and women in the overall sample. The effect of WfH on contractual hours is small and insignificant for men in both OLS and FE estimates. According to OLS results, women who use WfH have significantly lower contractual hours than women who do not use WfH. As we will see later, this negative effect on women's contractual hours seems to be driven by women who start working from home after having their first child, as these women tend to simultaneously switch from full-time to part-time employment. However, the OLS estimates are downward biased among women (column (5) vs. column (6)). Contrary to the contractual hours response, we find that WfH is

associated with longer overtime hours, which is consistent with other findings for the U.S. and the Netherlands (Noonan and Glass, 2012; Possenriede et al., 2016). The effects are smaller when controlling for individual fixed-effects suggesting that cross-sectional studies are likely to overestimate this effect. In Germany, both men and women increase their overtime by 0.7 and 1 hour per week, respectively, when starting WfH (column (8)).

Since WfH has, on average, a positive effect on overtime hours, we may expect that it increases wages if additional hours help signalling job commitment or reflect employer's needs for availability. However, in a compensating differential setting, the extra hour worked does not need to be compensated in monetary terms if employees value WfH. Table 5 provides the effect of WfH on monthly wages and hourly wages, calculated as the monthly pay divided by actual hours. The OLS estimates in column (1) show that both men and women using WfH arrangements earn higher hourly wages than employees who do not use WfH. For men, FE estimates in columns (2) and (4) show that the positive association between hourly wages and WfH is robust to controlling for individual time-invariant characteristics. Men starting WfH experience an increase in hourly wages of 5 percent on average. Monthly earnings for men even increase by more than 7 percent (see column (8)). Moreover, note that the increase in hourly and monthly wages for men is slightly smaller when controlling for occupational status (see column (2) vs. column (4) and column (6) vs. column (8)). This result indicates that being promoted while taking-up WfH is one driver of wage growth following WfH take-up, although it does not explain it fully.

Table 5: Effect of WfH on hourly and monthly wages, all employees

	Hourly wage				Monthly wage			
	OLS	FE	OLS	FE	OLS	FE	OLS	FE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
WfH (Male)	0.061***	0.056***	0.010	0.051***	0.142***	0.080***	0.076***	0.072***
	(0.016)	(0.018)	(0.016)	(0.018)	(0.017)	(0.018)	(0.015)	(0.018)
WfH (Female)	0.076***	0.024	0.041*	0.019	0.094***	0.047	0.040	0.038
	(0.024)	(0.025)	(0.023)	(0.025)	(0.034)	(0.033)	(0.032)	(0.031)
Occupation FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupational status	No	No	Yes	Yes	No	No	Yes	Yes
Observations	21392	21392	21392	21392	21392	21392	21392	21392
R-squared	0.549	0.863	0.585	0.864	0.609	0.896	0.650	0.898

Note: The table shows the estimates of OLS regressions and fixed effects regressions based on equation (1). The dependent variables are the log hourly wages (monthly gross wages divided by monthly actual working hours) and log gross monthly wages. Control variables included are as in Table 4. Standard errors are clustered at the individual level, $*p < 0.10, **p < 0.05, ***p < 0.01$. Because wages are in log and WfH is a dummy, the interpretation of the WfH coefficient requires to transform the coefficient using $exp(\beta) - 1$ to obtain the percentage increase in wages.

For women, the positive associations between hourly wages and WfH disappears when

controlling for individual time-invariant characteristics in column (2) and (4). There is also no significant increase in women's monthly earnings according to the FE results in columns (6) and (8). Hence, contrary to men, additional overtime provided by women who take up WfH is mostly uncompensated.

Yet, as we will see below, the average effects on the overall sample in Table 5 hide heterogeneous responses to WfH across sub-groups. In particular, parental status may influence the motives for taking up WfH, the corresponding signal given to employers and the actual productivity when working from home.

Childless employees. Table 6 and 7 show that hours and wage effects differ by parental status. Childless men and women starting WfH increase overtime by 0.9 and 1.2 hours, respectively, but do not increase contractual hours (columns (4) and (5) in Table 6). Moreover, they do not experience any significant wage increase (columns (6) to (8)). In contrast to results on the overall sample in Table 5, additional overtime while WfH is largely uncompensated for childless employees, suggesting that neither positive nor negative productivity or signaling effects of WfH dominate for this group. Hence, both men and women seem to "pay" for the possibility to work from home occasionally by providing around one hour of additional overtime per week. This is in line with evidence that workers are willing to pay for the flexibility to choose their place of work (Mas and Pallais, 2017; He et al., 2019).

Table 6: Effect of WfH on hours worked and wages, employees without children under 16

	Actual hours			Contracted hours	Overtime hours	Hourly wage		Monthly wage
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
WfH (Male)	1.157*	1.066*	0.929	0.008	0.921*	-0.005	-0.009	0.010
	(0.617)	(0.613)	(0.617)	(0.299)	(0.528)	(0.033)	(0.033)	(0.032)
WfH (Female)	1.185	1.076	0.924	-0.367	1.292**	0.009	0.004	0.019
	(0.905)	(0.843)	(0.843)	(0.721)	(0.630)	(0.033)	(0.034)	(0.042)
Occupation FE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupational status	No	No	Yes	Yes	Yes	No	Yes	Yes
Observations	13722	13722	13722	13722	13722	13722	13722	13722
R-squared	0.855	0.859	0.861	0.882	0.736	0.892	0.893	0.923

Note: The table shows the estimates of fixed effects regressions based on equation (1) on the sub-sample of employees without children under 16 years old. Control variables included are as in Table 4. Standard errors are clustered at the individual level, $*p < 0.10, **p < 0.05, ***p < 0.01$.

Parents. Given the findings for childless men, the positive wage effects for men in Table 5 must be driven by fathers. Indeed, Table 7 shows that monthly wages of fathers with children below age 16 increase by 10 percent, even when controlling for occupational status

(see column (8)). This reflects both an increase in hourly wages by 7 percent and a slight increase in working hours by 1.1 hours of which 0.4 hours are additional contractual hours.

Table 7: Effect of WfH on hours worked and wages, employees with children under 16

	Actual hours			Contracted hours	Overtime hours	Hourly wage		Monthly wage
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
WfH (Male)	1.276**	1.258**	1.065*	0.407**	0.658	0.071***	0.067***	0.092***
	(0.603)	(0.583)	(0.570)	(0.179)	(0.545)	(0.022)	(0.021)	(0.021)
WfH (Female)	4.427***	4.410**	3.943**	3.430**	0.513	0.117***	0.115***	0.279***
	(1.575)	(1.733)	(1.819)	(1.575)	(0.612)	(0.042)	(0.041)	(0.077)
Occupation FE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupational status	No	No	Yes	Yes	Yes	No	Yes	Yes
Observations	7670	7670	7670	7670	7670	7670	7670	7670
R-squared	0.899	0.909	0.911	0.927	0.773	0.908	0.909	0.941

Note: The table shows the estimates of fixed effects regressions based on equation (1) on the sub-sample of employees having children under 16 years old. Control variables included are as in Table 4. Standard errors are clustered at the individual level, $*p < 0.10, **p < 0.05, ***p < 0.01$.

