Do Women Expect Wage Cuts for Part-Time Work?

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Abstract

Wage expectations for full- and part-time employment are key for understanding the labor supply decisions of women. However, whether women expect different wages between part-time and full-time work is not fully understood. Using German survey data, I quantify the expected full-time/part-time wage differential for a representative sample of female workers. I document that women, on average, expect only minor part-time wage penalties (1-3 percent). Comparing beliefs to selectivity-adjusted estimates of the part-time wage gap indicates that women's mean expectations are realistic. I also show that women with children and those in managerial positions expect sizeable part-time wage cuts, with mothers overestimating the part-time wage penalty.

Keywords: expectations, female labor supply, part-time wage gap

JEL codes: D84; J22; J31

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1. Introduction

Many women will work part-time at some stage of their working career. This paper analyzes if women expect wage cuts for part-time work and evaluates if these beliefs are correct. Expectations about the wage impact of working part-time determine key labor supply choices women face throughout their lives: reducing hours to engage in care tasks or increasing them past the child-rearing years are examples of decisions that depend on expected wage offers in part-time and in full-time employment. Previous studies focus on estimating if a causal part-time wage gap exists, but unless one is willing to impose rational expectations, the expected part-time wage effect of real individuals remains unidentified.

This paper measures and assesses women's subjective expectations about the part-time wage effect in the context of the German labor market, offering two main results: First, I present representative survey evidence that women, on average, expect near-constant wages for part-time and full-time positions. Mean expected part-time wage penalties range between 1.45 and 2.78 percent and are statistically not different from zero. Hence, women expect neither a significant wage cut for part-time work, nor a wage premium for working full-time. This finding is robust to various sensitivity checks. Second, I show that women's expectations are realistic on average. Selectivity-corrected estimates yield only minor first-order wage effects of part-time work among women, in line with the existing literature (Gallego-Granados, 2019; Paul, 2016; Booth and Wood, 2008; Connolly and Gregory, 2008; Manning and Petrongolo, 2008; Aaronson and French, 2004; Wolf, 2002, to cite a few). The large raw wage gap between part-time and full-time working women observed in many countries is almost entirely driven by job segmentation and worker selection in part-time jobs, including differences in experience. Conditional on experience, first-order wage effects of part-time work are negligible on average.[2] In a final step, I study the heterogeneity in expectations and compare subgroup beliefs with estimated part-time wage effects. I document that expectations significantly correlate with motherhood and with having managerial responsibilities. Both mothers and managers expect sizeable part-time wage penalties exceeding the population mean in expectations by factors four and nine, respectively. While estimates confirm that women in management positions face significantly larger

[2] In the long-term, part-time employment can also generate second-order wage effects by causing productivity losses or different rates of promotions that in turn compress wages. Second-order effects can arise as part-time work becomes persistent, creating a 'part-time experience penalty' that goes beyond the direct first-order effect of working part-time in a given period. Unless noted otherwise, this paper refers to the first-order part-time wage effect.

wage penalties for working part-time than non-managers, I show that German mothers do not experience disproportional part-time wage cuts and, hence, tend to overestimate the negative part-time wage effect.

To derive these findings, I present a two-step empirical strategy. First, I study women's wage expectations, using novel data from the Innovation Sample of the German Socio-Economic Panel (SOEP-IS), a representative survey of German households. To identify expectations about the part-time wage effect, I use a within-subject design, thus allowing me to compare the part-time and the full-time scenarios at the individual respondent level. Specifically, I elicit respondents' expected gross income for a hypothetical switch between working full-time at 40 hours and part-time at 20 hours, *ceteris paribus*, and utilize information on current earnings and agreed working hours to measure the expected part-time wage effect. For robustness, I also check if results differ when working hours are defined to include overtime and when expectations are constructed using probability intervals instead of numerical point estimates. In the second step, I estimate the first-order wage effect of working part-time econometrically and use these estimates as a benchmark to assess if women's expectations are correct. To do so, I estimate Mincer-type log wage equations and then use coefficient estimates to isolate conditional part-time wage gaps. I account for the endogeneity of wages and working hours by estimating the wage process conditional on participation and on selection into part-time and full-time employment. First, I use standard 'reduced-form' techniques, including fixed effects regression and ordered-probit Heckman sample selection. Next, I build a static structural discrete choice model of female labor supply and estimate wages jointly with a multinomial logit hours equation, building on Van Soest (1995) and Francesconi (2002). I estimate the model on a sample of German women that is comparable to the SOEP-IS sample, exploiting the longitudinal dimension of the larger German Socio-Economic Panel (SOEP) to model selection. For identification, I use actual transitions between employment states, changes in socio-demographic characteristics and non-linearities in the German tax and benefit system. Throughout all analyses, I use various measures of working hours and part-time status to ensure that results do not depend on a specific hours threshold or on the exclusion of overtime. Using the main specification of the structural model, I compute a selectivity-corrected benchmark estimate of the part-time wage effect and compare this benchmark with the expected part-time wage effect of women constructed in the first step.

The contribution of this paper is three-fold. First, I show that, on average, women have surprisingly realistic expectations in an important labor market domain. Although the observed wage gaps between part-time and full-time workers are large (10-20 percent), women's expectations about the part-time wage effect are close to econometrically estimated wage gaps (around zero). In times of ever-growing evidence on behavioral anomalies in many domains, it seems to emerge that subjective income expectations are less affected by beliefs-biases (Bruenig et al., 2019; Zafar, 2011).[3] The risk to develop beliefs-biases depends on agents' information sets and increases with the complexity of the decision problem. Individuals, on average, have more experience in the domain of labor income, than, for instance, in the financial market domain. Furthermore, expectation formation concerning the short-run is less complex than belief-formation requiring long-run extrapolation. This paper adds to the literature on subjective income expectations, showcasing that women, on average, have realistic expectations about the first-order part-time wage effect.

Second, this paper contributes to our understanding of observed choice patterns in many OECD labor markets, where female part-time shares reach levels of almost 60 percent.[4] While child care availability (Müller and Wrohlich, 2020), inflexible work contracts (Manning and Petrongolo, 2008) or tax incentives (Steiner and Wrohlich, 2004) are well-identified determinants of female labor supply, wage expectations deliver an additional mechanism explaining both mobility and persistence in women's hours choices. The beliefs documented in this paper can rationalize why few women hesitate to reduce hours to engage in care work; at the same time, they explain why many postpone a return to full-time employment after spending years in part-time employment. If women expect neither a direct wage cut when reducing hours, nor an immediate reward in response to an increase, there are no first-order wage incentives to prefer

[3]Behavioral anomalies can be classified into nonstandard preferences, beliefs, and decision-making (DellaVigna, 2009). Empirical work shows that workers overpredict their productivity (Hoffman and Burks, 2017), the unemployed overestimate their job finding probability (Spinnewijn, 2015), and employees overrate the performance of their own company (Oyer and Schaefer, 2005). Agents' systematic mistakes can have implications for welfare analysis (Kőszegi and Rabin, 2007) and behavioral economists have made efforts to augment standard economic models with behavioral elements. However, divergence from standard rational beliefs comes at the expense of model simplicity. Given the appeal of rational expectations for modeling purposes, it is central to uncover under which circumstances the standard model remains appropriate.

[4]The female part-time share reached 58 percent in the Netherlands in 2018, in Germany and the UK the share is around 40 percent. OECD (2020), Part-time employment rate (indicator). doi: 10.1787/f2ad596c-en (Accessed on 30 January 2020)

full- over part-time in a given period. This can create an indifference between remaining in part-time just a bit longer and resuming a full-time job. However, this indifference and the persistence in part-time employment it can create have important second-order effects. Numerous studies point out that part-time work is harmful if it becomes persistent because there is no return to work experience accumulated during periods of part-time employment (Connolly and Gregory, 2010; Fernández-Kranz et al., 2015; Blundell et al., 2016; Eisenhauer et al., 2020). Expectations about the short-run impact of part-time work can generate persistent part-time employment if agents are either myopic, that is, not forward-looking, or if they are present-biased, thereby prioritizing immediate over future payoffs.[5] The beliefs documented in this paper help explain why women often make suboptimal choices that harm their labor market outcomes in the long-run.

Third, and finally, this paper contributes to the growing literature using stated expectations data to overcome the standard identification problem in revealed preference analysis (Manski, 2004; Zafar, 2011). Specifically, the results presented here provide a behavioral foundation for economists modeling female labor supply. Labor supply models require an assumption about the wage-hours locus and there are competing approaches in the literature. Standard discrete choice models in the tradition of Van Soest (1995) impose constant wage offers for full-time and part-time work, implicitly assuming that decision-makers do not expect a part-time wage effect. Others estimate counterfactual part-time and full-time wage offers, which translates into the implicit assumption that real agents' wage expectations match econometric predictions of the part-time wage effect (Francesconi, 2002; Löffler et al., 2014). So far, the choice between competing models is guided by whether researchers believe a rational agent *should* take into account a part-time wage effect. However, whether agents *actually* expect different wage offers in part-time and in full-time employment is ultimately an empirical question. This paper answers this question for a representative sample of female workers, and can serve as a behavioral guideline for researchers striving to capture key features of real agents' decision-processes within economic models.

The two questions addressed in this paper - do people expect wage cuts for part-time work and does a part-time wage effect exist - received differential attention in the existing literature.

[5]This paper does not speak to individuals' expectations about the second-order effects of part-time work. The work by Eisenhauer et al. (2020) suggests women overestimate future wage growth in part-time, which can also explain persistence for forward-looking agents.

The first question remains largely unanswered. As far as I am aware, no other study analyzed women's subjective expectations about the first-order wage impact of transitioning between full- and part-time. Currently, there exists only one related study by Stevens et al. (2004); they survey British women about various aspects of their work-life balance, including beliefs about firm-specific part-time wage gaps. They report that 74% of surveyed women believe their employer pays part-time and full-time workers the same hourly wage. While in line with the self-beliefs presented here, Stevens et al. (2004) do not measure women's expectations about their *own* wage effect when transitioning from full- to part-time. Eisenhauer et al. (2020) study women's self-beliefs about future returns to hours worked, hence focusing on the second-order effects of part-time work on future wage growth. Breunig et al. (2019) also study the long-run income expectations of households, but do not distinguish between part-time and full-time work. Thus, this paper clearly advances our understanding of women's wage expectations for part-time employment, which remains a prevalent labor supply choice in many female labor markets. The second question addressed in this paper received considerably more attention. To economize on space here, I review the vast theoretical and empirical literature about part-time wage effects in section 2. I build on this active literature in at least two important ways. First, I add yet another empirical strategy to the multitude of existing approaches that isolate part-time wage effects conditional on selection (for an up-to-date review, also see Gallego-Granados, 2019).[6] Specifically, I extend a static structural discrete choice model of female labor supply similar to Van Soest (1995) with features proposed by Francesconi (2002). This allows me to estimate the part-time wage effect conditional on a rich selection model that describes the hours choice through a consumption-leisure trade-off, capturing detailed features of the German tax and welfare regime. Second, using up-to-date representative panel data from Germany, I confirm the main finding from previous literature: if a first-order wage effect for working part-time exists, it is at most small, at least for women. This consensus across different countries, contexts and methodologies is striking, thus providing a convincing answer to the question if there exists a direct wage effect of working part-time.

[6] Manning and Petrongolo (2008) use reweighting and standard Heckman selection-correction or condition on occupation to eliminate the most important sources of selection bias. Others use simultaneous wage-hours models (Wolf, 2002), random effects with a dynamic multinomial probit component for employment choices (Paul, 2016), and semi-parametric estimation that builds on imputation-based sample selection correction for conditional quantiles (Gallego-Granados, 2019).

The remainder of this paper proceeds as follows. Section 2 discusses the mechanisms that generate part-time wage gaps and reviews previous empirical findings. Section 4 describes the empirical approach. Section 5 presents the results and section 6 concludes.

2. Part-Time Wage Gaps: Mechanisms and Empirical Literature

This section reviews the existing literature on part-time wage effects. There are three broad explanations why part-time workers earn lower wages than full-time workers: First, the jobs they do are different. Second, the workers themselves are different. Third, firms face different costs when employing workers part-time or full-time and compensate by paying different wages to otherwise identical workers in identical jobs. I review these three mechanisms in turn, starting with the last. The section concludes by summarizing empirical estimates of the part-time wage effect from the existing literature.

