Increasing Hours Worked: Moonlighting Responses to a Large Tax Reform

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Abstract

Holding multiple jobs – or moonlighting – is increasingly popular in OECD countries, with 5 to 10% of workers holding two or more jobs. Yet little is known about the determinants of moonlighting and its responsiveness to financial incentives: research has been held back by the lack of identifying variation, as most policies treat primary and secondary employments equally. This paper circumvents these limitations by studying a unique reform in Germany that allowed workers to hold small secondary jobs tax-free, thus decreasing the tax rate on secondary earnings by between 19.5 to 66pp. Using a difference-in-differences framework, I document three findings. First, I find that moonlighting participation elasticities are several times larger than participation elasticities in primary employment. Second, I show that individuals do not substitute primary earnings with secondary jobs, despite the large potential savings. Third, the number of low-income jobs increased rapidly after the reform, and did not result in decreased labor supply among low-income individuals. Finally, I explore mechanisms behind the varying rates of response, and find that hour constraints and job access are key determinants of moonlighting.

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Increasing working hours is on the agenda of most policymakers. Government policies often incentivize longer working hours of employed individuals through tax subsidies, tax breaks, or detaxation of overtime hours. Recent empirical evidence, however, documents weak intensive margin responses, even for policies with strong incentives.[1] However, little is known about the labor supply responses of employed individuals via secondary job holding. Yet, multiple job holding – or moonlighting – is widespread in OECD countries, with rates ranging between 5% of the working population in the United States to over 10% in the UK.[2] Furthermore, the increasing popularity and access to alternative work arrangements and flexible-contract job opportunities, due to proliferation of digital platforms such as Uber and TaskRabbit, make multiple job holding a potentially important channel of response.

If moonlighting is very responsive to tax incentives, cutting one's secondary tax rate could provide an equivalent incentive to cutting one's primary tax rate, while at the same time protecting the tax revenue collected on primary earnings. The efficacy of this approach though, crucially depends on moonlighting elasticities, which may differ dramatically from primary earnings elasticities because of the high costs associated with obtaining a secondary employment. But estimating the responsiveness of moonlighting to financial incentives and understanding the determinants of multiple job holding is challenging, due to the lack of identifying variation. The vast majority of tax systems do not differentiate between primary and secondary employments, and simply apply the tax schedule to the sum of earnings. Therefore changes in marginal income or payroll tax rates leave the relative wages of primary and secondary jobs unchanged, providing little scope for identification.

This paper provides the first plausibly causal estimates of secondary job participation elasticities and offers new insights into the determinants of moonlighting by studying a unique reform in Germany. Starting in April 2003, part-time and full-time workers earning more than €400 per month have been allowed to

[1] For example, Chetty et al. (2013) study intensive margin responses to EITC subsidies; Tazhitdinova (2018a) studies responses to a very large tax break in Germany; and Cahuc and Carcillo (2014) study detaxation of overtime pay in France.

[2] See Lal (2015) for the US statistics, and Heineck (2009) for the UK. About 6% of individuals moonlight in Germany (Heineck (2009)), and 5.5% in Canada (Kimmel and Powell (1999)).

hold a secondary job tax-free, if earnings from the secondary employment do not exceed €400 per month. The reform has thus exempted small secondary earnings from employee social security tax and income tax, with total savings ranging between 19.5% and 66% depending on one's marginal tax bracket. Full income and social security taxes are due on secondary earnings of €401 or more.[3] Using administrative data on a 2% representative panel sample of wage earners in Germany, I find two main results.

First, I show that the reform dramatically increased the number of low-paid secondary jobs: the share of individuals holding secondary employments increased from around 2.3% just prior to the reform to 5% within the first 2 years and has continued to grow. By 2010, nearly 6.8% of workers held secondary jobs. Considering that most eligible workers saved between 19.5 to 66 percent on their combined social security and income taxes, these responses translate into elasticities of participation between 0.26 to 1.15 in the short run, and 0.63 to 2.69 in the long run, depending on primary earnings. The magnitude of response is significantly larger than participation elasticities in primary employment, which are estimated to range between zero and 0.25 for men and between 0 and 0.35 for women.[4] For identification, I employ three difference-in-differences approaches. The first approach is to assign individuals to treatment and control, based on pre-reform income, and compare changes in the multiple-job holding rates of high-income individuals, who were less likely to be affected by the reform, to those of low-income individuals, who were most likely to be affected by the reform. Second, I compare moonlighting rates of individuals based on their current primary income, and choose very low-income individuals, whose incentives did not change, as a control group. Finally, I compare changes in the number of low-paid secondary jobs (€400 or less), which became attractive as a result of a tax break, to changes in the number of high-paid secondary jobs (over €1000), whose tax treatment remained unchanged. While none of these approaches provide an ideal control group, they utilize different points of comparison, yet result in similar estimates of participation elasticities.

Second, I find that the observed increase in moonlighting represents a real

[3] Employers pay social security taxes irrespective of the size of earnings, but the rates differ slightly (see Section 1.1).

[4] See Blundell and Macurdy (1999), Blundell et al. (2011) and McClelland and Mok (2012).

increase in working hours and is not driven by evasion or shifting of primary working hours into secondary jobs. Once again, I employ a difference-in-differences approach, and compare how primary earnings change relative to the previous year for individuals with *new* secondary jobs before and after the reform. Since having a secondary job that pays more than €400 does not lead to a tax break, individuals with high-paid secondary jobs constitute a natural control group for individuals with new secondary jobs that pay €400 or less. I find that individuals do not substitute high-taxed primary earnings with tax-free secondary earnings. As a further robustness check, I show that the likelihood of the primary earnings decreasing by approximately €400 when starting a new secondary job did not increase after the reform. While some individuals report having both regular employment and a tax-free secondary job at the *same* establishment, such reports are rare and result in higher combined earnings relative to the previous year, suggesting no cheating behavior. I also find that the increased supply of secondary job workers did not result in fewer job opportunities for low-income individuals; rather the number of small-earnings jobs increased accordingly. My findings, however, cannot eliminate the possibility that some full-time positions were split into multiple part-time jobs.[5]

Consistent with Shishko and Rostker (1976) and Paxson and Sicherman (1996), these empirical results suggest that hour constraints are likely to be the primary cause of moonlighting.[6] Most individuals moonlight at low-skilled service jobs that are unlikely to be appealing to workers wishing to expand their skill sets (Panos et al. (2014); Lundborg (1995); Renna and Oaxaca (2006)). The key evidence of hour constraints is the fact that individuals with new secondary jobs did not reduce earnings in their primary jobs. But unconstrained individuals would only hold a secondary job in order to take advantage of the tax arbitrage opportunity stemming from differential taxation of primary and secondary earnings, which necessitates a primary earnings reduction.[7] My findings

[5] Galassi (2018) studies labor demand responses to all aspects of the 2003 reform and finds some evidence of worker substitution, but results vary by firms' dependence on low-earnings workers.

[6] See also: Abdukadir (1992) finds that liquidity constrained individuals are more likely to moonlight when they plan to buy a house or a new car. Krishnan (1990) finds that a husband's decision to hold a second job is a substitute for spousal earnings.

[7] In this regard, the results of this study potentially differ from findings of Farrell and

also highlight the importance of having easy access to secondary employment: individuals who work in a popular secondary occupation as their primary job show higher moonlighting rates conditional on their earnings level.

The results of this paper are policy-relevant for the following reasons. First, the results demonstrate that low elasticities for primary employment are not predictive of moonlighting elasticities.[8] The elasticity estimates in this study, instead, are more consistent with recent experimental evidence, that finds large intertemporal or compensated elasticities for Uber drivers and other workers with highly flexible working hours (Angrist et al. (2017), Mas and Pallais (2019)), further highlighting the importance of frictions.[9] High elasticity estimates thus predict that as flexible work arrangements become more prevalent (Jackson et al. (2017); Katz and Krueger (2019a); Katz and Krueger (2019b)), we are likely to observe a large increase in the take up of secondary employment.

Second, the consensus in the public finance literature is that intensive margin labor supply elasticities are small (Saez et al. (2012)). This paper's findings suggest that labor supply responses depend on the labor market structure and can, in fact, be quite large. Therefore, the efficiency cost of taxation could be higher than currently predicted. On the upside, the results suggest a cost-effective approach to incentivizing working longer hours. This is because tax revenue depends not only on the elasticity of earnings and the magnitude of tax changes, but also on the income base the tax applies to. Cutting one's secondary tax rate therefore provides an equivalent incentive as cutting one's primary tax rate, but protects the tax revenue collected on primary earnings. Moreover, since low-income workers are most responsive to moonlighting incentives, a flat-rate secondary earnings tax break could be particularly effective by increasing labor supply of low-income workers, while leaving it unchanged for high-income workers.

Greig (2016) and Koustas (2018), who suggest that digital platform income is used to smooth consumption. The data used in this paper does not provide information on consumption, merely on earnings. I do not find any evidence of earnings smoothing through moonlighting.

[8] Among a number of recent studies of the 2003 reform (Gudgeon and Trenkle (2017); Tazhitdinova (2018a); Galassi (2018); Carrillo-Tudela et al. (2018)), only Carrillo-Tudela et al. (2018) provides descriptive analysis of moonlighting.

[9] The only other study that estimates elasticity of secondary earnings to taxes is O'Connell (1979), who finds combined intensive-extensive elasticities of between 0.43 and 0.56. O'Connell (1979) treated primary income as fixed and used a simple variation in marginal tax rates to estimate responses. Thus, the study is likely to suffer from omitted variable bias (Weber (2014)).

Third, the results highlight the importance of reducing evasion channels when designing tax rules. The moonlighting reform in Germany led to genuine increases in working hours because cheating through job splitting was too costly. In contrast, detaxation of overtime hours in France in 2007 did not increase working hours because workers were able to easily manipulate hour declarations (Cahuc and Carcillo (2014)). Furthermore, moonlighting responses can be particularly large if the secondary job opportunities are from self-employment, making them harder to tax (Saez et al. (2012)). For example, even though most digital platform earnings are third-party reported via Forms 1099-K and 1099-Misc in the U.S., these earnings can be offset with self-reported business expenses that are hard to verify (Carrillo et al. (2017); Slemrod et al. (2017); Tazhitdinova (2018b)). Hence, lower effective tax rates combined with flexible working schedules could make secondary jobs particularly attractive.