For mothers, the findings are similar, but of much greater magnitude. Mothers who start WfH increase their actual hours by 3.9 hours and their contractual hours by 3.4 hours per week (see columns (3) and (4)). This larger response of mothers' compared to fathers' contractual hours may be due to lower average contractual hours among mothers, and thus a greater margin of adjustment. The findings thus support the idea that WfH arrangements may help parents, and mothers in particular, to remain attached to the labour market by extending working hours. Moreover, wage growth is much larger for mothers than for fathers. Monthly wage increases on average by 32 percent. Moreover, the estimates suggest that opting for WfH pays off not only in terms of higher monthly earnings, but also in terms of higher hourly wage rates. In fact, the growth in hourly wages appears to be quite large and we will later examine to what extent simultaneous job changes drive these results.

Comparing the results in Table 6 and 7 suggests that WfH is associated with higher earnings and/or hourly wages only if there is a simultaneous increase in contractual hours, and not if it only coincides with an increase in overtime.[10] Glass and Noonan (2016) make a similar observation for the US.

Finally, note that the results for the overall sample are not a weighted average of the results for childless workers and parents. This is because the sub-samples are defined based on parental status, but parental status can change simultaneously with WfH take

[10]While both childless men and women increase overtime, they do not receive any additional earnings, however parents who mostly increase increase contractual hours do receive higher earnings and/or higher hourly wages.

up as discussed in section 3. Men and women who have their first child and start working from home within the same period are observed in the childless sample before WfH take-up and in the parents sample after WfH take-up. Hence, using the FE estimator, they neither contribute to the coefficient estimates for childless employees nor to the estimates for parents. Table A.3 in the appendix shows the results for men and women who have their first child. Since this is a small group, estimates are mostly insignificant. However, the negative point estimate of contractual hours for mothers might reflect that some women use WfH to return to work earlier after childbearing with reduced hours. For men, we find an insignificant increase in overtime hours and some significant wage increases.

5.2 Robustness of hours and wage effects

In this section, we test whether our main results are robust to addressing selection into paid employment, in addition to a number of further robustness checks.

Addressing selection into paid employment. We first investigate whether our wage estimates suffer from selection bias due to unobserved shocks to individuals' decision to (re)enter paid employment. Indeed, if the population that participates in the labour market is not representative of the overall population, the estimated effects of WfH might be biased. For instance, if women in paid employment have a higher wage potential and are also more likely to use flexible working arrangements, when compared women outside of the labour market, the effect of WfH on wages would be overestimated. Note that we already address an important part of this problem by controlling for any unobserved individual characteristics and preferences that remain constant over time. However, preferences and other determinants of working status may respond to shocks such as a partner's joblessness. In order to tackle such a remaining selection bias, we control for selection bias due to time-varying unobservable characteristics by using a control function approach adapted to the panel data setting, as in Wooldridge (1995), see Appendix B for details.

For the first stage, we use two sets of excluded variables that are assumed to affect selection into employment but not wages: (1) partner employment status and educational level, i.e. determinants of partner's earnings, both interacted with dummies for children in four age groups[11], and (2) education status of the mother of the respondent when aged 15 interacted with partner characteristics. Table B.1 in the appendix shows that these characteristics have a significant impact on the likelihood to be in paid employment (see section B for a detailed description).

[11]This approach has been applied by Dustmann and Rochina-Barrachina (2007) to the estimation of wage returns to experience for women. The excluded restriction they use is based on partner's employment status, partner's income and other household income.

Overall, the effects of WfH on wages, controlling for potential biases due to time-varying selection into paid employment, remain similar to the benchmark results (see Table B.2 in the appendix). The effect of WfH on wages are marginally smaller for fathers and larger for mothers when we correct for selection bias, but the difference is not significant (columns (2) vs. (3) in Panels A and B of Table B.2). We replicate this analysis on the sample of employees without children under the age of 16 in Panels C and D and find no significant differences in the estimated WfH effects when controlling for selection into the labour force. We conclude that individual fixed-effects and the vector of time-varying individual characteristics included in equation (1) already control for characteristics that simultaneously determine labour supply decisions, wages and WfH, such that the WfH estimates are not affected by this type of selection bias.

Additional leave days. Additional hours in response to the possibility of WfH might be compensated with additional days off rather than a wage increase. Columns (1) and (2) in Table 8 show the results of a conditional logit regression with the dependent variable equal to 1 if at least some overtime hours are converted into vacation, which is referred to as compensatory time. Columns (1) and (2) show that starting WfH does not increase the likelihood to use compensatory time, irrespective of gender or presence of children. In columns (3) to (6), we replicate the hourly and monthly wage regressions controlling for the use of time-off to compensate overtime. The main results remain unchanged. Compensation of overtime with days off does not explain the absence of wage increases among childless individuals while the positive wage effects for parents remain in the same magnitude.

Working from home intensity We run a number of further robustness checks in Table A.4 in the appendix. We start with exploring how the intensity of working from home affects the results. Panel A reports the benchmark results with WfH at least once a month, while Panel B shows results for the 60 percent of them with WfH at least once a week. The estimates turn out to be very similar, especially for women. For fathers, working from home on a weekly basis appears to have a much larger effect on overtime hours than on contracted hours. Because of this, the hourly wage estimate becomes smaller and insignificant, while the monthly wage estimate is still positive and statistically significant.