2.1. Firms' Cost Functions

Firms face fixed costs of labor for recruitment, training, and coordination. One argument proposed by Oi (1962) and later developed by Montgomery (1988) is that these fixed costs pay off less for part-time workers who work fewer hours; hence, firms pay them lower wages to offset relatively higher costs.[7] Goldin (2014) extends this argument, showing that coordination costs can be higher for part-time workers. She finds that returns to both long hours and to particular hours, for instance to being around when colleagues are, increase if coordination and transaction costs are high. Thus, firms reward workers who facilitate smooth workflows and do not cause communication or delegation costs by working irregular hours. Another reason why part-time workers may be less valuable to firms are productivity detriments caused by everyday 'set-up' costs. Set-up costs create rising marginal products of daily working hours until a 'fatigue' threshold, resulting in an S-shaped relationship between hours and productivity, and ultimately, wages (Barzel, 1973; Moffitt, 1984). Others argue that fewer hours may reduce fatigue effects and unproductive 'slack', rationalizing positive part-time premia (Tummers and Woittiez, 1991). Empirically, researchers analyze if firms reward workers with identical characteristics differently in part-time and in full-time employment, which could point to different cost functions for different hours arrangements. However, firms that do face higher costs when employing workers part-time may not always have the wriggle room to adjust hourly wages to match their costs. Worker protection regulation and principles of equal treatment limit their capabilities for cutting wages when their employees reduce hours. Instead, firms may choose to not offer flexible hours for all positions, which explains why part-time and full-time employees often do different jobs.

[7] See also Ermisch and Wright (1993) and Wolf (2002) for excellent reviews of the early literature.

2.2. *Job Segmentation*

The segmentation of jobs into those that are exclusively offered on a full-time basis and those that are 'part-time compatible' constitutes a challenge for researchers seeking to identify the true part-time wage penalty. Part-time workers are heavily concentrated in low-wage sectors and in work arrangements with fixed-term contracts, often deemed as marginal or secondary employment (Fernández-Kranz and Rodríguez-Planas, 2011). Wage gains generated by changes in the skill content of work due to technological change also fall exclusively upon full-time workers, spreading wages even further between sectors (Gallego-Granados, 2019; Black and Spitz-Oener, 2010). Notably, the task-level segregation of jobs hurts women more than men and remains a major obstacle toward full 'gender convergence' in pay (Goldin, 2014). Job segmentation also poses an identification challenge for researchers because it generates additional job mobility. If firms do not offer comparable part-time positions, workers seeking to reduce hours may have to change employers or move to a different position within their firm. This involuntary mobility comes with the risk of losing job-specific human capital, or making an occupational downward move; both can in turn compress wages (Manning and Petrongolo, 2008). There is no consensus whether one should include mobility-driven wage losses when estimating the part-time wage effect. An all-encompassing definition of the part-time penalty can include mobility-induced wage cuts, capturing the constraints and costs many workers face when making the transition to part-time in real life. If, instead, the goal is to test some of the theoretical predictions presented above, one needs rich enough data to isolate the part-time wage penalty for identical jobs from wage losses that are due to changes of employer, jobs, or tasks.

2.3. *Worker Selection*

Finally, part-time workers may earn lower wages because they differ in relevant ways from full-time workers. Some of these differences already exist when people initially select into part-time and full-time jobs, reflecting differences in preferences or constraints. One example is given by Adda et al. (2017), who show that career choices mirror worker differences in desired fertility, with women who have higher preferences for children choosing family friendly occupations - with the 'amenity' of part-time work - more often.[8] Other differences can arise

[8]The fact that workers accept lower wages for part-time positions is sometimes interpreted within the narrative of *compensating wage differentials*. If workers value the flexibility to re-

between previously identical workers, only emerging subsequently, after employment choices have persisted for prolonged periods of time. The most prominent example is the differential accumulation of human capital in part-time and full-time jobs (Blundell et al., 2016). Put differently, it is part-time work itself that makes part-time workers less productive, especially if the choice to work part-time becomes permanent. Work experience appears to be most valuable if it is accumulated in full-time, which can generate second-order effects and create a part-time experience penalty that goes beyond the direct wage effect of working part-time in a given period. In a related argument, Connolly and Gregory (2010) highlight the 'dual nature' of part-time work: a transition to part-time can both harm and support a career, depending on whether the move is permanent, marking the beginning of a "part-time/non-employment cycle," or a temporary "interlude" that maintains labor force attachment and leads back to a full-time career. Last, but not least, institutions and norms also matter. The extent to which part-time and full-time workers differ also depends on the labor force participation of women, in general, and of mothers, in particular. Whether and which women work, in turn, reflects the gender norms of a society and the political environment, such as whether part-time work and non-employment are incentivized through the joint taxation of married couples or if affordable child care reduces the opportunity costs for working mothers. In Germany, the selection of women into part-time has undergone a major transition, going from positive in the early 1990s to null, if not negative, in the 2010s (Gallego-Granados, 2019; Biewen et al., 2018). In the end, regardless if the differences between part-time and full-time workers are inherent, acquired along the way, or induced by institutions - taken together, these constitute the main identification challenge for researchers striving to estimate the part-time effect. A vast literature has emerged around the task of adjusting wage differentials for the non-random distribution of dissimilar workers across full-time and part-time jobs. The next section summarizes the main findings from this empirical literature.

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duce working hours, they may accept lower wages for part-time positions in return, especially if part-time jobs are scarce. An alternative reading is that more vulnerable employees face constraints that firms can exploit. Ermisch and Wright (1993) point out that *monopsonistic employers* can exploit the restricted geographic mobility and lower labor supply elasticities of potential part-time workers - often women with young children who face larger spatial constraints - by offering them lower wages.

2.4. Estimated Part-Time Wage Effects in Previous Literature

Estimates of the part-time wage effect in previous literature differ across countries and over time and depend on the definition of part-time status as well as sample composition, most crucially, whether the sample includes men and workers in marginal part-time contracts (Table 1). I broadly summarize the literature with four main findings: (1) adjusted gaps are substantially lower than raw gaps, in most cases adjustments reduce observed wage gaps by at least half, in some cases they even turn the raw penalty into a part-time premium; (2) adjusted gaps are larger for men than for women, no paper finds part-time premia for men in their main specification; (3) fixed effects estimates yield smaller part-time wage gaps than estimates that do not exclusively use within-individual variation; and (4) the wage exogeneity assumption is problematic, most studies attempt to jointly model wages and hours or correct for selection into part-time. For German females, estimates of the raw wage gap are around 20 percent including marginal part-time and adjusted penalties range from average part-time premia of eight percent (Gallego-Granados, 2019) to penalties of nine percent for short part-time work up to 15 hours per week (Paul, 2016). These findings confirm earlier results for German women by Wolf (2002), who reports lower wages only when working very few hours, but a flat wage-hours locus between 20 - 37 hours. Overall, most empirical studies yield only small first-order part-time wage effects for women, the bulk of observed pay differentials between workers is explained by job segmentation and worker selection into part-time.

Table 1: Part-Time Wage Effects in Previous Literature

Authors (Year)	Unadjusted	Adjusted	Country/ Years	Data
Gallego-Granados (2019)	9-19	-8-7	West GER/ 1990-2009	SOEP
Blundell et al. (2016)	n.r.	5-8	UK/ 1991-2008	BHPS
Paul (2016)	4-32	-2- 9	GER/ 1984 - 2011	SOEP
Fernández-Kranz et al. (2015)	31-37	6-8	Spain/ 1996-2006	CSWH
Preston and Yu (2015)	15-22	-4-9	Australia/ 2010	Australia at Work
Matteazzi et al. (2014)	8-22	-20-15	Cross Country/ 2009	EU-SILC
Fernández-Kranz and Rodríguez-Planas (2011)	35-38	9-14	Spain/ 1996-2006	CSWH
Fouarge and Muffels (2009)	n.r.	0-5	Cross Country/ 1984-2006	SEP, BHPS, SOEP
Bardasi and Gornick (2008)	-1-22	-3-18	Cross Country/ 1994-1995	LIS
Booth and Wood (2008)	1-13	-16 to -10	Australia/ 2001-2004	HILDA
Connolly and Gregory (2008)	15-29	3-11	UK/ 1975-2001	NESPD
Manning and Petrongolo (2008)	25-27	3-10	UK/ 2001-2003	LFS
Mumford and Smith (2008)	12-18	0-11	UK/ 2004	WERS04
Hardoy and Schøne (2006)	5	0	Norway/ 1997-1998	LLS
Hirsch (2005)	26-49	-5-18	US/ 1995-2002	CPS
Aaronson and French (2004)	20-56	-1-25	US/ 1968-2000	PSID, HRS, ORG, CPS
Wolf (2002)	n.r.	0-1	West GER/ 1995	SOEP
Averett and Hotchkiss (1996)	27-62	7-50	US/ 1989	CPS
Gornick and Jacobs (1996)	8-28	-19-23	Cross Country/ 1986-87	LIS
Ermisch and Wright (1993)	17	8	UK/ 1980	WES
Blank (1990)	19-26	-17-18	US/ 1987	CPS
Simpson (1986)	31	10	Canada/ 1981	Survey of Work History

Notes: Mean or median wage gaps (log difference*100%) rounded to the closest integer value. Negative values denote part-time premia. Some papers include males. All reporting errors are my own. Literature review incomplete, suggestions welcome. The review does not contain results by McGinnity and McManus (2007); Green and Ferber (2005); Montgomery and Cosgrove (1995) due to lack of access. n.r.= not reported.

3. Research Design

This section describes the empirical approach, which consists of two steps. In the first step, I estimate women's expectations about the part-time wage effect. For identification, I use a within-subject design. This allows me to compare the part-time *and* the full-time scenarios at the individual respondent level, thereby shutting off an important channel of selection bias by construction (section 3.1). In the second step of the empirical analysis, I estimate the part-time wage effect econometrically and use these estimates as a benchmark to assess if women's expectations are correct (section 3.2).

3.1. Expectations about the Part-Time Wage Effect

To measure expectations about the part-time wage effect, I utilize a within-subject design that provides information on both the full-time *and* the part-time scenario for the same respondent. Specifically, respondents are asked to consider a hypothetical switch of employment status, based on the following survey instrument if the respondent is employed full-time:[9]

'Please imagine you were to switch to a part-time job from now on, working 20 hours per week. Please only consider part-time jobs that you could carry-out with your current level of qualification. Which monthly gross income do you expect to earn when working part-time at 20 hours per week?'

Part-time working individuals are asked a corresponding question that enquires about their expected income when switching to a full-time position at 40 hours per week. I construct each respondent's expected part-time wage effect as follows:

Let n denote the individual respondent who is in one of two states of the world j, working either full-time (FT) or part-time (PT), $j_n \in \{FT, PT\}$. Based on $n's$ current working hours, h_n, her current monthly gross labor income, Y_n and her reported expected monthly gross labor income for a hypothetical switch between full-time and part-time, $\tilde{Y}_n$, her expected part-time wage effect $\tilde{p}_n$ is given by,

$$\tilde{p}_n = (lw_{FT,n} - lw_{PT,n}) \times 100\% \tag{1}$$

[9]The survey instrument is based on a filter question that splits according to self-reported employment status.

where $lw_{j,n}$ is the natural logarithm of current or expected gross hourly wage, obtained by converting weekly hours to monthly terms,

$$lw_{j,n} = \begin{cases} ln\left(\frac{Y_n}{h_n \cdot \frac{52}{12}}\right) & \text{if } j_n = j \\ \\ ln\left(\frac{\tilde{Y}_n}{h_j \cdot \frac{52}{12}}\right) & \text{if } j_n \neq j \end{cases} \tag{2}$$

with $h_j \in (40, 20)$, as specified in the question on expected income. The sample mean across all individual respondents yields the expected part-time wage effect, $\tilde{p}$.

To keep the survey instrument simple, the question does not specify whether working hours include overtime. Arguably, the more natural reading of the question is in terms of agreed contractual hours, therefore $\tilde{p}$ defines current working hours h_n as agreed hours in the main specification. However, to allow for the possibility that individuals read the question differently and also account for overtime, I specify a second measure of the expected part-time wage effect that uses actual hours, including overtime, for additional robustness.

The within-subject design shuts off an important channel of selection bias because expected wage offers for part-time and full-time work are compared within rather than across individuals. The underlying assumption is that respondents' current employment status does not affect the way they report counterfactual expectations (no cognitive dissonance). To provide descriptive evidence that this assumption is warranted in this setting, I test if mean expectations differ for full-time and part-time workers.

The question fixes qualification requirements, encouraging respondents to consider the impact of reducing hours in a *ceteris paribus* scenario. This should limit the extent to which people simultaneously account for occupational downgrading, upgrading or job switching. However, the survey instrument is not explicit in this regard and hence one cannot rule out that some individuals do make these kinds of adjustments. Therefore, the derived measure of the expected part-time wage effect is a broad one, potentially encompassing expected mobility-induced wage losses. Consequently, the estimates in this paper can be interpreted as an upper bound of women's expected wage penalties.

In the main specification, expectations are identified directly from reported Euro amounts. As a sensitivity check, I also construct estimates of the subjective mean probabilistically, using the

percent chance respondents expect to earn less than 80 percent and more than 120 percent of their individual-specific point estimate (Appendix C.1).