1 Institutional Setting and Data

1.1 Institutional Setting

There are two broad categories of employment in Germany: regular jobs subject to income and social security taxes, and mini-jobs, also known as marginal jobs, that are exempt from income tax and the employee portion of social security taxes. From 1999 until April 2003, these mini-jobs were limited to jobs in which employees earned less than €325 per month and worked less than 15 hours per week. All other jobs were considered regular, and therefore were subject to the 21% employee social security tax and income taxes, with a marginal tax rate ranging between 0 and 53% depending on own and spousal earnings.[10] If individuals held secondary jobs, the €325 threshold applied to the sum of earnings. Thus, for individuals with multiple employments, income and social security taxes were calculated based on the sum of primary and secondary earnings. Employer social security tax liability barely changed at the €325 threshold, decreasing from the 22% "mini-job tax" to the 21% regular employer social security tax.

The Hartz II reforms introduced on April 1, 2003 increased the mini-job

[10] Appendix Table B.1 summarizes tax rates.

Table 1: Tax Rules by Monthly Earnings in Primary and Secondary Jobs

	Before April 2003	After April 2003
Primary + Secondary $\leq$ €325	no tax	no tax
€325 $<$ Primary + Secondary $\leq$ €400	Primary: 21% tax Secondary: 21% tax	no tax
Primary $>$ €400, no Secondary	Primary: 21-74% tax	Primary: 19.5-66% tax
Primary $>$ €400, Secondary $\leq$€400	Primary: 21-74% tax Secondary: 21-74% tax	Primary: 19.5-66% tax Secondary: no tax
Primary $<$ €400, Primary + Secondary $>$ €400	Primary: 21-74% tax Secondary: 21-74% tax	Primary: 19.5-66% tax Secondary: 19.5-66% tax
Primary $>$ €400, Secondary $>$ €400	Primary: 21-74% tax Secondary: 21-74% tax	Primary: 19.5-66% tax Secondary: 19.5-66% tax

Notes: This table summarizes individual tax rules in Germany. Primary job is defined as the job with the highest earnings. The income tax rate depends on marital status and one's primary or total earnings, depending on whether secondary earnings are taxed. In all cases, employers must pay a social security or mini-job tax that ranges between 19.5% and 30%.

threshold from €325 to €400 and abolished the hour constraint. Crucially, the reform made mini-jobs attractive to individuals with regular jobs, by allowing them to hold one secondary mini-job tax free. Thus, a worker who earned more than €400 per month could now obtain a secondary mini-job and pay no income or social security taxes on his secondary earnings,as long as these earnings did not exceed €400. Secondary employments that earned over €400 per month were subject to the usual income and social security taxes on the full amount. However, the rules allow workers to occasionally exceed the mini-job threshold. Employer tax on mini-job wages was increased from 22% to 25% in 2003, and further to 30% in 2006. Employer social security tax, on the other hand, remained at 21% until 2006, at which point it decreased to 19.5%.[11]

As summarized in Table 1, the tax rules generate a large notch at the €325/€400 threshold for individuals with small incomes in all years. For individuals with at least one regular job – i.e. an employment that pays over €325/€400 per month – the mini-job threshold generated a large notch for secondary earnings starting in 2003. From perspective if taxes, mini-jobs and regular jobs are similar for employers. However, several recent studies show that mini-job workers receive smaller fringe benefits – e.g. sick day pay, vacation pay, bonuses, etc. (Bachmann et al. (2012); Wippermann (2012); Tazhitdinova (2018a)); for these reasons, mini-jobs may be attractive to firms. Finally, Germany did not have a universal minimum wage until 2015. Industry-specific minimum wages covered some workers, but these standards rarely apply to mini-job workers, who are typically employed in low-skilled service occupations, as discussed in the next Section 1.2.

Despite the low value of the mini-job threshold, mini-jobs are very popular in Germany. In 2010, approximately 7.3 million individuals held mini-jobs. Tazhitdinova (2018a) documents that most mini-jobs last less than one year, earn between €5 and €10 per hour, and imply working hours of 10 to 15 hours per week.

[11]Furthermore, for individuals with small earnings, the reform substituted the social security notch at the €400 mini-job threshold with a kink. In other words, a worker with primary earnings of €450 per month would pay social security tax on €50 only. The income tax liability would still be based on the full €450. This change did not apply to secondary employments.

1.2 Data

I use the weakly anonymous Sample of Integrated Labor Market Biographies 1975-2010 (SIAB), which provides information on employment, job search and receipt of unemployment benefits for a 2% sample of *wage earners* – 1,639,325 individuals – in Germany from 1975 until 2010.[12] Because the information on mini-job employments is only available beginning in 1999, I focus on the years 1999-2010. Employment histories consist of end-of-the-year notifications, along with employer notifications that are submitted when an employee is hired, terminated, or when an employment is interrupted. Thus, if no changes are made to the employment relationship, only one notification is recorded per year. Otherwise, multiple notifications, that are precise to the day, are recorded. The data provides demographic and establishment variables such as sex, age, citizenship status, education, occupation, economic activity of the establishment, number of employees at the establishment and the median wage. Unfortunately, marital status and number of children are known only for benefit recipients and those engaged in job search, while wage and working hours data is not available at all. Finally, the data does not provide information on self-employment; this is largely irrelevant because the studied tax changes apply to wage earners only.

I restrict the sample to individuals in regular and mini-jobs; employments of other types, e.g. trainees, etc, are dropped. Unless otherwise noted, I further restrict the sample to individuals aged 31 through 54, in order to focus on working-age adults. I study job holding behavior at the quarterly level. For each quarter, the observation with the largest monthly earnings is recorded as the main job, and the following employment by earnings level is recorded as the second job. Therefore, by construction, primary jobs generate the highest earnings. A very small number of individuals hold more than two concurrent employments; for these individuals, only the two highest-paid jobs are recorded. Earnings from the

[12] The 2% sample comprises all individuals who were subject to Social Security (i.e. regular employees) or received unemployment benefits according to Social Code books II and III (since 1975), have been marginally employed (i.e. mini-job workers since 1999), or registered as a job seeker or participated in a training measure (since 2000). In short, the SIAB dataset presents a 2% sample of the *non-self-employed* labor force in Germany. For details, see vom Berge et al. (2013). Data access was provided via on-site use at the Research Data Centre (FDZ) of the German Federal Employment Agency (BA) at the Institute for Employment Research (IAB), and, subsequently remote data access.

same establishment and the same employment category (i.e. regular or mini-job) are combined in the case of multiple concurrent records.

To ensure that the identified secondary employment represents actual secondary jobs rather than temporary job overlaps due to job-switching, I proceed as follows. For each quarter I identify employment of the longest duration. I then delete any job records within that quarter that do not overlap with this employment by at least 15 days.[13] For months of continuous employment, this procedure identifies the main job and the highest-paid secondary job held during that month. In months of job switches, employment spells of the longest duration are recorded. This procedure, therefore, could lead to omission of very short spells of multiple-job holding in between main jobs.[14] The results are not sensitive to the choice of the minimum overlap period (currently set at 15 days). This is not surprising considering the average duration of secondary jobs – an average individual works at the secondary job for approximately 8 months.

Throughout the paper I choose not to adjust for inflation because the mini-job thresholds are nominal. In regression estimates, inflation-driven increases in earnings will be accounted for by the year fixed effects.

Summary statistics are available in Table 2. After the 2003 reform, the number of secondary jobs increased rapidly, nearly doubling between 2002 and 2004, and nearly tripling by 2010. The vast majority of the secondary employment consist of mini-jobs with the average earnings of approximately €260 to €300 per month. Individuals who hold secondary jobs tend to have lower primary earnings. Finally, while multiple job holding rates increased after the reform, the overall levels remained low, with less than 7% of individuals holding secondary jobs.

Figure 1(a) reports the five most common occupations for secondary jobs in 2005, by earnings level. Among small secondary jobs, low-skill occupations prevail: doormen and custodians, waiters, house cleaners, warehouse and transport workers, and office workers represent the majority of employment. High-paying

[13] If several jobs have the same duration, I use the spell with the highest income as the "main" spell. A very small number of individuals report multiple employment spells of the same longest duration (typically of less than 3 days) and the same level of earnings. In this case a random spell is chosen.

[14] For example, if an individual holds job #1 for 12 days, then works jobs #2 and #3 simultaneously for 10 days, then my procedure would record only the job #1 spell.

secondary jobs, on the other hand, consist of higher-skilled jobs, such as teachers, nurses and assistants, entrepreneurs and consultants, social workers, and office workers. Interestingly, low-paid secondary job occupations do not appear to vary greatly with the primary earnings level – Figure 1(b) shows most common occupations among secondary mini-jobs by individuals' primary earnings, documenting that low-skill occupations are most common regardless of primary earnings level. Corroborating this finding, Figure 2 shows the percent of individuals whose occupation in the main job matches their occupation in the secondary job. As one would expect from Figure 1, individuals with low primary earnings are more likely to have matching occupations than individuals with higher primary earnings and low-paying secondary jobs. For all income levels, among individuals with primary and secondary jobs of similar level of earnings, 40% have the same occupation. As the earnings differential increases, this share decreases to 20%. Both the probability of a match and most popular secondary job occupations remain very stable across the years.

2 Theoretical Predictions

To better understand the incentives generated by the 2003 reform, consider a simple theoretical framework inspired by Shishko and Rostker (1976). To be concise, I assume that individuals experience no preferences for multiple job holding except for financial incentives or hour constraints. However, the predictions of this section can be extended to other explanations for multiple job holding, such as uncertainty (Bell et al. (1997)), complementarities (Lundborg (1995)), skill training (Panos et al. (2014)) and individual preferences (Renna and Oaxaca (2006)).

Consider an individual maximizing utility function

$$U = c - \frac{1}{1+1/\varepsilon}\left(h_1 + h_2\right)^{1+1/\varepsilon} \tag{1}$$

subject to a budget constraint

$$c = (1-\tau_1)w_1h_1 + (1-\tau_2)w_2h_2 \quad \text{and} \quad (1-\tau_1)w_1 \geq (1-\tau_2)w_2, \tag{2}$$

with h_i and w_i denoting working hours and wages in job i, respectively. For completeness, corresponding tax rates τ_i are allowed to differ across jobs, even though in most countries $\tau_1 = \tau_2$. If the working hours are unconstrained, an individual will hold one job that pays the highest after-tax wage and will work $h_1^* = w_1^{\varepsilon}(1-\tau_1)^{\varepsilon}$ hours. However, if the highest-paid job hours are constrained, an individual will work the maximum allowable hours at the highest-paid job and supplement with earnings from secondary employment.[15] The optimal working hours are $(h_1^*, h_2^*) = \left(\bar{h}_1, \max\{0, w_2^{\varepsilon}(1-\tau_2)^{\varepsilon} - \bar{h}_1\}\right)$, and the total income earned is equal to the total earnings an individual would be willing to achieve if he only worked at the secondary job. The combined earnings will be lower than if the individual could work without constraint at their primary job, unless the after-tax wages are equal in primary and secondary jobs.[16] While the budget constraint (2) does not include a fixed cost of secondary job holding, such a cost can be easily incorporated into the analysis, resulting in the following prediction.

