

Income Tax Notches and Working Hours Mismatch: Evidence from Mini Jobs in Germany*

Ulrike Unterhofer

Véra Zabrodina

Abstract

Many workers do not work their desired number of hours, especially in the low-earning segment. We study whether income tax notches cause hours mismatch among mini jobbers in Germany, which are small jobs exempt from taxes up to a specific earnings threshold. We find substantial underemployment at the threshold, indicating it limits the workers targeted by the policy from reaching their optimum hours. A reform that raised the threshold increased mini jobbers' earnings, but also raised underemployment, as desired hours increased more than actual ones. Our findings suggest that firms' preferences for mini jobs shape the earnings distribution, with implications for estimating labor supply responses.

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* Unterhofer: University of Basel, Faculty of Business and Economics, Peter-Merian Weg 6, 4002 Basel, Switzerland (email: ulrike.unterhofer@unibas.ch); Zabrodina: University of Basel, Faculty of Business and Economics, Peter-Merian Weg 6, 4002 Basel, Switzerland (email: vera.zabrodina@unibas.ch). We thank Hans Bloemen, Sydnee Caldwell, David Card, Pauline Carry, Hilary Hoynes, Rafael Lalive, Mariele Macaluso, Ioana Marinescu, Jesse Rothstein, Emmanuel Saez, Alisa Tazhitdinova, Linh Tô, Andrea Weber, Conny Wunsch, and Nicolas Ziebarth, as well as numerous conference and seminar participants for useful comments.

1 Introduction

Working hours are a key attribute of jobs, yet many workers do not achieve their desired number of hours.¹ Underemployment affected 5.5% of dependent workers in 2017 in the OECD ([MacDonald, 2019](#))—a large share of unused labor that is missed by the unemployment rate. The existence of hours mismatch challenges the canonical labor supply model where workers freely choose their working hours at the given wage, resulting in no hours mismatch in equilibrium. Understanding the determinants of hours mismatch is key for measuring labor supply responses and gauging the effects of tax policy.

Governments worldwide have aimed at stimulating employment among low-earning workers by introducing income tax benefits below given earnings or hours thresholds. Prominent examples of such policies include the Earned Income Tax Credit (EITC) in the United States, the Working Tax Credit (WTC) in the United Kingdom, and mini jobs in Germany—the context for this study. Mini jobs, introduced in 1999, are exempt from social security contributions and income taxes up to €325 of wage earnings. Taxes increase significantly upon crossing this threshold, incentivizing workers to decrease their labor supply to remain below it.² Yet as we will show, low-earning workers are also most prone to underemployment. Is this an unintended effect of the tax benefit?

This paper examines the effect of the mini job tax notch on hours mismatch among low-earning females in Germany. Our key insight is that tax benefits can drive underemployment among eligible workers. We find evidence that the mini job threshold constrains workers who wish to work and earn more. Our findings are consistent with firms creating jobs at the threshold to accommodate workers’ aggregate preference to bunch ([Chetty et al., 2011](#); [Haywood and Neumann, 2021](#)). However, they also suggest that firms impose their own hours preferences to offer mini jobs due to their flexibility and low labor costs ([Bachmann et al., 2012](#); [Wippermann, 2012](#); [Tazhitdinova, 2020](#)). This can result in more mini jobs than workers want. The bunching in earnings at the threshold then captures a lack of larger part-time jobs, on top of a behavioral labor supply response.

The German tax system offers several compelling features to analyze the effect of tax policy on hours mismatch. First, we use rich survey data from the German Socio-Economic Panel (GSOEP), which provide information on workers’ desired and actual working hours. This allows us to analyze the wedge between workers’ actual jobs and their stated preferences at the individual level. We conduct extensive checks to validate desired hours as a measure of optimal labor supply under the tax notch, and exclude that

¹Our focus is on a mismatch in working hours rather than in skill level, and so on the labor supply side. Following the existing literature, hours mismatch is defined as the difference between desired and actual working hours. A positive mismatch captures underemployment, and a negative one, overemployment, respectively.

²Extensive empirical evidence, starting with [Saez \(2010\)](#), has found support for this response with bunching at tax discontinuities in Germany and other settings. See [Blundell \(2000\)](#) and [Hoynes \(2019\)](#) for reviews focusing on the WTC and the EITC, respectively.

the resulting hours mismatch is pure measurement error or misunderstanding of the tax schedule. Second, the mini job tax notch is a salient and actively-debated feature of the German tax system. The threshold is nominal, rarely changed, and does not match any other policy discontinuity. Any bunching at the threshold is driven by the tax notch. Third, a reform in 2003 shifted the notch from €325 to €400 and reduced its size from €115 to €70 on average. This provides an additional source of exogenous variation to study how actual jobs and preferences track the threshold.³

We begin by documenting novel stylized facts on hours mismatch. We focus on women since they represent the vast majority of prime-age mini jobbers, and commonly seek part-time employment. First, mini jobbers are most affected by underemployment in the earnings distribution. Nearly half of them work less than their desired hours, with an hours mismatch of 4.8 hours on average. Underemployment drops at the mini job threshold—a first piece of descriptive evidence for the notch representing a constraint.

Second, we find excess bunching in desired earnings of 5% at the mini job threshold, which is more than twice smaller than the bunching in actual earnings of 12%. These findings support that workers state their desired hours while taking the tax notch into account. Many workers do want jobs below the notch. However, many actual mini jobbers are off their supply curve and would like to work more at the current wage. The mismatch in actual and desired earnings distributions suggests that firms accommodate workers' preference to bunch, but also impose their preferences and oversupply at-the-threshold jobs. We bolster this explanation by analyzing adjustments in the earnings distribution triggered by the mini job reform from 2003. The bunching mass in desired earnings tracks the threshold at the reform in 2003, while some of the mass in actual earnings lags behind at the old threshold. This is consistent with adjustment frictions due to hours constraints as in ([Gudgeon and Trenkle, 2024](#)).

Third, characteristics reflecting a larger average notch (e.g. having a high-earning partner, having young children, and living in West Germany), are associated with lower underemployment and higher bunching in desired earnings. These characteristics also match those of the group targeted by the tax policy, and are more prevalent among mini jobbers than in higher earnings segments. The associations are consistent with mini jobbers' underemployment being driven by workers who face a smaller incentive to bunch, but lack alternative options.

The second part of our analysis uses a difference-in-differences design to assess how the reform impacts hours mismatch. We compare the labor supply outcomes of mini-jobbers to those of higher-earning workers, whose tax schedule remained unchanged. Mini-

³While we study the 2003 reform, the mini job threshold was further increased to €450 in January 2013, and to €520 in October 2022 with the objective of triggering wage increases for mini jobbers. We do not consider later reforms due to the introduction of a country-wide minimum wage in 2015, which strongly affected the low-earning segment ([Dustmann et al., 2021](#)).

jobbers are expected to immediately adjust their desired hours to meet or exceed the new threshold. However, actual contract adjustments may be delayed due to demand-side constraints. Our estimates indicate that desired hours among mini-jobbers increased by 1.7 hours, while actual hours rose by less than one hour, resulting in a one-hour increase in underemployment (20 percent in relative terms). This underemployment is partly due to some mini jobbers being stuck at the previous threshold. Additionally, the reform's reduction of the notch may have driven optimal labor supply above the new threshold for some workers. Overall, the shift in the threshold does not resolve the mismatch. A heterogeneity analysis reveals that the rise in underemployment is more pronounced in highly competitive industries and those with greater dispersion of working hours.

Our paper contributes to the long-standing literature on the measurement of labor supply elasticities. A large body of papers have relied on a revealed-preferences approach and exploited bunching in the actual earnings distribution (Saez, 2010; Kleven and Waseem, 2013; Kleven, 2016). To recover the structural elasticity, they focus on frictions that prevent workers from bunching *at* the discontinuity. We highlight that workers can also be prevented from moving *away from* the discontinuity by exploiting an individual-level measure of hours mismatch. In our (local) case, relying solely on the actual earnings distribution leads to an overestimation of labor supply elasticities. Our stated-preferences analysis illustrates that a pure revealed-preferences approach may not provide sufficient statistics for the effects of tax notches when institutional features constrain workers or when demand-side factors are at play. This is in line with arguments in Ham (1982) and Kahn and Lang (1991).

Our analysis complements existing studies on mini jobs using administrative data from Germany. Tazhitdinova (2020) estimates labor supply elasticities using a bunching estimator at the mini job threshold. The author finds large elasticity estimates for groups with weak incentives to bunch. She provides evidence supporting that this heterogeneity reflects 'firm bunching', i.e. firms oversupplying mini jobs across the board because they come with lower fringe benefits. Our results are in the same vein. Gudgeon and Trenkle (2024) find a sluggish adjustment of actual earnings to increases in the threshold in 2003 and 2013. They provide evidence for firms' hours constraints driving these frictions. Our finding that desired hours adjust faster than actual hours support this interpretation. Haywood and Neumann (2021) estimate a structural job search model and illustrate that the distortionary welfare effects of the mini job threshold are amplified by firms. They find that removing the notch in a budget-neutral way would cause workers who take small part-time jobs mainly for the tax exemption (such as students and retirees) to leave the market. However, this change would benefit other part-time workers by increasing their gross earnings and hours.

Our paper also adds to the literature on the sources of hours mismatch. In particular,

we highlight a role for tax benefits, which interact with demand-side factors.⁴ Chetty et al. (2011) formalize this concept through a framework that incorporates job-switching costs and firms hours constraints, which are modeled as a commitment to a production technology. In equilibrium, individual workers may be off their labor supply curve due to the interaction between job-switching costs and hours constraints. However, the distribution of working hours offered by firms reflects workers' aggregate preference to bunch due to the market clearing condition. In our study, the mismatch between actual and desired working hours suggests that firms impose their own preferences rather than merely accommodating workers' preferences endogenously. Our results support models which feature firm bargaining power over working hours, as in Carry (2024) and Lachowska et al. (2023).⁵ They also resonate with findings in Dube et al. (2022) that working hours are a critical job attribute in the low-earning segment.

The paper proceeds as follows. Section 2 describes the institutional setting for mini jobs in Germany, as well as the data. Section 3 discusses the incentives generated by a tax notch for low-earning workers and firms. Section 4 presents stylized facts on working hours mismatch. Section 5 describes our difference-in-differences design to estimate the reform effect, presents corresponding results, robustness checks, and explores mechanisms. Finally, Section 6 concludes.

2 Institutional Setting and Data

2.1 Mini Jobs in Germany

Mini jobs are employment relationships with monthly earnings below a given threshold that are exempt from employee social security contributions (SSC) and income taxation.⁶ They were introduced in 1999 with a €325 limit to promote the labor market participation of individuals with low earning capacity. The tax schedule is described in Appendix Table A.1. Workers faced a salient tax notch, and an incentive to earn just below the threshold rather than just above.

Upon crossing the threshold, all workers were subject to approximately 21% of SSC. While a worker with gross monthly earnings of €325 could keep the full amount, a worker earning €326 could only keep €261 after paying SSC. Additionally, income taxes increased sharply for married workers, depending on the marginal income tax rate applicable to the household given its income. Married couples can choose between single and joint taxation,

⁴See, e.g., Altonji and Paxson (1988), Altonji and Paxson (1992), Lachowska et al. (2022) and Labanca and Pozzoli (2022) for empirical evidence on firm hours constraints.

⁵Recent studies have also documented low worker bargaining power over wages, e.g. Brenzel et al. (2014); Lachowska et al. (2022); Card (2022).

⁶Mini jobbers are not covered by health and unemployment insurance. However, mini jobbers are entitled to paid sick days, employment protection against dismissal and parental leave. Contributions to pensions are voluntary and, since 2013, the default option from which mini jobbers can opt out. If workers exceed this limit for three consecutive months, their jobs are converted into regular employment. In such cases, all social security payments fall onto the employer.

whereby filing taxes jointly is usually advantageous and chosen by the majority.⁷ In 2000, yearly income was tax-free up until a basic allowance of about €6,900, after which the tax rate jumped to 22.9% and increased nearly linearly with taxable income up until €59,000. Hence, workers who were single or had a household income below the basic allowance did not pay income taxes when crossing the mini job threshold (approximately 20% of our sample). The rest faced an average marginal income tax rate of 23.1%.

In our sample, the total notch amounted to €122 on average in 2000. Appendix Table A.2 gives an overview of the employee and employer SSC contributions, income tax rates, the notch size and their evolution over time. Up until 2003, employers paid only slightly higher SSC for mini jobbers than regular workers, at 22 and 21%, respectively.

2.2 The Mini Job Reform from 2003

In April 2003, a reform was implemented that aimed at further stimulating employment in the low earnings segment (Deutscher Bundestag, 2002). The bill was drafted in November 2002 and passed in December of the same year. The reform increased the mini job threshold from €325 to €400 (i.e. a real increase of around 18%). It also introduced so-called *midi jobs* with monthly earnings between €400 and €800. Employee SSC contributions increased linearly from 4% to 21% in this interval. The SSC notch at the mini job threshold thus became much smaller, which weakened the incentive to bunch. The income tax notch remained large for married workers, who continued not paying income taxes below the threshold and were taxed depending on their spouses' income above. Similarly to the pre-reform period, the marginal tax rate for earnings above the threshold amounted to around 21%.

There were several additional changes aiming at enhancing the flexibility of mini job creation in the German labor market. First, the reform abolished the 15-hour limit on weekly working hours for mini jobs. Second, it introduced the possibility to take up a tax-free secondary mini job in addition to a regular primary job at another firm. Third, a central administration, the *Minijob-Zentrale*, was established which is responsible for registering mini jobbers, assisting employers and workers with all administrative matters related to taxes and SSC, and facilitating the creation of mini jobs. Finally, to counteract the possible crowding out of regular jobs by mini jobs, the reform increased the employer SSC for mini jobs from 22 to 25%.

From 2000 to 2002, mini jobs constituted a substantial share of around 13% of total employment, corresponding to around 4 million workers (Eichhorst and Zimmermann, 2007). After 2003, the number of mini jobs increased to about 6 million, mostly due to

⁷When opting for joint taxation, the income tax of a married couple is calculated by applying the tax function to half of the total income of both spouses and multiplying the amount by two. The savings from filing jointly increase in the difference between the individual earnings of the spouses.

the take-up of secondary mini jobs.⁸

Other policy changes and macroeconomic environment. The mini job reform was part of the Hartz reforms, which were implemented in the years 2003 to 2006 (see e.g. [Jacobi and Kluve 2007](#) and [Wunsch 2005](#)). Their aim was to reduce unemployment and increase the matching efficiency in the German labor market. Temporary agency employment was deregulated, subsidies for entrepreneurs were introduced, and the employment agencies and their services were reorganized. An important part of the reform package was the introduction of means-tested social benefits for the long-term unemployed in January 2005. In February 2006, the potential duration of unemployment insurance benefits was reduced for workers older than 45 with stable employment.

In the early 2000s, Germany saw low economic growth and a high level of unemployment. In 2003, the job destruction rate started to decrease and the unemployment rate followed in 2005 ([Carrillo-Tudela et al., 2021](#)). This period also displayed modest wage growth overall and a rise in wage inequality, with a strong decline in real wages at the bottom of the wage distribution. This development went hand in hand with a decline in union coverage and a decentralization of the wage setting process from the industry to the firm level ([Dustmann et al., 2009, 2014](#)).

2.3 Data

Our empirical analysis is based on the German Socio-Economic Panel (GSOEP), a representative longitudinal study of private households in Germany. It gathers information from around 15,000 households on a wide range of topics (see [Goebel et al., 2019](#) for an overview). Interviews are conducted yearly between January and October. The GSOEP is the only dataset that allows observing working hours over an extended period of time in Germany.⁹ Specifically, a key advantage is the availability of *desired* working hours, which are unobserved in administrative social security data. Another one is in observing specific components of actual working hours, including overtime and contractual hours. We exploit this additional information to test to what extent our results are driven by responses in overtime, or by workers with defined contractual hours. Over a third of mini jobbers have unspecified or missing contractual hours compared to 13% among regular workers. Self-reported working hours are thus the most informative measure for this group, despite the possibility of measurement error. We now describe our analysis sample and the key variables used in our analysis.

Sample. Our estimation sample is a cross-section of employed females in the lower three

⁸[Tazhitdinova \(2022\)](#) finds that about half of the increase in secondary jobs can be causally explained by the reform. We address extensive-margin responses in the take up of primary mini jobs further in Section 5. See also [Caliendo and Wrohlich \(2010\)](#), [Tazhitdinova \(2020\)](#), and [Carrillo-Tudela et al. \(2021\)](#).

⁹Administrative data on actual working hours in Germany are only available for the years 2011 to 2014. Their precision for small jobs is limited, as some employers report actual and others contractual hours, and often do not update small hours changes ([Dustmann et al., 2021](#); [Gudgeon and Trenkle, 2024](#)).

quartiles of the wage earnings distribution. Specifically, we keep respondents with positive actual working hours and labor earnings lower than €2500 in the last month. Since we are interested in workers with standard tax and social insurance incentives, we restrict our analysis to women aged 26 to 55. This ensures that our results are not driven by students or part-time workers close to retirement (around 20% of mini jobbers). We then focus on women since they represent nearly 95% of prime-age mini jobbers. We also exclude women who reported receiving unemployment benefits or assistance, as they face different taxation rules.

We analyze the years 2000 to 2007, i.e. a symmetric window around the reform. Mini jobbers enter the data starting from 2000, at which point the sample size of the GSOEP was increased. The sampling and relevant questionnaires remained stable thereafter. We cut in 2007 to avoid the effects of the Great Recession, which strongly affected unemployment and underemployment rates (Faberman et al., 2020; Bell and Blanchflower, 2021). In our estimations, we exclude individuals interviewed after April in the 2003 wave (30% of observations), as these were already affected by the reform.

Identifying mini jobbers. Our time-constant definition of mini jobbers includes workers who report earning below €400 and being marginally or part-time employed. Beginning in 2001, the GSOEP includes a specific question asking whether the respondent works in a mini job. Marginal employment is additionally recorded through the labor force status. Our results are robust to using either of these variables as alternative means to identifying mini jobbers (Appendix Table D.6). Our sample excludes the few mini jobbers who report working more than 30 hours, which is implausible for such jobs.