3.2. Estimation of the Part-Time Wage Effect

To compute the benchmark part-time wage effect, I estimate Mincer-type log wage equations and then use coefficient estimates to isolate conditional part-time wage gaps. I account for the endogeneity of wages and working hours by estimating the wage process conditional on selection into employment states. First, I use 'reduced-form' techniques including fixed effects regression and ordered-probit Heckman sample selection (section 3.2.1), then I build a structural discrete choice model of female labor supply to estimate wages jointly with a multinomial logit hours equation (section 3.2.2).

3.2.1. Reduced-form

Individual n at time t is observed in one out of three mutually exclusive choice categories $j_n \in \{1,2,3\}$, where the choice set j is defined as $1 = FT$ (full-time), $2 = PT$ (part-time), and $3 = OLF$ (out of labor force). Let w_n denote $n's$ wage if n is working at time t.[10]

Combined Wage Equation

A single combined log wage equation for employed women, $j_n \in \{FT, PT\}$, is given by

$$ln(w_n) = \alpha + \beta \cdot \mathbb{1}(j_n = PT) + Z_n'\gamma + \mu_n + \varepsilon_n \tag{3}$$

where $\mathbb{1}(.)$ indicates current employment status j_n and β is the parameter of interest, measured conditional on a vector of exogenous covariates, Z_n, and an individual-specific fixed effect, μ_n. The vector Z_n collects basic controls for years of education, a quadratic in part-time and full-time work experience (in years), as well as binary indicators for region (East/West) and immigrant background; if specified broadly Z_n additionally contains occupation major group (1-digit ISCO-88), industry (2-digit NACE), linear and quadratic tenure, as well as binary indicators for firm size (> 200), public sector and fixed term contract. In the combined wage equation, the parameter vector γ, constant α and random shocks ε_n are constrained to be constant across j.

Separate Wage Equations

[10] We drop time subscript t for better readability.

Next, parameters and disturbances may vary over $j_n \in \{FT, PT\}$,

$$ln(w_{jn}) = \alpha_j + Z_n'\gamma_j + \mu_{jn} + \varepsilon_{jn} \tag{4}$$

yielding separate wage processes for part-time and full-time workers as in standard Blinder-Oaxaca decomposition analyses (Blinder, 1973; Oaxaca, 1973; Jann, 2008). The part-time wage effect can no longer be measured through a constant β, instead counterfactual full-time wages must be predicted for part-time workers and vice versa, holding fixed individual-specific characteristics (endowments). A part-time wage penalty then unfolds if parameters vary across j such that the 'returns' to identical characteristics differ between part-time and full-time; for instance if the returns to work experience or to having a permanent contract differ across employment states.

Ordered-Probit Selection Rule

Estimating the wage equations based on employed women alone can lead to inconsistent coefficient estimates and hence biased part-time wage effects (Heckman, 1979). Non-random choices of part-time and full-time employment generate additional sample selection (Ermisch and Wright, 1993; Paci et al., 1995). To account for the endogeneity of wages and working hours, consider a generalized two-step Heckman estimator as described in Chiburis and Lokshin (2007) with an ordered-probit selection rule,

$$j_n^* = W_n'\delta + u_n \tag{5}$$

where the latent categorical selection variable j_n^* is unobserved, W_n is a vector of individual-specific instruments of observed employment status $j_n \in \{FT, PT, OLF\}$ containing marital status, weekly labor income of woman $n's$ spouse, as well as presence and number of children. Then augmenting the wage equation by an estimate of the omitted regressor $\lambda_n \equiv E[u_n|j_n, W_n]$ obtained from a first-step ordered probit of j_n on W_n yields consistent estimates of 4, given W satisfies the exclusion restriction $Cov(W_n, \varepsilon_{jn}) = 0 \; \forall j_n$.

3.2.2. Structural Discrete Choice Model

This section develops a static discrete choice model of female labor supply to model the selection into part-time, full-time, and non-employment more comprehensively. The model in-

corporates incentives embodied in the German tax and welfare regime that affect employment choices through a classic consumption-leisure trade-off. Separate wage functions for part-time and full-time work are estimated jointly with individual employment choices to relax the exogeneity assumption between wages and hours (Van Soest, 1995; Francesconi, 2002; Löffler et al., 2014). Identification builds on individual transitions between employment states, changes in socio-demographic characteristics, and non-linearities in the tax-benefit system. The model is estimated by full information maximum simulated likelihood (FIMSL). Given the structural parameter estimates, one can predict the wage effect of part-time work conditional on selection into employment and into part-time and full-time jobs.

Model

Let n again denote the individual decision maker. Each decision-maker is assumed to maximize the instantaneous utility index $U(C_{nj}, L_j)$ over the choice set $j_n \in \{FT, PT, OLF\}$ according to a consumption-leisure trade-off, where leisure in choice j is given by $L_j = T - h_j$ with weekly time endowment defined as $T = (24-8)\cdot 5 = 80$ hours and weekly working hours derived from sample medians in the respective choice category. In the main specification based on self-reported part-time status and contractually agreed working hours, sample medians are $h_j \in \{39, 23, 0\}$ s.t. $L_j \in \{41, 57, 80\}$.

The budget constraint is given by

$$C_{nj} = w_{nj} \cdot h_j + s_n - T(w_{nj} \cdot h_j, s_n, k_n) \tag{6}$$

where C_{nj} is consumption, w_{nj} denotes hourly wage, s_n is weekly labor income of the spouse and $T(.)$ is the tax-benefit system that also depends on the number of children, k_n. In the main specification, I assume an isoelastic shape of the utility index with constant relative risk aversion (CRRA),

$$U(C_{nj}, h_j) = \left[\frac{C_{nj}^{1-\gamma}}{1-\gamma} - (\sum_k \alpha_k' x_{n,k}) \cdot h_j \right] + \varepsilon_{nj} \tag{7}$$

where γ denotes the coefficient of risk aversion and α_k measures disutility of hours worked, which may vary across decision-makers according to observable taste-shifters $x_{n,k}$ that include binary indicators for the presence of young children in the household and for living in former

East Germany. The additive random component ε_{nj} is assumed to be Type I extreme value distributed and independent over n and j (McFadden et al., 1973). As a sensitivity check, I also estimate the model with a more flexible translog specification of the utility index (see Appendix B.1 for details).

Following Francesconi (2002) and in accordance with the reduced-form approach, I specify separate wage functions for part-time and full-time work to let hourly wages vary over hours categories j. Wages are normalized to zero in the non-employment state, $w_{n,OLF} = 0$. Counterfactual wage offers $w_{FT,n}$ and $w_{PT,n}$ are imputed according to full-time and part-time sector specific log-wage equations,

$$ln(w_{jn}) = Z_n'\gamma_j + \zeta_{nj} \tag{8}$$

where the vector Z_n contains a constant and the same set of basic controls as in equation 3, γ_j is the corresponding parameter vector. Unobserved sector-specific factors ζ_{nj} are assumed to be normal and independent of Z_n and across j.

I derive net income by simulating income tax payments and transfers for each choice category based on the tax-benefit function $T(.)$, which incorporates detailed features of the 2005 German tax and welfare regime (see Appendix B.2 for specifics). In particular, $T(.)$ covers income tax formulas, social security contributions, solidarity surcharge tax, professional and deductible expenses, child benefits and unemployment transfers, and accounts for the joint taxation of married couples.

Estimation

Labor supply and wage equations are estimated simultaneously by full information maximum simulated likelihood (FIMSL). Following Van Soest (1995), I integrate out the wage equation prediction errors ζ, which may, if ignored, lead to inconsistent estimates.[11] Since the model contains separate wage equations for full-time and part-time sectors, two types of prediction errors must be integrated out (Francesconi, 2002). Technically, this complicates maximum likelihood estimation because computation of the likelihood function involves solving for two integrals over the ζ_j which usually requires numerical methods. Put simply, counterfactual

[11] Two-step procedures such as Heckman's two-step selection correction that impute w_n by $exp(Z_n'\gamma)$ implicitly assume that wages are predicted without error (Van Soest, 1995).

wages are predicted not just once, as in standard two-step procedures, but are drawn multiple times from the distributions of observed full-time and part-time wages. Thereby, the resulting averages take into account various potential realizations of ζ. In practice, the integrals can be approximated by simulated means over R independent draws from the conditional wage distributions (Van Soest, 1995). The resulting log likelihood function is given by equation (11) in Appendix B.3 and is estimated by approximating the expectation terms via Clenshaw-Curtis quadrature rather than by Monte-Carlo simulation. This reduces the number of draws needed and the resulting average that approximates the expectation entails an adequate weighting function (Train, 2009). I present measures of internal goodness of fit and the full set of estimation results in Appendices C.3 and C.2. When discussing results, I focus on the predicted part-time wage effect.

3.2.3. Predicted Part-Time Wage Effect

Given the 'reduced-form' and structural coefficient estimates from the respective wage functions, I predict full-time and part-time wages $\hat{w}_{FT,n}$ and $\hat{w}_{PT,n}$ for each decision-maker n. Analogous to equation (1), these predictions yield $n's$ individual part-time wage effect $\hat{p}_n$,

$$\hat{p}_n = (l\hat{w}_{FT,n} - l\hat{w}_{PT,n}) \times 100\% \tag{9}$$

and by averaging over all employed decision-makers, I obtain the part-time wage effect $\hat{p}$ used as a 'benchmark' to compare with women's average expectations $\tilde{p}$.

4. Data

This section presents the two data sets used throughout the empirical analyses, the SOEP and the SOEP Innovation Sample (SOEP-IS). I first describe key features of the data (section 4.1) and then define the subject pool used for estimation (section 4.2). Appendix A.2 provides additional details on survey administration.

4.1. The SOEP and the SOEP Innovation Sample

The SOEP and the SOEP Innovation Sample (SOEP-IS) are two related longitudinal surveys of private households in Germany, which together constitute the German Socio-Economic Panel.[12] Both the SOEP and the SOEP-IS are annual panel surveys and representative of the German population. Sample design and field processes of both studies are almost identical; in addition, the two surveys share a sizeable part of the questionnaire, using identical wording to facilitate comparability. The SOEP and SOEP-IS differ in longitudinal depth, sample size, and focus; this paper draws on both to combine the strengths of the two data sets. The larger SOEP was launched in 1984 and comprises the life-time trajectories of approximately 15,000 households over more than 30 years. It is widely used by the general scientific community and complements employment and earnings paths with a rich set of household characteristics and socio-demographic indicators. The smaller SOEP Innovation Sample was established in 2011 as a supplement to the SOEP. The SOEP-IS facilitates particularly innovative research by inviting users to submit their own proposals for questions, which must pass a competitive review process before being included on the survey. The 2016 wave of the SOEP-IS introduced an innovative module on income expectations. I utilize this module, which contains 1,057 households, to estimate expectations about the part-time wage effect for a representative sample of employed women.[13] In addition, I draw on waves 2005-2016 of the larger SOEP study, which outperforms the SOEP-IS in longitudinal depth and sample size. Specifically, I exploit the rich panel dimension of the full SOEP to model the endogeneity of part-time status when estimating the part-time wage effect. Tables APP.1 and APP.2 in Appendix A.3 present summary

[12] For a jump-start on using the SOEP, see Haisken-DeNew and Frick (2005). For information about the SOEP-IS, see Richter and Schupp (2012); Richter et al. (2015).

[13] The SOEP-IS contains about 4,000 households in total. To ensure a reasonable length of the questionnaire but still accomodate the proposals of as many researchers as possible, the proposed innovative modules are assigned to different subsamples. As a result, each innovative module features only a subset of the full SOEP-IS sample.

statistics for both SOEP and SOEP-IS samples to show the two data sets are comparable and representative of the same population.

4.2. Sample Definition

The estimation sample contains all employed women with flexible labor supply.[14] Income expectations in the SOEP-IS were only surveyed for women who are working, but non-working women are included to model labor force participation when estimating the part-time wage effect using the full SOEP. Observations in the top and bottom one percent of the factual and expected income distributions are dropped. Furthermore, I exclude workers in marginal part-time contracts and use self-reported part-time status and contractually agreed working hours excluding overtime in the main specification.[15] I present additional results for hours-based definitions of part-time work and weekly hours including overtime for robustness. The subject pool contains N=286 women in the SOEP-IS sample and an unbalanced panel of N=5,492 women in the full SOEP.

[14] I exclude self-employed individuals, pensioners, civil servants, as well as those in training, the military or community service.

[15] Marginal employment in Germany describes contracts with a maximum monthly income of 450 Euros, which are exempted from income tax obligations. These contracts are also known as "Mini-Jobs" or "geringfügige Beschäftigung."

5. Results

Empirical results are presented in three steps: I start by discussing expectations about the part-time wage effect (section 5.1). Next, I show econometric estimates of the part-time wage effect from 'reduced-form' and structural discrete choice analyses (section 5.2). Third, and finally, using the main specification of the structural model as a benchmark, I analyze if women's expectations align with estimated wage effects, both overall and within subgroups (section 5.3). Throughout, the main specification is based on self-reported part-time status and contractually agreed working hours, alternative specifications show sensitivity regarding overtime.