Prediction 1: Prior to the 2003 reform, individuals would not hold secondary jobs unless the following three conditions were satisfied: (a) the primary working hours are constrained and sufficiently far from optimum, (b) the fixed cost of finding and/or holding a secondary job is sufficiently low, and (c) the after-tax secondary wage is not too low, relative to the after-tax primary wage.

Now suppose instead of (2) individuals face the following budget constraint:

$$c = (1-\tau_1)w_1h_1 + w_2h_2 - T(h_2), \text{ with } T(h_2) = \begin{cases} 0 & \text{if } w_2h_2 \leq K \text{ and } w_1h_1 \geq M \\ \tau_2 w_2 h_2 & \text{if } w_2h_2 > K, \end{cases} \tag{3}$$

thus, allowing individuals to earn up to K tax-free in job 2 if they earn at least M in job 1. If the secondary wage is too low even in the absence of taxes, i.e. $(1-\tau_1)w_1 \geq w_2$, then Prediction 1 stands, but we would expect an increase in

[15] For simplicity, I assume that lower-paid earnings are unconstrained.

[16] Note that the hours worked at the secondary job do not depend on the tax rate at the primary job, because of the choice of quasi-linear utility function, which does not allow for income effects. In the presence of income effects, a decrease in τ_1 would lead to a decrease in working hours at the secondary job only. Unless the tax cut is large enough that the new $h_1^* < \bar{h}_1$, in which case, an individual would quit the secondary job and work less in the first job.

moonlighting as the number of individuals satisfying condition (c) increases.

If the secondary wages are sufficiently high, so that $(1-\tau_2)w_2 < (1-\tau_1)w_1 < w_2$, and the primary hours are unconstrained, individuals will take advantage of secondary job opportunities by shifting their primary earnings into secondary. Provided the thresholds M and K are sufficiently low, as is the case in Germany, these individuals will earn K in the secondary job and the rest in the primary job, resulting in the same combined earnings as under budget constraint (2). If the primary hours are constrained, various responses are possible, depending on the nature of the constraint. If the primary working hours cannot be reduced, as is the case for most salaried workers, individuals will still obtain a secondary job and earn K or less. Among these, those who worked the desired unconstrained number of hours prior to the reform, will now earn up to K in their secondary job, and will work more total hours than they would ideally like. Finally, if the primary constraint allows for reduction of working hours but not for increases, we might see a reduction of primary earnings among the constrained individuals if the primary job constraint is no longer binding, given the preferences for reduced primary earnings. Note that these individuals will never earn less than K in the secondary job unless they earn precisely M at the primary job, because it is more advantageous to reduce working hours at the higher-taxed primary job than at the secondary.

The above cases are formally described in Appendix A. This simple framework generates three additional predictions that will help us understand the observed outcome of the reform in Germany.

Prediction 2: The reform will induce the previously constrained individuals who earned less than K in their secondary jobs to increase their secondary earnings up to K, and will induce those with secondary earnings just above K to reduce them to K.

Prediction 3: The reform will induce the following groups of individuals to moonlight. (i) Previously unconstrained individuals who obtain secondary jobs with $w_2 > (1-\tau_1)w_1$ and $w_2 h_2 = K$. (ii) Constrained individuals who previously could not satisfy condition (c) but now earn $w_2 h_2 \leq K$ with $w_2 > (1-\tau_1)w_1$ or $w_2 \leq (1-\tau_1)w_1$. (iii) Constrained individuals who previously worked optimal hours in their primary job and now obtain a secondary job with $w_2 h_2 \leq K$ and

$w_2 > (1 - \tau_1)w_1$.

Prediction 4: The reform will induce unconstrained individuals (and some constrained individuals) to reduce their primary earnings by the amount of secondary earnings $w_2 h_2$. Note that these individuals obtain the secondary job only if $w_2 > (1 - \tau_1)w_1$.

3 Empirical Results: Take-Up of Secondary Jobs

3.1 Graphical Evidence

Predictions 2 and 3 of Section 2 suggest that we should observe an increase in the number of €0-€400 secondary jobs and a decrease in above-€400 secondary jobs. Figures 3 (a)-(b) confirm these predictions and show the distributions of secondary jobs before (dashed line) and after the reform (solid). As secondary employment could be seasonal, I show the pre- and post-reform distributions for corresponding months, allowing us to compare the distributions of secondary jobs 3 and 12 months after the reform. Figure 3 documents that the number of secondary jobs increased gradually. Within 3 months of the reform a large share of secondary jobs shifted to the €400 threshold, but the number of lower-paying secondary jobs remained the same. As time progressed, the number of secondary jobs – both low-paying (under €400) and at-the-threshold jobs – increased dramatically. Figures 3(c)-(d) zoom in on the distribution above €425 and show a decrease in the number of mid-range secondary jobs, with pre- and post- reform distributions overlapping around €1000 per month. The number of secondary jobs paying over €1000 was not affected by the reform.

Next, I explore how the moonlighting rates changed from 1999 to 2010 in Figure 4. Figure 4(a) shows the percent of individuals who held secondary jobs paying less than €400 per month, €400-€1000, or more than €1000 over time. Few individuals moonlighted in Germany prior to the reform – just over 2% held secondary jobs in the beginning of 2003, and the majority of these employments earned less than €400. Thus, using Prediction 1 we can conclude that either few individuals in Germany experience hour constraints, secondary jobs offer low wages relative to primary job, or individuals experience high fixed costs of

obtaining and holding secondary jobs. Figure 4(a) again provides strong support for Predictions 2 and 3: secondary jobs with earnings below €400 increased immediately after the reform and kept growing until about 2009. In the last year of data, 2010, roughly 7% of individuals held secondary jobs. The relatively low levels of moonlighting – despite large tax savings – suggest that either the fixed costs of secondary job holding are very high, or the available secondary jobs offer wages that are too low, even when tax-exempt. If secondary jobs offered similar wages to primary jobs, we would observe most individuals picking up secondary jobs according to Prediction 3.

Figure 4(b) allows us to evaluate patterns of secondary jobs paying €400 or more, by changing the y-axis. Figure 4(b) provides further support for Prediction 2: secondary employment in the mid-range, with earnings between €400 to €1000 per month, have decreased rapidly after the reform and stagnated ever since. The number of these jobs, however, has stabilized quickly, within 2 years. Importantly, Figure 4(b) shows that the increase in the number of secondary mini-jobs cannot be explained by the reduction in the number of secondary jobs that paid more than €400, as the number of €400+ secondary jobs was too small before the reform. Finally, we see a small increase in the number of high-paying secondary jobs (over €1000 per month), but this increase is very small in comparison to the dramatic increase in the number of secondary mini-jobs.

Figure 4 highlights the relatively slow adjustment process. It could be that the gradual increase in secondary job holding is due to salience effects, whereby individuals slowly adjusted their moonlighting behavior as they learned about the new rules. However, mini-job rules are well-known in Germany, making this channel unlikely. Alternatively, the slow adjustment could be driven by firm constraints, consistent with the findings of Gudgeon and Trenkle (2017) who investigate firms' adjustment to the mini-job threshold shift from €325 to €400. Gudgeon and Trenkle (2017) show that it took firms more than 3 years to transform €325 jobs into €400 jobs. If labor demand is not perfectly elastic, then the participation elasticities estimated in this section represent a lower bound on the true structural elasticities of labor supply. It is worth noting that the increase in the number of secondary jobs cannot be attributed to the legalization of previously held under-the-table jobs, because secondary job employers pay

a 25-30% tax on these employments. Therefore, bringing these jobs from the informal sector would not be attractive from the firms' point of view.

Figure 5 explores the persistence of moonlighting among individuals and shows the percent of individuals in a given year who have moonlighted at least once since January 1999. These moonlighting rates can be compared to two extremes. First, to a lower bound calculated under the assumption that a person who starts to moonlight, continues moonlighting for each year thereafter. Alternatively, to an upper bound under the assumption that each individual moonlights for at most one year between 1999 and 2010. As the solid curves are closer to the lower bound, Figure 5 suggests that there is a substantial amount of persistence among moonlighters: many individuals moonlight in multiple years.

Finally, Figure 6 provides evidence that increased labor supply of moonlighters has not led to a decrease in the labor supply of individuals with low primary earnings: the number of primary jobs with earnings of less than €400 has not decreased as a result of the reform. An important caveat is that the 2003 reform may have led to extensive responses within the primary jobs market: since the mini-job threshold was increased from €325 to €400, individuals who previously chose not to work at all might have joined the workforce. However, such extensive margin responses should only affect the number of at-the-threshold jobs (€162 to €400), but should not affect small jobs (under €162). Figure 6 shows a small increase in the number of primary jobs both below and above €162, suggesting no substitution between primary and secondary workers. However, it remains a possibility that the increase in secondary jobs came as a result of splitting larger full-time jobs into multiple mini-jobs.

3.2 Microdata Regression Estimates

The 2003 reform allowed individuals with regular jobs (i.e. earning more than €400) to hold a secondary job tax-free as long as the secondary earnings do not exceed €400. To estimate the effect of the reform on the take-up of secondary jobs, the most natural identification approach would be to compare secondary job holding rates of pre-reform ineligible individuals – those with primary earnings of less than €400 per month in March 2003 – to secondary job holding rates of pre-reform eligible individuals – those with primary earnings of €400 or more in

March 2003. There are two complications with this approach. First, individuals with small earnings experience particularly large fluctuation in earnings levels over time. In this setting, this would result in higher earnings in after-reform years, eligibility for the secondary job tax break, and large downward bias of the estimate. Second, in addition to changing the secondary job incentives, the 2003 reform increased the cumulative mini-job threshold from €325 to €400. Recall that tax liability does not start until cumulative earnings from all jobs exceed this mini-job threshold; therefore, this rule change could have incentivized individuals with small earnings to increase their earnings, perhaps by obtaining a secondary job. Again, this would result in a large downward bias. For these reasons, I use three alternative approaches to estimate the effect of the 2003 reform on moonlighting.