Desired hours. Desired hours measure the number of hours per week that employed respondents state wanting to work: “If you could choose your own number of working hours, taking into account that your earnings would change according to the number of hours: How many hours would you want to work?” Our stated-preferences perspective relies on self-reported desired hours being an accurate measure of optimal labor supply, given individuals’ current net wage, budget and time constraints, as well as preferences. Several elements support this claim, starting with the questionnaire itself. The question creates an anchor to the current earnings, such that we can expect respondents to answer given their current wage. Other anchoring effects are unlikely because respondents are asked about desired hours before actual hours and other questions about current employment. Furthermore, the question excludes any external constraints by pointing to the possibility of choosing own hours.

In Section 4, we present evidence to validate desired hours by analyzing the determinants of hours mismatch, and bunching in desired earnings at the mini job threshold. Previous studies support the validity of desired hours reported in the GSOEP (Beckmannshagen and Schröder, 2022), as well as in survey data from, e.g. the Netherlands

(Bloemen, 2008) and the United States (Faberman et al., 2020). The latter shows that desired hours do not only reflect ‘cheap talk’, and are strongly correlated with job search effort.

Actual hours. Employed respondents are asked about their actual working hours in their primary job: “How many hours do you actually work per week on average including overtime?”¹⁰

Hours mismatch. Our main measure of hours mismatch is the difference between desired and actual hours. The variable is continuous, but its interpretation depends on its sign. A positive mismatch indicates underemployment, i.e. the worker has a positive unused labor capacity, and reports wanting to work more than they are. A negative mismatch indicates overemployment, respectively. We also compute a binary indicator for being underemployed, i.e. wanting to work at least 2.5 hours more.

Earnings and wage. For monthly earnings, we use gross labor earnings in the primary job in the previous month, which are imputed in case of item non-response (see Frick and Grabka, 2005). This variable includes overtime payments but not irregular payments such as holidays or bonuses. It serves for our main definition of the treatment groups (see Section 5). We construct the hourly wage at the primary job using the monthly earnings and the actual hours worked per week, and winsorize this variable at the 0.5 and 99 percentiles to limit the influence of outliers.

Multiple job holding. Our main analysis excludes multiple job holders, because actual working hours are only recorded for the primary job, while desired hours cannot be attributed to a specific job in the questionnaire. With this restriction, we also avoid a direct confounding effect of secondary mini jobs becoming tax free at the reform. While the reform incentivized workers earning more than €400 to take up a secondary mini job, the incentives did not change for primary mini jobbers (i.e. our treatment group). In our sample, only 3% of them held a secondary job before and after the reform. Tazhitdinova (2022) finds that high-earning workers (i.e. our control group), who typically work full-time, were the least likely to take up secondary jobs due to low marginal returns and time constraints. Importantly, the author finds no crowding out effect on primary earnings, or primary mini jobs as such. A robustness check relaxing this restriction does not affect our main results (Table D.6). We are thus confident that excluding multiple job holders does not lead to selection into treatment based on the propensity to take up a secondary tax-free mini job.

¹⁰We top code actual and desired hours at 60 hours per week, which corresponds to the legal limit for working hours in Germany, and the 95th percentile in our main estimation sample. Our results are not sensitive to this cap, see Appendix Table D.6.

3 Conceptual Framework

This section provides a conceptual framework for interpreting the stylized facts presented in the next section. We explore potential responses of workers and firms to the tax notch and the resulting predictions about hours mismatch. We begin with a static analysis, followed by a discussion of dynamic adjustments to a shift in the notch.

3.1 Worker and Firm Responses to Tax Notches

In the canonical labor supply model, workers choose their optimal labor supply through their working hours, given the tax schedule. Throughout this discussion, we assume that workers take wages as given, and that wages are orthogonal to hours preferences.¹¹ Workers are able to achieve their optimal working hours (and earnings), if there are no frictions (e.g. search costs, inattention).¹² The sharp jump in the income tax rate at the mini job threshold creates a convex tax notch. Workers who would optimally earn slightly more than the threshold amount in the absence of the notch can increase their utility by choosing working hours to reach the threshold amount. This response drives bunching in desired earnings at the threshold with smoothly-distributed ability among workers (Kleven and Waseem, 2013).

In a general equilibrium framework however, jobs are only achievable if they are created by firms. In Chetty et al. (2011), firms post jobs with given hours, and face hours constraints modelled as an inability to adjust the hours of the job after the match happens. Workers' preferences endogenously determine the distribution of hours offered in equilibrium. With a tax notch, actual bunching occurs through firms accommodating the preferences of workers, and creating the desired amount of jobs at the threshold. The aggregate earnings distribution matches the optimal one for workers under a market clearing condition that all workers are employed. There is no mismatch in the aggregate in equilibrium, but some individual workers do not work their optimal hours due to the interaction between hours constraints and search costs. Their optimal job exists, but frictions essentially prevent them from swapping with other workers. Importantly, search costs alone do not generate such an aggregate mismatch, as the actual earnings distribution would still match the desired one despite individual-level mismatches.

Now let firms have idiosyncratic preferences (and bargaining power) over working hours, which is assumed away by Chetty et al. (2011). This is a plausible scenario in the

¹¹This assumption builds on evidence for low bargaining power over wages in the low-earning segment (Card, 2022; Lachowska et al., 2022), and for small uncompensated labor supply elasticities (Lachowska et al., 2023).

¹²Alternative, supply-side explanations for hours mismatch proposed in the literature are unlikely in our setting. First, mini jobs are a well-known, salient and frequently-debated feature of the German tax system. Second, coordination on hours (Rogerson, 2011; Labanca and Pozzoli, 2022) can be discarded given the hours dispersion we observe among mini jobbers, and the fact that the incentives to bunch apply in the earnings dimension. This differs from bunching in hours at institutional thresholds, e.g. 40 hours for full-time jobs.

low-earning segment. It is supported by recent empirical evidence (Labanca and Pozzoli, 2022; Lachowska et al., 2023), although models incorporating firm preferences remain sparse. If mini jobs create rent that firms can extract compared to regular (part-time) jobs, firms will create more mini jobs than workers would want. Firms may then push workers off their labor supply curve, such that workers can no longer achieve their optimal working hours. This creates a mismatch between actual and desired earnings distributions, with larger bunching in actual than in desired earnings at the threshold. Low-earning workers still take up suboptimal mini jobs (e.g. as a stepping stone into regular employment), but some end up underemployed as the market offers few alternatives to choose from.¹³

Several characteristics of mini jobs may incentivize their creation for firms. First, mini jobs have standardized features, as well as lower fringe benefits (e.g. vacation days or bonuses), and administrative costs (Bachmann et al., 2012; Wippermann, 2012; Tazhitdinova, 2020).¹⁴ They thus entail lower labor costs per employee relative to regular part-time employees. Employer SSC are only slightly higher than for regular workers. Conditional on offering mini jobs, firms have an incentive to bunch contracts at the threshold to minimize fixed costs. Second, mini jobs offer more flexibility than regular contracts for adjusting the workforce in response to short- and medium-term fluctuations in labor demand. They are more prevalent in sectors with such fluctuations (e.g. hospitality, retail, agriculture). Third, the tax benefit may create rent for firms with monopsony power. Holding monthly earnings at the threshold, firms can lower the hourly wage by setting higher hours.

3.2 Adjustments to a Shift of the Notch

By shifting up the tax notch and decreasing its size, the 2003 reform exogenously altered labor supply incentives for low-earning workers, particularly those earning below €400. The adjustment in the workers' optimal earnings depends on the desired earnings segment relative to the pre-reform threshold, and the incentive to bunch at the new threshold (see Seibold 2021 for a formal exposition of this intuition). The segment strictly below the old threshold is not affected by the reform. The old bunching mass spreads over the interval between the old and the new threshold, and part of it moves to the new threshold. Due to the decrease in the notch size and weakening of incentives to bunch, we expect more workers to want to locate above the new threshold, leading to smaller bunching at the new threshold. Overall, we expect a positive average reform effect on the desired working hours of mini jobbers driven by workers who target the new threshold and above. There may be few new bunchers who decrease their desired hours to target the new notch. The negative effect should be negligible given that the notch size decreases.

The shift in optimal working hours may also affect actual mini job contracts, which are shaped by both labor demand and supply. Firms may cater to workers' preferences

¹³The overprovision of jobs at the threshold can also lead some workers to be overemployed in case of a low availability of even smaller jobs.

¹⁴See also Johnson (2011) on the role of fringe benefits for hours mismatch.

to locate at the new notch. They may also themselves want to (over)supply mini jobs at the new threshold, by the same intuition as before. However, hours constraints or search costs may prevent adjustments in actual hours (Chetty et al., 2011; Gudgeon and Trenkle, 2024), and drive an increase in underemployment among workers who target the new notch but are stuck at the old one. Notice that a contract with earnings at the threshold creates a mechanical link between working hours and the hourly wage.

4 Anatomy of Hours Mismatch

We present three stylized facts about hours mismatch in Germany, focusing on mini jobbers. The analyses also provide evidence for self-reported desired hours being a reliable measure of optimal labor supply, which we discuss later in this section.

FACT 1: Mini jobbers are the most underemployed group in the earnings distribution.

Table 1 presents summary statistics for the key labor supply outcomes of interest across different earnings segments¹⁵ for the pre-reform period from January 2000 to April 2003. Mini jobbers (column 1) work on average 11.7 hours per week, but wish to work 16.5 hours. This difference results in a mismatch of 4.8 hours, with 48% of mini jobbers being underemployed. Notice that the hours constraint of 15 hours that applied before 2003 is not binding on average.

Figure 1 displays the distribution of actual and desired working hours for mini jobbers (see also Appendix Figure B.2 for the distribution of hours mismatch). The majority of them work up to 15 hours,¹⁶ with noticeable heterogeneity around the mode at 10 hours. There is clear underemployment both before and after the reform. Many mini jobbers would like part-time jobs with 20 or 30 hours, and some full-time, 40-hour jobs. These spikes increase after the reform (panel b). Very few mini jobbers wish not to work. The hours mismatch is quantitatively important in the aggregate. The total number of desired hours was 41% larger than actual hours in our sample of mini jobbers before the reform.

When moving up the earnings distribution, actual hours increase more steeply than desired hours. Figure 2 shows that hours mismatch turns from under- into overemployment on average at around 25 actual working hours per week, and €900 of monthly earnings. The highest-earning workers in our sample are overemployed by 4.6 hours on average, and only 7% are underemployed. The share of underemployed workers converges to nearly zero for full-time jobs. Importantly, hours mismatch and the share of underemployed workers drops at the mini job threshold. This provides an additional piece of descriptive evidence supporting that mini jobbers are constrained by the threshold.

¹⁵The mini job threshold corresponds to the 10th percentile of the distribution of primary earnings in our sample, €800 to the 20th, €1500 to the 45th, and €2500 to the 75th.

¹⁶Before the reform (panel a), 16% of mini jobbers report working more than 15-hour constraint, possibly due to informal overtime, or misreporting.

FACT 2: *The actual earnings distribution lies to the left of desired earnings, and displays twice larger bunching at the mini job threshold.*

We analyze how the hours mismatch maps into the earnings distribution by comparing the distribution of actual and desired monthly earnings, i.e. desired hours multiplied by the current hourly wage and weeks.¹⁷ Figure 1 plots the distribution of actual¹⁸ and desired monthly earnings for mini jobbers. The density of desired earnings for mini jobbers lies strictly to the right of actual earnings and overspills above the threshold. There is sharp bunching in actual and desired earnings at the pre-reform mini job threshold at €325 (panel c).

Actual earnings exhibit much larger bunching than desired earnings. To quantify the bunching, we use standard methods developed by Saez (2010) and Kleven and Waseem (2013) to compute the bunching mass at the threshold in both distributions (details are given in Appendix C). Specifically, we compare the observed spike at the threshold to a counterfactual earnings density obtained by fitting a polynomial to the density away from the threshold. The spike captures the local response to the mini job threshold, assuming that earnings would have been smoothly distributed in the absence of the notch. Table 2 presents the bunching estimates. We find a bunching mass of 12.2% in actual earnings, but only of 4.6% in desired earnings in the pre-reform period.

The actual earnings distribution does not match workers' desired one in the aggregate, as seen in Appendix Figure B.1. Importantly, the mismatch is asymmetric. Mini jobbers want to move up the earnings distribution, but there are few jobs actually available above the threshold. Among those workers actually earning more than €400, very few wish to locate below the threshold. In this case, factors that prevent mini jobbers from moving up the distribution appear more important than those preventing workers from precisely locating at the threshold (as in Kleven and Waseem, 2013). In light of the discussion in Section 3, this suggests that firms play a role in shaping the actual earnings distribution.

Panel (d) of Figure 1 shows a clear shift of the bunching in actual and desired earnings to the new threshold at €400. Post reform, both masses decrease to 7.0% and 2.8% for actual and desired earnings, respectively. This is consistent with workers responding to the smaller notch size. Meanwhile, the actual earnings distribution shows some residual bunching at the old threshold after the reform, which takes about three years to dissipate (Appendix Figure B.3 shows earnings distributions by year).¹⁹ This pattern suggests that

¹⁷Beckmannshagen and Schröder (2022) use this measure to decompose earnings inequality.

¹⁸The actual earnings distribution matches existing results using administrative data (Gudgeon and Trenkle, 2024; Tazhitdinova, 2020), and suggests that the earnings measures from the GSOEP are precise enough to reliably identify mini jobbers and their labor supply responses.

¹⁹Gudgeon and Trenkle (2024) and Tazhitdinova (2020) also document these patterns in the mini job context using administrative data. In the same vein, Gelber et al. (2020) in the United States, and Mavrokonstantis and Seibold (2022) in Cyprus find evidence for adjustment frictions substantially attenuating labor supply responses to tax policy changes, in the form of residual bunching at removed tax

adjustment frictions attenuate the shift to the new threshold.

FACT 3: The degree of underemployment of mini jobbers is negatively associated with the strength of the incentive to bunch.

We now analyze the determinants of hours mismatch among mini jobbers in Appendix Table B.3. A positive (negative) coefficient indicates an increase (decrease) in underemployment, as mini jobbers have a positive hours mismatch on average. The characteristics associated with lower underemployment are mainly those reflecting stronger incentives to bunch due to a higher household income, and a larger income tax notch. In other words, these characteristics reflect a lower propensity for being constrained by the threshold. All else being equal, underemployment is lower for workers who are married, reside in West Germany, and have children under 16 years of age. These results further support that individuals respond to tax incentives in terms of their optimal labor supply, as measured by desired hours. They are in line with similar checks in [Beckmannshagen and Schröder \(2022\)](#).

These characteristics align with the group targeted by the tax benefit policy and are more common among mini jobbers than in higher earnings segments (Table 1). Although mini-jobbers are of similar age on average, they are more likely to be married, live in West Germany, and have children under 16 years old. They tend to have lower educational levels and are less represented in the public sector, but more concentrated in the service sector. These differences persist both before and after the reform. [Tazhitdinova \(2020\)](#) finds similar patterns with a comparison group of regular workers that does not limit earnings.

We now assess how the bunching mass varies with worker characteristics that are correlated with lower hours mismatch, and a larger income tax notch. They might also capture heterogeneity in preferences. We run the bunching estimation separately in subsamples of workers who (i) live in West Germany, (ii) have children younger than 16, and (iii) whose partner income is above the median (unmarried women are coded as having a zero partner income). In all three subsamples, the degree of actual and desired bunching is higher than in the overall sample both before and after the reform. These patterns support that desired hours meaningfully capture optimal working hours, because workers with stronger incentives to bunch also want to more.

Finally, we analyze how the bunching mass varies with industry-level proxies of bargaining power and hours constraints. First, we consider the degree of market concentration of the industry, as measured by the Herfindahl–Hirschman index (HHI).²⁰ Market concentration discontinuities.

²⁰Previous studies ([Labanca and Pozzoli, 2022](#)) have used the standard deviation of hours as a measure of hours constraints within a firm. We use the industry-level HHI values computed by the German Monopolies Commission for the year 2007 ([Heidorn and Weche, 2021](#)). To merge these data to the GSOEP, we compute averages at the 2-digit NACE 1.1 level by weighing the underlying 4-digit industries by revenue. Highly-concentrated markets are those with an HHI above the median.

tion has been linked to the monopsony power of firms, with more concentrated industries tending to set lower wages (Azar et al., 2020). In our case where earnings are tied to the threshold, monopsonistic firms may be able to set higher hours for at-the-threshold mini jobs. Second, we take industries with above-median hours dispersion, as measured by the standard deviation of actual hours of all workers in this industry. This variable has been used as a proxy for hours constraints, whereby firms with higher dispersion have higher flexibility in offering varying working hours (see e.g. Labanca and Pozzoli 2022). As we do not have firm identifiers, we compute the hours dispersion within the worker’s industry. A higher hours dispersion is highly correlated with a higher share of mini jobs relative to full-time jobs. This does not necessarily translate into a higher flexibility in adjusting hours for mini jobbers specifically. We find that market concentration and hours dispersion have little bearing on the extent of bunching in the cross-section. In Section 5, we analyze whether these dimensions matter for the effect of the reform.

Validity of desired hours. While we cannot rule out reporting biases, all three sets of facts above indicate that underemployment among mini jobbers capture a true preference to work more, rather than mere ignorance of the notch.²¹ First, workers facing a larger tax notch want to and do bunch more, and have a lower hours mismatch. Second, the bunching at the threshold in desired earnings, and its shift at the reform, indicate that workers understand the tax schedule, respond to the incentives to locate at the notch, and state their desired hours at the current wage with the notch in mind. If workers did not know about or consider the notch in their answer, we would observe a smooth distribution of desired earnings, which would not change in response to a notch shift (Chetty et al., 2013). In our difference-in-differences analysis, we explore whether these characteristics influence the degree of adjustment in response to the reform. If some workers ignore the notch, the estimated response of the reform effect on desired hours is attenuated, because people not considering the notch have no incentive to change desired hours.