5.1. Expectations about the Part-Time Wage Effect

The first compelling finding is that, on average, women do not expect wage cuts for part-time work. Estimates of the mean expected pay cut for a switch from full-time to part-time range from 1.45 to 2.78 percent and are not statistically different from zero (Figure 1). The median woman expects a part-time wage cut of zero, regardless of whether working hours are defined to exclude or include overtime. The same result also holds if expectations are constructed based on probability intervals rather than direct point estimates (see Appendix C.1). On average, female employees expect to earn wages that are near-constant in hours worked.

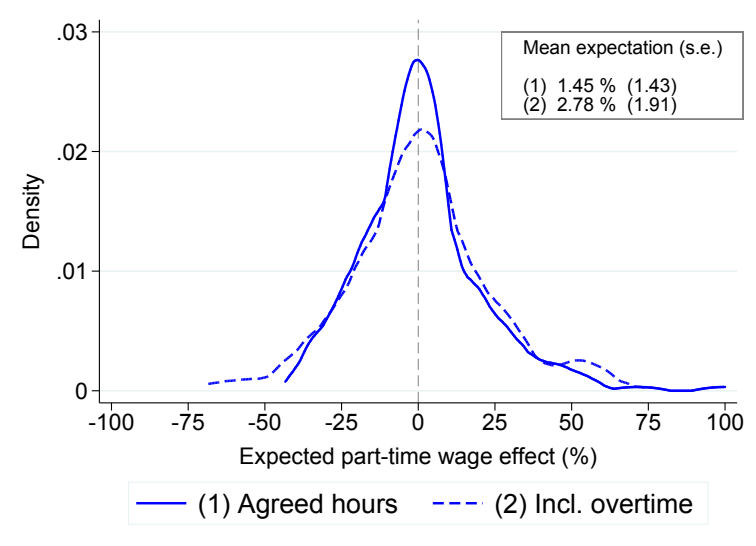


Figure 1: Plot shows the distribution of the expected part-time wage effect in percent for two definitions of working hours, contractually agreed hours (1, solid line, N=219) and hours including overtime (2, dashed line, N=226). Box shows sample mean with standard errors (s.e.) in parentheses. SOEP-IS (2016).

Table 2: Mean Comparison Tests of the Expected Part-Time Wage Effect ($\tilde{p}$)

Dep. Var. = $\tilde{p_n}$	Mean (D=yes)	Mean (D=no)	Mean Diff. (Δ)	p-value Δ	N
Socio-demographics					
With children	6.43	−0.84	7.26	0.02	219
Married	3.81	−5.14	8.95	0.04	188
Eastern Germany	−3.40	2.40	−5.81	0.13	219
Native born	1.00	2.83	−1.83	0.58	219
Human capital					
Tertiary degree	−0.13	1.84	−1.97	0.59	219
Tenure > 10y.	1.94	1.20	0.74	0.80	218
Age > 40y.	0.50	2.95	−2.46	0.40	219
Job characteristics					
Part-time	2.40	0.33	2.07	0.47	219
Temporary contract	3.42	1.13	2.29	0.60	218
Public sector	−1.51	2.81	−4.32	0.16	219
Firm size > 200	−1.70	4.82	−6.53	0.02	216
Overtime hrs. > 0	−0.42	2.74	−3.16	0.25	218
Manager	13.80	0.73	13.07	0.04	219

Notes: SOEP-IS 2016. Two sample mean comparison tests. Dependent variable $\tilde{p_n}$ is the expected part-time wage effect in percent. Results based on self-reported part-time status and contractually agreed working hours.

Table 3: Multivariate Analysis of the Expected Part-Time Wage Effect ($\tilde{p}$): OLS Results

	(1)		(2)		(3)	
Dep. Var.= $\tilde{p_n}$	Coef.	Std.Err.	Coef.	Std.Err.	Coef.	Std.Err.
Socio-demographics						
With children	6.01*	(3.56)	6.80*	(3.79)	8.22**	(3.80)
Married	8.78**	(4.33)	8.57*	(4.38)	7.60*	(4.17)
Eastern Germany	−6.69**	(2.92)	−5.83**	(2.87)	−3.80	(3.13)
Native born	1.71	(4.23)	1.30	(4.31)	−0.53	(3.97)
Human capital						
Education: Tertiary			−3.47	(3.30)	−0.40	(4.46)
Education: Basic			3.94	(4.66)	5.89	(6.22)
Tenure > 10y.			1.91	(3.40)	2.47	(3.13)
Age > 40y.			−0.25	(3.88)	1.62	(3.98)
Job characteristics						
Part-time					−2.05	(3.17)
Temporary contract					6.60	(5.70)
Public sector					−3.70	(3.04)
Firm size > 200					−4.28	(2.95)
Overtime hrs. > 0					−5.81**	(2.85)
Manager					21.52*	(10.94)
Constant	yes		yes		yes	
Occupation controls	no		no		yes	
Mean dep. variable	2.43		2.43		1.95	
N	188		188		183	

Notes: SOEP-IS 2016. Dependent variable $\tilde{p_n}$ is the expected part-time wage effect in percent. Estimates from multivariate OLS regressions with robust standard errors in parentheses. Based on self-reported part-time status and contractually agreed working hours. Base categories: intermediate education. Model (3) with controls for 1-digit occupation (ISCO 88). * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Figure 1 also reveals substantial dispersion in expectations. To understand this heterogeneity, I disaggregate mean expectations by worker attributes (Table 2) and run multivariate OLS regressions on joint characteristics to isolate conditional correlations (Table 3). Given the limited sample size of the SOEP-IS sample, standard errors tend to be large, but point estimates are mostly robust across specifications. Bivariate tests indicate that motherhood, marital status, firm size, and managerial responsibily are significant correlates of heterogeneity in expectations. The correlation with motherhood is robust to the inclusion of worker characteristics in all multivariate specifications. Mothers expect significantly larger wage penalties for working part-time than women without children (+8.2 percent, $p<0.05$). Hence, the difference between mothers and non-mothers is roughly four times the size of the population mean, which is about two percent. Multivariate analysis also confirms that women in managerial positions expect notably larger wage effects of part-time work than non-managers (+21.5 percent, $p<0.1$), the difference in expectations between managers and non-managers exceeds the population mean approximately by factor ten. Furthermore, women with positive overtime expect lower part-time wage effects than those without (-5.8 percent, $p<0.05$) and married individuals expect larger pay cuts than singles (+7.6 percent, $p<0.1$). Beyond these factors, differences in worker attributes do not contribute much to explaining the dispersion in expectations. With the exception of mothers and managers who expect sizeable part-time wage effects, women seem to agree that they would earn about the same wage in part-time and in full-time employment.

5.2. Estimates of the Part-Time Wage Effect

Table 4 presents estimates of the benchmark part-time wage effect, column 1 contains the main specification with self-reported part-time status and agreed hours.

Reduced-form Estimates

Unadjusted part-time wage differentials for women in Germany reach up to 21 percent if samples include marginal part-time workers and vary between 7-10 percent once marginal part-time is excluded (row 1). Adjusting for differences between part-time and full-time workers in terms of basic characteristics, such as education and work experience, through OLS reduces the wage gap to roughly four percent (rows 2 and 6). With a broad set of controls that adjust for job segmentation, including occupational segregation and differences in sector and tenure, OLS estimation no longer yields significant differences in pay between part-time and full-time working women (rows 3 and 7). Reduced-form wage equations estimated with individual fixed effects

even yield small wage premiums for working part-time of about three percent if individual transitions between part-time and full-time employment are used for identification (rows 4-5). The same holds if sample selection is estimated by an ordered-probit selection rule: conditional on selection, women are predicted to earn 2.6 percent more in part-time than in full-time (row 10). Fixed effects regression of separate wage functions for part-time and full-time workers where within-variation in employment status is not used for identification yields a part-time wage penalty of 5.8 percent (row 9).

Table 4: Estimates of the Part-Time Wage Effect ($\hat{p}$)

	(1)		(2)		(3)		(4)	
Part-time wage effect ($\hat{p}$)	Coef.	Std.Err.	Coef.	Std.Err.	Coef.	Std.Err.	Coef.	Std.Err.
1. Unadjusted (raw gap)	9.67	(0.80)	10.17	(0.78)	8.85	(0.79)	7.17	(0.77)
(A) Combined wage function								
2. OLS, basic controls	4.12	(0.73)	4.74	(0.73)	2.32	(0.73)	1.02	(0.70)
3. OLS, broad controls	0.31	(0.57)	1.15	(0.58)	−2.75	(0.57)	−3.70	(0.56)
4. Fixed effects, basic controls	−3.06	(0.56)	−1.24	(0.58)	−8.99	(0.64)	−10.52	(0.59)
5. Fixed effects, broad controls	−3.31	(0.55)	−1.49	(0.56)	−9.50	(0.63)	−11.01	(0.58)
(B) Separate FT/PT wage functions								
6. OLS, basic controls	3.90	(0.13)	4.54	(0.13)	2.30	(0.11)	2.04	(0.11)
7. OLS, broad controls	0.32	(0.11)	1.22	(0.10)	−2.48	(0.11)	−3.09	(0.09)
8. Fixed effects, basic controls	8.12	(0.21)	8.97	(0.20)	4.74	(0.17)	5.62	(0.16)
9. Fixed effects, broad controls	5.78	(0.22)	6.88	(0.21)	4.10	(0.19)	4.42	(0.18)
10. Ordered probit Heckman sample selection (basic controls)	−2.63	(0.12)	−2.40	(0.12)	−3.75	(0.10)	−5.35	(0.11)
(C) Structural estimates								
11. Discrete choice, CRRA utility	4.74	(0.63)	1.13	(0.66)	4.65	(0.62)	2.51	(0.66)
12. Discrete choice, Translog utility	3.56	(0.64)	−0.07	(0.67)	3.79	(0.63)	1.96	(0.66)
Part-time status	self-reported		self-reported		hours <30		hours <30	
Working hours	agreed hrs.		incl. overtime		agreed hrs.		incl. overtime	

Notes: Table presents estimates of the part-time wage effect $\hat{p}$ in percent. Panel (A) gives the coefficient estimate of a binary part-time indicator from a combined log wage regression on full- and part-time workers. Panels (B) and (C) give the mean difference in full-and part-time log wage predictions obtained after separate full-and part-time log wage regressions. All wage regressions are based on SOEP waves 2005-2016, with a minimum sample size of N=48,603. Predictions reported in Panels (B) and (C) are restricted to the 2016 sample to obtain part-time wage effects for a sample that is comparable to the SOEP-IS 2016. Basic controls include years of education, linear and quadratic work experience in part-time and full-time, region (Eastern/ Western GER) and immigrant background. Broad controls add occupation major group (ISCO 88, 1 digit), industry (NACE,2 digit), linear and quadratic tenure and indicators for firm size >200, public sector and fixed term contract. Selection equation for the multinomial choice to work full-time, part-time or not at all (row 10) contains marital status, partner income and presence and number of children. Structural estimates from multinomial logit models with separate wage functions for part- and full-time. CRRA = constant relative risk aversion.

Structural Estimates

Estimates of the benchmark part-time wage effect based on the structural discrete choice model range from -0.1 to 4.7 percent and, hence, are comparable in size to reduced-form estimates (Table 4, rows 11-12). Again, I estimate wage gaps for different definitions of hourly wages and part-time status. Additionally, I check for sensitivity regarding the functional form of the utility index. The estimated part-time wage effect is similar across different specifications, albeit slightly smaller if hours include overtime.

Taken together, although point estimates vary somewhat across specifications, these findings align with the related literature discussed in depth in section 2.4: among women, the wage penalty for working part-time is positive but only modest in size. Most of the raw wage gap that can be observed between full- and part-time workers is explained by differences in worker characteristics, job segmentation, and the non-random selection of dissimilar workers into full-time and part-time jobs. This is especially true if workers in marginal employment are excluded. For the German case, the results relate to Wolf (2002) and Paul (2016), who find wage penalties only for short part-time work, but a flat, if not negative, wage-hours locus for regular work arrangements between 15-37 hours, as well as to findings by Gallego-Granados (2019) who reports sizeable part-time wage effects at the bottom of the wage distribution, but no part-time wage penalty for a median female worker.

5.3. Comparison of Expected and Estimated Part-Time Wage Effects

This section takes women's expectations and compares them to estimated wage effects, using the main specification of the structural model as the benchmark. For subgroup analysis, multivariate OLS regressions of expected and estimated part-time wage penalties condition on worker characteristics. If there is insufficient statistical power to conduct inference for a given subgroup, I only comment on the sign of the point estimate. I illustrate all results graphically here and report the corresponding regression estimates in Table APP.8 in the Appendix.