First, I assign individuals to treatment and control groups based on their primary earnings in January-March 2003, the three months before the reform. The control group consists of individuals with primary earnings of €4000 or more, while the treatment groups consist of workers with primary earnings of €400 to €4000, broken down by primary income tranches. The identification relies on the intuition that high-income individuals were less likely to be affected by the secondary job tax break, but their moonlighting decisions should reflect changes due to other factors. Since these individuals are nonetheless treated, this approach yields a lower bound on the true magnitude of the response.

In my second approach, I assign individuals to treatment and control groups based on their current levels of earnings. I choose individuals with very small primary earnings as a control group – less than €162 per month. By sample construction, these individuals' secondary jobs are limited to €162 or less, and therefore their combined income is limited to €325. Hence, these individuals should not be affected by the 2003 mini-job threshold increase, as their desired cumulative earnings do not exceed €325. Again, I assign individuals to treatment groups by tranches of current income, starting at €400. The main advantage of this approach is that it accurately reflects individuals' incentives. Note that this approach is unusual because the same individual might be assigned to a control group in some years, but to various treatment groups in other years. Treatment group switches do not affect the validity of the empirical approach, merely the

interpretation of the results. The break down of treated individuals into primary earnings groups is done (a) for computational convenience, and (b) to gauge the importance of financial incentives as they vary with one's primary earnings. On the other hand, the possibility of selection into treatment would invalidate my empirical approach. I provide some evidence that such selection is highly unlikely in Section 3.2.2.

The treatment and control groups are not perfectly comparable and differ in many dimensions. However, the two approaches allow for distinctly different control groups – one with high incomes and the other with low incomes – thus offering a good comparison for high-income individuals under the first approach and for low-income individuals under the second approach. Importantly, both approaches lead to similar results and satisfy the parallel trend assumptions as shown in the following sections.

For these two approaches, I estimate a linear probability model (LPM):

$$P(2nd\_Mini_{it} = 1) = \beta_0 + \beta_1 Treat_{it} + \beta_2 After_{it} + \beta_3 (Treat_{it} \times After_{it}) + \delta X_{it} + \varepsilon_{it}, \quad (4)$$

where $2nd\_Mini_{it}$ is equal to 1 if the individual holds a secondary mini-job and zero otherwise, while $After$ identifies the after-the-reform months. $Treat$ identifies one of the several treatment groups – individuals with primary earnings of €400 to €1000, €1000 to €3000, or over €3000 (based on current or pre-reform earnings level). Available controls X_{it} include demographic characteristics such as gender, age, state (länder), occupation, quarter and year fixed effects, and individual fixed effects. The coefficient of interest β_3 measures an increase in the take up of secondary jobs as a result of the tax break. Standard errors are clustered by individual.

I choose the LPM over a nonlinear model such as a logit or a probit for several reasons. First, LPM is easy to interpret and the regression results can be directly compared to graphical evidence. Second and most importantly, LPM is more suitable for including individuals fixed effects because nonlinear models with fixed effects suffer from the incidental parameters problem (Neyman and Scott (1948); Lancaster (2000)). Third, the difference-in-differences approach is

harder to interpret within a nonlinear framework. The parallel trend assumption necessary for causal estimation is hard to justify because of the bounded support of the outcome variable, and the estimated interaction term is difficult to interpret (Ai and Norton (2003); Puhani (2012)).

Finally, for my third approach, I utilize the fact that the reform increased the attractiveness of secondary mini-jobs but did not change the attractiveness of high-paying secondary jobs. Therefore, the secondary job holding rates of €1000+ jobs could be used as a control for the secondary job holding rates of €0 to €400 jobs. In the following sections, I discuss the results and provide further empirical support for each of these approaches.

3.2.1 Approach 1: Assignment Based on Pre-Reform Primary Earnings

Table 3 shows the results of estimating equation (4) with treatment group assignment based on primary earnings in January-March of 2003. The main advantage of this approach is that it avoids selection, as treatment status is based on pre-reform earnings. The downside of the approach is that the treatment/control assignment does not necessarily reflect the current incentives of individuals, which could lead to a downward bias.

The necessary identifying assumption is that the likelihood of secondary employment evolved similarly for individuals with high primary incomes (more than €4000) as for individuals with lower primary incomes (€400 to €4000) prior to the 2003 reform. Figure 7(a) investigates the validity of this assumption and shows the secondary mini-job holding rates over time. Prior to the reform in April 2003, the percent of secondary job holders appears to follow a similar downward trend for all income groups. Individuals, of course, differ in the levels of multiple job-holding: high-income individuals are less likely to hold secondary jobs than individuals with small primary earnings. Appendix Figure B.1 verifies the parallel trend assumption formally, by regressing the outcome variable on the treatment indicator, the time period indicators, and the interaction of treatment indicator with time indicators. The parallel trend holds for lower income groups; however, it appears to be slightly violated for the highest income group, which should result in a small downward bias. Figure 7(a) also shows that moonlighting

rates increased in the control group as well. It is not possible to say whether this increase is a result of treatment or whether it is due to other factors.

Columns (1) – (3) of Table 3 focus on short term effects and are estimated using the observations from 2001-2005. Columns (4) – (5) focus on long term effects and are estimated using the observations from 2001-2003 and 2009-2010. For expositional convenience, the outcome variable takes values 0 or 100, and therefore the estimates shown are measured in percentages rather than fractions. Columns (1) and (4) do not include any controls, while columns (2) and (5) include demographic controls, as well as year and quarter fixed effects. Focusing on columns (3) and (6), which include all demographic controls, and year and quarter fixed effects, as well as individual fixed effects, the results show a large increase in secondary job holding rates over time. For individuals with pre-reform primary earnings of €400-€1000, the 2003 reform increased moonlighting rates by 2.59 pp within 2 years, and by 6.04 pp in 7 years, from a pre-reform mean of 4.58%. Higher income groups experienced smaller increases of 1.30-2.86 pp and 0.67- 1.62pp from the baselines of 2.72% and 2.03%, respectively. These results suggest that individuals with small pre-reform primary earnings increased their moonlighting rates by 30-50% in the first 2 years, and by 80-130% by 2010. In all specifications, higher-income individuals show weaker response than individuals with small primary earnings.

3.2.2 Approach 2: Assignment Based on Current Earnings

Table 4 shows the results of estimating equation (4) with treatment and control status assigned, based on current primary earnings. The necessary identifying assumption is that the likelihood of secondary employment evolved similarly for individuals with very low primary earnings (less than €162) as for individuals with higher primary earnings (€400 or more). Figure 7(b) investigates the validity of this assumption and shows the secondary mini-job holding rates over time. Prior to the reform in April 2003, the percent of secondary job holders appears to follow a similar downward trend for all income groups except for individuals with highest incomes. Appendix Figure B.1 verifies the parallel trend assumption formally, again by regressing the outcome variable on treatment indicator, time period indicators and the interaction of treatment indicator with time indicators.

The parallel trend assumption appears to be satisfied for all income groups.

Figure 7 shows that the reform led to an increase in the fraction of secondary job holders among individuals with primary earnings of less than €162. While the reform did not change the incentives of the control individuals, it did change the availability of small-paying jobs. These general equilibrium changes may be one explanation for the increased secondary job holding rates in this group.

While relying on contemporaneous earnings is best suited for estimating one's true moonlighting incentives as it assigns treatment and control status based on current primary income level, the approach is sensitive to selection bias. A natural concern could be that individuals in the control group are negatively selected. To investigate this possibility, I identify individuals with primary earnings of €162 or less in a given year and then plot their earnings two years later in the Appendix Figure B.4. Figure B.4 shows that roughly 25-30% of individuals continue earning less than €162 per month, an additional 15% increase earnings up to €400, and the rest earn over €400. Importantly, these group changes appear to be persistent over time, with no noticeable differences between the pre- and post-reform periods. While this evidence does not eliminate the possibility of control/treatment group selection, it provides evidence against it.

The results in Table 4 are very similar to the results in Table 3 except for individuals with very high primary earnings (€3000+). For individuals with primary earnings between €400 to €1000, moonlighting increased by 2.22 percentage points in the first 2 years after the reform, and by 6.84 percentage points by 2010 (from the initial level of 4.51%). For individuals with primary earnings of €1000 to €3000, the likelihood of a secondary job holding increased by 0.64 percentage points in the first 2 years after the reform, and by 2.92 percentage points by 2010 (from the initial level of 2.67%). The highest income group does not show an increase in the take-up of secondary jobs relative to the control group, with most estimates being not statistically significant. Thus, the reform resulted in a 24-50% increase in moonlighting rates in the first two years, and a 110-150% increase by 2010.

3.2.3 Approach 3: High-Paid Secondary Jobs as a Control

Finally, I estimate the effect of the reform on the take-up of small secondary jobs using counts from Figure 4. Recall that while the incentives to hold a low-paying secondary job increased dramatically after the reform, the incentives to hold a high-paying secondary job did not change. Therefore, one could use the number of high-paying secondary jobs as a control group for the number of secondary mini-jobs. To account for shifting of mid-range secondary jobs into €400-or-lower jobs, I use the number of secondary employments with monthly earnings of more than €1000 per month as a control group, based on evidence from Figure 3 that shows no shifting of jobs within this earnings range.

Formally, I estimate

$$\log(Num\_Second\_Jobs_{jt}) = \gamma_0 + \gamma_1 Treat_{jt} + \gamma_2 After_{jt} + \gamma_3 (Treat_{jt} \times After_{jt}) + \varepsilon_{jt} \tag{5}$$

and

$$\begin{aligned}\log(Num\_Second\_Jobs_{jt}) = {} & \gamma_0 + \gamma_1 Treat_{jt} + \gamma_2 After_{jt} + \gamma_3\, t + \gamma_4\, (t \times After_{jt}) \\ & + \gamma_5\, (t \times Treat_{jt}) + \gamma_6 (Treat_{jt} \times After_{jt}) + \gamma_7 (t \times Treat_{jt} \times After_{jt}) + \varepsilon_{jt}.\end{aligned} \tag{6}$$

$Num\_Second\_Jobs_{jt}$ measures the number of secondary jobs with income level j in month t. Variable t measures time in months, with 0 identifying April 2003 – the month of the reform, and $After_{jt}$ identifies post-reform months. $Treat_{jt}$ equals to 1 for secondary jobs with earnings of €400 per month or less, and zero for secondary jobs with earnings of €1000 or more. Specification (6) allows for differential time trends before and after the reform.

Parallel trend assumption is verified in Figure 4(b): the identifying assumption is that the number of secondary mini-jobs evolves similarly to high-paying secondary jobs appears to be satisfied for years immediately prior to the reform – starting from 2001. For this reason, I restrict the sample to 2001-2010. Appendix Figure B.3 verifies the parallel trend assumption formally, again by regressing the outcome variable on treatment indicator, year indicators and the interaction of

treatment indicator with year indicators. The parallel trend assumption appears to be satisfied for both income groups. Large secondary job holding rates are shown in Appendix Figure B.5.