Discussion. Taken together, our results indicate that a large share of mini jobbers want to work more, but are constrained by the tax notch. In other words, if all workers could optimize their hours at their current wage, they would move up the earnings distribution, and actual bunching at the threshold would be smaller. This mismatch implies a large amount of unused labor capacity due to the notch. It is consistent with firms imposing their preferences over workers’ earnings, and oversupplying mini jobs. Underemployed workers then cannot reach their optimal hours due to the limited set of alternative part-time contracts offered by firms. Supply-side frictions alone do not explain the asymmetric mismatch that we observe, as then the actual earnings distribution would match workers’ preferences in the aggregate, as in Chetty et al. (2011). Our results support models that allow for firm preferences over working hours (Carry, 2024; Lachowska et al., 2023).

²¹If some workers ignore the tax notch in their answer, we overestimate underemployment among mini jobbers, as they may actually want to bunch under the notch. Conversely, if some workers do not think that bigger jobs even exist, we may underestimate it.

Another implication of the underemployment we observe is that the labor supply elasticity estimated using the bunching in actual earnings at the notch is biased upwards. In the bunching at the tax notches framework in (Kleven and Waseem, 2013), frictions prevent workers from locating at the threshold, leading to attenuated labor supply elasticity estimates. Here however, workers are prevented from locating *above* the threshold. Hence, a pure revealed-preferences perspective might not offer a comprehensive picture of workers' labor supply responses to taxation.

5 Effect of the 2003 Mini Job Reform

This part of our analysis complements the bunching estimation by informing how the reform in 2003 affected hours mismatch among mini jobbers, and through which channels.

5.1 Difference-In-Differences Design

The reform exogenously altered the labor supply incentives for mini jobbers related to income taxation. However, since it concerned all mini jobbers in Germany, we need a comparison group outside of this population. We use a difference-in-differences design where we compare the labor supply outcomes of female mini jobbers to those of female workers in higher earnings segments that were not affected by the reform. To this end, we estimate specifications of the form

$$y_{it} = \alpha + \beta D_i + \delta(D_i \times Post_t) + \gamma_t + \eta(D_i \times time_t) + \nu X_{it} + \varepsilon_{it} \quad (1)$$

where y_{it} is the labor supply outcome for worker i and year t . We consider five key outcomes: desired hours, actual hours, hours mismatch, an indicator for being underemployed by over 2.5 hours, log earnings, and log hourly wages. The indicator D_i equals 1 for mini jobbers (treated), and 0 for workers earning between €1500 and 2500 (control). The indicator $Post_t$ switches on after 2004.²² Year fixed effects γ_t control for time-varying factors that are common across groups. $time_t$ additionally accounts for group-specific linear trends in outcomes. Finally, X_{it} includes individual characteristics such as age, marital status, having children below the age of 3 and 16, education, occupation and federal state.

Our main control group is chosen such that workers are plausibly exposed to similar aggregate labor market shocks while not being affected by the reform itself. Workers earning just above the mini job threshold may be affected by the introduction of midi jobs (see Section 2), as well as spillover effects. Workers higher up the earnings distribution mostly work full-time and have little scope to adjust hours. We show that our results are robust to varying the earnings cutoffs used to define the control group in Section 5.4.

²²In all estimations, we exclude individuals surveyed between April and December 2003 (30% of individuals in that year). Thus, 2003 is the last pre-reform data point, which includes individuals surveyed between January and March 2003. The year 2004 is the first post-reform period.

We estimate the model based on repeated cross-sections of employed workers, and define the treatment status in terms of current primary earnings. The coefficient estimate δ can be interpreted as the ATET of the reform for the representative female mini jobber—our key object of interest—and reflects contemporaneous incentives. This approach follows previous studies on the labor supply effects of income taxation (e.g. Kleven and Schultz, 2014, Tazhitdinova, 2022). We do not rely on a definition of the treatment status based on pre-reform earnings for two reasons. First, we do not observe the desired hours for individuals who are not employed. Since individuals in small jobs frequently go in and out of the labor force, the number of mini jobbers in our data is reduced once we condition on being continuously employed for several consecutive years. Second, workers in lower earnings segments are more likely to move up the earnings distribution compared to workers in higher earnings segments, e.g. by taking up a full-time job.²³ We cluster standard errors at the individual level, i.e. the level of treatment assignment (Abadie et al., 2022), to allow for time series correlation and individual-specific shocks for those individuals who are observed repeatedly, and heteroskedasticity for those observed only once.

Identifying assumptions and validity checks. The main specification (1) controls for differences in linear trends between mini jobbers and the control group (see Dustmann et al., 2021 for a similar approach). Identification thus relies on the assumption that any pre-existing trends in the average outcomes of mini jobbers and workers earning (1500, 2500] are linear, and outcomes would have diverged at the same rate in the absence of the reform. Allowing for linear trends is motivated by the results from event studies in Figure 3, which point to diverging linear pre-trends in actual hours and hours mismatch, despite mainly non-significant point estimates. These trends are mostly coming from the control group, which exhibits a slight decrease in actual working hours (Appendix Figure D.6) due to the general shift towards part-time work and a decrease in working hours per worker (Bell and Blanchflower, 2019; Carrillo-Tudela et al., 2021). This phenomenon is observable across subsamples defined by region, marital status, education, and the number of children, such it does not come from changes in sample composition. As for anticipatory responses, the event study results support that there none took place before the reform. Workers or firms had no obvious incentives to adjust their actual (or desired) hours in advance.

Since we use repeated cross-sections, the validity of our design relies on the absence of differential selection into treatment in response to the reform. For instance, the increased monthly earnings could incentivize different workers to enter the labor force to take up mini jobs (or delay a planned entry if jobs cannot be switched easily). In Appendix D.1, we provide supporting evidence that our effect estimates are not solely driven by

²³We run a complementary analysis using a balanced panel of employed workers and a time-constant treatment definition based on pre-reform earnings. The results, shown in Appendix D.3, are qualitatively comparable to our main analysis but suffer from limitations that are linked to the discussion above.

compositional changes. We find no significant effect of the reform on the probability of switching treatment groups. There are no differential entries into the treatment groups from non- or unemployment, or from the earnings interval in between. Furthermore, there is no significant effect on the exit rate into non-employment or unemployment. We do not observe a jump in the total number of mini jobs after the reform in our sample. Taken together, these results support existing evidence that the 2003 reform did not increase the uptake of primary mini jobs, neither did it cause mini jobbers to leave the labor force (Caliendo and Wrohlich, 2010; Tazhitdinova, 2022).

We also test for differences in the composition in terms of observable characteristics by taking them as outcomes. The share of women from East Germany increased more amongst mini jobbers after the reform. Other characteristics are not differentially affected. We control for demographic and socioeconomic characteristics in our main specification to control for any compositional changes in relevant observables. In Section 5.3, we analyze heterogeneous reform effects. Our approach still relies on the absence of time-varying selection in unobservables after the reform.

Finally, we need to exclude that macroeconomic conditions or other policy changes affected mini jobbers and higher-earning workers differently. The recent literature has documented a correlation between the business cycle and underemployment, which is more prevalent in the low-earning segment (e.g. Faberman et al., 2020; Valletta et al., 2020; Bell and Blanchflower, 2021). After the reform, economic conditions in Germany were particularly favourable for high-earning workers, who have benefited from the increase in wage inequality. However, wages at the bottom and in the middle of the distribution (i.e. our treatment groups) already began diverging in the late 1990s (Dustmann et al., 2014). We do not see strong different pre-trends in our event study results (Figures 3). In Section 5.4, we present further checks supporting that there are no differential or spillover effects across treatment groups.

The other Hartz reforms in the 2000s primarily focused on the unemployed, and should not confound the effects of the mini job reform. Furthermore, large parts were only implemented after 2005. Mini jobs have not been identified as a significant factor contributing to the decline in unemployment in Germany during the early 2000s. Carrillo-Tudela et al. (2021) document that unemployment mainly fell because a large number of long-term unemployed deregistered as jobseekers. Nevertheless, we cannot rule out that the availability of jobs in the low-earnings segment was influenced by a higher flexibility in the labor market enabled by the Hartz reforms.²⁴

²⁴There were minor changes in the income tax schedule in our observation period which affected income brackets above our control group (see Table A.1). From 2003 to 2004, the basic allowance was increased from €7,235 to €7,664, and the tax rates in the first and the highest income bracket were reduced by 4 and 3.5 percentage points, respectively. The top marginal income tax was lowered even further in 2005. These changes were minor compared to those for mini jobs. They primarily affected the labor supply incentives of individuals whose monthly earnings were slightly above the mini job threshold and those earning more than €4,000 per month. Hence, mini jobbers and our control group were not directly affected.

5.2 Results

The results from the difference-in-differences estimation are shown in Table 3 for the key hours and earnings outcomes.²⁵ Figure 3 presents the estimates for dynamic treatment effects from the corresponding event studies.

Effects on hours outcomes. As expected, mini jobbers increase their desired hours in response to the reform. The effect amounts to around 1.7 hours and is not sensitive to the inclusion of covariates. This effect size is slightly lower but comparable in magnitude to the additional 2.0 hours needed to reach the new threshold at the average pre-reform hourly wage. The adjustment in optimal labor supply is immediate and persists over the observation period, as seen in Figure 3a. The effect on actual hours is positive at 0.64 but non-significant, and smaller than for desired hours. This result reflects the patterns observed in the event study results, after taking out the mini jobber-specific trend (Figure 3b).

Jointly, these results suggest that mini jobbers are not able to match the increase in desired hours through actual working hours. We find a positive effect on hours mismatch of 1 hour in our main specification, i.e. a quantitatively-important increase of 20% in underemployment. This effect is statistically significant, immediate and persistent as seen in the event study (Figure 3c).

Effects on earnings. The positive significant effect on earnings reflects the shift of the excess mass to the new notch found in the descriptive analysis. It materializes through an increase of 4.5 percentage points after the reform which is also visible in the event study (Figure 3e). The estimates change little with the inclusion of additional control variables. Meanwhile, the point estimates for hourly wages suggest that there is a weakly positive increase, but we do not have enough power and precise measures to pin down the effect size.

Discussion. Overall, our findings indicate an increase in underemployment among mini-jobbers following the reform. The adjustments in actual working hours are minimal and do not match the increases in desired hours. Consistent with our descriptive evidence, the mini-job threshold remains a binding constraint for many workers, preventing them from reaching their optimal hours. Shifting the threshold did not reduce underemployment in the mini-job segment. Given the rise in earnings, the reform's overall impact on worker welfare may have been mixed.

In light of the discussion in Section 4, there are several explanations for this finding. First, there are mini jobbers who want to bunch at the new threshold but are unable to do so. Note that the estimates quantify an average treatment effect on the treated, which includes workers below the old mini job threshold who face frictions in adjusting their

²⁵Regression results without group-specific trends are displayed in Appendix Table D.4.

contracts. We provide further support for this mechanism in the next section. Second, the decrease in the SSC notch size leads some mini jobbers to increase their desired hours beyond the threshold as the incentives to bunch weaken. Third, some of the increase in the desired hours might be explained by an increase in hourly wages for some workers.

5.3 Effect Heterogeneity

This section analyzes how the reform effect varies with worker and industry characteristics. The results of subsample estimations are presented in Table 4.

On the worker side, we replicate the analysis in subsamples of workers based on characteristics associated with heterogeneity in bunching, as discussed in Section 4. We split workers depending on whether they live in West Germany, have children under 16, and have a partner earning over €10k. The share of residents in West Germany evolved differentially across mini jobbers and the control group. The effects on hours outcomes in West Germany are close to the pooled sample, despite a non-significant increase in underemployment. Recall that baseline underemployment is larger among mini jobbers in West Germany. Female mini jobbers in West Germany had a slightly smaller increase in desired hours, perhaps due to stronger incentives to bunch due to larger notch sizes and higher wages. In East Germany, mini jobs are less prevalent but growing in our observation period. The increases in both desired and actual hours are larger than two, but less precisely estimated. As incomes are lower in the East, there are also more jobs within reach not far above the threshold. If anything, the increasing share of mini jobbers living in East Germany attenuates the underemployment effect in the main sample.

Mini jobbers without children have slightly larger adjustments in desired and actual hours. This response may be explained by weaker incentives to bunch in this group. For workers with a partner income above €10k, we find statistically significant increases in both desired and actual hours, with no effect on hours mismatch. The effects are non-significant in the sample of workers with lower partner income. This may be due to sharp targeting of the threshold in the high partner income subsample, which faces a larger tax notch.

In terms of industry-level market concentration, there is no substantial difference in the increase in desired hours, which is close to the pooled sample. There is however a smaller adjustment in actual hours in more competitive industries. This suggests that workers there may have more bargaining power to increase their earnings to the new threshold via wages rather than hours. This may in turn drive the increase in underemployment, as workers are willing to work even more at the higher hourly wage rate.

Industry-level hours dispersion is highly correlated with the share of mini jobbers in the industry. The more mini jobbers, the higher the share of small part-time jobs, and the higher the dispersion. In industries with low hours dispersion, the number of mini jobbers

entering the estimation sample is small. This may explain the small and imprecise effect estimate on desired hours. In industries with high hours dispersion, the reform effect on desired hours equals 2.1, which is larger than in the pooled sample. Actual hours adjust by 0.7-0.8 in both subsamples. Only the high-dispersion subsample displays a statistically-significant increase in underemployment of over an hour. While these results can be partly driven by worker sorting, they support that the hours mismatch effect of the tax policy is shaped by both demand and supply-side factors.

5.4 Robustness Checks

Effects on middle earnings segments. We now present evidence supporting that our estimates are not biased by spillover effects on the control group. Such spillovers could arise due to general equilibrium effects, for example if the reform incentivizes firms to substitute mini jobbers for regular workers. Spillovers are more likely to transpire for outcomes in low-earning jobs that are similar to mini jobs, i.e. in an earnings segment that is closer. We extend the specification in (1) to include two additional treatment groups. On top of mini jobbers, we also compare workers in the earnings segments (400,800] and (800,1500] to the control group (1500,2500]. Appendix Table D.5 shows the reform effects for the treatment groups. Appendix Figure D.11 presents the dynamic treatment effects based on the corresponding event study. We find little evidence for spillover effects on working hours, earnings and wages in the middle segments. Merely workers in the (800,1500] segment seem to experience an increase in hours mismatch in absolute value, and a small decrease in actual earnings compared to the control group. Nevertheless, the corresponding event study graphs do not show a clear pattern nor significant point estimates for these outcomes. These findings support that our main control group, which is further away in the earnings distribution, is not affected by the reform. This analysis also serves to check for differential impacts of macroeconomic conditions across earnings segments, particularly in terms of wage growth. The event studies (Appendix Figure D.11) do not show a systematic gradient in the treatment effects for middle segments relative to the main control group which would point at differential trends.

Control group definition. Our choice of the primary control group was driven by the need to minimize the likelihood that the reform would impact it, while ensuring comparability with mini jobbers. We now test the sensitivity of our results to the definition of the control group by varying its earnings interval between €800 and €3000. We start from (800,1800] and move the segment up by €100 increments. Each estimate, displayed in Figure D.12, is based on a separate regression. Control groups based on earnings segments below the main definition yield slightly larger point estimates in absolute terms for all outcomes but actual hours. The effects are very similar to our main definition in the range €1400 to €3000. These results support that the estimates show little sensitivity to the control group definition, and are unlikely to be biased by spillover effects.

Sample restrictions. Finally, we alter further sample restrictions and methodological choices in Table D.6. First, we consider contract features that may shape labor supply responses. We restrict the sample to workers who (i) are compensated for overtime, and (ii) have specified contractual hours. Second, we analyze groups that face particular tax incentives by (iii) excluding the self-employed, (iv) including workers with secondary jobs, and (v) including unemployment insurance beneficiaries. Third, we check the sensitivity to (vi) using mini jobbers recorded as such with a specific variable in the GSOEP, and (vii) taking uncensored hours outcomes. Our main results are unaffected by these changes in the sample.

5.5 Adjustment Mechanisms

We present evidence on how existing mini jobbers adjust their labor supply in response to the reform, based on a balanced panel of 246 females who held a mini job right before the reform, and are observed as employed the two years after.²⁶ Although purely descriptive and reliant on a small subsample, this step informs on the adjustment channels that might drive the responses underlying our cross-sectional results.

Of the workers in mini jobs in 2002–2003, three quarters remain below the €400 threshold in 2005, with over a third still below the old earnings threshold of €325. This is in line with contracts adjusting sluggishly to the new threshold. Figure 4 shows the development of hours and wage outcomes of pre-reform mini jobbers conditional on their post-reform monthly earnings in 2005. The red bars show their average pre-reform outcomes in 2002–2003, while the blue bars show their average post-reform outcomes in 2005.

The results reveal some interesting patterns. Workers who stay in mini jobs increase their desired hours by about 2 hours (panel a)—a magnitude that fits with our difference-in-differences results. These workers have stable actual hours (panel b) before and after the reform. The increase in desired hours leads to an overall increase in the hours mismatch (panel c). It is larger for workers still earning below €325 in 2005, who might be stuck at the old threshold. This group contains comparatively more workers residing in East Germany, holding jobs which do not require a qualification, working at small firms, and shorter tenure. Mini jobbers who increase their earnings beyond €400 are more likely to be single, have high education, skills and tenure, and a fixed term job compared to workers who stay mini jobbers. These may be workers who are less constrained by care work. They also experience a reduction in hours mismatch (panel c) by around 2 hours. Wages in the pre-reform period are very similar across post-reform earnings groups (panel d). They do not increase for workers earning up to €325, increase little for workers earn-

²⁶ Appendix D.3 provides further details on the sample construction. The mini jobbers in the panel are a selected sample with relatively stable employment paths, since we have to condition on employment to observe hours outcomes. Mini jobbers in the panel sample are similar in terms of observable characteristics to the cross-sectional sample.

ing (325,400] and more substantially for workers in the highest segment. These workers' earnings increase through both hours and wages.

Taken together, this descriptive analysis corroborates our cross-sectional findings. Workers who stay in mini jobs after the reform increase their desired hours. Those who stay stuck at the old threshold experience an increase in underemployment. Those who adjust to the new threshold the actual hours and wages increase moderately, with a slight increase in underemployment. Mini jobbers who move to higher earnings brackets are able to resolve their mismatch, and to increase all actual labor supply outcomes.