Overall Comparison

Overall, expectations are quite well aligned with estimated part-time wage effects (Figure 2). On average, the wage effect of moving between full- and part-time is small ($<$5 percent); moreover, women expect almost no wage penalty ($<$3 percent) on average. In all four model specifications, estimated wage effects are within the confidence bands around women's expected wage changes, suggesting women's expectations about the wage-hours locus are, on average, realistic. In what follows, I further document that expected and estimated part-time wage effects remain small and congruent if the sample is split into subgroups according to socio-demographics, job characteristics, human capital, and occupation. Two notable exceptions are mothers and women with managerial responsibilities, which are discussed first.

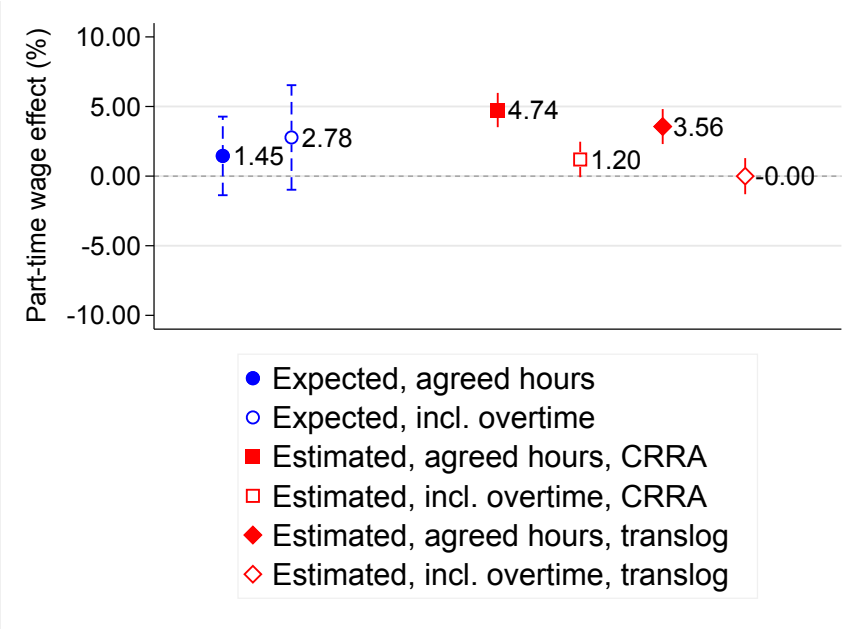


Figure 2: Comparison of expected (dashed line) and estimated (solid line) part-time wage effect. Based on SOEP-IS and SOEP (2016) and self-reported part-time status. Markers indicate mean wage gaps and whiskers 95% C.I.s.

Mothers and Managers

While the average woman expects about the same wage for full- and part-time, mothers and managers expect sizeable part-time wage penalties, as noted in section 5.1. Women with children expect 8.2 percent stronger wage cuts for working part-time than women without children. However, I do not find evidence that mothers truly face larger part-time wage penalties than non-mothers. In contrast, estimates indicate that mothers experience significantly *lower* wage effects when they work part-time than women without children; perhaps because it is socially less accepted if a woman without children opts for a part-time contract (-2.5, $p<0.1$, Figure 3a). Hence, mothers overestimate the part-time wage effect, possibly because they internalize the second-order consequences of part-time employment, such as reduced career progression. The second group of women who reports large expected part-time wage effects are managers. Women with managerial responsibilities expect 21.5 percent stronger wage reductions for working part-time than non-managers. Given the small number of women in executive positions in the SOEP-IS sample, standard errors are substantial, but one can say with confidence that managers expect above-zero part-time wage effects. This mirrors the pattern in estimated part-time wage effects for women with managerial tasks. In fact, the only group for whom estimated wage effects are significantly positive are managers (+7.5, $p<0.1$, Figure 3b). Hence, women in executive positions face notable wage cuts when they transition from full- to part-time and they also expect a part-time wage effect. This relates to the job-mobility argument by Manning and Petrongolo (2008) and others: women in positions that are not deemed 'part-time compatible' face an occupational downward move when switching from full- to part-time and, in turn, undergo cuts in hourly pay. Here I show that women who are particularly likely to suffer mobility-induced wage losses also fear these wage cuts most.

Socio-Demographics

If the sample is split by region into former East and West German states, expected and predicted part-time wage effects do not differ significantly, although the point estimate suggests that women in Eastern Germany view part-time employment somewhat more favorably, suggesting a role for institutions and norms for shaping individuals' beliefs (Figure 3a). Women in Eastern Germany are significantly more likely to work full-time and they tend to have shorter career breaks when they have children. Point estimates indicate that easterners do not view part-time work as a career disruption, which may reflect that part-time work is usually a temporary

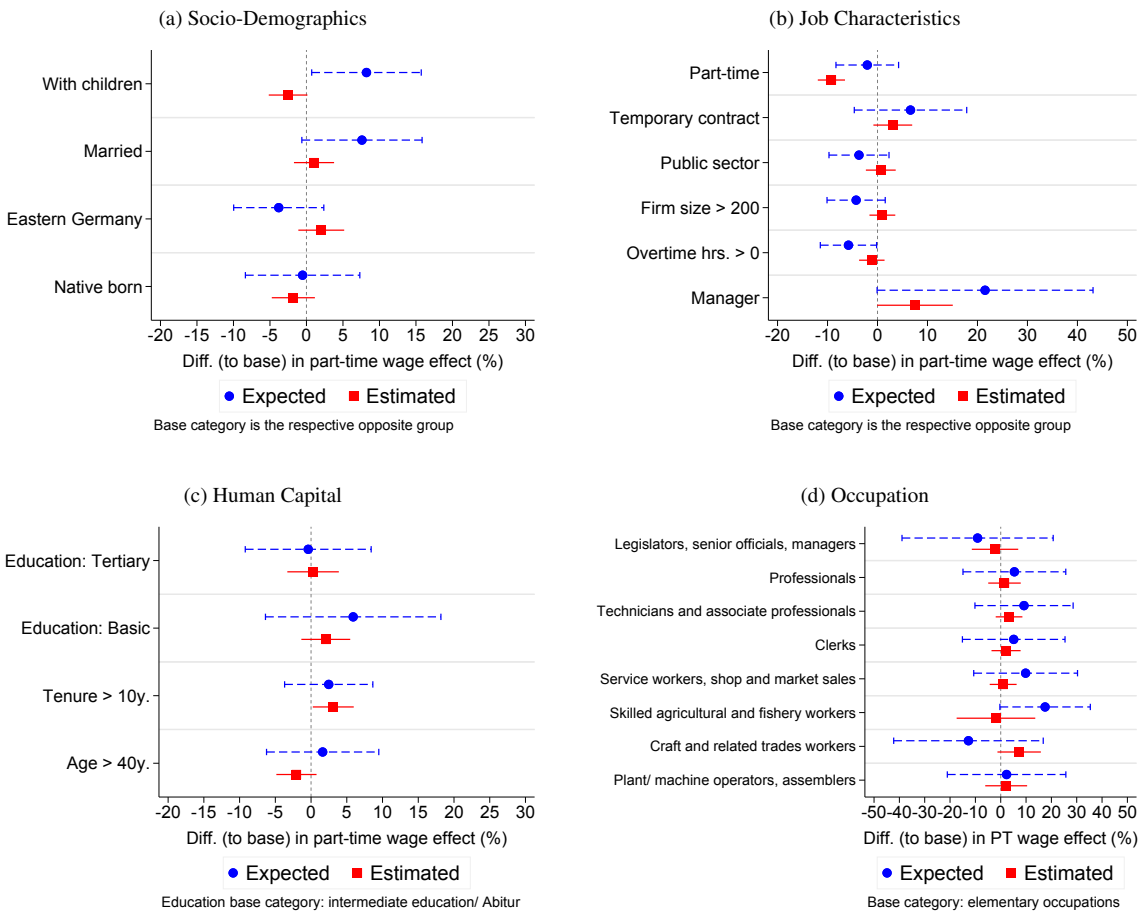


Figure 3: Group differences in expected (dashed line) and estimated (solid line) part-time wage effect from multivariate OLS. Based on SOEP-IS and SOEP (2016) and self-reported part-time status. Markers indicate point estimates and whiskers 95% C.I.s.

solution. In contrast, a move from full-to part-time is often permanent in Western Germany, partly because child care infrastructure remains less developed. These differences exemplify the 'dual nature' of part-time work discussed by Connolly and Gregory (2010), who argue that spells of part-time employment can be both "a support (...) and a trap to a successful career," depending on whether these spells are short "interludes," as is the more common pattern in Eastern Germany, or whether part-time work becomes the norm in alternation with periods of non-employment, as is often the case in Western Germany. When disaggregating workers by other socio-demographic characteristics, such as immigrant background or marital status, point estimates of the expected and estimated part-time wage effects remain aligned, as in the overall sample.

Job Characteristics

Part-time workers expect to gain less from switching to full-time than full-time workers expect to lose from moving to part-time (point estimate), mirroring the asymmetric pattern in estimated part-time penalties (Figure 3b). On average, part-time workers have accumulated more part-time work experience, which is not rewarded in full-time positions (see Table APP.6 and also compare Blundell et al. (2016)). For an average part-time worker, the benefits of moving to a full-time job are not immediate but will only materialize once she accumulates additional work experience in full-time. Results also show that public sector employees and individuals in larger firms do not fear part-time work as much as employees in the private sector and in smaller firms (point estimate), but estimates indicate no differential remuneration of part-time work across these groups. Women with fixed-term contracts expect larger part-time wage effects than women with permanent contracts (point estimate). These results, in line with previous work by Fernández-Kranz and Rodríguez-Planas (2011), confirm that women in these types of secondary work arrangements indeed face larger part-time wage penalties. I also find that women who work overtime see part-time work more favorably than women without overtime (point estimate), suggesting they expect more overtime in full-time work. Although full-time workers report significantly more overtime in *absolute* terms - 1.1 hours more per week, on average ($p<0.05$) - when computed in relation to current working hours, part-timers work *relatively more* overtime, namely roughly one percentage point more ($p<0.05$), rationalizing why part-time penalties effectively do not differ between these groups.

Human Capital

Women with higher levels of firm-specific human capital (tenure above 10 years) are predicted to lose more by moving to part-time and they also expect larger penalties (Figure 3c). This again relates to the argument by Manning and Petrongolo (2008) who point out that women risk an occupational downwards-move and may have to change their employer if part-time contracts are not easily available. The results are also in line with Gallego-Granados (2019), confirming larger predicted wage penalties for women with low levels of education who tend to be found at the bottom of the wage distribution. These women also report larger expected wage cuts.

Occupation

In Figure 3d, I examine group differences across broad measures of occupation, based on one-digit ISCO-1988. For six out of eight occupational subgroups, the signs of the expected and predicted part-time penalties correspond.[16] I take this as suggestive evidence that employees are, on average, aware of occupation-specific gaps in the returns to full-time and part-time work. However, occupation-specific mean expectations are slightly larger in absolute terms than respective estimates. Put differently, in occupations where part-time wage effects persist, women also expect part-time penalties, but their expectations tend to exceed the estimated wage effect. The results also imply that although there is some variation across broad occupation groups, the predicted wage penalty for switching from full- to part-time is very small overall, confirming the main finding and previous findings from the literature for female workers. More detailed measures of occupation that distinguish different levels of task complexity yield larger variability, but the overall picture does not change.

[16]The signs deviate for agricultural and fishery workers (ISCO-6) as well as craft and related trades workers (ISCO-7), but the sample size in both of these groups is below N=10 in the expectations data.

6. Discussion

In this paper, I analyze the wage expectations of women for part-time and full-time employment and evaluate if women's beliefs about the part-time wage effect are correct. Using representative German survey data, I document that women, on average, expect only minor part-time wage penalties that are statistically not different from zero. I show these beliefs are realistic, given first-order part-time wage effects for women are negligible overall (confirming findings across countries, among others Wolf, 2002; Aaronson and French, 2004; Hirsch, 2005; Hardoy and Schøne, 2006; Booth and Wood, 2008; Fouarge and Muffels, 2009; Gallego-Granados, 2019).