Table 5 shows the results of estimating equations (5) and (6). The basic differences (not accounting for time trends) suggest that for individuals with primary earnings between €1000 and €3000, the moonlighting rate increased by 79% within 2 years after the reform, and by 91% by 2010. For individuals with primary earnings of more than €3000, the moonlighting rate increased by 75% and 99% respectively.

3.3 Heterogeneity of Responses

I explore how the magnitude of response differs by individuals' demographics in Figure 8. The results document substantial heterogeneity in moonlighting decisions among individuals with relatively low earnings, less than €2000. For higher levels of earnings, the patterns are less clear. With the exception of high-earning women, women are more likely to hold secondary jobs than men, and respond more strongly to tax incentives. Young individuals – younger than 30 – and older individuals – 55 or older – are less likely to moonlight than individuals in the middle of their careers. (More detailed figures by age are available in Appendix Figure B.6.) Finally, Figures 8(e) and (f) explore the importance of occupations by grouping individuals based on the prevalence of these occupations among secondary jobs. Specifically, individuals whose primary occupation is also a common secondary occupation (doorman, custodian, waiter, house cleaner, warehouse or transport worker, or office worker) are shown in Figure (e), all other occupations in Figure (f). The results suggest that familiarity with common secondary occupations significantly increases the likelihood of moonlighting, even after controlling for earnings level.

3.4 Participation Elasticities

The results of Tables 3, 4, and 5 can be used to estimate elasticities of participation in the secondary job market. I define elasticities as

$$\eta \equiv \frac{\%\Delta Participation}{\%\Delta(1-\tau)} = \frac{\%\Delta Participation}{\%\Delta(1-\tau_{SS}-\tau_{Income})}, \tag{7}$$

where $\tau_{SS} = 0.21$ and τ_{Income} identify social security and income taxes on the first dollar of secondary earnings. An appropriate measure of τ_{Income} would take into account spousal earnings, information on which is not available. As an approximation, I use individual's marginal income tax based on their primary earnings alone minus a 20% deduction (following the results of Doerrenberg et al. (2017)). Thus, average τ_{Income} is 13% for individuals with low primary earnings (€400-€1000), 28% for individuals with €1000-€3000 earnings, and 38% for individuals with primary earnings of over €3000. Because married individuals are subject to lower marginal income tax rates, the estimated elasticities present a lower bound on the true elasticities. The elasticities are also calculated under the assumption that all individuals who looked for a secondary job were able obtain such a job, in other words, that labor demand elasticity is infinity. However, if labor demand is less than perfectly elastic, the estimated response is a combination of labor supply and labor demand responses, and therefore the estimated participation elasticities again represent a lower bound on the true structural elasticities of labor supply.

Elasticity estimates are summarized in Figure 9 and are based on columns (3) and (6) of Tables 3 and 4, as well as columns (1) and (3) of Table 5. The results imply short-term elasticities of approximately 1 and long-term elasticities of 2.5 to 3 for individuals with small primary earnings (€400-€1000). For individuals with primary earnings of €1000 to €3000, short-term elasticities range between 0.26 to 0.75, while long-term elasticities cluster around 1. Finally elasticities for highest income individuals depend on the specification, but focusing on positive estimates, the results imply short-run elasticities of 0.26 to 0.5 and long-run elasticities of 0.75. Most importantly, except for the highest income group, all elasticities are very similar in magnitude and are significantly larger than participation elasticities for the primary jobs, which are estimated to be

between 0 and 0.25 for men and between 0 and 0.35 for women.[17] The results thus imply that moonlighting is highly responsive to tax incentives.

The estimated participation elasticities cannot be easily compared to elasticities of taxable income (ETI): the secondary job incentive was limited to €400, and thus constrained the maximum taxable income change to €400 irrespective of pre-reform income. Therefore, any estimates of ETI are flawed. Nonetheless, one could convert estimates from Tables 3, 4, and 5 into ETI by accounting for the pre-reform primary earnings and after-reform secondary earnings. Specifically, I calculate

$$ETI \equiv \frac{\%\Delta Income}{\%\Delta(1-\tau)} = \frac{\Delta Participation \cdot Ave\_Secondary\_Earnings}{Ave\_Primary\_Earnings \cdot \%\Delta(1-\tau_{SS}-\tau_{Income})}. \quad (8)$$

Given the low moonlighting rates, the resulting earnings elasticity estimates are low, all well below 0.05.[18] Therefore the observed responses do not contradict studies that estimate cumulative earnings elasticities. But this comparison ignores differences in tax bases: a change of marginal tax applied to the sum of income would lead to a large change in revenue collected, as it applies to all earnings. However, changes to the moonlighting taxes, studied in this paper, however, only affect tax revenue collected on moonlighting earnings.

4 Empirical Results: Primary Earnings Responses

Prediction 4 of Section 2 shows that some of the increase in moonlighting hours may be offset by lower working hours at the primary jobs. In this section I provide empirical evidence that this prediction does not hold in practice, and that the increased moonlighting rates were not offset by reductions in primary working hours.

As the tax reform reduced taxation of secondary jobs but not of primary jobs, the reform could lead to an arbitrage opportunity if the after-tax primary wage is

[17] See Blundell and Macurdy (1999), Blundell et al. (2011) and McClelland and Mok (2012).

[18] The highest elasticity is obtained for the long run response of individuals with primary earnings of €400-€1000, whose pre-reform primary earnings were €783 and after-reform secondary earnings are €270, resulting in a 2.08% increase in earnings as a result of a 6.04 pp increase in moonlighting.

lower than the untaxed secondary wage. Tazhitdinova (2018a) studies mini-jobs using a firm and a household survey, and documents that most mini-job workers were paid an average of €7-€9 per hour in 2006-2010. This hourly wage can be compared, for example, to an unmarried worker with primary earnings of €2000 per month, whose implied before-tax hourly wage is approximately €12 per hour and implied after-tax wage is €8, similar to average mini-job wages. This back-of-envelope comparison suggests that except for the lowest-earning workers – e.g. those with primary earnings of less than €1000 – the reform did not present much of an arbitrage opportunity. Moreover, even if individuals wanted to reduce their primary working hours, many would not be able to do so because they are salaried or because doing so is costly. Finally, while regular jobs increase one's pension and unemployment insurance entitlements, secondary mini-jobs do not. For these reasons, it is unlikely that most secondary job holders would want or be able to reduce their primary working hours.

4.1 Graphical Evidence

Empirically, there are several difficulties in identifying shifting of primary earnings into secondary jobs. First, it is imaginable that individuals who obtain a secondary job do so because they experienced an earnings decrease at the primary job. It follows that simply studying the changes in primary earnings upon take-up of a secondary job is not sufficient. Second, one cannot compare average primary earnings over time of individuals with new secondary mini-jobs and new secondary high-paying jobs because the composition of secondary job holders is likely to change as a result of the reform. In particular, the reform increased the take-up of secondary mini-jobs by relatively high-earning individuals. In this section, I use several approaches to investigate primary earnings responses and find no evidence of substitution between primary and secondary earnings.

In order to minimize the importance of selection, I focus on *changes* in primary earnings. Figures 10 shows average changes in primary earnings from the previous year separately for individuals who obtained a new secondary mini-job (€0 to €400) or a new high-paying secondary job (€400 or more), as well as for individuals with no secondary jobs. I consider a secondary job new if the individual did not hold a secondary job a year ago. This allows me to account for

delayed response to secondary job holding, as long as these delays do not exceed 12 months. If individuals were shifting earnings from primary employment to secondary, we would observe a decrease in the solid curve after the reform, and no similar decrease for dashed curves. No such decrease is apparent. Instead, Figure 10 shows a similar evolution of primary earnings changes for all three groups. Importantly, Figure 10 also shows that individuals who obtain a new secondary job do not necessarily do so because of a negative earnings shock in the primary employment – an average change in primary earnings from previous year is positive for all three groups.

Finally, I also consider the possibility that employees may collude with their employers to split regular job earnings into a lesser-paying regular job and a mini-job. While this cheating behavior would be attractive to employees, it would not generate benefits for the employer unless the tax savings are shared, because employers must pay social security tax on mini-job wages. Approximately 44,050 individuals held both a regular and a mini-job with the same employer.[19] However, 61% of these new secondary job holders experienced an increase in pay when they first started the new secondary job. For 6.5%, their earnings remained within €100 of their previous month's wage. This suggests that few individuals (if any) split their primary jobs into a lower-paid taxed job and an untaxed secondary job.

4.2 Regression Estimates

To test Prediction 4 formally, I apply a difference-in-differences approach to two distinct comparison groups, as in Figure 10. First, Table 6 compares changes in primary earnings for individuals who have obtained a new €0-€400 secondary jobs to changes in primary earnings of individuals with new secondary jobs paying more than €400. Since having a secondary job with earnings above €400 does not lead to a tax break, these individuals constitute a natural control group for individuals with new secondary jobs that pay €400 or less. The downside of this approach is that only individuals with large earnings can have high-paying secondary jobs because earnings in the primary job must always exceed earnings

[19] Scaled from 881 observations from a 2% random sample of wage earners.

in the secondary job. For this reason, in my sample I only include individuals with last year's primary earnings of €1000 or more, and this quarter's earnings of €600 or more.

To consider substitution behaviors among lower-income individuals, Table 7 compares changes in primary earnings for individuals who have obtained a new secondary mini-job (≤€400) to changes in primary earnings of individuals who did not obtain a new secondary job. I restrict the sample to individuals with this quarter's earnings of €400 to €1000, and last year's earnings of €400 or more.

Formally, I estimate

$$\Delta PrimaryEarnings_{it} = \beta_0 + \beta_1 Treat_{it} + \beta_2 After_{it} + \beta_3 (Treat_{it} \times After_{it}) + \delta X_{it} + \varepsilon_{it}, \quad (9)$$

where $\Delta PrimaryEarnings_{it} = PrimaryEarnings_{it} - PrimaryEarnings_{i(t-12)}$ measures the change in primary earnings from 12 months ago for individuals with *new* secondary jobs. $Treat_{it}$ is equal to one for individuals with new secondary jobs paying less than €400 per month, and zero otherwise. If individuals shift earnings from primary to secondary jobs, the coefficient β_3 will be negative and statistically significant. Moreover, since prior to the reform average $\Delta PrimaryEarnings \approx$ €0 , if all individuals obtain secondary jobs with the purpose of reducing primary earnings, $\beta_3 \approx -400$. For the identification approach to be valid, earnings changes should follow a similar trend for individuals with low-paying new secondary jobs and individuals with high-paying secondary jobs. This parallel trend assumption appears to be satisfied in Figure 10.