More regional and household characteristics As shown in Table A.5 in the appendix, our results also turn out to be robust when conditioning on additional variables whose omission could induce biases. Panel A displays results controlling for state $\times$ year fixed-effects to control for any regional trends that might be influenced by regional policies

Table 8: Effect of WfH on overtime compensation

	All employees		W/o children under 16		With children under 16	
	Compensatory time Conditional Logit		Hourly wage FE	Monthly wage FE	Hourly wage FE	Monthly wage FE
	(1)	(2)	(3)	(4)	(5)	(6)
WfH (Male)	-0.148	-0.140	-0.007	0.014	0.066***	0.090***
	(0.269)	(0.277)	(0.034)	(0.033)	(0.022)	(0.021)
WfH (Female)	-0.006	0.013	0.001	0.019	0.119***	0.279***
	(0.297)	(0.301)	(0.034)	(0.042)	(0.041)	(0.077)
WfH (male)	-0.005	-0.086				
×child under 16	(0.384)	(0.390)				
WfH (female)	0.153	0.113				
×child under 16	(0.419)	(0.425)				
Time-off			-0.030***	0.002	-0.010	0.016**
			(0.007)	(0.007)	(0.008)	(0.008)
Time-off × Female			-0.004	0.006	-0.059***	-0.015
			(0.010)	(0.011)	(0.015)	(0.018)
Occupation FE	No	Yes	Yes	Yes	Yes	Yes
Occupational status	No	Yes	Yes	Yes	Yes	Yes
Observations	10224	10224	13541	13541	7579	7579
R-squared			0.895	0.924	0.911	0.942

Note: Control variables included are as in Table 4. Standard errors are clustered at the individual level, $*p < 0.10, **p < 0.05, ***p < 0.01$.

or labour market conditions. In Panel B, we control for partner's employment status and earnings, as well as their interaction with a gender dummy, since WfH take-up might be a response to partner's employment changes. In Panel C, focusing on the sample of parents with children under 16, we add the number of childcare places at the federal state level for children aged 0-3 and 3-6, as well as places in after school programs for children in primary school, interacted with dummies for having children in the corresponding age group. We do so because the WfH effect on the extension of working hours might be stronger for parents who lack alternative institutional childcare. Yet, the estimated effects of WfH remain robust.

Commuting In Table A.6 we further control for commuting distance. While the baseline results on the sub-sample of individuals with information on commuting become less precise (Panel A), controlling for commuting distance does not affect the results (Panel B). In particular, the large positive effect of WfH on mothers' contractual hours remains unchanged. Moreover, we find that an increase in commuting distance reduces contractual hours for this group, just as predicted by theoretical models on the time cost of working

and the intensive margin of the labour supply.[12]

Occupational characteristics We also take into account time-varying occupational characteristics such as task composition and computer use that may affect both productivity and the availability of WfH arrangements. We thus compute occupational level averages of computer use and five groups of job tasks from several employment surveys carried out by the Federal Institute for Vocational Education and Training (BiBB) and include these as further control variables.[13] The results turn out to be very similar to the baseline estimates.[14]

5.3 The role of career changes

Changing firm or changing job position within the firm may lead to simultaneous changes in wages, hours and working from home status. For example, an individual may move to a more innovative and productive firm, and negotiate both a higher wage and the possibility of WfH. Similarly, a new position within the firm might be associated with a change in tasks or responsibilities, including a higher probability of working from home and an increase in working hours and wages. Note that we already control for job change and job status in all regressions. However, this may not be sufficient to ensure that the results are not driven by such career changes. We thus explore this issue in Table 9. Compared to the benchmark results in Panel A, Panel B replicates the analysis for employees who remain in the same firm and Panel C on those employees who remain in the same position in the same firm.

Comparing Panel A and Panel B for childless individuals in columns (1) to (4), we see that the benchmark results remain unchanged when we exclude those who have changed employer. The increase in overtime hours remains significant both for childless men and women staying with the same firm when taking-up WfH. However, looking at the effect for those who remain in the same position within the firm in panel C, the positive effect on overtime hours decreases and becomes insignificant for men. This suggests that a simultaneous change in position with WfH take-up explains part of the increase in hours worked for childless men. Childless women, however, also increase overtime hours with WfH while remaining in the same position.

[12] However, when including interaction terms between WfH and commuting distance, we do not find that the WfH effects differ significantly across employees with different commuting distances.

[13] Since the waves of the BiBB employment survey do not match all SOEP waves that we use in the analysis, we exclude the 1999 wave from the analysis and merge waves from the BiBB survey carried out 2 to 5 years before the remaining four SOEP waves.

[14] Results available upon request.

Table 9: Effect of WfH on hours and wages excluding job changes

	Without children under 16				With children under 16			
	Contracted hours (1)	Overtime hours (2)	Hourly wage (3)	Monthly wage (4)	Contracted hours (5)	Overtime hours (6)	Hourly wage (7)	Monthly wage (8)
Panel A: Baseline regressions								
WfH (Male)	0.008	0.921*	-0.009	0.010	0.407**	0.658	0.067***	0.092***
	(0.299)	(0.528)	(0.033)	(0.032)	(0.179)	(0.545)	(0.021)	(0.021)
WfH (Female)	-0.367	1.292**	0.004	0.019	3.430**	0.513	0.115***	0.279***
	(0.721)	(0.630)	(0.034)	(0.042)	(1.575)	(0.612)	(0.041)	(0.077)
Observations	13722	13722	13722	13722	7670	7670	7670	7670
R-squared	0.882	0.736	0.893	0.923	0.927	0.773	0.909	0.941
Panel B: Excluding employer changes								
WfH (Male)	0.207	1.081*	-0.014	0.017	0.387*	0.928	0.091***	0.121***
	(0.270)	(0.564)	(0.037)	(0.035)	(0.213)	(0.683)	(0.029)	(0.027)
WfH (Female)	0.312	1.053*	0.020	0.052	4.670***	0.839	0.045	0.250***
	(0.603)	(0.631)	(0.026)	(0.033)	(1.601)	(0.836)	(0.044)	(0.086)
Observations	11670	11670	11670	11670	6419	6419	6419	6419
R-squared	0.912	0.781	0.911	0.939	0.951	0.811	0.929	0.957
Panel C: Excluding changes of employer and position within firm								
WfH (Male)	0.194	0.797	-0.016	0.009	0.446**	0.776	0.101***	0.129***
	(0.283)	(0.595)	(0.039)	(0.037)	(0.225)	(0.753)	(0.033)	(0.030)
WfH (Female)	0.285	1.104*	0.024	0.057*	4.202***	0.173	0.043	0.215**
	(0.608)	(0.628)	(0.026)	(0.032)	(1.628)	(0.772)	(0.048)	(0.091)
Observations	11437	11437	11437	11437	6277	6277	6277	6277
R-squared	0.916	0.784	0.913	0.940	0.952	0.813	0.929	0.958

Note: The table shows the estimates of fixed effects regressions based on equation (1). Panel B refers to the sub-sample of individuals not changing the employer compared to the previous observed wave. Panel C refers to the sub-sample of individuals not changing employer nor position within the firm. Control variables included are as in Table 4 and include occupational status and occupation fixed effects. Standard errors are clustered at the individual level, $*p < 0.10, **p < 0.05, ***p < 0.01$.