On the one hand, these findings are reassuring from a policy perspective, because many women value part-time work (Wippermann, 2018) and spells of part-time employment can support a woman's career by maintaining labor force attachment (Connolly and Gregory, 2010). However, as part-time work becomes persistent, it can harm workers in the long-run by creating second-order effects. The reasons are manifold and include the lack of transferability of work experience from part- to full-time employment, causing steeper wage growth in full-time (Francesconi, 2002; Blundell et al., 2016), or different rates of promotions in jobs where 'being around when others are' is rewarded disproportionately, ultimately driving up gender wage gaps (Goldin, 2014). Not least, even with constant wage rates, part-time workers accumulate lower pension entitlements across the life-cycle, contributing to gender pension gaps (Frericks et al., 2009; Hammerschmid and Rowold, 2019). Taken together, whilst short interludes of part-time work are innocuous, a growing consensus emerges that persistent part-time employment should be avoided. The findings from this paper provide new insights explaining both mobility and persistence in working hours observed in many OECD labor markets. The beliefs documented here can rationalize why few women hesitate to reduce hours to engage in care work, at the same time, they explain why many postpone returning to full-time after spending years in part-time employment, thereby harming their long-term labor market outcomes. If women expect no direct wage impact of switching between full- and part-time, there exist no first-order wage incentives to prefer full- over part-time in a given period. Among agents who prioritize present over future rewards, the lack of first-order wage effects can create an indifference between remaining in part-time just a bit longer and resuming a full-time job, ultimately driving persistent part-time employment. Hence, beyond other factors, wage expectations deliver an important mechanism explaining key labor supply choices women face over the life-cycle.

References

Aaronson, D., French, E., 2004. The effect of part-time work on wages: Evidence from the social security rules. Journal of Labor Economics 22, 329–252.

Adda, J., Dustmann, C., Stevens, K., 2017. The career costs of children. Journal of Political Economy 125, 293–337.

Averett, S.L., Hotchkiss, J.L., 1996. Discrimination in the payment of full-time wage premiums. ILR Review 49, 287–301.

Bardasi, E., Gornick, J.C., 2008. Working for less? women's part-time wage penalties across countries. Feminist economics 14, 37–72.

Barzel, Y., 1973. The determination of daily hours and wages. The Quarterly Journal of Economics 87, 220–238.

Bellemare, C., Bissonnette, L., Kröger, S., 2012. Flexible approximation of subjective expectations using probability questions. Journal of Business & Economic Statistics 30, 125–131.

Biewen, M., Fitzenberger, B., de Lazzer, J., 2018. The role of employment interruptions and part-time work for the rise in wage inequality. IZA Journal of Labor Economics 7, 10.

Black, S.E., Spitz-Oener, A., 2010. Explaining women's success: technological change and the skill content of women's work. The Review of Economics and Statistics 92, 187–194.

Blank, R.M., 1990. Are part-time jobs bad jobs? A future of lousy jobs , 123–155.

Blinder, A.S., 1973. Wage discrimination: reduced form and structural estimates. Journal of Human resources , 436–455.

Blundell, R., Costa Dias, M., Meghir, C., Shaw, J., 2016. Female labor supply, human capital, and welfare reform. Econometrica 84, 1705–1753.

Booth, A.L., Wood, M., 2008. Back-to-front down under? part-time/full-time wage differentials in australia. Industrial Relations: A Journal of economy and society 47, 114–135.

Breunig, C., Grabova, I., Haan, P., Weinhardt, F., Weizsäcker, G., 2019. Long-run expectations of households. CRC Discussion Paper No. 218 .

Chiburis, R., Lokshin, M., 2007. Maximum likelihood and two-step estimation of an ordered-probit selection model. The Stata Journal 7, 167–182.

Connolly, S., Gregory, M., 2008. The part-time pay penalty: earnings trajectories of british women. Oxford Economic Papers 61, i76–i97.

Connolly, S., Gregory, M., 2010. Dual tracks: part-time work in life-cycle employment for british women. Journal of Population Economics 23, 907–931.

DellaVigna, S., 2009. Psychology and economics: Evidence from the field. Journal of Economic literature 47, 315–72.

Eisenhauer, P., Haan, P., Ilieva, B., Schrenker, A., Weizsäcker, G., 2020. Biased wage expectations and female labor supply: a structural approach Mimeo.

Ermisch, J.F., Wright, R.E., 1993. Wage offers and full-time and part-time employment by british women. Journal of Human Resources , 111–133.

Fernández-Kranz, D., Paul, M., Rodríguez-Planas, N., 2015. Part-time work, fixed-term contracts, and the returns to experience. Oxford Bulletin of Economics and Statistics 77, 512–541.

Fernández-Kranz, D., Rodríguez-Planas, N., 2011. The part-time pay penalty in a segmented labor market. Labour Economics 18, 591–606.

Fouarge, D., Muffels, R., 2009. Working part-time in the british, german and dutch labour market: Scarring for the wage career? Schmollers Jahrbuch 129, 217–226.

Francesconi, M., 2002. A joint dynamic model of fertility and work of married women. Journal of Labor Economics 20, 336–380.

Frericks, P., Knijn, T., Maier, R., 2009. Pension reforms, working patterns and gender pension gaps in europe. Gender, Work & Organization 16, 710–730.
Gallego-Granados, P., 2019. The part-time wage gap across the wage distribution .
Goldin, C., 2014. A grand gender convergence: Its last chapter. American Economic Review 104, 1091–1119.
Gornick, J.C., Jacobs, J.A., 1996. A cross-national analysis of the wages of part-time workers: Evidence from the united states, the united kingdom, canada and australia. Work, Employment and Society 10, 1–27.
Green, C.A., Ferber, M.A., 2005. The long-run effect of part-time work. Journal of Labor Research 26, 323–333.
Haan, P., 2006. Much ado about nothing: Conditional logit vs. random coefficient models for estimating labour supply elasticities. Applied Economics Letters 13, 251–256.
Haisken-DeNew, J.P., Frick, J.R., 2005. Desktop companion to the german socio-economic panel study (gsoep).
Hammerschmid, A., Rowold, C., 2019. Gender pension gaps in europe are more explicitly associated with labor markets than with pension systems. DIW Weekly Report 9, 203–211.
Hardoy, I., Schøne, P., 2006. The part-time wage gap in norway: How large is it really? British Journal of Industrial Relations 44, 263–282.
Heckman, J.J., 1979. Sample selection bias as a specification error. Econometrica: Journal of the econometric society , 153–161.
Hirsch, B.T., 2005. Why do part-time workers earn less? the role of worker and job skills. ILR Review 58, 525–551.
Hoffman, M., Burks, S.V., 2017. Worker overconfidence: Field evidence and implications for employee turnover and returns from training. Technical Report. National Bureau of Economic Research.
Jann, B., 2008. The blinder–oaxaca decomposition for linear regression models. The Stata Journal 8, 453–479.
Kőszegi, B., Rabin, M., 2007. Mistakes in choice-based welfare analysis. American economic review 97, 477–481.
Löffler, M., Peichl, A., Siegloch, S., 2014. Structural labor supply models and wage exogeneity. ZEW-Centre for European Economic Research Discussion Paper .
Manning, A., Petrongolo, B., 2008. The part-time pay penalty for women in britain. The economic journal 118, F28–F51.
Manski, C.F., 2004. Measuring expectations. Econometrica 72, 1329–1376.
Matteazzi, E., Pailhé, A., Solaz, A., 2014. Part-time wage penalties for women in prime age: A matter of selection or segregation? evidence from four european countries. ILR Review 67, 955–985.
McFadden, D., et al., 1973. Conditional logit analysis of qualitative choice behavior .
McGinnity, F., McManus, P., 2007. Paying the price for reconciling work and family life: Comparing the wage penalty for women's part-time work in britain, germany and the united states. Journal of Comparative Policy Analysis 9, 115–134.
Moffitt, R., 1984. The estimation of a joint wage-hours labor supply model. Journal of Labor Economics 2, 550–566.
Montgomery, M., 1988. On the determinants of employer demand for part-time workers. The Review of Economics and Statistics , 112–117.
Montgomery, M., Cosgrove, J., 1995. Are part-time women paid less? a model with firm-specific effects. Economic Inquiry 33, 119–133.
Müller, K.U., Wrohlich, K., 2020. Does subsidized care for toddlers increase maternal labor

supply? evidence from a large-scale expansion of early childcare. Labour Economics 62, 101776.

Mumford, K., Smith, P.N., 2008. What determines the part-time and gender earnings gaps in britain: evidence from the workplace. Oxford Economic Papers 61, i56–i75.

Oaxaca, R., 1973. Male-female wage differentials in urban labor markets. International economic review , 693–709.

Oi, W.Y., 1962. Labor as a quasi-fixed factor. Journal of political economy 70, 538–555.

Oyer, P., Schaefer, S., 2005. Why do some firms give stock options to all employees?: An empirical examination of alternative theories. Journal of financial Economics 76, 99–133.

Paci, P., Joshi, H., Makepeace, G., Dolton, P., 1995. Is pay discrimination against young women a thing of the past? a tale of two cohorts. International Journal of Manpower 16, 60–65.

Paul, M., 2016. Is there a causal effect of working part-time on current and future wages? The Scandinavian Journal of Economics 118, 494–523.

Preston, A., Yu, S., 2015. Is there a part-time/full-time pay differential in australia? Journal of Industrial Relations 57, 24–47.

Richter, D., Schupp, J., 2012. Soep innovation sample (soep-is)Ůdescription, structure and documentation .

Richter, D., Schupp, J., et al., 2015. The soep innovation sample (soep is). Schmollers Jahrbuch: Journal of Applied Social Science Studies/Zeitschrift für Wirtschafts-und Sozialwissenschaften 135, 389–400.

Simpson, W., 1986. Analysis of part-time pay in canada. Canadian Journal of Economics , 798–807.

Spinnewijn, J., 2015. Unemployed but optimistic: Optimal insurance design with biased beliefs. Journal of the European Economic Association 13, 130–167.

Steiner, V., Wrohlich, K., 2004. Household taxation, income splitting and labor supply incentives–a microsimulation study for germany. CESifo Economic Studies 50, 541–568.

Steiner, V., Wrohlich, K., 2008. Introducing family tax splitting in germany: How would it affect the income distribution, work incentives, and household welfare? FinanzArchiv/Public Finance Analysis , 115–142.

Steiner, V., Wrohlich, K., Haan, P., Geyer, J., 2012. Documentation of the tax-benefit microsimulation model STSM: Version 2012. Technical Report. DIW Data Documentation.

Stevens, J., Brown, J., Lee, C., 2004. The second work-life balance study: results from the employeesŠ survey .

Train, K.E., 2009. Discrete choice methods with simulation. Cambridge university press.

Tummers, M.P., Woittiez, I., 1991. A simultaneous wage and labor supply model with hours restrictions. Journal of Human Resources , 393–423.

Van Soest, A., 1995. Structural models of family labor supply: a discrete choice approach. Journal of human Resources , 63–88.

Wippermann, C., 2018. Frauen in teilzeit: Lebensqualität oder teilzeitfalle.

Wolf, E., 2002. Lower wage rates for fewer hours? a simultaneous wage-hours model for germany. Labour Economics 9, 643–663.

Zafar, B., 2011. Can subjective expectations data be used in choice models? evidence on cognitive biases. Journal of Applied Econometrics 26, 520–544.

Appendix

A Data: Further Details

A.1 Expectations Survey

Below is a description of the survey instrument used to elicit expectations of full-time workers about counterfactual earnings in part-time. Part-time workers are asked to consider the opposite scenario of switching to a full-time position of 40 hours per week.

Please imagine you were to switch to a part-time job from now on working 20 hours per week. Please only consider part-time jobs that you could carry out with your qualification.

(a) Which monthly gross income do you expect to earn when working part-time at 20 hours per week?

(b) How likely do you think it is that a part-time position at 20 hours per week yields a gross income of less than X-20% per month?*

(c) How likely do you think it is that a part-time position at 20 hours per week yields a gross income of more than X+20% per month?*

**Please report your answer in percent. 0% means you consider it impossible, 100% means that you are certain. You can use the percent values in between to graduate your answer.* [Note: X is the individual-specific response to (a)]

A.2 Survey Administration

This section describes key features of the sample design and field work of the SOEP and the SOEP Innovation Sample (SOEP-IS), which together constitute the German Socio-Economic Panel.

For both the SOEP and the SOEP-IS surveys, participating households were initially selected through multi-stage random sampling with regional clustering. Face-to-face interviews take place once a year and last approximately 1.5-2 hours. Participants receive small gifts upon completion of each interview, as well as small cash incentives. Households either receive 5 Euros per completed personal interview and 10 Euros per household interview, or they receive a lottery ticket for the charitable TV lottery "Ein Platz an der Sonne" (A place in the sun). Administration of both surveys lies with the German Institute for Economic Research, DIW

Berlin, but Kantar Public (formerly TNS Infratest) is responsible for the field work, including software programming, interviewer recruitment, interviewer training, and coordination of interviews.

A.3 Sample Comparison of SOEP and SOEP-IS

Table APP.1 displays summary statistics for the full sample of women surveyed in the SOEP-IS and the SOEP (2016) to demonstrate that samples are comparable and representative of the same population. Table APP.2 shows the equivalent analysis for the restricted samples used in estimation.