6 Conclusion

This paper studies the effect of tax notches on hours mismatch among low-earning workers. We consider the case of Germany, where so-called mini jobs create a salient jump in income tax and social security contribution rates. We focus on prime-age, female mini jobbers, who have scope to adjust labor supply on the intensive margin. We provide evidence for substantial underemployment at the mini job tax notch, with nearly half of mini jobbers wanting to work and earn more. A reform that shifted the threshold upwards caused an increase in mini jobbers' optimal labor supply, as measured by desired hours. After the reform, firms offered jobs at the new threshold, but an excess mass of jobs remained at the old threshold. Actual hours adjusted less than desired hours, which translated into an increase in underemployment among mini jobbers. Although the reform made mini jobs larger, underemployment increased, as workers were still not able to increase working hours to reach their new optimum. The combination of earnings and underemployment increases points to ambiguous effects of the tax reform on worker welfare.

Our findings offer several insights for designing tax policies targeting low-earning workers. First, tax notches can create unused labor capacity by limiting the intensive-margin labor supply of those workers who are precisely the ones the policy aims to stimulate and who lack larger alternatives. Second, working hours are a crucial job attribute for both employers and employees. The widespread underemployment among mini-jobbers suggests that firms often prefer standardized, threshold-based contracts, leading to more mini jobs than workers actually want. Third, responses to tax benefits at the intensive margin may not be entirely voluntary on the part of workers, which affects our understanding of the distortionary effects of taxation. When evaluating tax policies, it is relevant to consider preferences for hours and potential welfare losses from suboptimal working hours for both sides of the market. Finally, an interesting avenue for research is to explore the long-run implications of tax benefits on the accumulation of experience and human capital, as well as earnings prospects for part-time workers, who represent a growing share of the labor force.

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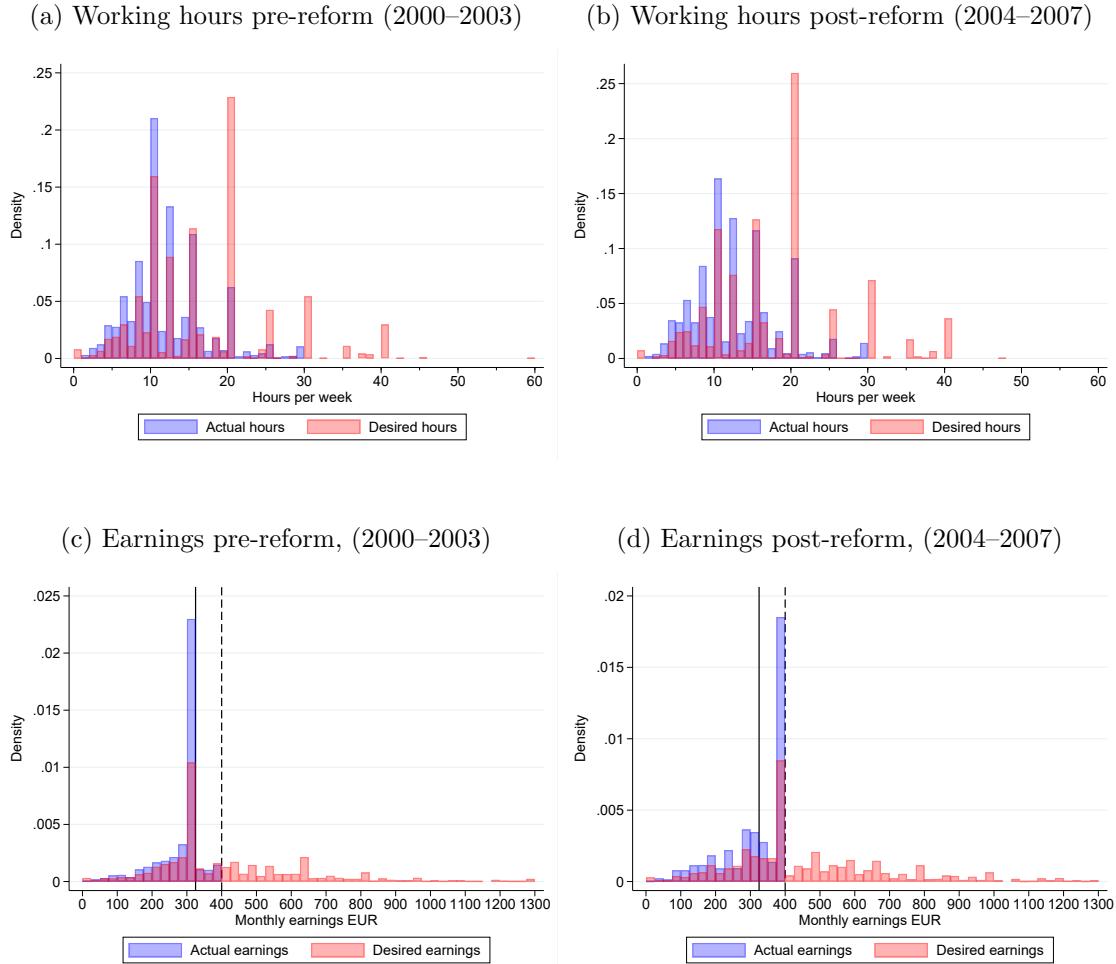
Tables and Figures

Table 1: Summary Statistics by Earnings Segment

	(1) Mini jobbers	(2) Earnings (400,800]	(3) Earnings (800,1500]	(4) Earnings (1500,2500]
<i>Labor market outcomes</i>				
Actual hours	11.65	23.73	30.89	38.04
Desired hours	16.47	24.63	29.02	33.44
Hours mismatch	4.81	0.90	-1.87	-4.60
Underemployed	0.48	0.31	0.17	0.07
Overemployed	0.06	0.21	0.35	0.53
Earnings	291.51	627.67	1,167.30	1,974.22
Hourly wage	6.82	7.66	9.92	12.73
<i>Individual and job characteristics</i>				
Age	40.22	40.98	40.85	40.33
Married	0.90	0.80	0.74	0.58
German Nationality	0.88	0.93	0.93	0.93
East Germany	0.05	0.26	0.32	0.30
Any children under the age of 3	0.11	0.05	0.04	0.04
Vocational education or higher	0.21	0.22	0.27	0.43
Managerial and professional workers	0.12	0.14	0.22	0.39
Partner income	38,472	32,544	33,670	32,397
Service sector	0.79	0.80	0.79	0.78
Firm with over 200 employees	0.23	0.27	0.35	0.50
No contracted working hours	0.28	0.16	0.09	0.07

Notes: The table displays unweighted sample averages for our sample of female workers in mini jobs and higher earnings segments, for the period January 2000 to March 2003. Hours are measured per week. All earnings are in euros, monthly and nominal.

Figure 1: Distribution of Actual and Desired Hours and Earnings for Mini Jobbers



Notes: The figures display the density of actual and desired working hours for our sample of female mini jobbers, before (panel a) and after the reform (panel b), in 1-hour bins. Panels (c) and (d) show desired and actual earnings distributions, respectively, in €25 bins. Desired earnings are constructed using desired hours multiplied by the current hourly wage. Earnings are in euros and nominal. The solid black line marks the €325 mini job threshold that applied until March 2003. The dashed black line marks the €400 threshold that applied from April 2003. We exclude observations from 2003 with interviews after April.

Figure 2: Hours Mismatch by Actual Hours and Earnings

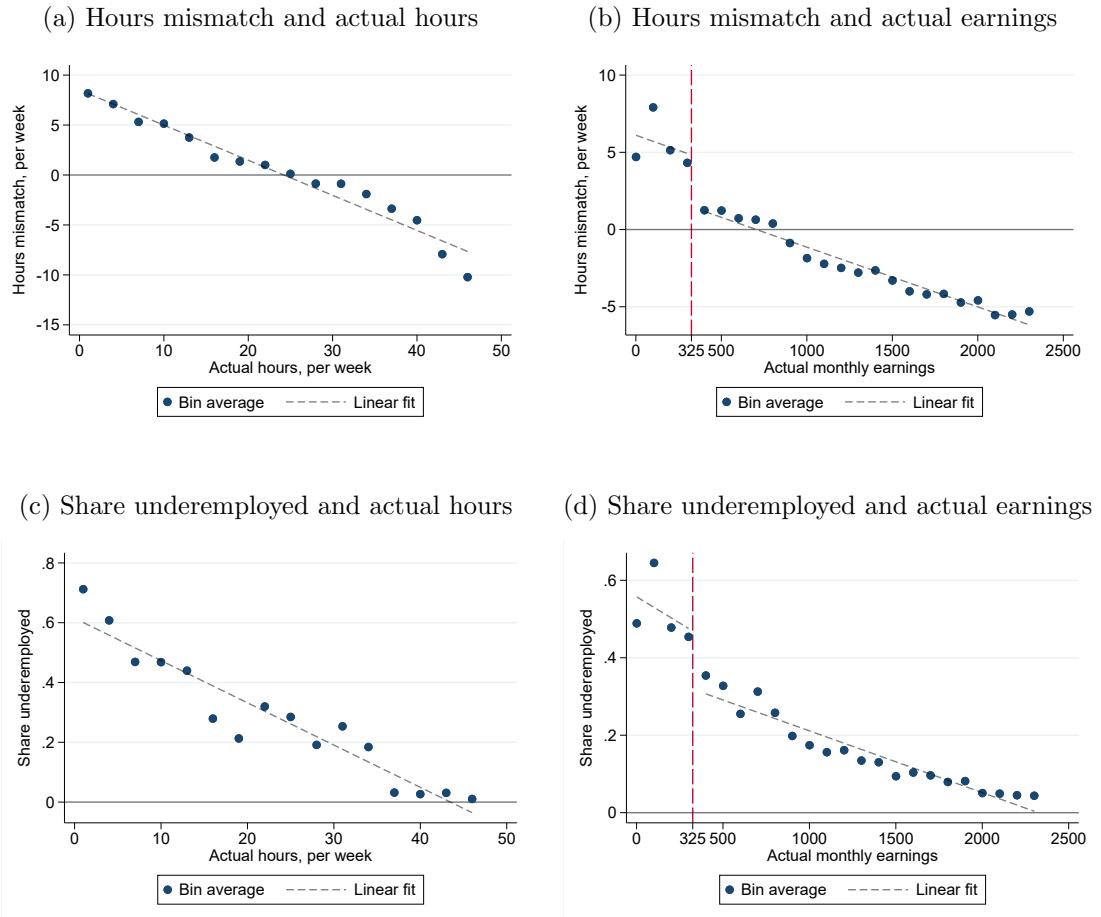


Table 2: Bunching at the mini job threshold

	Pre-reform (2000-2003)			Post-reform (2004-2007)		
	(1)	(2)	(3)	(4)	(5)	(6)
	Actual earnings	Desired earnings	Difference	Actual earnings	Desired earnings	Difference
Full sample	0.122	0.046	0.076	0.070	0.028	0.042
SE	(0.012)	(0.005)	(0.013)	(0.006)	(0.004)	(0.007)
West Germany	0.158	0.060	0.098	0.086	0.037	0.048
SE	(0.012)	(0.005)	(0.013)	(0.008)	(0.005)	(0.009)
Children under 16	0.152	0.061	0.092	0.094	0.038	0.056
SE	(0.011)	(0.005)	(0.012)	(0.007)	(0.005)	(0.009)
Partner income above €10k	0.145	0.057	0.088	0.102	0.038	0.064
SE	(0.010)	(0.005)	(0.011)	(0.007)	(0.004)	(0.008)
High HHI index	0.112	0.042	0.069	0.064	0.020	0.044
SE	(0.012)	(0.008)	(0.014)	(0.009)	(0.008)	(0.012)
High hours dispersion	0.129	0.051	0.078	0.074	0.031	0.043
SE	(0.013)	(0.006)	(0.014)	(0.006)	(0.005)	(0.008)

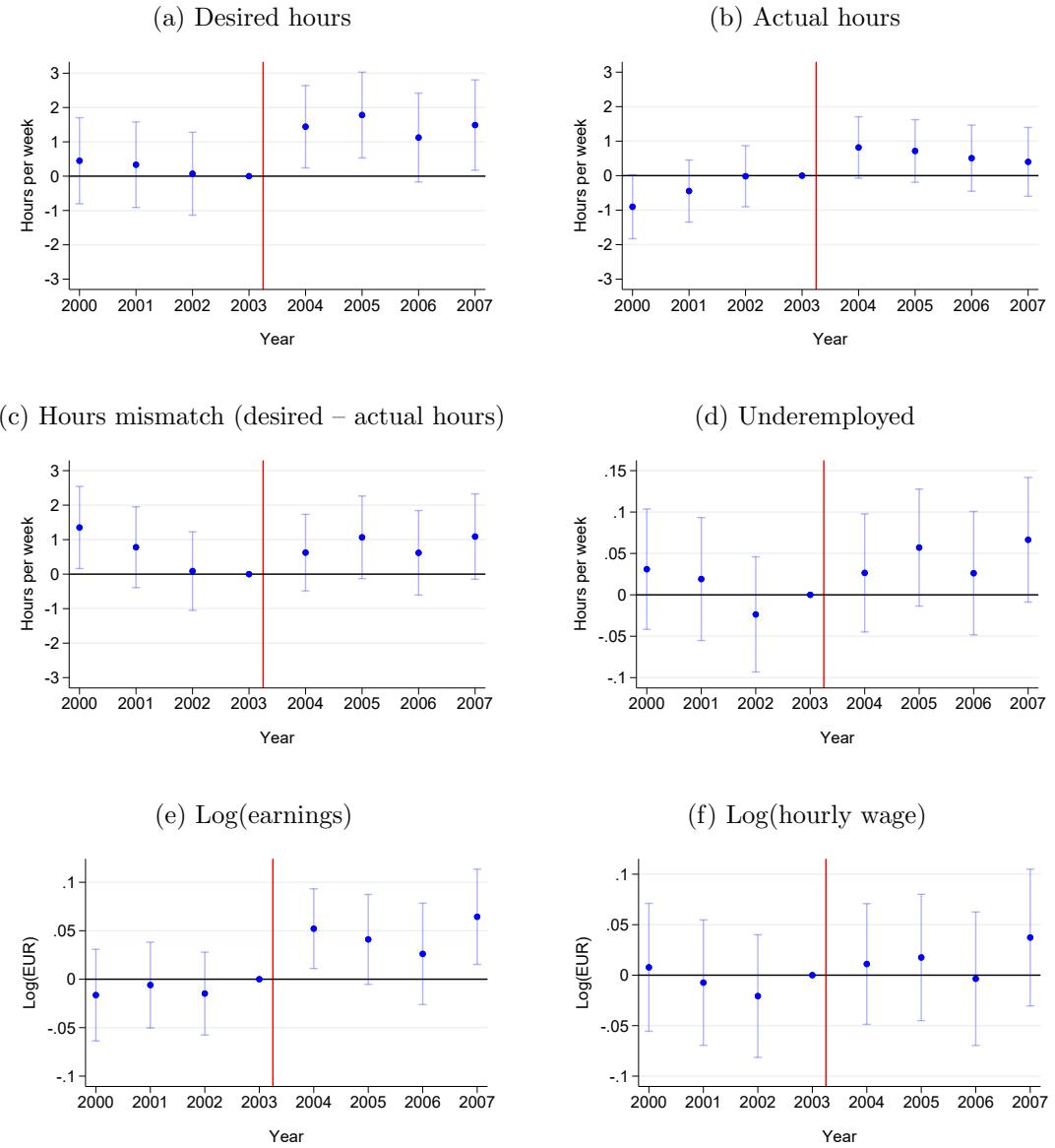
Notes: The table shows the bunching mass in actual and desired earnings estimated using the methods described in Appendix C. The observations are from the sample of female workers earning up to €2,500. The estimation is carried out separately in the pre- and post-reform periods. Pre-reform years include observations from January 2000 to March 2003. Standard errors are computed by bootstrap based on 100 replications.