Turning to the effect for parents in columns (5) to (8), we see that the large increase in contractual hours, and thus monthly wages, is not driven by people who change employer or job position. However, the positive hourly wage effect for mothers is entirely driven by mothers who access WfH when changing employer (in column (7) the WfH effect turns insignificant for women in Panel B). Fathers still experience an increase in hourly wages with WfH when remaining in the same firm, and even in the same position (column (7)). This may indicate that it is more difficult for mothers than for fathers to re-negotiate wages when remaining in the same firm. This might reflect that employers have gendered perceptions regarding the underlying motives for working from home and the implied productivity

as suggested by experimental evidence in Leslie et al. (2012). In addition to gendered perceptions on WfH-related productivity, employers might perceive mothers' fall-back options outside the firm to be poorer than fathers', hence reducing their bargaining power. Finally, fathers might be more likely to initiate wage negotiations with their employer. Leibbrandt and List (2015) find that when there is no explicit statement that wages are negotiable, men are more likely to negotiate for a higher wage, whereas women are more likely to signal their willingness to work for a lower wage.

All in all, the results for employees taking up WfH without changing job are very similar to the baseline results. Only the effects on hourly wages of mothers are smaller and statistically insignificant. Hence, the positive effect of WfH for mothers may be partially driven by positively selected mothers who change employer and bargain both higher hourly wages and the possibility to work from home.

5.4 Effects on job and life satisfaction

If workers attach a positive value to WfH, we should find a higher job satisfaction once wage and hours adjustments are taken into account. The latter is important, as such adjustments might be compensating for the additional utility associated with WfH. Hence, we follow the literature and control for earnings, the number of hours worked and also allow for heterogeneous effects across gender (see e.g. Clark and Oswald, 1996). Moreover, as before, we account for individual fixed-effects which have been shown to be particularly important when estimating the determinants of satisfaction because of unobservable personality traits (Ferrer-i Carbonell and Frijters, 2004).

Table 10 provides the corresponding estimates for the effect of WfH on job and life satisfaction, as measured on a 11-point Likert scale. Columns (1) to (4) show the effect of WfH at least once a month for workers with and without children below age 16. The OLS results, not reported here, show that job satisfaction tends to be higher among those WfH. However, the increase in job satisfaction for those who take-up WfH arrangements is not significant for men and women irrespective of their parental status, although point estimates are positive for all groups (columns (1) and (3)). The coefficients for wages and hours have the expected signs, and are mostly significant. Given the typical noise in measures of job satisfaction, effects may become clearer if WfH were to be done on a more regular basis. Hence, columns (5) to (8) replicate the analysis when working from home is done at least once a week. For childless employees, job satisfaction significantly increases for both genders when using the weekly WfH indicator. The effect corresponds to a 10 percent increase in the average job satisfaction of childless women, and a 6 percent increase in the average job satisfaction of childless men. In contrast, the corresponding coefficients

Table 10: Effect of WfH on job and life satisfaction

	Monthly WfH				Weekly WfH			
	W/o children < 16		W. children < 16		W/o children < 16		W. children < 16	
	Job sat. (1)	Life sat. (2)	Job sat. (3)	Life sat. (4)	Job sat. (5)	Life sat. (6)	Job sat. (7)	Life sat. (8)
WfH (Male)	0.157	0.275**	0.146	0.152	0.405*	0.131	-0.031	-0.250
	(0.169)	(0.137)	(0.218)	(0.149)	(0.215)	(0.136)	(0.328)	(0.205)
WfH (Female)	0.323	-0.190	0.379	-0.124	0.724*	-0.105	0.633	0.084
	(0.301)	(0.198)	(0.357)	(0.241)	(0.382)	(0.260)	(0.401)	(0.325)
Log monthly wage	0.298*	0.391***	0.489**	0.279*	0.301*	0.392***	0.500**	0.295*
× Male	(0.172)	(0.121)	(0.219)	(0.152)	(0.172)	(0.121)	(0.219)	(0.152)
Log monthly wage	0.251	0.194	0.324	0.192	0.261	0.191	0.324	0.182
× Female	(0.165)	(0.123)	(0.239)	(0.165)	(0.165)	(0.123)	(0.238)	(0.165)
Contracted hours	-0.009	-0.009	-0.019	-0.014	-0.009	-0.008	-0.018	-0.014
× Male	(0.013)	(0.009)	(0.015)	(0.014)	(0.013)	(0.009)	(0.015)	(0.014)
Contracted hours	-0.010	-0.003	-0.027*	-0.014	-0.010	-0.003	-0.027*	-0.015
× Female	(0.009)	(0.006)	(0.014)	(0.009)	(0.009)	(0.006)	(0.014)	(0.009)
Overtime hours	-0.008	-0.014**	-0.006	-0.008	-0.009	-0.014**	-0.006	-0.007
× Male	(0.009)	(0.006)	(0.010)	(0.008)	(0.009)	(0.006)	(0.010)	(0.008)
Overtime hours	-0.023*	-0.017**	-0.008	0.004	-0.023*	-0.017**	-0.008	0.004
× Female	(0.012)	(0.008)	(0.020)	(0.016)	(0.012)	(0.008)	(0.020)	(0.016)
Occupation FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupational status	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	13651	13704	7640	7662	13651	13704	7640	7662
R-squared	0.691	0.741	0.703	0.752	0.691	0.741	0.703	0.752

Note: The table shows the estimates of fixed effects regressions based on equation (1). Columns (3) and (4) refer to the sub-sample without children under 16. Columns (5) and (6) refer to the sub-sample having children under 16. The dependent variables are job and life satisfaction measured on a 11-point Likert scale. Control variables included are as in Table 4. Standard errors are clustered at the individual level, $*p < 0.10, **p < 0.05, ***p < 0.01$.

for parents with children below age 16 are not statistically significant, even if the point estimate is quite high for mothers.

While we find conclusive evidence that workers, especially when childless, attach a positive value to WfH, effects for life satisfaction tend to be insignificant and often lower in terms of point estimates than the effects on job satisfaction. The only exception is childless men for whom working from home occasionally seems to increase life satisfaction. For all other groups no such effect can be found. Compared to the slightly positive effects on job satisfaction, this might indicate that WfH actually exerts some negative impact on the private domain, for instance, due to new conflicts between the job and the private sphere.

6 Concluding remarks

In the last two decades, working arrangements have become more flexible, opening up new options regarding when and where to work. Given the growing importance of working from home in the last two decades, there is remarkably little research on how WfH affects careers and on how it varies with workers' characteristics. Moreover, apart from very few experiments on specific samples, much of the literature suffers from unresolved endogeneity issues and has not sufficiently explored differences between groups that are likely to respond differently to the opportunity to work from home.

In order to close this research gap, this paper investigates how WfH affect men's and women's careers in terms of working hours and labour earnings and further distinguishes effects by parental status. Controlling for workers' observed and unobserved heterogeneity, we find that men and women without children below age 16 use WfH to increase overtime hours and experience a somewhat higher job satisfaction despite not obtaining any significant wage increase in the short to medium run.