Table APP.1: Composition of SOEP and SOEP-IS (2016): All Women

	SOEP	SOEP-IS	p-value (Δ)
Gross wage	15.56	16.14	0.28
Agreed weekly hrs.	29.90	29.00	0.22
Overtime hrs. per week	2.50	2.65	0.60
Education in years	12.22	12.12	0.25
Tenure in years	9.90	10.25	0.54
Public sector (yes/no)	0.30	0.29	0.86
Firm size $>$ 200 (yes/no)	0.49	0.49	0.92
Temporary contract (yes/no)	0.18	0.16	0.53
Age in years	51.75	49.79	0.01
Eastern Germany (yes/no)	0.18	0.18	0.79
With children (yes/no)	0.24	0.23	0.63
Native born (yes/no)	0.83	0.82	0.64
N	15,077	792	

Notes: SOEP and SOEP-IS (2016). Sample averages with population weights. P-value from two sample mean comparison test of the mean difference Δ.

Table APP.2: Composition of SOEP and SOEP-IS (2016): Estimation Sample

	SOEP	SOEP-IS	p-value (Δ)
Gross wage	16.23	16.52	0.62
Agreed weekly hrs.	31.78	30.82	0.18
Overtime hrs. per week	2.71	2.80	0.76
Education in years	12.71	12.47	0.08
Tenure in years	10.42	10.16	0.69
Public sector (yes/no)	0.26	0.28	0.56
Firm size $>$200 (yes/no)	0.50	0.50	0.96
Temporary contract (yes/no)	0.13	0.14	0.76
Age in years	44.26	43.50	0.33
Eastern Germany (yes/no)	0.18	0.17	0.64
With children (yes/no)	0.30	0.30	0.84
Native born (yes/no)	0.82	0.82	0.88
N	5,492	286	

Notes: SOEP and SOEP-IS (2016). Sample averages with population weights. Estimation sample excludes women who are not working, self-employed, in marginal employment, civil servants, pensioners, in training, in community service or in the military.

B Model: Further Details

B.1 Translog Utility Index

The translog specification takes the following form:

$$U_{nj}(C_{nj}, L_j) = \beta_1 \cdot lnC_{nj} + \beta_2 \cdot lnL_j + \beta_3 \cdot (lnC_{nj})^2 + \beta_4 \cdot (lnL_j)^2 + \beta_5 \cdot (lnC_{nj} \times lnL_j) + (\sum_k \alpha_k' x_{n,k}) \cdot L_j + \varepsilon_{nj}$$

where β collects the coefficients of the linear and the non-linear terms by which the natural logarithms of C_{nj} and L_j enter utility; see also Van Soest (1995) . As before, α_k measures the utility from leisure, which depends on observable taste-shifters $x_{n,k}$. The additive random component ε_n is assumed to be iid Type I extreme value distributed.

B.2 Tax and Welfare Regime

The model implements details of the 2005 German tax and benefit system based on features of the German Tax and Benefit Microsimulation Model (STSM) described in Steiner et al. (2012) to simulate net income for each employment choice, following three steps: First, I subtract professional and deductible expenses to derive taxable income. Second, I calculate income tax liability by applying tax formulas depending on marital status. Finally, I deduct liabilities from gross income and add transfers to obtain net income.

To obtain taxable income in step one, gross labor income of the household is converted into real terms (base year 2005) and aggregated to annual amounts. For counterfactual choice categories, I derive alternative-specific gross earnings by multiplying hours times the hourly wage rate that is allowed to vary across full-time and part-time choices. I disregard income components from alternative sources such as capital income or income from renting and leasing.[17] Given gross annual real income, I deduct the lump-sum amount of 920 Euros for professional expenses ("Werbungskosten") for all workers. In addition, actual or lump-sum deductible expenses ("Sonderausgaben") are subtracted up to a maximum amount. I simplify this step and consider only the general flat rate amount of 36 Euros ("Pauschbetrag") as well as expenses for social security contributions.[18] Table APP.3 presents detailed information on how deductible

[17] Since I exclude pensioners and self-employed women, I also disregard income from pensions or self-employment.

[18] I abstract from other deductible expenses such as insurance contributions, alimony payments, church tax, expenses for training, donations and tax consultancy expenses

expenses are accounted for. For simplicity, the model does not incorporate loss deductions and extraordinary deductable expenses ("aussergewöhnliche Belastungen"). One further simplification I resume to involves the distinction between child allowances that are deducted before applying the tax function and child benefits ("Kindergeld"), which are added afterwards. A more accurate account of the tax-benefit system would conduct a higher-yield test ("Günstigerprüfung") and assign the more favorable rule (Steiner and Wrohlich, 2008). I abstract from this distinction and assume all couples with children receive child benefits.

Table APP.3: Annual Deductable Expenses for Social Security Contributions in 2005

	Single individual	Married couple
Minimum ("Vorsorgepauschale")	$0.2 \cdot RV + min(0.12 \cdot INC, 1900)$	$0.2 \cdot RV_{HH} + min(0.12 \cdot INC_{HH}, 3800)$
Actual expenses		
Bracket 1 ("Diff. Vorwegabzug")	$max(0, 3068 - 0.16 \cdot INC)$	$max(0, 6136 - 0.16 \cdot INC_{HH})$
Bracket 2	$min(1334, SV - Bracket\ 1)$	$min(2668, SV - Bracket\ 1)$
Bracket 3	$min(667, SV - Bracket\ 1 - Bracket\ 2)$	$min(1334, SV - Bracket\ 1 - Bracket\ 2)$
Maximum	2001	4002

Notes: All amounts in Euros and annual terms. RV= old age pension contributions ("Rentenversicherung"). HH= household level. INC= gross income. SV= total social security contributions ("Sozialversicherung"). Old age (RV) contributions deductable up to a correction factor (20% in 2005)

Given taxable income, I obtain income tax liability of the household in step two. In Germany, due to the joint taxation of married couples ("Ehegattensplitting"), singles and married individuals are taxed differently. For singles, income tax formulas are applied directly to individual taxable income. For married couples, total taxable income of the household is first divided by two. Income tax formulas are then applied to half the amount of total taxable household income. The derived tax liability is then doubled to determine overall tax liability of the couple. Table APP.4 contains income tax formulas as well as minimal and maximal marginal tax rates for all available tax brackets. Income is not taxed below an annual allowance of 7,664 Euros and tax rates evolve according to a partially linear rule until a top income threshold of 52,152 Euros after which income is taxed at a constant marginal rate of 42%.

Table APP.4: Income Tax Formula in 2005 (§ 32 a Abs. 1 EStG)

Zone	Tax bracket	Tax formula	MTR (min)	MTR (max)
1	$\leq$ 7664	t=0	0	0
2	7665-12739	t=(883.74Y + 1500)Y	15%	23.97%
3	12740-52151	t=(228.74Z + 2397)Z + 989	23.97%	42%
4	$\geq$ 52152	t=0.42X - 7914	42%	42%

Notes: Income and tax liabilities refer to annual Euro amounts. MTR = marginal tax rate. Y and Z are 1/10000 of excess income over upper bound of the previous bracket. X is taxable income.

In step three, I compute net income by deducting income tax, social security contributions, and

the solidarity surcharge ("Solidaritätszuschlag")[19] from gross income and by adding transfers and benefits. I calculate unemployment benefits according to ALG II standard rates ("Regelbedarfssätze") that differ between East and West German regions and by household composition (Table APP.5). Payments are means-tested and individuals are only eligible for unemployment transfers if joint household income, including spousal income, is lower than transfer claims and if household assets are below exempted wealth allowances. I simplify the means-test by assuming households are ineligible for social assistance as soon as one spouse has positive labor income. In accordance with the STSM, I do not model payments from unemployment insurance (ALG I).[20] Child benefits are added once for each couple (the first three children receive 154 Euros each, all additional children receive 179 Euros each). I refrain from covering any additional benefits (e.g. allowances for housing, education, widows etc.).

Table APP.5: Unemployment Benefit Standard Rates in 2005 (SGB II/Hartz IV and SGB XII)

	Single adults (I)	Adults in couples (II)	Youth 14 - 18 (III)	Children $<$ 14 (IV)
East	331	298	265	199
West	345	311	276	207

Notes: Monthly allowances per person in Euros.

B.3 Simulated Log Likelihood Function

If full-time and part-time wages were observed for all individuals, including non-workers, the log-likelihood function would be given by

$$ln(L(\theta)) = \sum^{N} ln\left(\frac{exp(\beta' x_{ni})}{\sum_j exp(\beta' x_{nj})}\right) + \sum^{N}\left\{ln\ \phi\left(\frac{lnw_n - Z_n'\gamma}{\sigma_w}\right) - ln\ \sigma_w\right\} \tag{10}$$

where the first summand denotes the likelihood contributions from logit choice probabilities over hours choices and the second term gives the likelihood of the wage equation residuals, assuming log-normality, where $\phi(.)$ is the normal density.

Accounting for unobserved wage offers, two types of prediction errors must be integrated out, resulting in the following simulated log-likelihood function:

[19] Solidarity surcharge of 5.5% on tax liability accrues for couples (individuals) owing above 1944 (972) Euros annual tax.

[20] Individuals who worked in the previous year are, in principle, entitled to payments from unemployment insurance for the first 6 months after becoming unemployed. These payments are not means-tested and replace 60-67% of previous net income. I follow the STSM and assume all unemployed directly apply for unemployment benefits (ALG II).

$$
\begin{aligned}
ln(SL) = & \sum^{FT} ln \left\{ \frac{1}{R} \sum^{R} P_{n,FT}^{(r)} \right\} + \sum^{FT} \left\{ ln\ \phi \left(\frac{lnw_n^{FT} - Z_n' \gamma^{FT}}{\sigma_w^{FT}} \right) - ln\ \sigma_w^{FT} \right\} \\
& + \sum^{FT} \left\{ ln\ \frac{1}{R} \sum^{R} \phi \left(\frac{lnw_n^{PT,(r)} - Z_n' \gamma^{PT}}{\sigma_w^{PT}} \right) - ln\ \sigma_w^{PT} \right\} \\
& + \sum^{PT} ln \left\{ \frac{1}{R} \sum^{R} P_{n,PT}^{(r)} \right\} + \sum^{PT} \left\{ ln\ \phi \left(\frac{lnw_n^{PT} - Z_n' \gamma^{PT}}{\sigma_w^{PT}} \right) - ln\ \sigma_w^{PT} \right\} \\
& + \sum^{PT} \left\{ ln\ \frac{1}{R} \sum^{R} \phi \left(\frac{lnw_n^{FT,(r)} - Z_n' \gamma^{FT}}{\sigma_w^{FT}} \right) - ln\ \sigma_w^{FT} \right\} \\
& + \sum^{OLF} ln \left\{ \frac{1}{R} \sum^{R} P_{n,OLF}^{(r)} \right\} + \sum^{OLF} \left\{ ln\ \frac{1}{R} \sum^{R} \phi \left(\frac{lnw_n^{FT,(r)} - Z_n' \gamma^{FT}}{\sigma_w^{FT}} \right) - ln\ \sigma_w^{FT} \right\} \\
& + \sum^{OLF} \left\{ ln\ \frac{1}{R} \sum^{R} \phi \left(\frac{lnw_n^{PT,(r)} - Z_n' \gamma^{PT}}{\sigma_w^{PT}} \right) - ln\ \sigma_w^{PT} \right\}
\end{aligned}
\tag{11}
$$

where $P_{n,i}^{(r)} = \frac{exp(\beta' x_{ni})}{\sum_j exp(\beta' x_{nj}^{(r)})}$ denotes the simulated logit choice probability from draw $r \in R$. $w_n^{FT,(r)}$ and $w_n^{PT,(r)} \in x_{nj}^{(r)}$ are simulated full-time and part-time wage offers.

A full information maximum simulated likelihood estimator is given by

$$
\hat{\theta}_{FIMSL} = argmax_\theta\ ln(SL), \qquad \theta = (\beta, \gamma, \sigma_w^{FT}, \sigma_w^{PT})
$$

C Additional Results

C.1 Probabilistic Expectations

Here I show that constructing expected part-time wage effects from probability intervals yields similar point estimates as when asking for numerical Euro amounts directly. I use respondents' subjective probabilities for earning less than 80 percent and more than 120 percent of their numeric point estimate to construct individual-specific probability distributions (Figures APP.1, APP.2). I use non-parametric spline interpolation that allows for flexible approximations to individuals' subjective distributions, which outperforms parametric approximations (Bellemare et al., 2012). From these fitted distributions, I derive alternative measures of central tendency (subjective means and medians). I show subjective means and medians also center symmetrically around zero, mirroring point estimates built from direct numerical questions (Figures APP.3, APP.4).