Specification (9) will pick up earnings shifting if the majority of new secondary job-holders decide to optimize by decreasing their primary earnings. This is not likely to be the case. Therefore, in addition to estimating changes in levels of earnings, I estimate a linear probability model to investigate whether the likelihood of primary earnings decreases of approximately €400 became more prevalent among new secondary mini-job holders after the reform. To do so, I

estimate the following equation:

$$P(\Delta Primary\_Earnings_{it} \in [-350, -450]) \\ = \gamma_0 + \gamma_1 Treat_{it} + \gamma_2 After_{it} + \gamma_3 (Treat_{it} \times After_{it}) + \delta X_{it} + \varepsilon_{it}. \quad (10)$$

A positive and statistically significant coefficient γ_3 would imply that an increased number of individuals experience primary earnings decreases when starting a new secondary mini-job, which suggests income shifting. Standard errors are clustered by individual.

The results of estimating (9) – (10) are presented in Tables 6 and 7. While the results are noisy, they strongly suggest that individuals chose not to reduce primary earnings when they obtained new secondary jobs. Table 6 shows no discernible decrease in primary earnings, nor any increased likelihood of having an approximately €400 decrease in primary earnings.

5 Interpreting the Results: Determinants of Moonlighting

The findings of this paper allow us to learn more about individuals' motivations to moonlight. First, the results provide strong evidence that moonlighting decisions are primarily driven by hour constraints. As Figure 1 shows, most secondary jobs consist of low-skilled service jobs that are unlikely to be appealing to workers wishing to expand their skill sets (Panos et al. (2014); Lundborg (1995); Renna and Oaxaca (2006)). Moreover, if job complementarities were a common reason for multiple job holding, we would see relatively similar shares of matching occupations across income groups. This is not what is observed in Figure 2. Instead, results of Section 4 provide key evidence that individuals experience hour constraints at their primary employment and are unable or unwilling to change their working hours. A relatively large share of below-the-threshold secondary jobs further suggests that hour constraints are not limited to primary employment, but also apply to secondary jobs.

Second, Figures 8 (e) and (f) suggest that having easy access to secondary jobs has a strong effect on moonlighting decisions. Individuals whose primary

occupation matches one of the common secondary occupations are much more likely to moonlight, controlling for primary earnings level. Thus, the fixed costs of finding an appropriate secondary job appear to be very high.

Third, Figure 10 documents that most individuals' earnings increase on the take-up of a secondary employment. Thus, while some individuals may obtain a secondary job to counteract a drop in primary hours, most individuals moonlight in order to increase their earnings from the status quo.

Finally, the results suggest that high-skill jobs are generally not available in the form of the low-hour employment suitable for secondary jobs. The arbitrage opportunity created by the reform should have led individuals to seek out secondary employment with comparable wages. Given the combined marginal income tax rates and social security taxes of 19.5-66%, these individuals could save between €84 to €264 per month in taxes by splitting their primary job into two. While many workers are likely to have high fixed costs for moonlighting, which would explain the overall low take-up of secondary jobs, the low probabilities of occupation matches, together with the high prevalence of low-skilled secondary occupations, suggest that lack of suitable jobs is another key reason for low moonlighting rates. Thus, if digital platforms such as TaskRabbit expand access to high-paying secondary jobs, we might observe an increase in the take-up of secondary employment. Importantly, the response is likely to be even larger if these jobs can "avoid" income and payroll taxation.

6 Conclusion

Leveraging a unique reform in Germany that eliminated social security and income taxes on low-paying secondary jobs, this paper estimates the effect of taxes on multiple job holding. The results show that moonlighting is highly responsive to taxes, with short-term participation elasticities of 0.26 to 1.15 and long-term participation elasticities of 0.63 to 2.69, which are several times larger than participation elasticities for primary employment. Importantly, the increased moonlighting rates were not offset by reductions in primary earnings, resulting in a net increase in working hours. Moreover, despite the regressive nature of the reform – tax incentives increased with one's income – low income individuals responded

most strongly, and thus accounted for the large share of the tax break.

While the moonlighting responses were strong, the overall change in working hours and implied total earnings elasticities are very small – well below 0.05. For example, for individuals with earnings of €400 to €1000, average total earnings increased by only 2%. Nonetheless, achieving this rate of earnings increase using the traditional approach of cutting marginal tax rates would be very costly, as such reforms would necessarily apply to individuals' total earnings rather than marginal earnings. Instead, the 2003 tax reform resulted in only a small tax revenue loss because of the positive fiscal externalities – a decrease in individual tax revenue collected was offset by substantially increased employer payroll tax revenue.

The above discussion, however, relies on a crucial assumption – that the rapid increase in the number of secondary job holders did not result in a reduction of labor force participation of individuals, for whom small under-€400 jobs are the main source of income, or from splitting of high-income jobs into smaller secondary jobs. While I provide some evidence against substitution between primary low-income workers and secondary workers, it remains a possibility that the increase in secondary jobs came as a result of the splitting of larger full-time jobs into multiple mini-jobs. I defer this analysis to future research.

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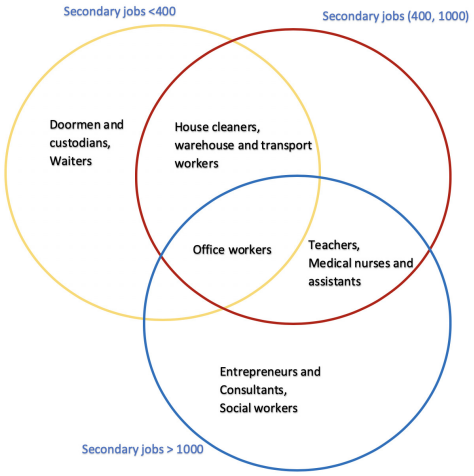
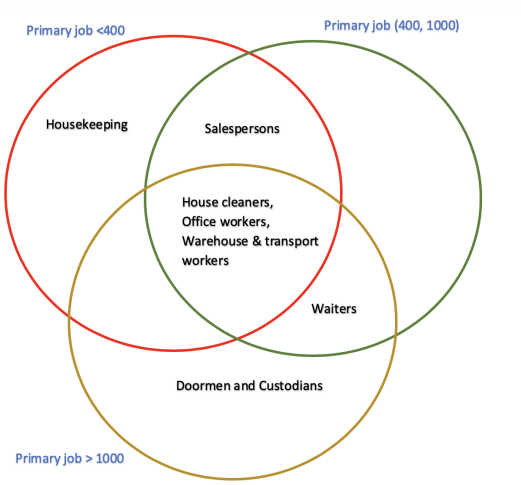
Figure 1: Top 5 Most Common Secondary Job Occupations

(a) by secondary earnings



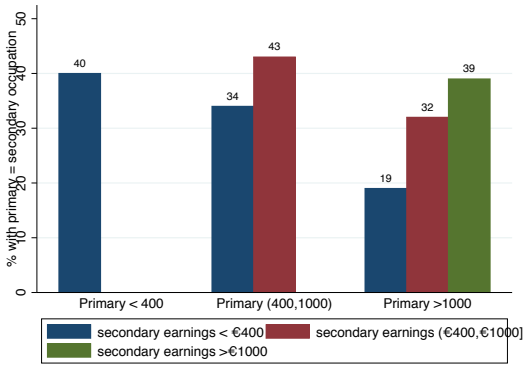
(b) ≤€400, by primary earnings



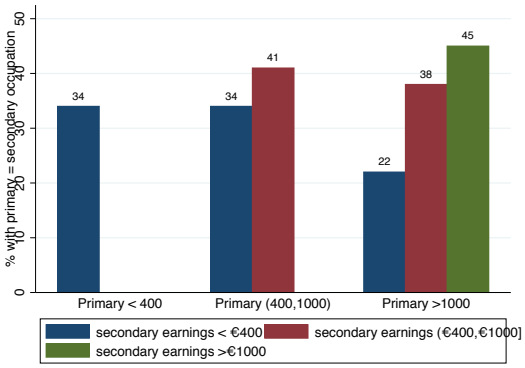
Notes: Figure (a) shows Venn diagrams of the five most common occupations in secondary job by level of secondary job earnings. Figure (b) shows Venn diagrams of the five most common occupations in secondary jobs that earn ≤€400/month by levels of primary earnings: below €400, €400-€1000, and above €1000. *Source*: Sample of Integrated Labour Market Biographies (SIAB) 1975 - 2010, Nuremberg 2013.

Figure 2: Occupations Matches in Primary and Secondary Employments

(a) 2000



(b) 2010

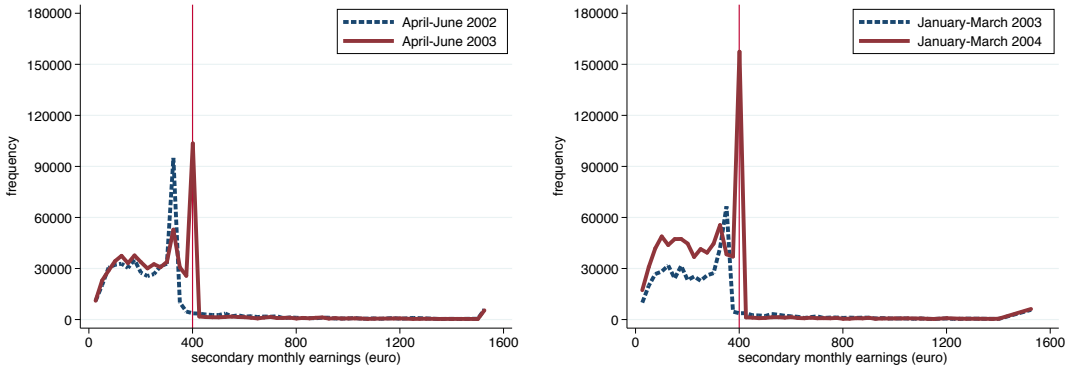


Notes: This figure shows the percent of individuals whose occupation in the primary job matches the occupation in the secondary job, in 2000 and 2010. The matches are broken down by earnings in the primary and secondary jobs respectively. Note that, by construction, earnings in the secondary job are always lower than earnings in the primary job. *Source*: Sample of Integrated Labour Market Biographies (SIAB) 1975 - 2010, Nuremberg 2013.