Among parents, WfH take-up comes with increased contractual hours, higher monthly earnings, and higher hourly wages. Moreover, the increase in contractual hours is much stronger among mothers than among fathers, and explains in part the larger increase in monthly earnings for mothers than for fathers. The growth in hourly wages of 12 percent for women, however, is driven by women who simultaneously change employers and take-up WfH. Fathers experience an increase in hourly wages of 7 percent even if they remain in the same firm. Conditioning on these changes, job satisfaction among parents increases in the same range as for non-parents, but effects are not significant. This may indicate that WfH-related conflicts between the job and the private domain may be more severe for parents.

All in all, our results are consistent with much of the existing literature, and provide important new insights. In line with Mas and Pallais (2017) and Angelici and Profeta (2020), we find evidence that workers attach a positive value to the additional flexibility provided by WfH. However, the evidence is conclusive only for workers without children under the age of 16 and we cannot confirm any significant gender differences. Similar to previous papers such as Noonan and Glass (2012) and Possenriede et al. (2016), we find WfH to increase overtime hours. However, extended overtime seems to be the main response only among employees without children under 16 years old and it does not lead to wage gains. Another novel finding indicates that WfH has large and significant effects on contractual hours and monthly earnings for mothers, and to a smaller extent for fathers, with children under 16 years old.

WfH hence proves to be a means of raising mothers' labour force attachment. Yet,

our results also indicate that mothers, in contrast to their male counterparts, do not benefit from higher hourly wages when remaining in the same firm. This may indicate that their bargaining power is weaker than men's for re-negotiating wages when adopting WfH within established employer-employee relationships. On the one hand, this might reflect that employers act on gendered preconceptions regarding the motives for WfH and the expected productivity effects or the actual productivity effects of WfH differ by gender. On the other hand, it might indicate that mothers are more reluctant to ask for an hourly wage increase than their male counterparts when changing working arrangements. Hence, while to some extent WfH can be a means to close gender differences in terms of working hours and monthly earnings, it does not necessarily help to close the gender difference in hourly wages.

From a policy perspective, promoting WfH may thus be helpful in strengthening women's careers. Yet, the findings also indicate that the promotion of WfH practices should be accompanied by equal pay measures, such as the need for employers to provide information on the wages of male colleagues with similar work-related characteristics. In Germany such a law was introduced in 2017, but its impact remains to be evaluated.

Finally, WfH is likely to be of consistently increasing importance after the Covid-19 pandemic. Due to the need to explore new or better ways to work remotely and remain connected with colleagues and clients, the productivity of WfH is likely to increase in the future, as well as its acceptance as a substitute for onsite work and business trips. This might also weaken gendered perceptions regarding WfH, thereby also potentially contributing to closing the gender gap in the wage returns to WfH. Hence, re-evaluating the effects of WfH after the Covid-19 crisis would be an interesting route for future research.

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A Additional tables

Table A.1: Share of employees working from home by industries

Industry 1-digit	Employment share	Share WfH	Male WfH	Female WfH
Services	.47	.15	.18	.13
Agriculture, Forestry	.01	.11	.12	.11
Bank, Insurance	.04	.07	.07	.07
Construction	.12	.07	.06	.10
Manufacturing	.19	.05	.04	.06
Transport	.05	.05	.04	.08
Trade	.11	.03	.05	.01
Energy, Water	.01	0	0	0
Mining	.003	0	0	0

Notes: Data for 2014 only. Share of employees working from home (WfH) at least once a month. Industries are ranked by their share of employees working from home.

Table A.2: Share of employees working from home by occupations

Occupation 2-digit KldB	Employment share	Share WfH	Male WfH	Female WfH
Teachers	.047	.65	.66	.65
Managers, consultants	.048	.23	.20	.27
Accountants, data processing specialists	.066	.18	.27	.09
Senior officials	.037	.15	.18	.11
Engineers	.035	.12	.13	.05
Social work associate professionals	.068	.09	.10	.09
...				
Surface transport occupations	.021	.01	.01	0
Warehouse workers	.024	.01	.01	0
Protective services workers	.023	.01	.02	0
Goods examiner, despatchers	.01	0	0	0
Metal workers	.01	0	0	0
Cleaning occupations	.017	0	0	0
Autonomy level				
Highest	.04	.48	.39	.60
High	.25	.21	.18	.24
Middle	.38	.06	.07	.06
Low	.25	.02	.01	.03
Lowest	.08	.01	0	.02
Tasks & Tools				
Analytical task above 75th perc	.26	.13	.18	.09
Analytical task below 25th perc	.25	.02	.01	.02
PC use above 75th perc	.28	.11	.16	.07
PC use below 25th perc	.26	.03	.02	.04

Notes: Data for 2014 only. Share of employees working from home at least once a month. Occupations are ranked by their share of employees working from home. The top panel displays the five occupations with the highest and the lowest share of employees working from home. Only occupations representing at least 1% of the employee population are presented here. The third panel displays occupations by their task/tools intensity. In the occupation with the use of personal computer (PC) at the 75th percentile, 83% of employees report that a PC is their main working tool. In the occupation at the 25th percentile of PC use, 9% of employees report that their main working tool is a PC.

Table A.3: Effect of WfH on worked hours and wages, employees getting the first child

	Actual hours			Contracted hours	Overtime hours	Hourly wage		Monthly wage
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
WfH (Male)	0.881	1.450	0.998	0.086	0.912	0.118**	0.131**	0.155***
	(0.925)	(1.067)	(1.024)	(0.610)	(0.829)	(0.059)	(0.060)	(0.058)
WfH (Female)	-1.890	-0.724	-1.762	-2.079	0.316	0.041	0.049	-0.044
	(2.045)	(2.246)	(2.140)	(1.779)	(0.926)	(0.087)	(0.094)	(0.135)
Occupation FE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupational status	No	No	Yes	Yes	Yes	No	Yes	Yes
Observations	1629	1629	1629	1629	1629	1629	1629	1629
R-squared	0.839	0.866	0.876	0.872	0.797	0.895	0.902	0.906

Note: The table shows the estimates of fixed effects regressions based on equation (1) on the sub-sample of employees observed just before and after becoming parents for the first time. Control variables included are as in Table 4. Standard errors are clustered at the individual level, $*p < 0.10, **p < 0.05, ***p < 0.01$.