Table 3: Difference-in-Differences Estimates

	Desired hours		Actual hours		Hours mismatch	
	(1)	(2)	(3)	(4)	(5)	(6)
Mini jobber \times post	1.76*** (0.66)	1.66*** (0.63)	0.64 (0.48)	0.64 (0.46)	1.12* (0.60)	1.03* (0.60)
Observations	12766	12766	12766	12766	12766	12766
Mean outcome mini jobbers	16.47	16.47	11.65	11.65	4.81	4.81
Covariates		✓		✓		✓
Group-specific trend	✓	✓	✓	✓	✓	✓
	Underemployed		Log(earnings)		Log(hourly wage)	
	(7)	(8)	(9)	(10)	(11)	(12)
Mini jobber \times post	0.058 (0.037)	0.049 (0.037)	0.046* (0.024)	0.045* (0.023)	0.020 (0.033)	0.019 (0.032)
Observations	12766	12766	12766	12766	12766	12766
Mean outcome mini jobbers	0.48	0.48	5.63	5.63	1.81	1.81
Covariates		✓		✓		✓
Group-specific trend	✓	✓	✓	✓	✓	✓

Notes: The table displays treatment effect estimates from the difference-in-differences analysis comparing the pre-reform period (2000 to 2003), to the post-reform period (2004 to 2007) outcomes in our sample of female workers. Mini jobbers are compared with those earning [1500,2500] euro, controlling for linear group-specific trends. Hours outcomes are measured per week. Earnings and wages are nominal in log(euro). Covariates include individual characteristics (age, marital status, children, education), as well as occupation and state (Bundesland) fixed effects. We exclude observations from 2003 with interviews after April. Standard errors (in parentheses) are clustered at the individual level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Figure 3: Event Study of Reform Effects



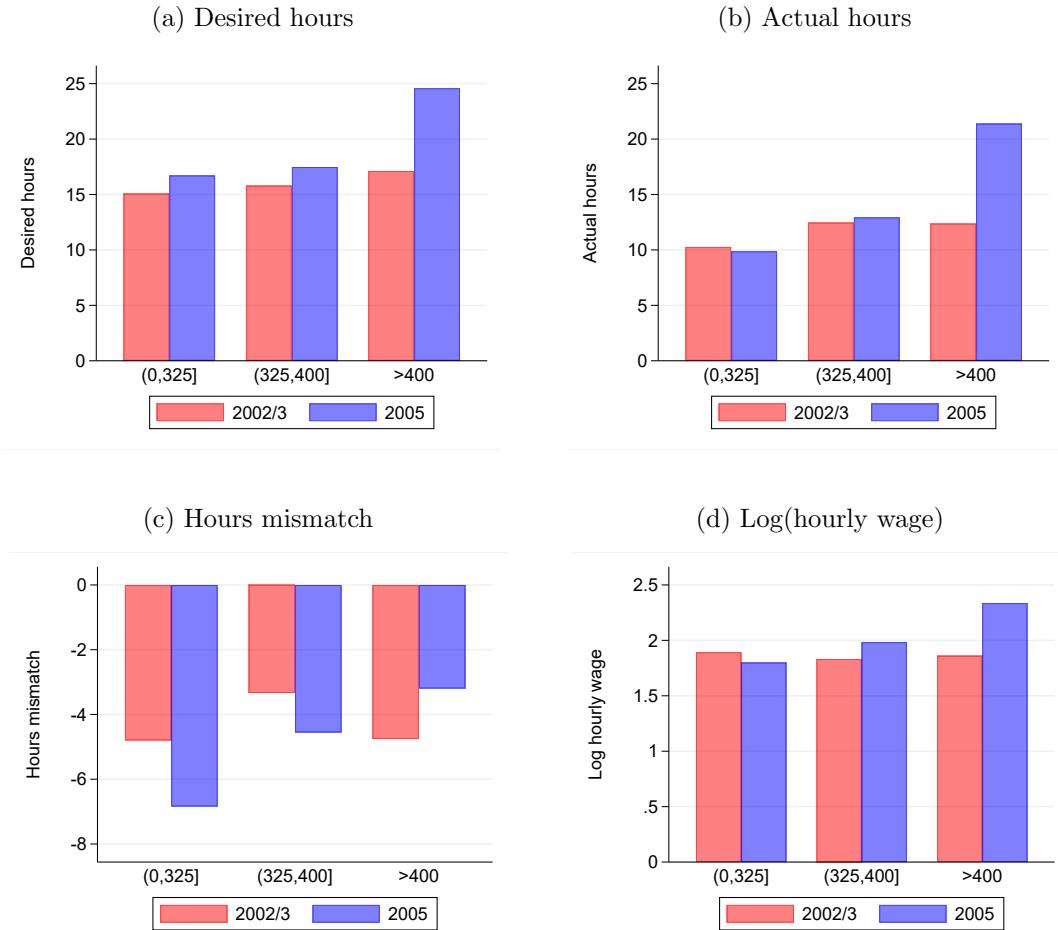
Notes: The figures display the dynamic treatment effect estimates from the event study analysis. The solid red line marks the implementation of the mini job reform in April 2003. The data point for 2003 includes only those respondents interviewed before April 2003. Hours outcomes are measured per week. Earnings and wages are nominal in log(euro). Estimations control for covariates (age, marital status, children, education, occupation and state (Bundesland) fixed effects). Confidence intervals at the 95% level are based on standard errors clustered at the individual level.

Table 4: Heterogeneity in the Effects of the Mini Job Reform

	(1)	(2)	(3)	(4)	(5)	(6)
Obs.	Desired hours	Actual hours	Hours mismatch	Under-employed	Monthly earnings	Hourly wage
<i>West Germany</i>						
Mini jobber × post	9762	1.54*	0.58	0.96	0.05	0.05*
		(0.67)	(0.51)	(0.62)	(0.04)	(0.02)
<i>East Germany</i>						
Mini jobber × post	3004	2.45	2.40	0.04	-0.07	0.02
		(2.69)	(1.86)	(2.62)	(0.11)	(0.11)
<i>Any children under 16</i>						
Mini jobber × post	5187	1.27	0.56	0.71	0.08	0.07*
		(0.86)	(0.73)	(0.76)	(0.05)	(0.03)
<i>No children under 16</i>						
Mini jobber × post	7579	1.61	1.21*	0.40	-0.00	0.02
		(1.09)	(0.72)	(1.12)	(0.06)	(0.04)
<i>Partner income above €10,000</i>						
Mini jobber × post	7383	1.72*	1.42*	0.29	0.04	0.06*
		(0.72)	(0.60)	(0.67)	(0.04)	(0.02)
<i>Partner income below €10,000</i>						
Mini jobber × post	5383	1.60	-0.81	2.41	0.04	0.04
		(1.74)	(1.04)	(1.65)	(0.08)	(0.07)
<i>Highly HHI industry</i>						
Mini jobber × post	4232	1.91	1.44	0.47	0.06	0.03
		(1.26)	(0.89)	(1.28)	(0.07)	(0.05)
<i>Low HHI industry</i>						
Mini jobber × post	5623	1.64*	0.14	1.50*	0.05	0.05
		(0.93)	(0.68)	(0.87)	(0.05)	(0.03)
<i>High industry hours dispersion</i>						
Mini jobber × post	7881	2.12***	0.88	1.24*	0.06	0.06*
		(0.76)	(0.60)	(0.74)	(0.04)	(0.03)
<i>Low industry hours dispersion</i>						
Mini jobber × post	3716	0.14	0.77	-0.63	-0.01	0.01
		(1.78)	(1.09)	(1.59)	(0.10)	(0.06)

Notes: The table displays treatment effect estimates from the difference-in-differences analysis comparing the pre-reform period (2000 to 2003) to the post-reform period (2004 to 2007) outcomes in subsamples of female workers. Mini jobbers are compared with workers earning [1500,2500] euro. All estimations control for group-specific linear trends. Hours are measured per week. Earnings and wages are nominal in log(euro). All estimations control for individual characteristics (age, marital status, children, education), as well as occupation and state (Bundesland) fixed effects. We exclude observations from 2003 with interviews after April. Standard errors (in parentheses) are clustered at the individual level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Figure 4: Adjustments in Labour Supply Outcomes of Female Pre-Reform Mini Jobbers



Notes: The figures plot the average pre- (2002/3, in red) and post-reform (2005, in blue) outcomes of a sample of 246 pre-reform mini jobbers conditional on their post-reform monthly earnings in 2005. The pre-reform outcomes are recorded in 2002 for workers surveyed after April and in 2003 for workers surveyed after April of the respective year. We condition on workers being employed from 2002/3 to 2005. Earnings intervals are in euros.

Appendix

A Institutional Details

Table A.1 presents the tax schedule in Germany. The tax schedule is defined for single individuals but also applies to married workers, with the exception that the tax liability is calculated by summing up the income of both spouses and dividing it in half. The tax rates shown in the table apply to this halved income and are then doubled to determine the total tax liability of the household. In each income segment, taxes increase linearly with taxable income.

Table A.2 provides an overview of the evolution of social security contribution (SSC) rates and income tax rates, as well as any discontinuities, for different types of jobs in Germany. Column (2) details the maximum threshold amount that can be earned in mini jobs during the specified years. This amount increases from €325 to €400 in April 2003. Column (3) outlines the change in the average tax and contribution rate at the mini job threshold, known as the notch size. This is calculated as the lump sum of the income tax and the employee SSC due when posted earnings slightly exceed the mini job threshold. We follow [Tazhitdinova \(2020\)](#) and [Gudgeon and Trenkle \(2024\)](#) for its derivation in our sample. The notch size decreases by around €40 in 2003 because the discontinuity in the social security rates is reduced.

Column (4) outlines the average marginal tax rate that workers in our sample face when they slightly exceed the mini job threshold and are taxed based on their household income (80% of mini jobbers in our sample). These workers are subject to income taxation only if they are married and taxed jointly, which applies to the majority of German couples, and if their household income exceeds the basic tax allowance (see Appendix Table A.1 for the development of tax rates). We calculate the average marginal tax rates based on the average taxable income of mini jobbers' spouses (80% of yearly labor earnings). To increase our sample size, we pool observations from the three years surrounding the year of interest.

Columns (5) through (10) display the social security contribution (SSC) rates paid by employers and employees in mini, midi, and regular jobs. Employees in mini jobs are exempt from SSC. The contributions they encounter when surpassing the mini job threshold changed with the introduction of midi jobs in 2003. Before April 2003, employees paid about 21% in contributions; after that, SSC rates gradually increase from 4% to 21% in the midi job region (€400 to €800). Employers' SSC rates vary minimally by job type, being slightly higher for mini jobs. They amount to around 22% for mini jobs in the early 2000s and increase to 25% in 2003 and 30% in 2007.

Table A.1: German Tax Schedule for Taxable Income

Year	Interval 1	MTR	Interval 2	MTR	Interval 3	MTR	Interval 4	MTR	Interval 5	MTR
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
2000	0-6,901	0%	6,902-8,945	22.9-25.0%	8,946-58,642	25.0-51.0%	> 58,643	51.0%		
2001	0-7,205	0%	7,206-9,248	19.9-23.0%	9,249-55,008	23.0-48.5%	> 55,009	48.5%		
2002-3	0-7,234	0%	7,235-9,251	19.9-23.0%	9,252-55,007	23.0-48.5%	> 55,008	48.5%		
2004	0-7,664	0%	7,665-12,739	16.0-24.5%	12,740-52,151	24.1-45.0%	> 52,152	45.0%		
2005-6	0-7,664	0%	7,665-12,739	15.0-24.0%	12,740-52,151	24.0-42.0%	> 52,152	42.0%		
2007-8	0-7,664	0%	7,665-12,739	15.0-24.0%	12,740-52,151	24.0-42.0%	52,152-250,000	42.0%	> 250,001	45%

Notes: The table shows the marginal tax rates (MTR) for different intervals of taxable income in euros.

Sources: Gudgeon and Trenkle (2024), Appendix Table C.3, page 81, and www.bmf-steuerrechner.de (accessed in July 2022). The DM to € conversion rate for the cut-offs in the years 2000 and 2001 is 1DM = €1.95583.

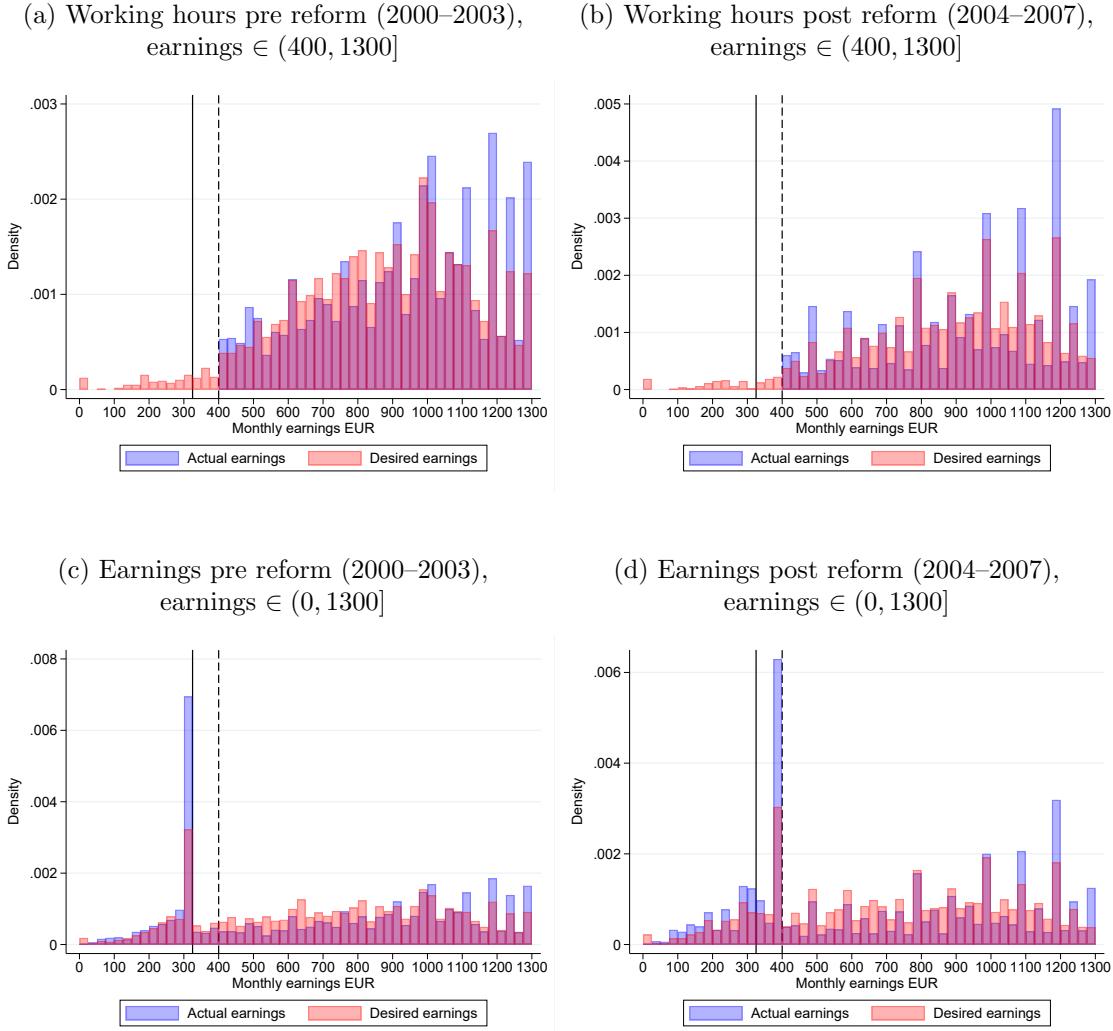
Table A.2: Social Security and Income Tax Rates

Year	Mini Job				Midi Job				Regular Job	
	Threshold (EUR)	Notch size (EUR)	Average MTR (%)	Employee SSC rate (%)	Employer SSC rate (%)	Employee SSC rate (%)	Employer SSC rate (%)	Employee SSC rate (%)	Employer SSC rate (%)	Employee SSC rate (%)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	
2000	325	122.31	23.09	0	22.00			20.54	20.54	
2001	325	115.54	21.58	0	22.00			20.44	20.44	
2002	325	115.91	21.91	0	22.00			20.64	20.64	
2003 (Jan-Apr)	325	114.19	21.99	0	22.00			20.85	20.85	
2003 (Apr-Dec)	400	70.99	21.99	0	25.00	4.15	21.00	21.00	21.00	
2004	400	67.23	21.35	0	25.00	4.00	20.98	20.98	20.98	
2005	400	65.80	21.09	0	25.00	4.05	20.95	20.95	20.95	
2006	400	66.28	21.11	0	25.00	3.50	19.55	19.55	19.55	
2007	400	77.37	21.09	0	30.00	10.45	19.40	19.40	19.40	

Notes: The table shows the mini job threshold, the notch size and the marginal tax rate at the threshold as well as the social security contribution (SSC) rates associated with different types of jobs. SSC rates are based on www.minijob-zentrale.de and www.bmas.de/DE/Soziales/Gesetzliche-Unfallversicherung (accessed in July 2022). Marginal tax rates (MTR) and the notch sizes are based on own calculations using the SOEP and www.bmf-steuerrechner.de (accessed in July 2022).

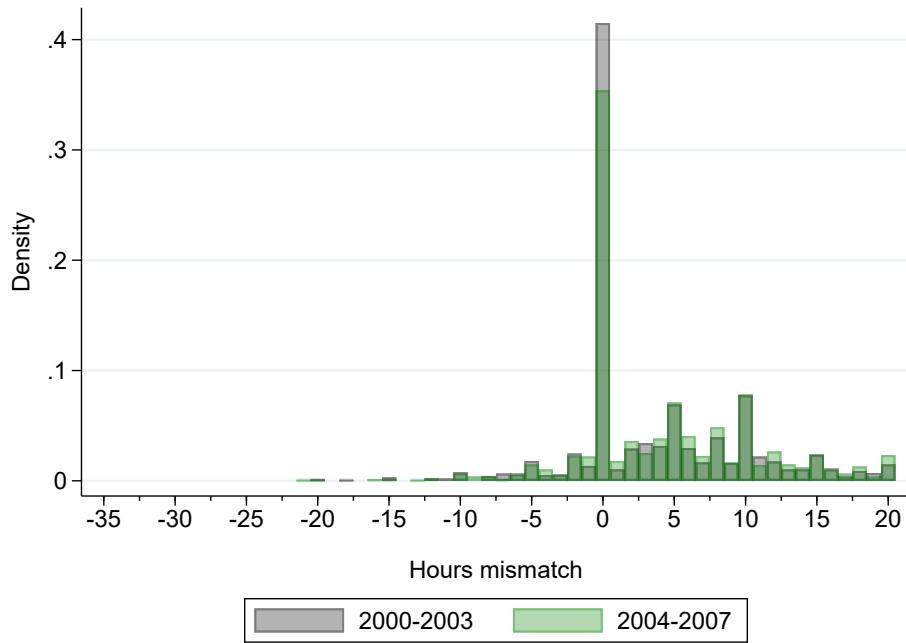
B Descriptive Statistics

Figure B.1: Distribution of Actual and Desired Working Hours per Week for Female Mini Jobbers