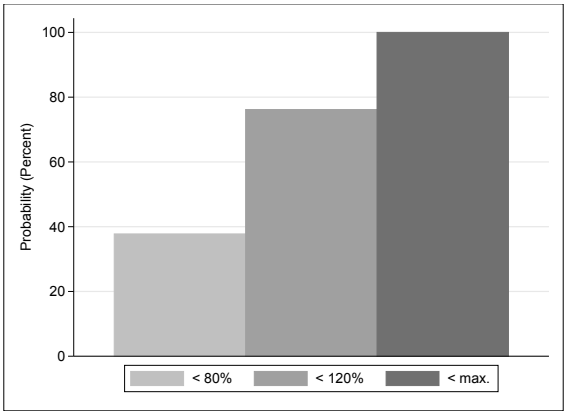


Figure APP.1: Mean discrete subjective cumulative density functions (C.D.F.s) for expected wages based on reported probabilities. SOEP-IS (2016).

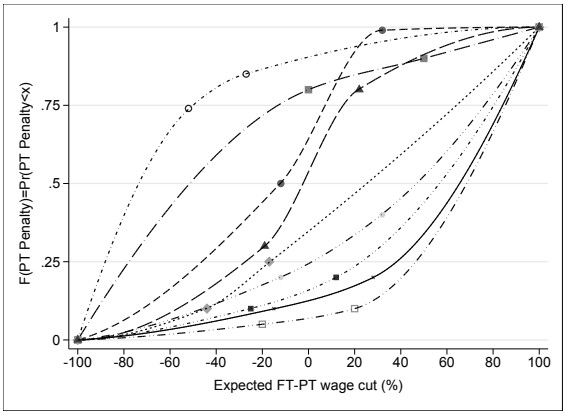


Figure APP.2: Interpolated smooth subjective C.D.F.s for expected part-time wage effect from subjective probabilities and non-parametric piecewise cubic hermite interpolating polynomials for selected individuals. SOEP-IS (2016).

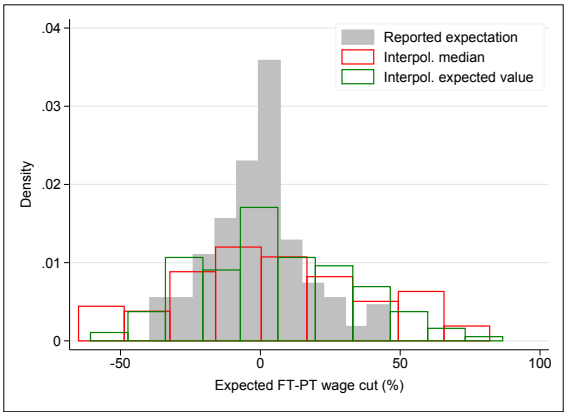


Figure APP.3: Distribution of central tendency, comparing reported point estimates (grey), interpolated medians (red), and interpolated mean (green). Interpolation based on probabilistic questions and non-parametric splines. SOEP-IS (2016).

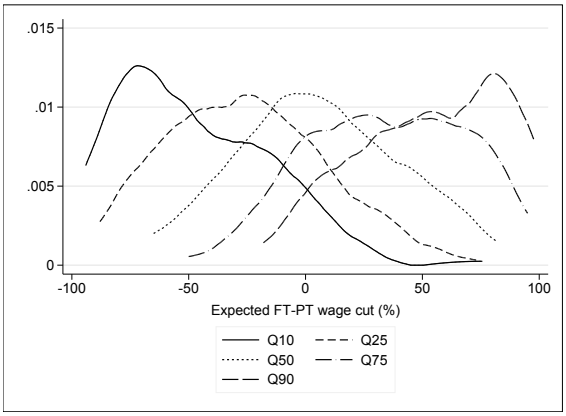


Figure APP.4: Distribution of subjective quantiles, based on probabilistic questions and non-parametric spline interpolation. SOEP-IS (2016).

C.2 FIMSL Estimation Results

Table APP.6 presents the full set of estimation results of the discrete choice model for different specifications of part-time status and working hours, using a constant relative risk aversion (CRRA) utility index.

Table APP.6: FIMSL Estimation Results of the Discrete Choice Model

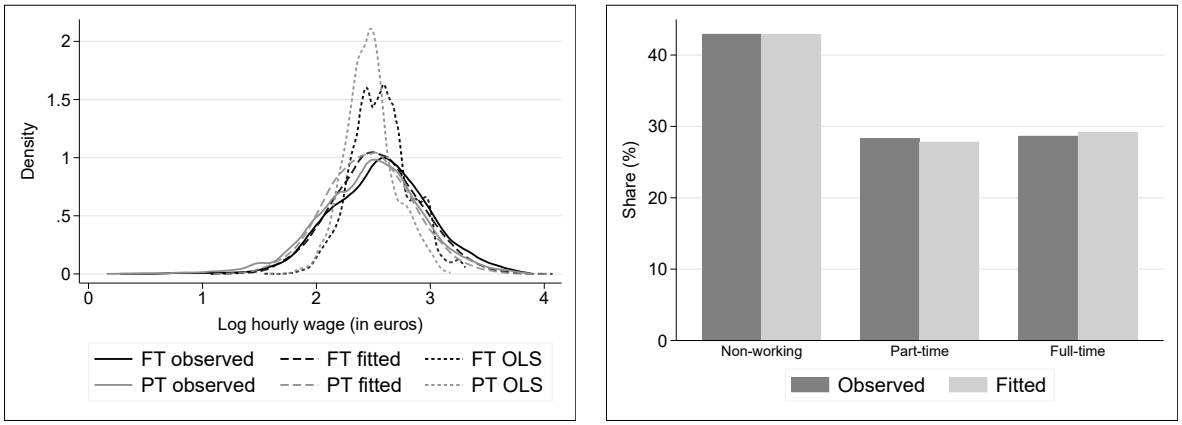
PT status: self-reported	**(1) Agreed hours**				**(2) Incl. overtime**			
	Full-time		Part-time		Full-time		Part-time	
Log wages	Coef.	Std.Err.	Coef.	Std.Err.	Coef.	Std.Err.	Coef.	Std.Err.
Education (years)	0.091	0.001	0.090	0.001	0.091	0.001	0.087	0.001
FT experience (years)	0.030	0.001	0.028	0.001	0.034	0.001	0.030	0.001
FT experience sq.	0.000	0.000	−0.001	0.000	−0.001	0.000	−0.001	0.000
PT experience (years)	0.000	0.001	0.018	0.001	−0.003	0.001	0.016	0.001
PT experience sq.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
East	−0.282	0.003	−0.261	0.004	−0.287	0.004	−0.267	0.004
Foreign born	−0.061	0.004	−0.050	0.004	−0.066	0.004	−0.052	0.004
Constant	1.140	0.009	1.060	0.010	0.994	0.011	1.018	0.012
Std.Dev.	0.076	0.001	0.090	0.001	0.087	0.001	0.102	0.001
Hours choice		Coef.	Std.Err.			Coef.	Std.Err.	
Consumption		0.124	0.003			0.138	0.003	
Hours		0.038	0.001			0.036	0.001	
Hours × Kids		0.041	0.001			0.039	0.001	
Hours × East		−0.018	0.001			−0.017	0.001	
Log likelihood		167219.180				186678.8172		
PT status: hours-based	**(3) Agreed hours**				**(4) Incl. overtime**			
	Full-time		Part-time		Full-time		Part-time	
Log wages	Coef.	Std.Err.	Coef.	Std.Err.	Coef.	Std.Err.	Coef.	Std.Err.
Education (years)	0.090	0.001	0.091	0.001	0.092	0.001	0.086	0.001
FT experience (years)	0.030	0.001	0.027	0.001	0.034	0.001	0.028	0.001
FT experience sq.	0.000	0.000	−0.001	0.000	−0.001	0.000	−0.001	0.000
PT experience (years)	0.001	0.001	0.017	0.001	0.000	0.001	0.017	0.001
PT experience sq.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
East	−0.280	0.003	−0.261	0.004	−0.279	0.004	−0.277	0.005
Foreign born	−0.064	0.004	−0.048	0.004	−0.068	0.004	−0.051	0.004
Constant	1.145	0.009	1.060	0.010	0.976	0.010	1.028	0.011
Std.Dev.	0.077	0.001	0.090	0.001	0.093	0.001	0.098	0.001
Hours choice		Coef.	Std.Err.			Coef.	Std.Err.	
Consumption		0.120	0.003			0.149	0.003	
Hours		0.037	0.001			0.035	0.001	
Hours × Kids		0.043	0.001			0.041	0.001	
Hours × East		−0.019	0.001			−0.021	0.001	
Log likelihood		167485.728				186786.764		

Notes: SOEP (2005-2016). Results from full information maximum simulated likelihood (FIMSL) estimation with constant relative risk aversion (CRRA) utility index.

C.3 Internal Goodness of Fit

I present graphical evidence of model fit (Figure APP.5) and estimated wage elasticities (Table APP.7) for the main specification of the discrete choice model with self-reported part-time status, agreed working hours, and a CRRA utility index.

C.3.1. Model Fit: Wages and Hours Choices



(a) Hourly Wages

(b) Hours Choices

Figure APP.5: Goodness of Fit of the Discrete Choice Model

C.3.2. Wage Elasticities

Estimated elasticities for a one percent increase in gross hourly wage for females in the sample are 0.41 percent for working hours and 0.22 percentage points for participation. These elasticities are mostly within the confidence intervals of comparable estimates by Haan (2006), deviations can be explained by differences in sample composition, most notably I include singles whereas Haan (2006) focuses on married couples.

Table APP.7: Labor Supply Elasticities

	Δ Hours (percent)		Δ Participation (p.p.)	
	Coef.	Std.Err.	Coef.	Std.Err.
All women	0.41	0.00	0.22	0.02
By region				
East	0.34	0.00	0.25	0.04
West	0.43	0.00	0.21	0.02

Notes: Predicted changes for a 1% increase in gross hourly wage.

C.4 Multivariate OLS Results on Group Differences

Table APP.8 presents the full set of multivariate OLS estimates corresponding to the graphical evidence in Figure 3 in section 5.3.

Table APP.8: Multivariate Analysis of Expected and Estimated Part-Time Wage Effects

	(1) Expected		(2) CRRA estimates		(3) Translog estimates	
Dep. Var. = part-time wage effect	Coef.	Std.Err.	Coef.	Std.Err.	Coef.	Std.Err.
Socio-demographics						
With children	8.22**	(3.80)	−2.52*	(1.35)	−2.53*	(1.37)
Married	7.60*	(4.17)	1.04	(1.40)	1.09	(1.43)
Eastern Germany	−3.80	(3.13)	2.03	(1.60)	2.61	(1.63)
Native born	−0.53	(3.97)	−1.80	(1.51)	−2.16	(1.53)
Human capital						
Education: Tertiary	−0.40	(4.46)	0.28	(1.84)	0.56	(1.87)
Education: Basic	5.89	(6.22)	2.06	(1.74)	1.97	(1.77)
Tenure > 10y.	2.47	(3.13)	3.11**	(1.46)	3.18**	(1.49)
Age > 40y.	1.62	(3.98)	−2.04	(1.43)	−2.75*	(1.46)
Job characteristics						
Part-time	−2.05	(3.17)	−9.23***	(1.39)	−11.52***	(1.41)
Temporary contract	6.60	(5.70)	3.06	(1.98)	3.26	(2.01)
Public sector	−3.70	(3.04)	0.66	(1.52)	0.53	(1.55)
Firm size > 200	−4.28	(2.95)	0.97	(1.32)	1.00	(1.34)
Overtime hrs. > 0	−5.81**	(2.85)	−1.14	(1.30)	−1.14	(1.32)
Manager	21.52*	(10.94)	7.49*	(3.86)	7.51*	(3.93)
Occupation (ISCO 88)						
ISCO 88 -1	−9.13	(15.11)	−2.25	(4.67)	−2.23	(4.76)
ISCO 88 -2	5.39	(10.27)	1.49	(3.27)	1.40	(3.33)
ISCO 88 -3	9.20	(9.81)	3.29	(2.69)	3.47	(2.74)
ISCO 88 -4	5.13	(10.25)	2.11	(2.93)	2.22	(2.99)
ISCO 88 -5	9.83	(10.37)	0.97	(2.71)	0.98	(2.76)
ISCO 88 -6	17.52*	(9.04)	−1.88	(7.92)	−2.04	(8.08)
ISCO 88 -7	−12.73	(14.94)	7.28*	(4.37)	7.45*	(4.45)
ISCO 88 -8	2.32	(11.84)	2.16	(4.22)	2.47	(4.29)
Mean dep. variable (s.e.)	1.45	(1.43)	4.74	(0.63)	3.56	(0.64)
Constant	yes		yes		yes	
N	183		4,488		4,488	

Notes: SOEP-IS and SOEP (2016). Dependent variable is the expected (1) or estimated (2,3) part-time wage effect in percent. Estimates from multivariate OLS regressions with robust standard errors in parentheses. Based on self-reported part-time status and contractually agreed working hours. Base categories: intermediate education and ISCO-88-9. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$