Figure 3: Distributions of Secondary Earnings Before and After the Reform

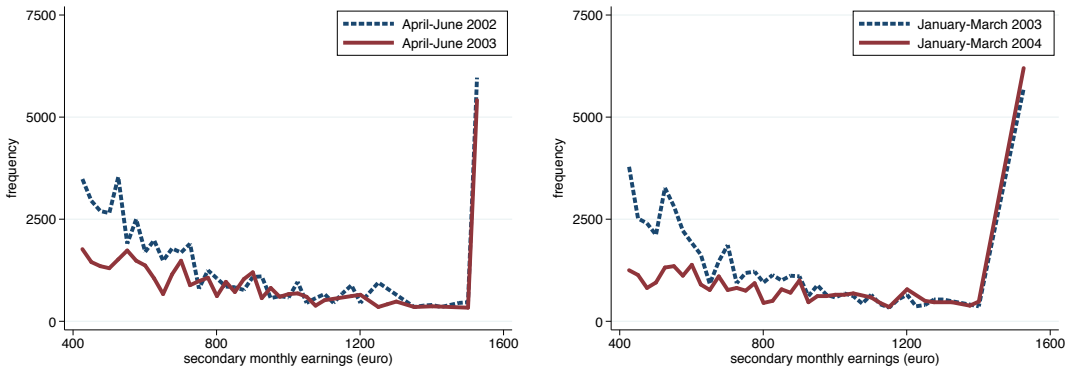
(a) April - June: 2002 and 2003

(b) January - March: 2003 and 2004



(c) April - June: 2002 and 2003

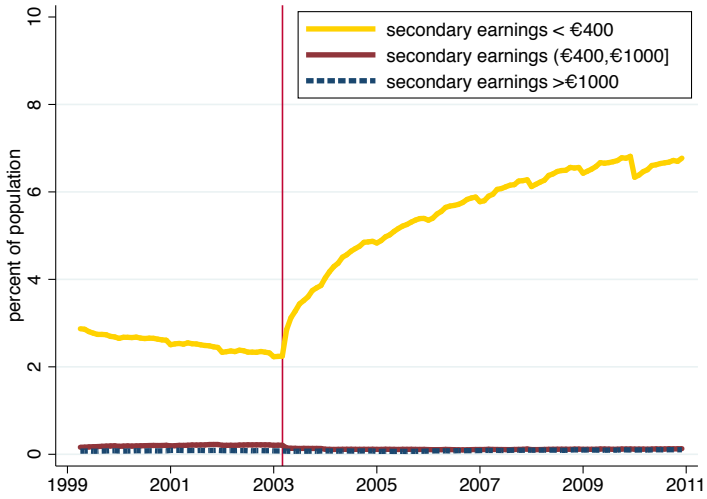
(d) January - March: 2003 and 2004



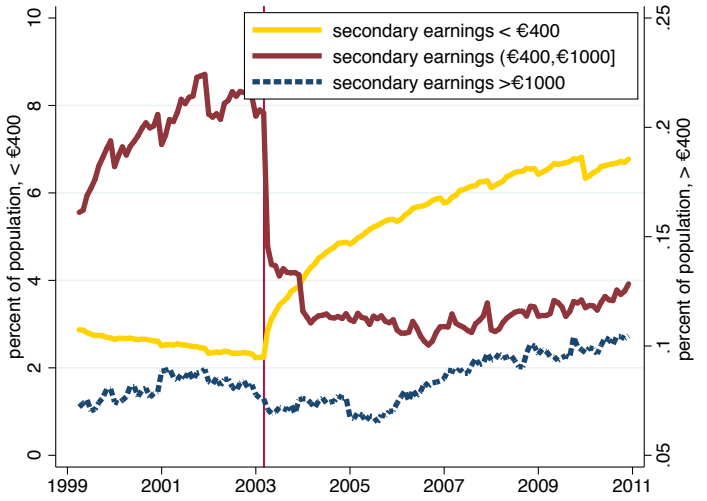
Notes: This figure shows the distributions of (positive) secondary monthly earnings. Each point shows the number of individuals in an €25 bin, scaled to represent the German population in that year from a 2% random sample. The vertical red line identifies the mini-job threshold. Pre-reform distributions are shown as dashed lines. Figures (c) and (d) zoom in on the portion of the distribution with secondary earnings of €425 or more. The last bin shows the number of individuals with secondary earnings of €1500 or more. *Source*: Sample of Integrated Labour Market Biographies (SIAB) 1975 - 2010, Nuremberg 2013.

Figure 4: Secondary Job Holding Rates by Secondary Earnings Level

(a) same axis

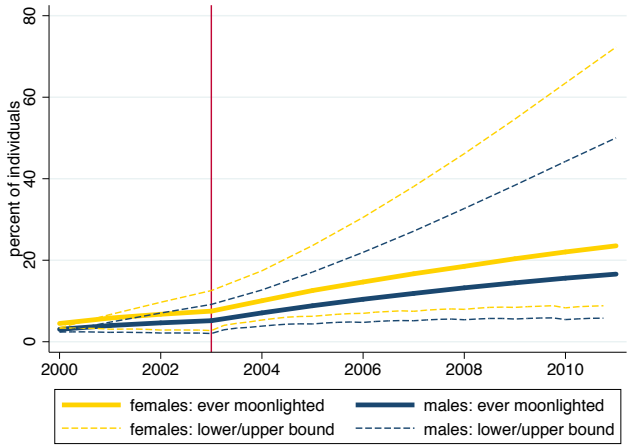


(b) different axis



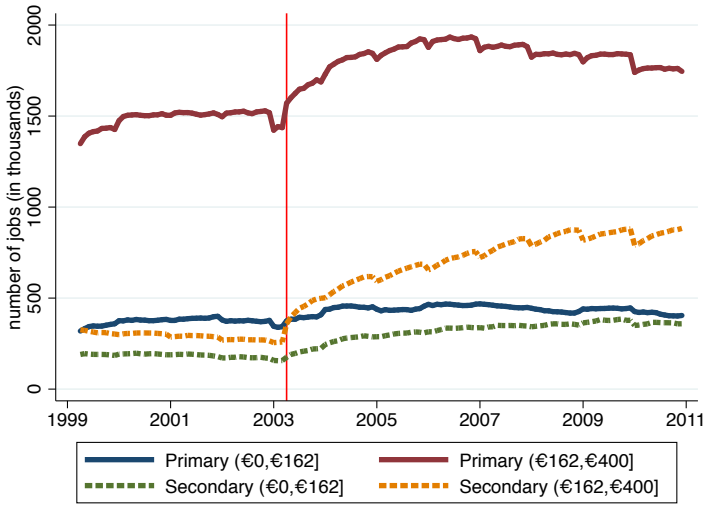
Notes: This figure shows the share of individuals with secondary jobs paying less than €400 per month, paying between €400 and €1000, or more than €1000 per month. The vertical red line identifies the 2003 tax reform. *Source*: Sample of Integrated Labour Market Biographies (SIAB) 1975 - 2010, Nuremberg 2013.

Figure 5: Persistence



Notes: This figure shows the percent of individuals in a given year who have moonlighted at least once since January 1999. The lower bound is calculated assuming every person who ever moonlights continues moonlighting for each year thereafter. The upper bound assumes that each individual moonlights in at most one year between 1999 and 2010. *Source*: Sample of Integrated Labour Market Biographies (SIAB) 1975 - 2010, Nuremberg 2013.

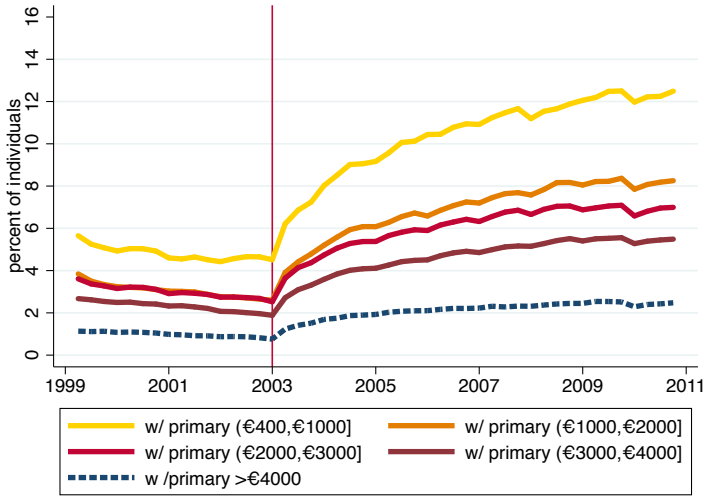
Figure 6: Availability of Jobs Over Time



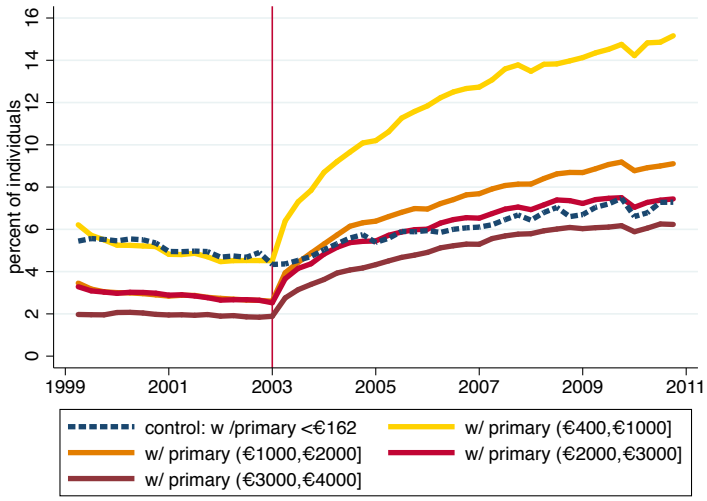
Notes: This Figure shows the number of jobs taken as primary or secondary jobs by monthly earnings level: under €162, between €162 and €400. The vertical red line identifies the tax reform. *Source*: Sample of Integrated Labour Market Biographies (SIAB) 1975 - 2010, Nuremberg 2013.