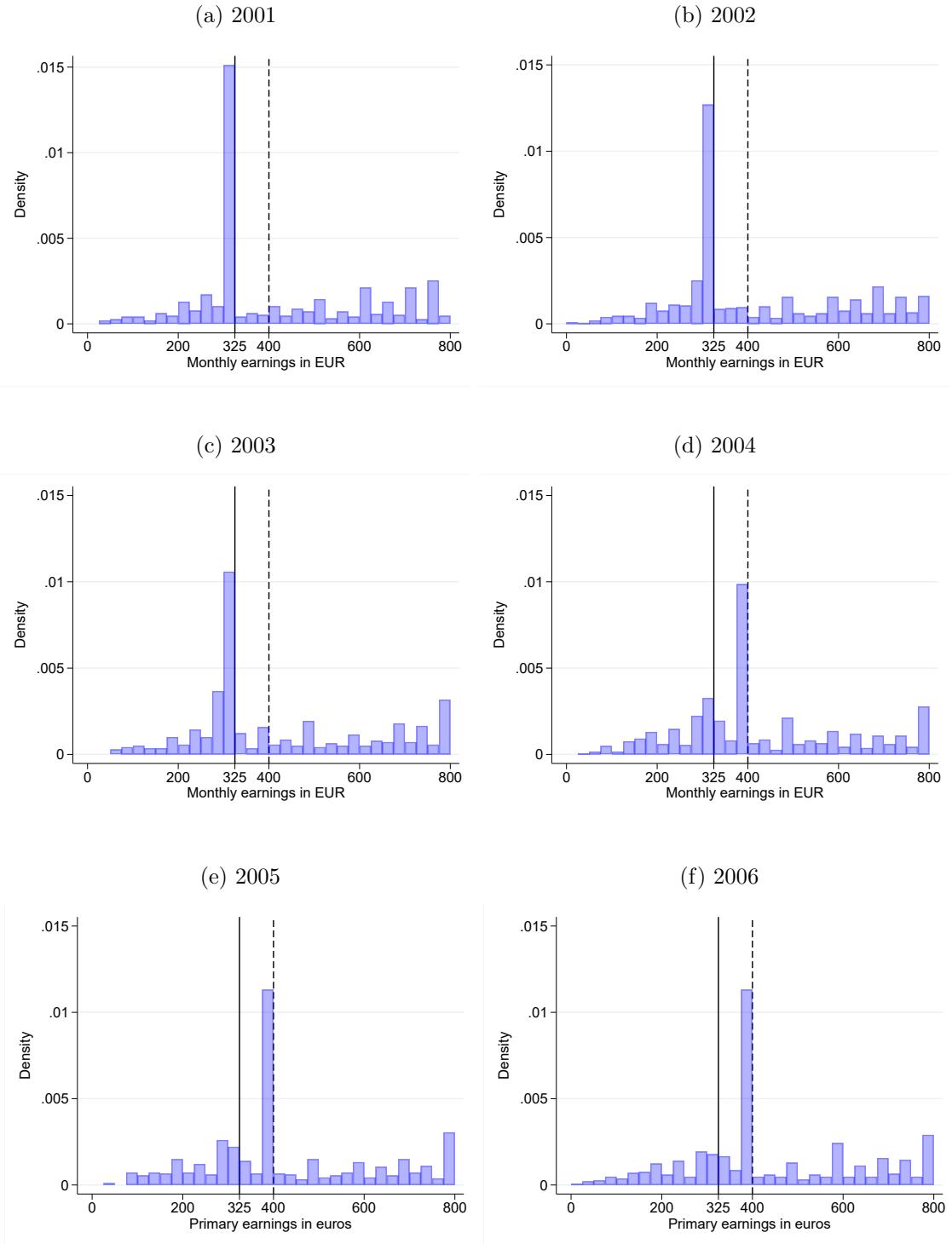
Notes: The figures display the density of actual and desired working hours before (panel a) and after the reform (panel b), in 1-hour bins. Panels (c) and (d) show desired and actual earnings distributions in €25 bins. The sample contains female workers earning up to €1,300. Earnings are in euros and nominal. Desired earnings are constructed using desired hours multiplied by the current hourly wage. The solid black line marks the €325 mini job threshold that applied until March 2003. The dashed black line marks the €400 threshold that applied from April 2003. We exclude observations from 2003 with interviews after April.

Figure B.2: Distribution of Hours Mismatch for Female Mini Jobbers



Notes: The figure plots the distribution of hours mismatch (defined as the difference between actual and desired working hours) for our sample of female mini jobbers. Underlying actual hours are capped at 30, and desired at 60. The pre-reform period spans from January 2000 and March 2003, the post-reform period from 2004 to 2007. We exclude observations from 2003 with interviews after April.

Figure B.3: Earnings Distribution for Females Earning up to €800, by Year



Notes: The figure plots the distribution of earnings in our sample of females with primary earnings of less than €800 per month by year. Earnings in €25 bins. The solid black line marks the €325 mini job threshold that applied until March 2003. The dashed black line marks the €400 threshold that applied from April 2003. We exclude observations from 2003 with interviews after April.

Table B.3: Determinants of Hours Mismatch among Mini Jobbers

	(1)	
	Hours mismatch	
	Coef.	S.E.
Age	0.026	(0.022)
Married	-3.233***	(0.464)
German Nationality	-1.046**	(0.428)
East Germany	5.381***	(0.566)
Any children under the age of 16	-1.034***	(0.347)
Vocational education or higher	0.094	(0.335)
Managerial and professional workers	-0.823*	(0.425)
Self employed	0.343	(0.625)
Tenure at current employer (in years)	-0.158***	(0.028)
Public sector	-0.011	(0.012)
Service sector	0.013	(0.012)
Firm with over 200 employees	0.299	(0.367)
No contracted working hours	1.198***	(0.304)
Over hours compensated or no over hours	2.003**	(0.979)
Employment status/ earnings t-1	0.008	(0.008)
Log hourly wage	2.945***	(0.305)
Constant	1.280	(1.522)
Observations	3312	

Notes: The table shows the estimated coefficients from a regression of hours mismatch on individual characteristics. The relevant sample is female mini jobbers from 2000 to 2007. Standard errors clustered at the individual level are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

C Bunching Estimation

Following standard bunching methods (Saez, 2010; Kleven and Waseem, 2013; Chetty et al., 2011), we estimate a counterfactual density in the absence of the notch to the observed distribution of actual and desired earnings. In doing so, we exclude bins located near the mini job threshold z^* . The counterfactual is estimated with the following regression:

$$C_j = \sum_{i=0}^p \beta_j(z_j)^i + \sum_{i=z_L}^{z_U} \gamma_i \mathbf{1}[z_j = i] + \sum_{k \in K} \sum_{i=0}^2 \delta_{k,i} \mathbf{1}[z_j = k](z_j)^i + \epsilon_j$$

where C_j is the density in bin j . The first term fits a polynomial of degree p to the density, while excluding the range $[z_L, z_U]$ around the mini job threshold (second term), and accounting for bunching at round-number values of earnings with a set of dummies $K = \{n \in \mathbb{N} : \exists k \in \mathbb{N} (n = 100k | n = 1000k)\}$ that switch on at multiples of 100 and 1000, and are interacted with a quadratic polynomial (third term). The lower bound z_L is determined visually, while the upper bound z_U is estimated iteratively by incrementing its value by one bin starting from $z^* + 1$ until the bunching mass equals the missing mass above the threshold.

The counterfactual density is computed by turning off the dummies in the excluded range:

$$\hat{C}_j = \sum_{i=0}^p \hat{\beta}_j(z_j)^i + \sum_{k \in K} \sum_{i=0}^2 \delta_{k,i} \mathbf{1}[z_j = k](z_j)^i$$

The bunching mass is the difference between the observed and the counterfactual values in the excluded area below the threshold:

$$\hat{B} = \sum_{k=z_L}^{z^*} (C_j - \hat{C}_j)$$

Similarly, the missing mass is the difference between the observed and the counterfactual values in the excluded area above the threshold:

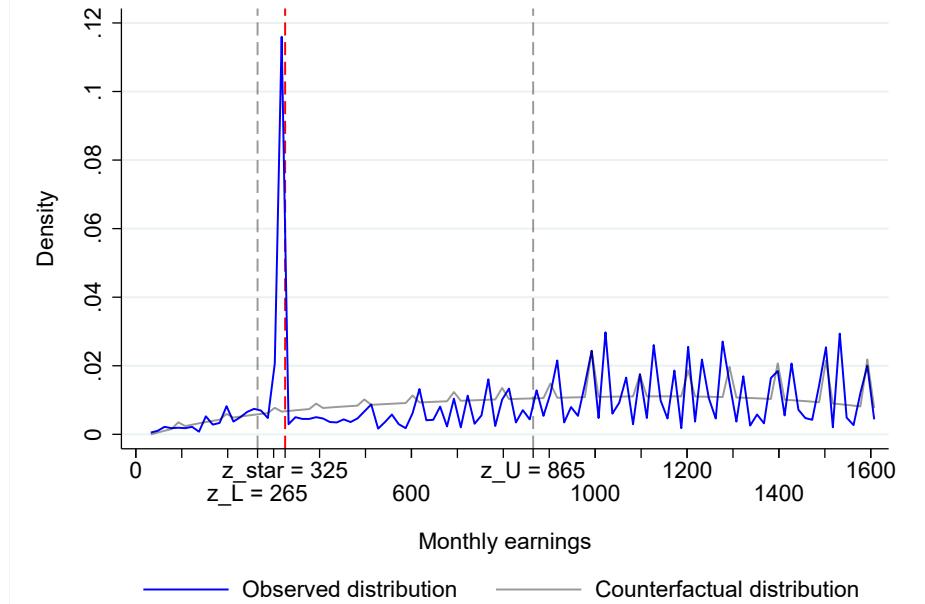
$$\hat{M} = \sum_{k=z^*+1}^{z_U} (\hat{C}_j - C_j)$$

We use $p = 5$ in practice, but the results are robust to values between 4 and 7. We set z_L to €265 pre, and to €340 post-reform, respectively. For the post-reform estimation, we also dummy out the €325 bin, in order to account for residual bunching at the old threshold. We additionally reweigh the observations such that their characteristics match those of the pre-reform mini jobbers using a propensity score and inverse probability

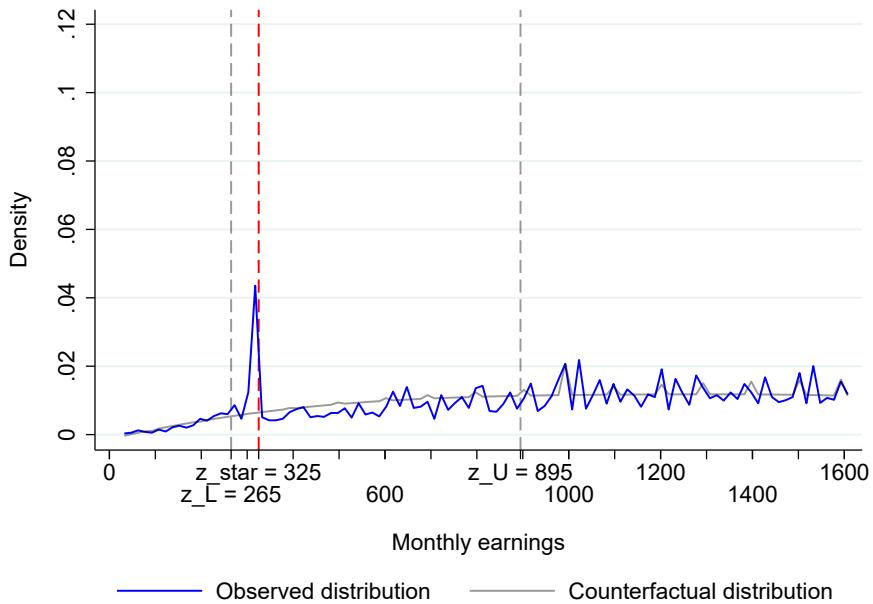
weighting. The estimation window goes up to €1600 (our results are not sensitive to expanding this interval).

Figure C.4: Bunching estimation (2000–2003)

(a) Actual monthly earnings



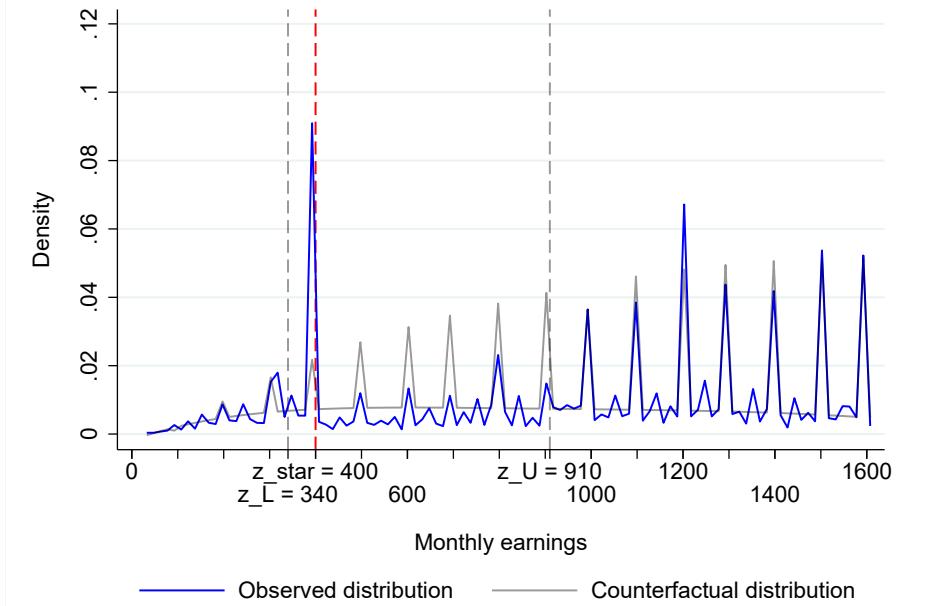
(b) Desired monthly earnings



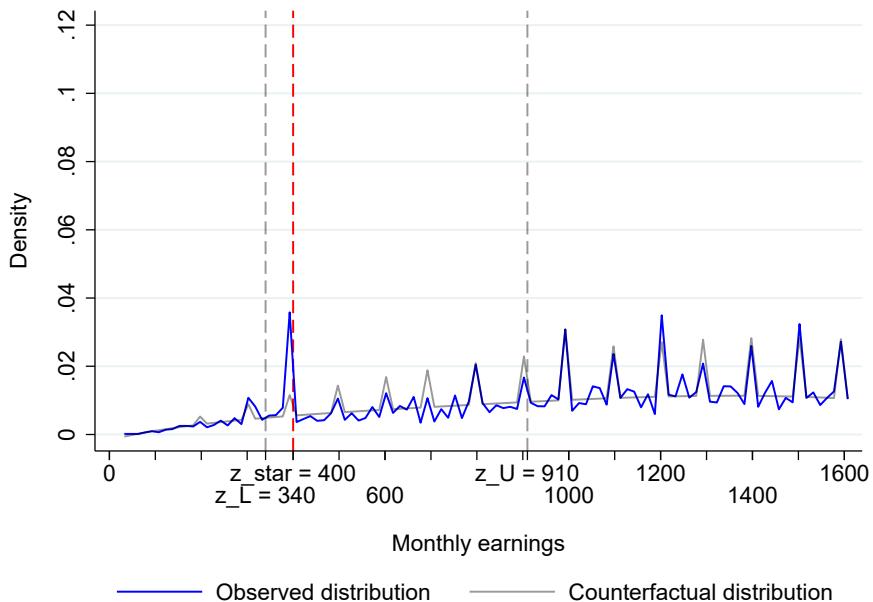
Notes: The figures show the excess mass at the pre-reform mini job threshold z^* at €325 for our sample of female workers observed between January 2000 to March 2003. Panel (a) shows actual, and Panel (b) desired earnings (panel b), in €25 bins. The blue line is the observed density of earnings, and the grey line the counterfactual density estimated using the bunching methods described in Appendix C with a quintic polynomial, and excluding the range $[z_L, z_U]$.

Figure C.5: Bunching estimation (2004–2007)

(a) Actual monthly earnings



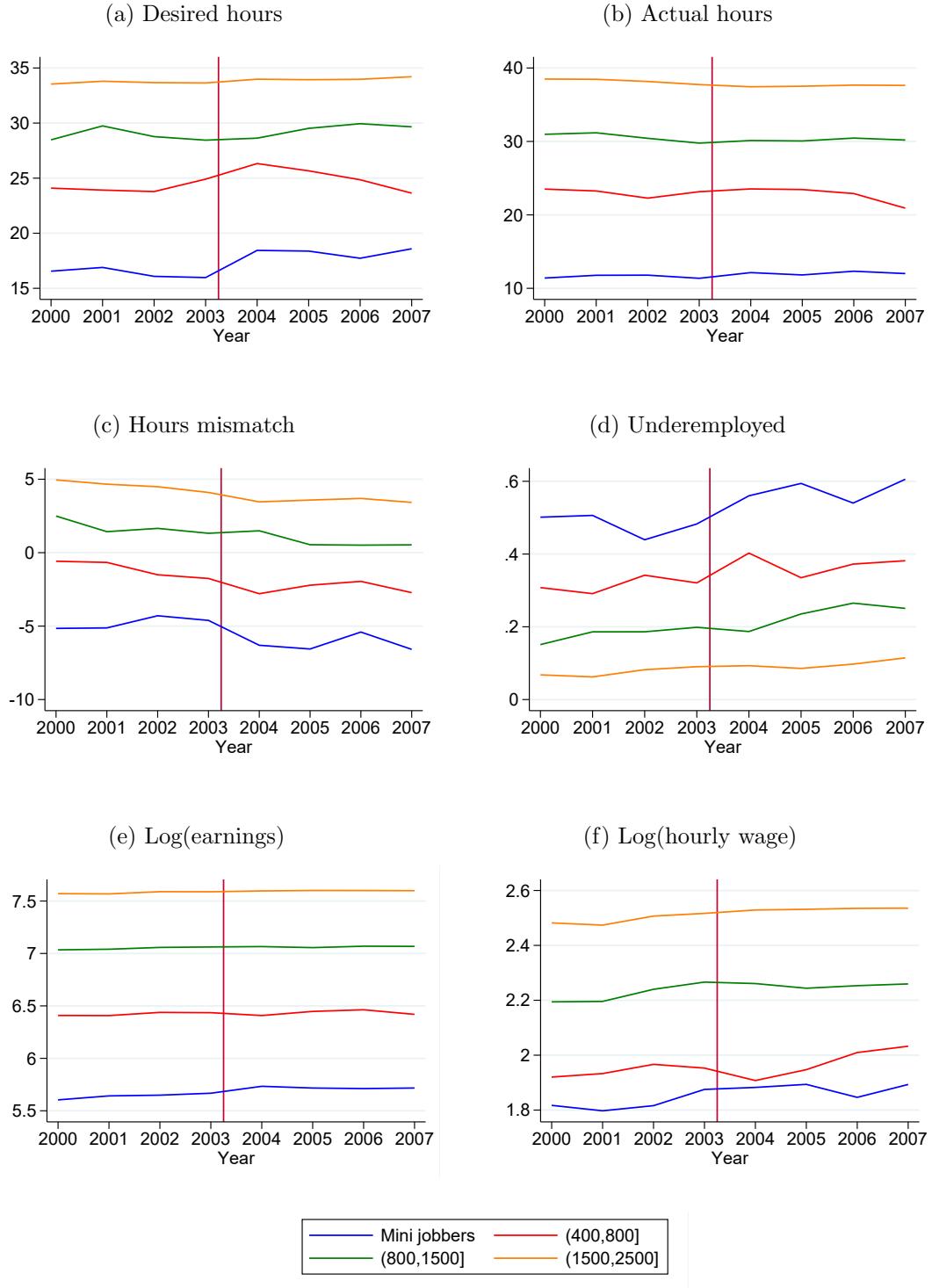
(b) Desired monthly earnings



Notes: The figures show the excess mass at the post-reform mini job threshold z^* at €400 for our sample of female workers observed between April 2003 to December 2007. Panel (a) shows actual, and Panel (b) desired earnings (panel b), in €25 bins. The blue line is the observed density of earnings, and the grey line the counterfactual density estimated using the bunching methods described in Appendix C with a quintic polynomial, and excluding the range $[z_L, z_U]$.