Table A.4: Effect of weekly WfH

	Without children under 16				With children under 16			
	Contracted hours (1)	Overtime hours (2)	Hourly wage (3)	Monthly wage (4)	Contracted hours (5)	Overtime hours (6)	Hourly wage (7)	Monthly wage (8)
Panel A: Baseline regressions								
WfH (Male)	0.008	0.921*	-0.009	0.010	0.407**	0.658	0.067***	0.092***
	(0.299)	(0.528)	(0.033)	(0.032)	(0.179)	(0.545)	(0.021)	(0.021)
WfH (Female)	-0.367	1.292**	0.004	0.019	3.430**	0.513	0.115***	0.279***
	(0.721)	(0.630)	(0.034)	(0.042)	(1.575)	(0.612)	(0.041)	(0.077)
Observations	13722	13722	13722	13722	7670	7670	7670	7670
R-squared	0.882	0.736	0.893	0.923	0.927	0.773	0.909	0.941
Panel B: Working from home at least once a week								
Weekly WfH (Male)	-0.354	1.082	-0.026	-0.015	0.283	1.681**	0.020	0.062**
	(0.398)	(0.673)	(0.038)	(0.038)	(0.238)	(0.711)	(0.027)	(0.025)
Weekly WfH (Female)	-0.248	1.686**	-0.057	-0.033	3.813*	0.372	0.129**	0.277***
	(1.068)	(0.817)	(0.047)	(0.062)	(2.123)	(0.747)	(0.062)	(0.108)
Observations	13722	13722	13722	13722	7670	7670	7670	7670
R-squared	0.882	0.736	0.893	0.923	0.927	0.774	0.909	0.941

Note: Standard errors in parentheses, $*p < 0.10, **p < 0.05, ***p < 0.01$. Control variables included are as in Table 4.

Table A.5: Effect of WfH on hours and wages, more controls

	Without children under 16				With children under 16			
	Contracted hours (1)	Overtime hours (2)	Hourly wage (3)	Monthly wage (4)	Contracted hours (5)	Overtime hours (6)	Hourly wage (7)	Monthly wage (8)
Panel A: Baseline regressions controlling for state×year effects								
WfH (Male)	0.073	0.458	-0.028	-0.012	0.390**	0.466	0.078***	0.098***
	(0.299)	(0.679)	(0.045)	(0.044)	(0.199)	(0.572)	(0.022)	(0.022)
WfH (Female)	-0.298	1.525**	0.002	0.029	3.221**	0.118	0.111**	0.274***
	(0.867)	(0.752)	(0.043)	(0.053)	(1.284)	(0.634)	(0.044)	(0.070)
Observations	9226	9226	9226	9226	6762	6762	6762	6762
R-squared	0.915	0.796	0.917	0.944	0.943	0.787	0.919	0.950
Panel B: Adding partner's characteristics								
WfH (Male)	0.089	0.490	-0.019	-0.001	0.420**	0.458	0.075***	0.096***
	(0.299)	(0.676)	(0.043)	(0.042)	(0.202)	(0.572)	(0.022)	(0.022)
WfH (Female)	-0.250	1.499**	0.000	0.028	3.329***	0.171	0.111**	0.280***
	(0.861)	(0.750)	(0.043)	(0.053)	(1.271)	(0.630)	(0.044)	(0.070)
Partner in employment	-0.160	0.102	-0.027*	-0.032**	-0.366**	-0.105	-0.016	-0.024*
	(0.197)	(0.321)	(0.016)	(0.015)	(0.159)	(0.246)	(0.013)	(0.013)
...×female	0.660*	-0.516	0.015	0.030	-0.255	0.382	-0.002	-0.026
	(0.343)	(0.384)	(0.021)	(0.023)	(0.933)	(0.481)	(0.034)	(0.049)
Partner's earnings	0.000	0.000	0.000***	0.000***	-0.000	0.000	0.000**	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
... ×female	-0.000	-0.000	-0.000***	-0.000***	-0.000	-0.000	-0.000	-0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	9226	9226	9226	9226	6762	6762	6762	6762
R-squared	0.915	0.796	0.917	0.944	0.943	0.787	0.920	0.950
Panel C: Adding child care availability depending on child's age								
WfH (Male)					0.419**	0.456	0.075***	0.096***
					(0.203)	(0.569)	(0.022)	(0.022)
WfH (Female)					3.322***	0.125	0.113**	0.281***
					(1.266)	(0.639)	(0.044)	(0.070)
Child care places per 100 children								
...below 3 yrs'					0.010	-0.019	0.001	0.000
					(0.012)	(0.016)	(0.001)	(0.001)
...between 3 to 6 yrs'					-0.003	0.009	-0.000	-0.000
					(0.005)	(0.006)	(0.000)	(0.000)
...between 6 to 10 yrs'					0.004	0.002	-0.000	-0.000
					(0.004)	(0.004)	(0.000)	(0.000)
Observations					6762	6762	6762	6762
R-squared					0.943	0.788	0.920	0.950

Note: Standard errors in parentheses, $*p < 0.10, **p < 0.05, ***p < 0.01$. Control variables included are as in Table 4.

Table A.6: Effect of WfH on hours and wages, controlling for commuting distance

	Without children under 16				With children under 16			
	Contracted hours (1)	Overtime hours (2)	Hourly wage (3)	Monthly wage (4)	Contracted hours (5)	Overtime hours (6)	Hourly wage (7)	Monthly wage (8)
Panel A: Baseline regressions, commuting sub-sample								
WfH (Male)	-0.035	0.718	-0.034	-0.021	0.306*	0.849	0.077***	0.103***
	(0.326)	(0.564)	(0.035)	(0.033)	(0.177)	(0.589)	(0.023)	(0.022)
WfH (Female)	-0.101	0.780	0.005	0.017	3.807**	0.136	0.128***	0.295***
	(0.694)	(0.608)	(0.033)	(0.040)	(1.669)	(0.668)	(0.048)	(0.082)
Observations	12882	12882	12882	12882	7070	7070	7070	7070
R-squared	0.894	0.753	0.900	0.929	0.936	0.784	0.917	0.948
Panel B: Adding commuting distance								
WfH (Male)	-0.038	0.738	-0.036	-0.024	0.282	0.817	0.074***	0.099***
	(0.328)	(0.557)	(0.035)	(0.034)	(0.180)	(0.591)	(0.022)	(0.022)
WfH (Female)	-0.093	0.777	0.006	0.018	3.808**	0.136	0.128***	0.295***
	(0.692)	(0.609)	(0.033)	(0.040)	(1.671)	(0.664)	(0.048)	(0.082)
Commuting distance (in km)	0.003	0.004	-0.000	-0.000	0.005	0.002	0.000*	0.001**
	(0.002)	(0.003)	(0.000)	(0.000)	(0.006)	(0.005)	(0.000)	(0.000)
...×female	0.009	0.003	0.000	0.001	-0.052**	0.013	0.000	-0.001
	(0.007)	(0.007)	(0.000)	(0.000)	(0.023)	(0.013)	(0.001)	(0.001)
Commuting distance squared	-0.000	-0.000	0.000**	0.000	-0.000	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
...×female	-0.000	-0.000	-0.000	-0.000	0.000***	-0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	12882	12882	12882	12882	7070	7070	7070	7070
R-squared	0.895	0.754	0.900	0.929	0.936	0.786	0.918	0.948

Note: Standard errors in parentheses, $*p < 0.10, **p < 0.05, ***p < 0.01$. Control variables included are as in Table 4.