D Difference-In-Differences -- Additional Results

Figure D.6: Raw Trends in Outcomes



Notes: The figures display raw trends across earnings brackets for the sample of female workers earning up to €2,500. The vertical solid red line marks the implementation of the mini job reform in April 2003. The data point for 2003 includes only those respondents interviewed before April 2003. Hours outcomes are measured per week. Earnings and wages are nominal in log(euro).

D.1 Validity Checks

We investigate whether the composition of workers changed differentially across workers in the treated and control group in response to the reform.

Composition of the sample. First, we investigate whether the shares of workers in the earnings segments $(0,400]$, $(400,800]$, $(800, 1500]$ and $(1500, 2500]$ change around the time of the reform in our estimation sample in Figure D.7. We find no large changes, especially around the time of the reform. Mini jobbers comprise about 15 percent, and workers earning $(1500, 2500]$ euro 40 percent of the sample. Second, we test whether there is differential responses between mini jobbers and high-earning workers in terms of switching earnings segments, as well as entering and exiting the sample from non-employment. For this purpose, we construct two data sets of workers followed at least two years in a row.

Switching treatment groups, and to non- or unemployment. The first dataset is used to analyze whether workers in mini jobs are more likely to (i) switch between the treatment and the control group, and (ii) exit employment compared to the control group in response to the reform. We draw yearly samples from our main sample keeping only workers that are either mini jobbers or in the control group in a particular year (reference year) and who are also observed in the year after (8913 observations). We then generate indicator variables recording whether (i) they switched from a mini job group to the control group or vice versa, and (ii) they transitioned to being non- or unemployed. Based on this data set, we estimate whether the probability of switching groups or exiting employment changes around the reform. The event study results are shown in Figures D.8a and D.8b, with the x-axis referring to the second year. We do not find evidence for differential group switching, or entering non-employment or unemployment in response to the reform.

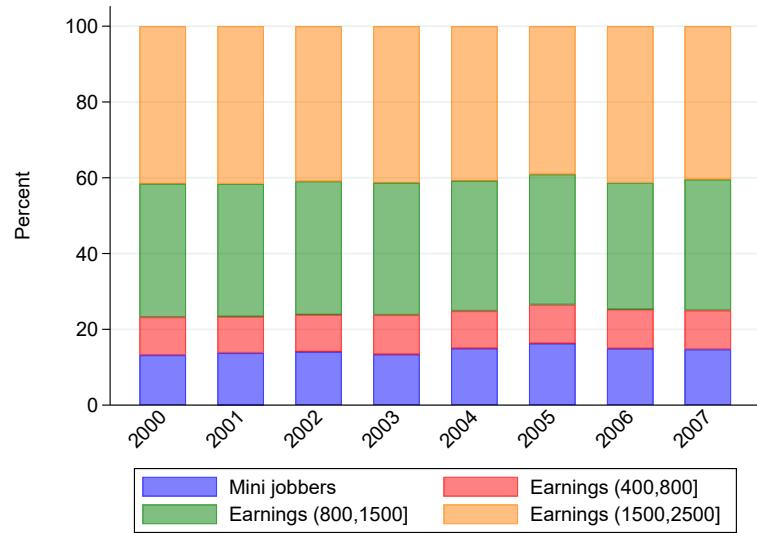
Switching from non-employment or the middle of the earnings distribution. The second data set is used to test for reform effects on (i) entering the treatment or control group from the middle of the earnings distribution; or (ii) entering the treatment or control group from non or unemployment. We draw workers from our main sample who are either mini jobbers or in the control group in a particular reference year, and who are also observed the year before (8850 observations). Thus, we condition on being in a specific earnings segment in the reference year, and do not impose any restrictions on the employment status in the year before. For all workers, we generate indicator variables recording whether (i) they were non-employed or unemployed and (ii) earned between €400 and €1500 the year before the reference. The event studies for these two indicators are shown in Figures D.8d and D.8c, where we find no evidence for such a response.

To summarize, we find no evidence of differential inflows into the treatment or control group from individuals entering the labour force, nor being located in the middle of the

earnings distribution in response to the reform. The absence of such differential responses helps rule out confounding compositional effects.

Observable characteristics. We estimate event studies where we use observable characteristics as outcomes to explore possible compositional changes induced by the reform (Figures D.9 and D.10). While most covariates do not show any changes, we observe an increase in the share of mini jobbers in East Germany after 2003. This is due to the fact that mini jobs became more prominent in East Germany over time. We further find that the share of women with children below the age of three decreases compared to the control group in response to the reform, although not statistically significantly. The share of women with older children does not change differentially across groups. We investigate whether these compositional changes drive the effects by running subsample analyses in these dimensions.

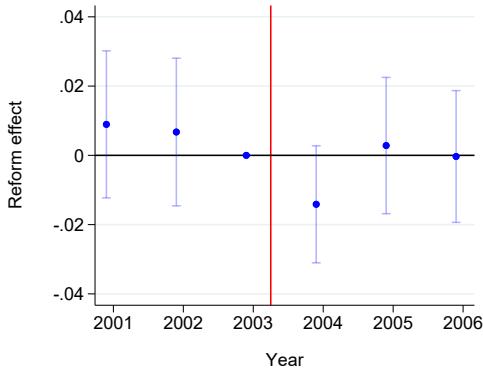
Figure D.7: Shares of Earnings Groups over Time, female workers earning up to €2,500



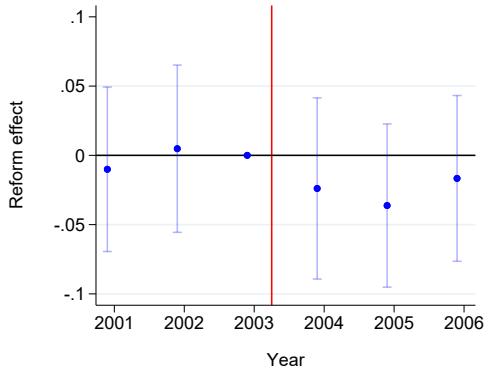
Notes: The figures display the relative shares of workers in given earnings brackets over time in the sample of female workers earning up to €2,500. The data for 2003 includes only those respondents interviewed before April 2003.

Figure D.8: Switching Behavior

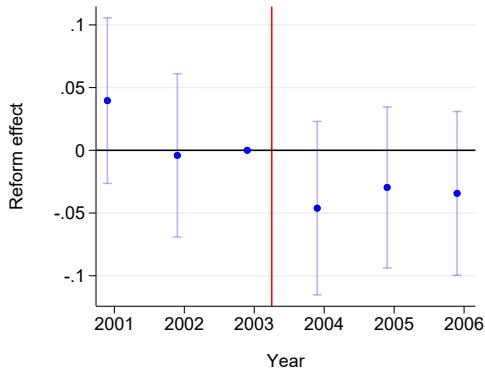
(a) Switching between mini job or control group



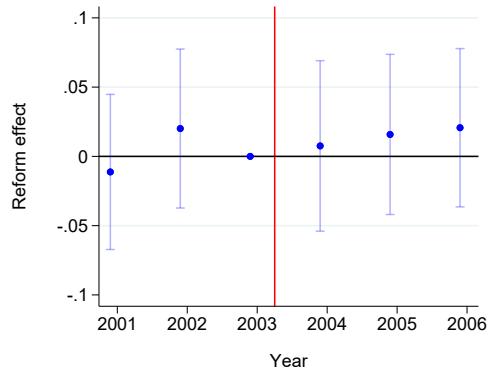
(b) Switching to non- or unemployment



(c) Switching from non- or unemployment

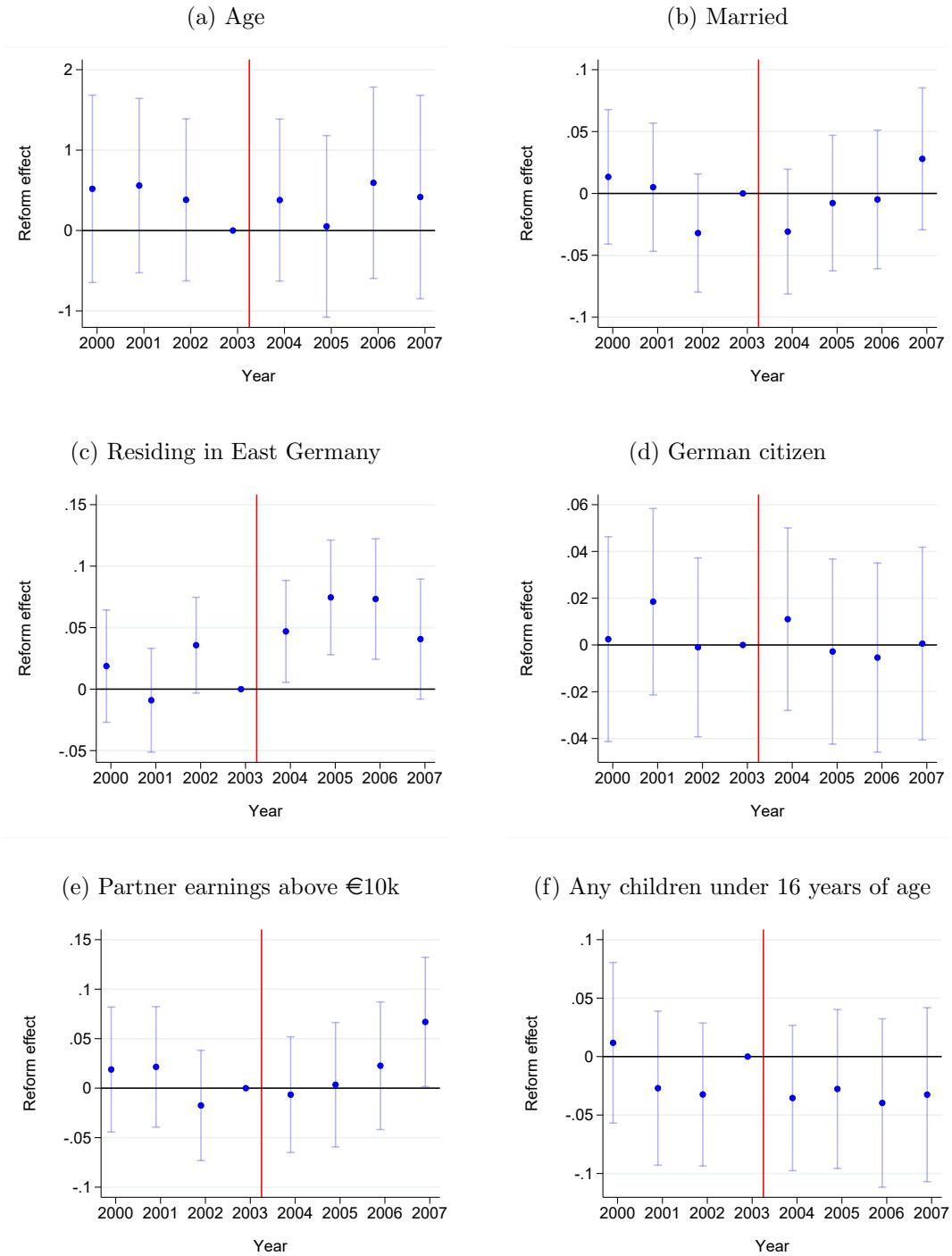


(d) Switching from the earnings bracket
(400,1500]



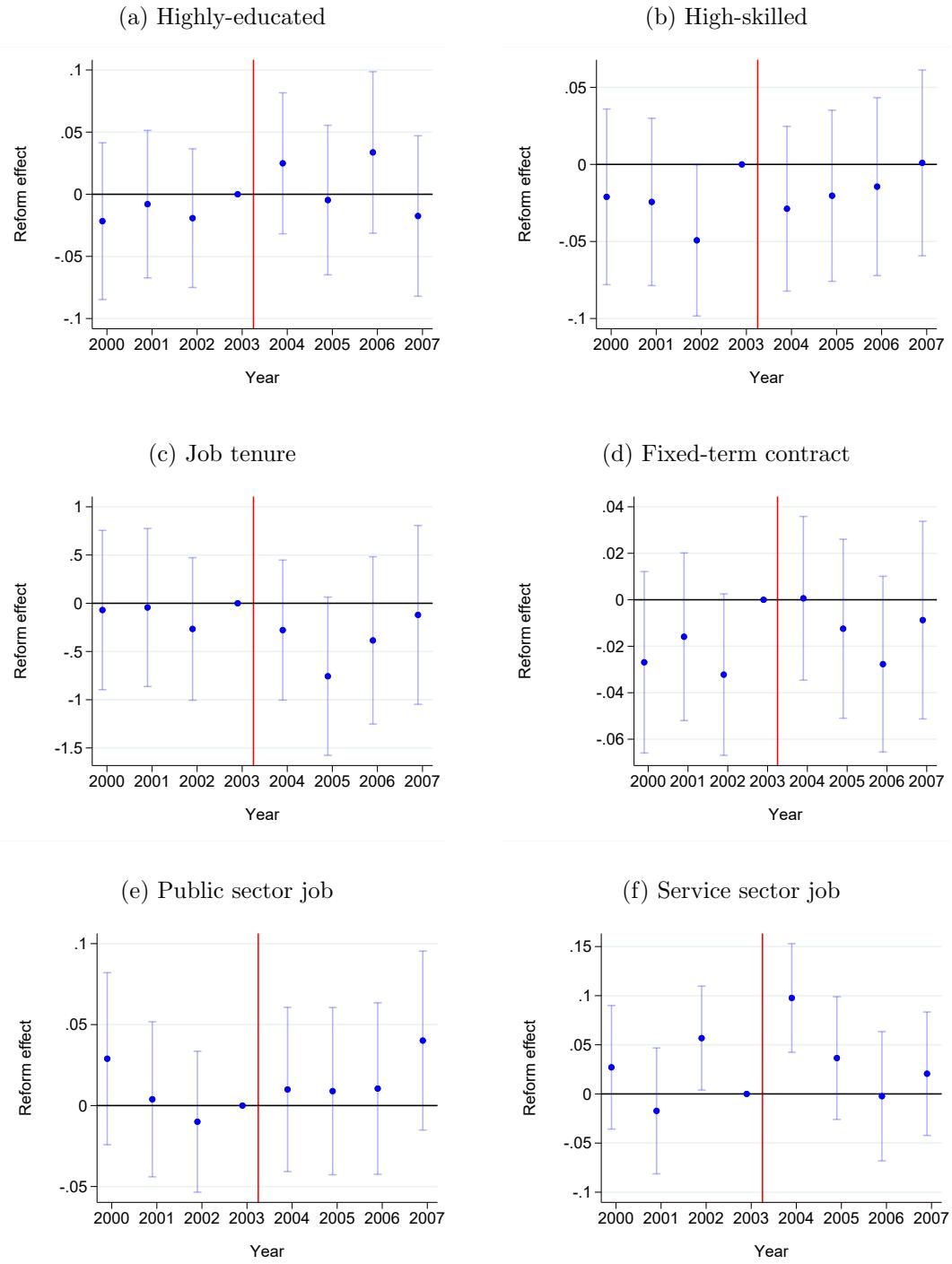
Notes: The figures display the dynamic treatment effect estimates from an event study analysis, using a sample of female workers observed for two consecutive years. To enter the respective samples workers need to be observed in two consecutive years and be mini jobbers or in the control group in year 1 (panels a and b) or be mini jobbers or in the control group in year 2 (panel c and d). The outcomes record switching behavior between two consecutive years and are displayed with the second year on the x-axis. The solid red line marks the implementation of the mini job reform in April 2003. The data point for 2003 includes only those respondents interviewed before April 2003. Confidence intervals at the 95% level are based on standard errors clustered at the individual level.

Figure D.9: Event Study of Reform Effects on Covariates I



Notes: The figures display the dynamic treatment effect estimates for mini jobbers compared with workers earning EUR [1500,2500] from an event study that takes observable characteristics as outcomes. The solid red line marks the implementation of the mini job reform in April 2003. The data point for 2003 includes only those respondents interviewed before April 2003. Confidence intervals at the 95% level are based on standard errors clustered at the individual level.

Figure D.10: Event Study of Reform Effects on Covariates II



Notes: The figures display the dynamic treatment effect estimates for mini jobbers compared with workers earning EUR [1500,2500] from an event study that takes observable characteristics as outcomes. The solid red line marks the implementation of the mini job reform in April 2003. The data point for 2003 includes only those respondents interviewed before April 2003. Confidence intervals at the 95% level are based on standard errors clustered at the individual level.