B Model with correlated individual effects and correction for selection into work

Here we follow Wooldridge (1995) and present a model that accounts for correlated individual effects, as well as dealing with potential selection bias due to shocks to individuals' decision to work. We use this method to estimate the effect of WfH on wages accounting for the fact that men and women in paid employment may have different potential wages than men and women out of the labour force.

The model is composed of an outcome equation, in this case the wage equation, and a selection equation, in this case selection into paid employment.

$$y_{it} = \boldsymbol{x}_{1it}\boldsymbol{\beta}_1 + \boldsymbol{x}_{2it}\boldsymbol{\beta}_2 + \theta_t + \alpha_i + u_{it} \qquad t = 1, ...T \tag{2}$$

$$h^*_{it} = \boldsymbol{x}_{1it}\boldsymbol{\gamma}_1 + \boldsymbol{z}_{it}\boldsymbol{\gamma}_2 + \eta_i + v_{it} \text{and } s_{it} = \mathbb{1}[h^*_{it} > 0] \tag{3}$$

where y_{it} is the outcome of individual i at time t, h^*_{it} is the hours worked by individual i in year t. Because h^*_{it} is unobserved for people who are not working in year t, we use an indicator variable s_{it} which is equal to one if individual i is working (i.e. has a strictly positive number of worked hours at time t) and zero if individual i is not working. The vector $\boldsymbol{x}_1$ includes variables that appear in both the outcome and the selection equation, while the vector $\boldsymbol{x}_2$ appears only in the outcome equation. $\boldsymbol{z}$ is the vector of excluded variables that appear only in the selection equation. θ_t is a set of time fixed effects. In both equations we account for time invariant individual unobserved characteristics, α_i in equation (2) and η_i in equation (3).

We use Chamberlain's approach to panel data models to control for individual unobservable characteristics and at the same time deal with self-selection into the work force. In this setting we make the following assumptions. First, following Chamberlain (1984), Wooldridge (1995) and Wooldridge (2010), the conditional expectation of the individual effects in the outcome equation and in the selection equation are linear functions of the mean of the observable variables :

$$\eta_i = \overline{\boldsymbol{x}}_{1i}\boldsymbol{\delta}_1 + \overline{\boldsymbol{z}}_i\boldsymbol{\delta}_2 + e_i,$$

$$E(\alpha_i|\boldsymbol{x}_i, \boldsymbol{z}_i, \varepsilon_{it}) = \overline{\boldsymbol{x}}_{1i}\tilde{\boldsymbol{\phi}}_1 + \overline{\boldsymbol{x}}_{2i}\tilde{\boldsymbol{\phi}}_2 + e_i.$$

Second, the errors in the selection equation (3) $\varepsilon_{it} = e_i + v_{it}$ are independent of $\boldsymbol{z}_i$.

Third, the errors in the outcome equation (2) u_{it} are mean independent of $(\boldsymbol{x}_i, \boldsymbol{z}_i)$ conditional on the errors in the selection equation (3) ε_{it} ; and the conditional expectations of u_{it} is linear in ε_{it} :

$$E(u_{it}|\boldsymbol{x}_i, \boldsymbol{z}_i, \varepsilon_{it}) = E(u_{it}|\varepsilon_{it}) = \rho_t \varepsilon_{it}.$$

As we do not observe h^*_{it} but only s_{it}, we use the selection indicator and transform the last expression into : $E(u_{it}|\boldsymbol{x}_i, \boldsymbol{z}_i, s_{it=1}) = \rho_t E(\varepsilon_{it}|\boldsymbol{x}_i, \boldsymbol{z}_i, s_{it=1})$.

Under the previous assumptions, we obtain:

$$E(\alpha_i + u_{it}) = E(c_i|\boldsymbol{x}_i, \boldsymbol{z}_i, s_{it=1}) + E(u_{it}|\boldsymbol{x}_i, \boldsymbol{z}_i, s_{it=1})$$

$$= \overline{\boldsymbol{x}}_i \psi + \rho_t E(\varepsilon_{it}|\boldsymbol{x}_i, \boldsymbol{z}_i, s_{it=1}).$$

We thus estimate the following model:

$$y_{it} = \boldsymbol{x}_{1it}\boldsymbol{\beta}_1 + \boldsymbol{x}_{2it}\boldsymbol{\beta}_2 + \overline{\boldsymbol{x}}_i \psi + \rho_t \lambda(s_{it}) + \theta_t + \mu_{it} \tag{4}$$

where $\lambda(s_{it}) = E(\varepsilon_{it}|\boldsymbol{x}_i, \boldsymbol{z}_i, s_{it=1})$. The vector $\boldsymbol{x}_1$ includes the educational degree, demographic characteristics, namely age and its square, marital status, migration background, and number of children in three age groups. Theses characteristics are interacted with a female dummy to allow for heterogenous effects across men and women. The vector $\boldsymbol{x}_2$ appears only in the outcome equation and includes the following job characteristics interacted with a female dummy: public sector, size of the firm, tenure in the firm and its square, full-time and part-time experience in years. We also control for gender-specific industry, occupation and occupational status fixed-effects.

To get estimates of $\lambda(s_{it})$ we first run the following probit model on a paid employment dummy s_{it} for each time period t and separately for men and for women :

$$P(s_{it} = 1|\boldsymbol{x}_{1i}, \boldsymbol{z}_i, \eta_i) = \Phi(\boldsymbol{x}_{1it}\boldsymbol{\gamma}_1 + \boldsymbol{z}_{it}\boldsymbol{\gamma}_2 + \overline{\boldsymbol{x}}_{1i}\boldsymbol{\delta}_1 + \overline{\boldsymbol{z}}_i\boldsymbol{\delta}_2) \tag{5}$$

where $\boldsymbol{x}_1$ is defined as above and the vector of excluded variables $\boldsymbol{z}$ includes parnter's employment status and educational level, a determinant of partner's earning, both interacted with dummies for children in four age groups. In another specification, we consider the case in which children may directly affect wages and use instead, the education level of the mother's of the surveyed individual when she/he was 15 years old. We interact the mother's education with partner's employment and education level. We then compute

$\lambda(s_{it}) = \frac{\phi(s_{it})}{\Phi(s_{it})}$ where ϕ is the standard density function and Φ is the standard cumulative distribution function.

The results of this first step on the pooled sample of years are reported in Table B.1.[15] We show results with the two sets of excluded variable: 1) partner's characteristics and their interaction with children 2) partner's characteristics and their interaction with the education of the mother of the surveyed individual. Note that children are in all regressions but not in the set of excluded variables because we also control for children in the wage regressions. Column (1) and (2) in Table B.1 report the results on the female probability of being in paid employment while column (3) and (4) report the results for men. The female probability of being in paid employment decreases significantly with the number of children, especially if the children are young. The impact of children on men's probability of working is much smaller, and insignificant in most cases. For women and men, the negative effect of young children on the probability of working is stronger if the partner is in paid employment. Column (2) and (4) show that having a mother with a higher level of education increases the probability of being in paid employment. For women, the effect is especially strong if they have a partner with a high level of education. For men, the effect of their mother's education does not depend on the characteristics of their partner.

In a second step, we estimate equation 4 adding the control function $\lambda(s_{it})$ previously estimated. The results on the different samples are reported in Table B.2. The sample size is smaller here because we drop individuals with missing information on the excluded variables used in the first step. Results on the sample of parents with children under the age of 16 are reported in Panel A and B, while results for childless employees are reported in Panels C and D. Similarly to our main specification, the regressors include demographic characteristics, job characteristics, as well as gender-specific industry, occupation and occupational status fixed-effects. It is now augmented with a control function to correct for the selection bias. We allow the effect of the control function to vary by gender and time.

[15] Results by year are available upon request.

Table B.1: Probability to work, by gender

Excluded variables: characteristics of	Women		Men	
	Partner & children (1)	Partner & mother (2)	Partner & children (3)	Partner & mother (4)
Children under age 3	-1.498***	-1.903***	0.088	-0.033
	(0.076)	(0.045)	(0.064)	(0.060)
Children aged between 3 and 6	-1.151***	-1.406***	-0.246*	-0.319**
	(0.114)	(0.101)	(0.140)	(0.141)
Children between 6 and 15	-0.760***	-0.894***	0.010	-0.102
	(0.075)	(0.057)	(0.082)	(0.076)
Has children aged 16 or older	-0.572***	-0.650***	-0.012	-0.057
	(0.078)	(0.067)	(0.094)	(0.089)
Living with a partner/married	-0.055	-0.105*	-0.096*	-0.107*
	(0.052)	(0.056)	(0.056)	(0.061)
Partner has vocational degree	-0.067	-0.176***	0.075	0.040
	(0.047)	(0.068)	(0.047)	(0.078)
Partner has tertiary education degree	-0.037	-0.314**	0.141	0.179
	(0.076)	(0.134)	(0.100)	(0.198)
Partner in paid employment	0.185***	0.082	0.187***	0.124**
	(0.058)	(0.054)	(0.052)	(0.055)
... × teriary education	0.096	0.113*	0.044	0.047
	(0.064)	(0.068)	(0.076)	(0.081)
... × vocational education	-0.024	-0.027	-0.052	-0.068
	(0.049)	(0.053)	(0.051)	(0.054)
... × children under 3	-0.460***		-0.416***	
	(0.074)		(0.078)	
... × children aged 3-5	-0.257***		-0.159**	
	(0.073)		(0.072)	
... × children aged 6-15	-0.146**		-0.155***	
	(0.060)		(0.057)	
... × children above 16	-0.088*		-0.019	
	(0.052)		(0.057)	
Mother's years of education		0.079***		0.201***
		(0.028)		(0.027)
... × Partner in employment		-0.012		-0.031
		(0.031)		(0.036)
... × Partner has tertiary degree		0.229***		0.006
		(0.081)		(0.116)
...× Partner has vocational degree		0.107**		0.068
		(0.047)		(0.061)
Observations	67247	61954	55329	51427

Note: Standard errors in parentheses, $*p < 0.10, **p < 0.05, ***p < 0.01$. Additional control variables included are age and its square, migration background, cohort fixed effects, regions and year fixed-effects and urban area. We also control for individual effects using Chamberlain approach and add the time average of all explanatory variables.

Table B.2: Effect of WfH on wages controlling for selection into the labour force

	Hourly wage			Monthly wage	
	FE	CRE	CRE	CRE	CRE
	(1)	(2)	(3)	(4)	(5)
Panel A: With children, excluded variable partner's characteristics & interactions with children					
WfH × Male	0.071***	0.071***	0.065***	0.097***	0.091***
	(0.022)	(0.023)	(0.023)	(0.023)	(0.023)
WfH × Female	0.089**	0.089*	0.091**	0.223***	0.229***
	(0.044)	(0.045)	(0.045)	(0.074)	(0.077)
Selection correction	No	No	Yes	No	Yes
Observations	6770	6770	6770	6770	6770
Panel B: With children, excluded variable partner's & mother's characteristics					
WfH × Male	0.069***	0.069***	0.061***	0.095***	0.086***
	(0.022)	(0.023)	(0.023)	(0.023)	(0.023)
WfH × Female	0.082*	0.082*	0.085*	0.229***	0.233***
	(0.043)	(0.044)	(0.044)	(0.073)	(0.076)
Selection correction	No	No	Yes	No	Yes
Observations	6461	6461	6461	6461	6461
Panel C: Without children under 16, excluded variable partner's characteristics					
WfH × Male	-0.030	-0.030	-0.030	-0.012	-0.011
	(0.044)	(0.045)	(0.044)	(0.044)	(0.044)
WfH × Female	0.005	0.005	0.009	0.027	0.030
	(0.043)	(0.043)	(0.043)	(0.053)	(0.053)
Selection correction	No	No	Yes	No	Yes
Observations	9234	9234	9234	9234	9234
Panel D: Without children under 16, excluded variable mother's characteristics					
WfH × Male	-0.031	-0.031	-0.031	-0.015	-0.014
	(0.048)	(0.048)	(0.048)	(0.047)	(0.047)
WfH × Female	-0.016	-0.016	-0.014	0.013	0.015
	(0.042)	(0.042)	(0.042)	(0.055)	(0.055)
Selection correction	No	No	Yes	No	Yes
Observations	8632	8632	8632	8632	8632

Note: Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01. Control variables included are gender-specific year fixed effects, gender-specific demographic controls (age, age squared, migration background, marital status, children), gender-specific human capital controls (highest degree and actual work experience), job characteristics (tenure, tenure squared, public sector dummy, firm size), macro-regions, urban area, gender-specific occupation fixed effects (95 occupation dummies) and gender-specific occupational status fixed effects (15 occupation dummies).