D.2 Robustness Checks for the Cross-Sectional Estimation

Table D.4: Difference-In-Differences Estimates without Group-Specific Trends

	Desired hours		Actual hours		Hours mismatch	
	(1)	(2)	(3)	(4)	(5)	(6)
Mini jobber × post	1.61*** (0.38)	1.22*** (0.36)	1.50*** (0.28)	0.99*** (0.27)	0.11 (0.34)	0.24 (0.34)
Observations	12766	12766	12766	12766	12766	12766
Mean outcome mini jobbers	16.47	16.47	11.65	11.65	4.81	4.81
Covariates		✓		✓		✓
Group-specific trend						
	Underemployed		Log(earnings)		Log(hourly wage)	
	(7)	(8)	(9)	(10)	(11)	(12)
Mini jobber × post	0.034* (0.019)	0.036* (0.019)	0.066*** (0.015)	0.056*** (0.014)	0.005 (0.019)	0.021 (0.018)
Observations	12766	12766	12766	12766	12766	12766
Mean outcome mini jobbers	0.48	0.48	5.63	5.63	1.81	1.81
Covariates		✓		✓		✓
Group-specific trend						

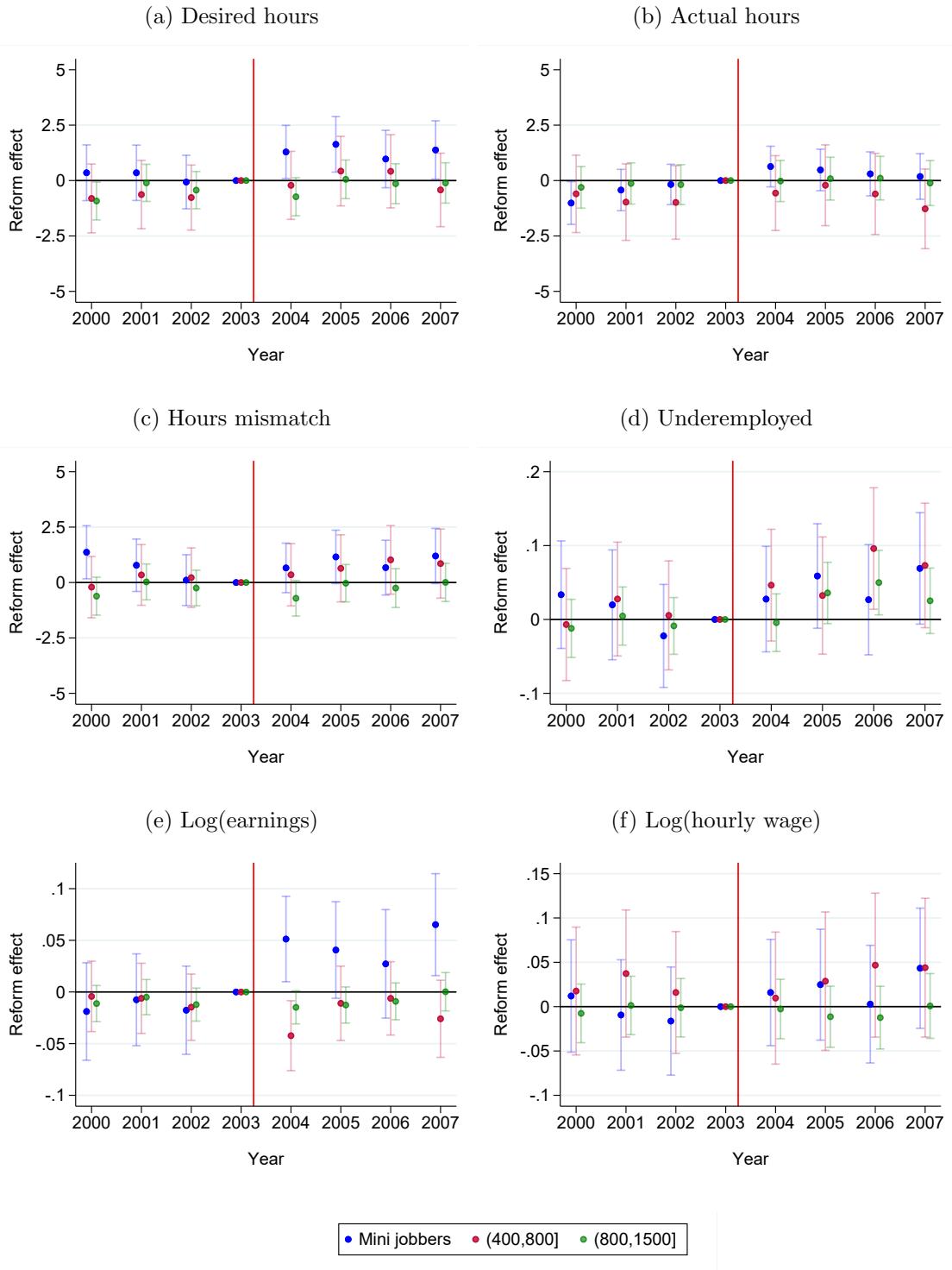
Notes: The table displays treatment effect estimates from the difference-in-differences analysis comparing the pre-reform period (2000 to 2003), to the post-reform period (2004 to 2007) outcomes in our estimation sample of female workers. Mini jobbers are compared with workers earning [1500,2500] euro, without controlling for linear group-specific trends. Hours outcomes are measured per week. Earnings and wages are nominal in log(euro). Covariates include individual characteristics (age, marital status, children, education), as well as occupation and state (Bundesland) fixed effects. We exclude observations from 2003 with interviews after April. Standard errors (in parentheses) are clustered at the individual level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table D.5: Difference-In-Differences Estimates with Multiple Treatment Groups

	Desired hours		Actual hours		Hours mismatch	
	(1)	(2)	(3)	(4)	(5)	(6)
Mini jobber \times post	1.74*** (0.66)	1.52* (0.63)	0.63 (0.48)	0.48 (0.48)	1.11* (0.60)	1.04* (0.60)
Earnings (400,800] \times post	0.30 (0.91)	0.33 (0.81)	0.24 (0.98)	0.25 (0.86)	0.06 (0.74)	0.08 (0.73)
Earnings (800,1500] \times post	-0.27 (0.51)	-0.71 (0.45)	0.49 (0.55)	0.05 (0.49)	-0.76* (0.43)	-0.77* (0.43)
Observations	23083	23083	23083	23083	23083	23083
Mean outcome mini jobbers	16.47	16.47	11.65	11.65	4.81	4.81
Covariates		✓		✓		✓
Group-specific trend						
	Underemployed		Log(earnings)		Log(hourly wage)	
	(7)	(8)	(9)	(10)	(11)	(12)
Mini jobber \times post	0.058 (0.037)	0.050 (0.037)	0.046* (0.024)	0.044* (0.023)	0.020 (0.033)	0.024 (0.032)
Earnings (400,800] \times post	0.031 (0.040)	0.024 (0.040)	-0.019 (0.017)	-0.026 (0.018)	0.006 (0.043)	0.002 (0.039)
Earnings (800,1500] \times post	0.007 (0.020)	0.004 (0.020)	-0.014* (0.008)	-0.016* (0.008)	-0.029 (0.019)	-0.010 (0.017)
Observations	23083	23083	23083	23083	23083	23083
Mean outcome mini jobbers	0.48	0.48	5.63	5.63	1.81	1.81
Covariates		✓		✓		✓
Group-specific trend						

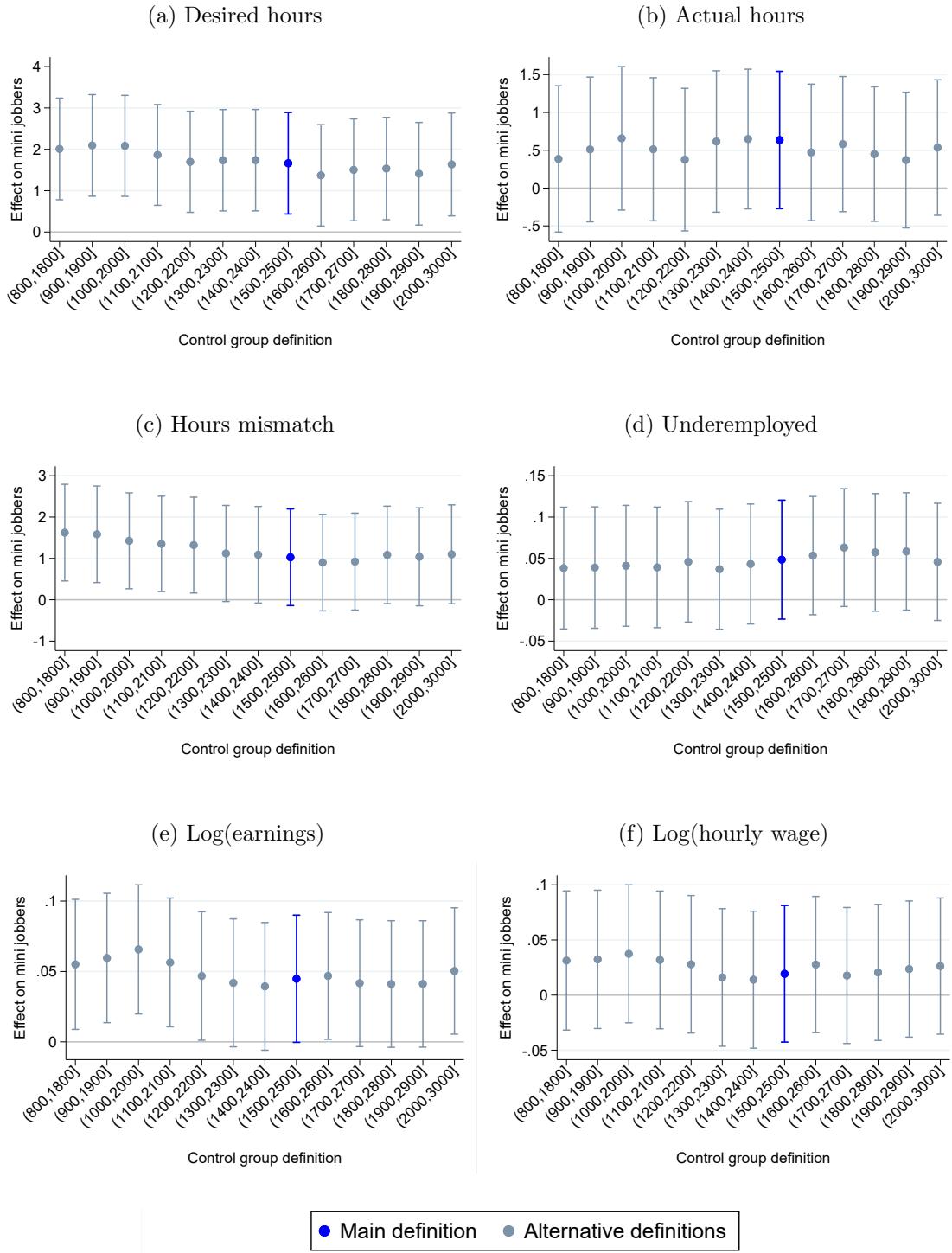
Notes: The table displays treatment effect estimates from the difference-in-differences analysis comparing the pre-reform period (2000 to 2003), to the post-reform period (2004 to 2007) outcomes in our sample of female workers. Mini jobbers, as well as workers with primary earnings in the [400,800], and [800,1500] segment are compared with those earning [1500,2500] euro, controlling for linear group-specific trends. Hours outcomes are measured per week. Earnings and wages are nominal in log(euro). Covariates include individual characteristics (age, marital status, children, education), as well as occupation and state (Bundesland) fixed effects. We exclude observations from 2003 with interviews after April. Standard errors (in parentheses) are clustered at the individual level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Figure D.11: Event Study of Reform Effects with Multiple Treatment Groups



Notes: The figures display the dynamic treatment effect estimates from the main event study analysis, which includes all treatment groups (defined in euro intervals). The solid red line marks the implementation of the mini job reform in April 2003. The data point for 2003 includes only those respondents interviewed before April 2003. Hours outcomes are measured per week. Earnings and wages are nominal in log(euro). Confidence intervals at the 95% level are based on standard errors clustered at the individual level.

Figure D.12: Difference-In-Differences Estimates Varying the Control Group



Notes: The figures display the treatment effect estimates from the difference-in-differences analysis comparing the pre-reform period (2000 to 2003), to the post-reform period (2004 to 2007) outcomes in our sample of female workers. Mini jobbers' outcomes are compared those of workers with earnings falling in the respective intervals (x-axis, in euro), controlling for linear group-specific trends. The data point for 2003 includes only those respondents interviewed before April 2003. Hours outcomes are measured per week. Earnings and wages are nominal in log(euro). Confidence intervals at the 95% level are based on standard errors clustered at the individual level.

Table D.6: Robustness Checks for the Reform Effect Based on Employment Characteristics

	Observations	(1) Desired hours	(2) Actual hours	(3) Hours mismatch	(4) Under- employed	(5) Monthly earnings	(6) Hourly wage
<i>Compensated for overtime</i>							
Mini jobber × post	12060	1.66*** (0.64)	0.60 (0.47)	1.06* (0.60)	0.05 (0.04)	0.05* (0.02)	0.02 (0.03)
<i>With contractual hours</i>							
Mini jobber × post	11081	1.53* (0.71)	0.39 (0.50)	1.14* (0.69)	0.04 (0.04)	0.07* (0.03)	0.05 (0.03)
<i>No self-employed</i>							
Mini jobber × post	12099	1.67*** (0.64)	0.73 (0.46)	0.94 (0.61)	0.05 (0.04)	0.05* (0.02)	0.01 (0.03)
<i>No restriction on secondary job</i>							
Mini jobber × post	13262	1.69*** (0.62)	0.62 (0.46)	1.08* (0.59)	0.05 (0.04)	0.04* (0.02)	0.02 (0.03)
<i>Including unemployment benefit recipients</i>							
Mini jobber × post	13034	1.51* (0.62)	0.48 (0.46)	1.03* (0.61)	0.05 (0.03)	0.04* (0.02)	0.03 (0.03)
<i>Recorded as mini jobbers</i>							
Mini jobber × post	10535	1.58* (0.68)	0.88* (0.47)	0.71 (0.66)	0.04 (0.04)	0.07*** (0.02)	0.01 (0.03)
<i>Cross-sectional weights</i>							
Mini jobber × post	12534	2.71*** (0.84)	1.25* (0.61)	1.46* (0.75)	0.12* (0.05)	0.05* (0.03)	0.01 (0.04)
<i>Uncensored hours outcomes</i>							
Mini jobber × post	12766	1.64*** (0.63)	0.71 (0.47)	0.93 (0.60)			

Notes: The table displays treatment effect estimates from the difference-in-differences analysis comparing the pre-reform period (2000 to 2003) to the post-reform period (2004 to 2007) outcomes in our sample of female workers. Mini jobbers are compared with workers earning [1500,2500] euro, controlling for linear group-specific linear trends. Hours are measured per week. Earnings and wages are nominal in log(euro). All estimations control for individual characteristics (age, marital status, children, education), as well as occupation and state (Bundesland) fixed effects. We exclude observations from 2003 with interviews after April. Standard errors (in parentheses) are clustered at the individual level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

D.3 Difference-In-Differences Analysis with a Balanced Panel

We run a complementary regression analysis based on a balanced panel of workers that investigates how existing mini jobbers adjust their labour supply in response to the reform. The panel sample includes mini jobbers or have primary earnings in the segment (1500, 2500] before the reform, and are continuously employed the two years after. To be consistent with our cross-sectional analysis, mini jobbers are defined as workers earning less than €400. Similarly to the cross-sectional analysis, we do not consider outcomes in the second half of 2003. To increase the sample size, we take the latest observation point for each individual just before the reform. Specifically, we define the treatment status based on the 2003 wave for all individuals surveyed between January and March 2003, and based on the 2002 wave for those surveyed after April. For the post-treatment period, we consider labour market outcomes in the years 2004 and 2005. Following individuals further than 2005 drastically reduces the sample of mini jobbers. This yields a sample of 1,137 females amongst which 246 are mini jobbers, and for whom we can observe short-term adjustment patterns.

We estimate the reform effect in the panel with the following specification:

$$y_{it} = \alpha + \delta(D_i \times Post_t) + \phi_i + \gamma_t + \varepsilon_{it} \quad (2)$$

which is similar to our main specification (1), with three key differences. First, it includes individual fixed effects which take out all time-constant observable and unobservable differences between individuals. Second, it takes a within-individual perspective since the treatment status D_i is defined based on pre-reform earnings. The interpretation of the coefficients δ changes compared to the cross-sectional analysis, since workers can move out of their original earnings segments, e.g. pre-reform mini jobbers can take up regular jobs. Third, due to the short nature of the panel, we do not control for group-specific linear trends.

The estimation results are shown in Appendix Table D.7. We find that pre-reform mini jobbers increase their desired hours by 2.41 after the reform. This is almost matched by the 2.15 hour increase in actual hours, such that the effect on hours mismatch is negative, but small and non-significant. At the same time workers experience an hourly wage increase of 14% (about €1). Their total monthly earnings rise by 28% to which the working hours and the wage increase each contribute about half.

Overall, the results are qualitatively consistent with those from the cross section, but with larger effect sizes. One explanation is that the effects are overestimated because low-earning workers tend to move up the earnings distribution at a faster rate than other groups independently of any reform effect, conditional on remaining employed. The results might then be driven by mini jobbers taking up more regular jobs with higher hours, and possibly wages. Workers in higher earnings segments might thus not be a valid control

group for a within-person analysis since their earnings grow at a lower rate and we cannot control for such group-specific trends.

The differences in effects are unlikely to be driven by workers in this reduced sample differing in their characteristics from workers in the cross-section. Appendix Table ?? shows that observable pre-reform characteristics of mini jobbers and the control group are comparable between the panel and the cross-sectional samples. The standardized bias ([Rosenbaum and Rubin, 1985](#)) lies mostly below ten, with the exception of only few variables. Mini jobbers in the panel are slightly more likely to be married, less likely to be self-employed and less likely to have no contractual hours. As for the control group, individuals in the panel are slightly less likely to have small kids.

Table D.7: Difference-In-Differences Panel Analysis

	(1)	(2)	(3)
	Desired hours	Actual hours	Hours mismatch
Mini jobber post	2.41*** (0.58)	2.15*** (0.44)	-0.26 (0.55)
Observations	3411	3411	3411
Mean outcome mini jobbers	16.59	11.75	-4.85
	(5)	(6)	
	Log(earnings)	Log(hourly wage)	
Mini jobber post	0.28*** (0.03)	0.14*** (0.03)	
Observations	3411	3411	
Mean outcome mini jobbers	5.73	1.88	
Individual fixed effects	✓	✓	✓
Year fixed effects	✓	✓	✓

Notes: The table displays treatment effect estimates from the difference-in-differences analysis based on a balanced panel of female workers comparing pre- (2002/3), to the post-reform period outcomes (2004 and 2005). The treatment status is defined in 2002 for workers surveyed after April and in 2003 for workers surveyed after April of the respective year. Mini jobbers are compared with workers earning [1500,2500) euro. Hours outcomes are measured per week. Earnings and wages are nominal in log(euro). Standard errors (in parentheses) are clustered at the individual level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.