Figure 7: Secondary Job Holding Rates by Primary Earnings

(a) By Pre-Reform Earnings



(b) By Current Earnings

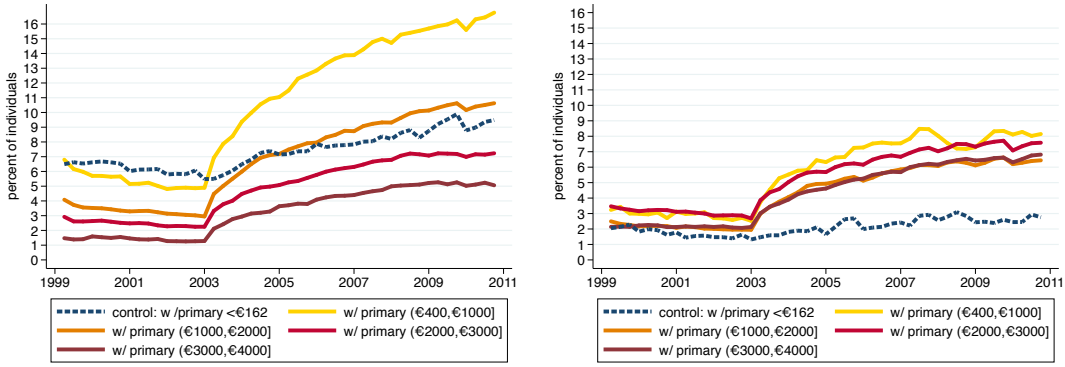


Notes: This figure plots the share of individuals who hold secondary jobs earning €400 or less by levels of primary earnings in (a) January-March 2003 or (b) in current quarter. The vertical red line identifies the tax reform. *Source*: Sample of Integrated Labour Market Biographies (SIAB) 1975 - 2010, Nuremberg 2013.

Figure 8: Heterogeneity: Secondary Job Holding Rates by Demographics

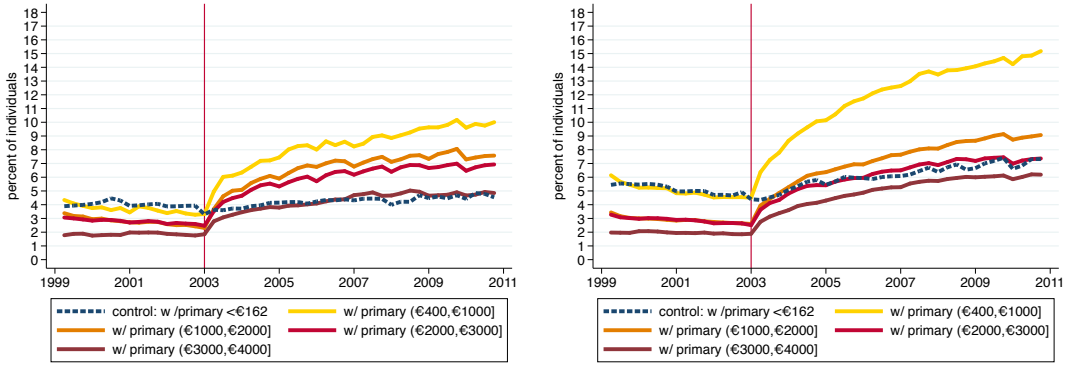
(a) Females

(b) Males



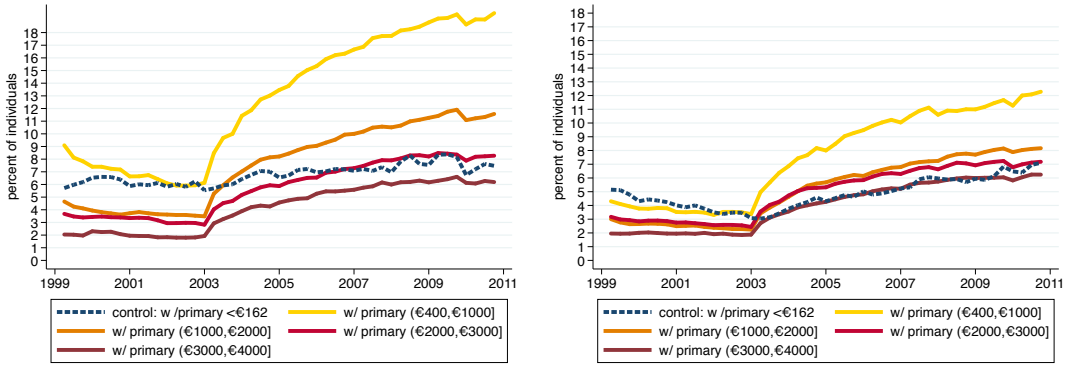
(c) Age $\leq$ 30 or $>$ 55

(d) 30 $<$ Age $\leq$ 55



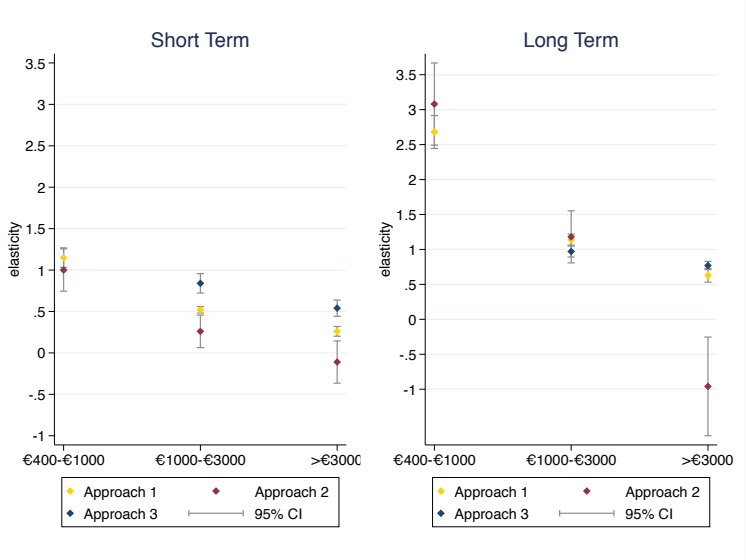
(e) Common Occupations

(f) Uncommon Occupations



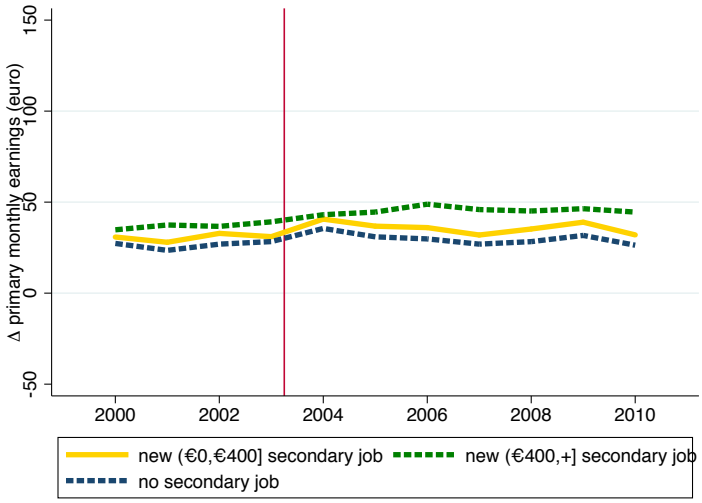
Notes: This figure plots the share of individuals who hold secondary jobs earning up to €400 by levels of primary earnings in current period. Individuals whose primary occupation is also a common secondary occupation (doorman, custodian, waiter, house cleaner, warehouse or transport worker, or office worker) are shown in figure (e), all other individuals in figure (f). The vertical red line identifies the tax reform. *Source*: Sample of Integrated Labour Market Biographies (SIAB) 1975 - 2010, Nuremberg 2013.

Figure 9: Participation Elasticities



Notes: This figure shows elasticity estimates based on columns (3) and (6) of Tables 3 and 4, as well as columns (1) and (3) of Table 5. *Source*: Sample of Integrated Labour Market Biographies (SIAB) 1975 - 2010, Nuremberg 2013.

Figure 10: Change in Primary Earnings from Previous Year



Notes: This figure shows mean changes in primary monthly earnings from a year ago in € for: (i) individuals with new €0-€400 secondary jobs (solid yellow), (ii) new €400+ secondary jobs (dashed green), and (iii) no new secondary jobs (dashed blue). The vertical red line identifies the tax reform. *Source*: Sample of Integrated Labour Market Biographies (SIAB) 1975 - 2010, Nuremberg 2013.

Table 2: Summary Statistics

		Men				Women			
		1999	2002	2004	2010	1999	2002	2004	2010
All Individuals	Number of Observations	593,225	810,300	796,732	767,477	525,389	741,736	733,772	729,482
	Number Individuals	205,846	214,761	211,315	202,519	185,293	199,140	196,772	194,969
	Average Age	41	42	42	43	42	42	43	44
	Percent East Germany	18	17	17	16	19	18	18	16
	Average Monthly Pay (1st job)	2,655	2,801	2,892	3,089	1,582	1,675	1,689	1,838
	Median Monthly Pay (1st job)	2,557	2,713	2,756	2,950	1,454	1,535	1,515	1,609
With $\geq$2 jobs	Percent with Secondary Jobs	2.68	2.32	4.18	5.65	3.79	3.10	5.79	8.46
	Number of Observations with Secondary Jobs	16,291	19,523	34,569	45,002	20,500	24,193	44,477	64,952
	Number of 2nd Jobs Individuals	5,508	4,983	8,834	11,442	7,020	6,175	11,387	16,488
	Average Monthly Pay (1st job)	2,459	2,592	2,621	2,776	1,332	1,377	1,431	1,501
	Median Monthly Pay (1st job)	2,436	2,578	2,582	2,712	1,207	1,250	1,260	1,297
	Average Monthly Pay (2nd job)	291	309	293	303	249	269	260	271

Notes: This table shows summary statistics for the data sample described in Section 1.2. Monthly pay in euro per month.
Source: Sample of Integrated Labour Market Biographies (SIAB) 1975 - 2010, Nuremberg 2013.

Table 3: Take Up of Secondary Jobs (Approach 1)

Outcome:	Short Term			Long Term		
100 if holds secondary job (€0,€400]	(1)	(2)	(3)	(4)	(5)	(6)
Treatment Group: Individuals with Primary Earnings of (€400,€1000] in Jan-Mar 2003						
Treat × After	2.60***	2.59***	2.59***	6.12***	6.05***	6.04***
	(0.14)	(0.14)	(0.14)	(0.26)	(0.26)	(0.26)
Pre-reform Mean Outcome	4.58	4.58	4.58	4.58	4.58	4.58
N of Observations	1,074,375	1,069,300	1,069,300	915,671	911,525	911,525
Treatment Group: Individuals with Primary Earnings of (€1000,€3000) in Jan-Mar 2003						
Treat × After	1.38***	1.31***	1.30***	3.09***	2.88***	2.86***
	(0.06)	(0.06)	(0.06)	(0.10)	(0.10)	(0.10)
Pre-reform Mean Outcome	2.72	2.72	2.72	2.72	2.72	2.72
N of Observations	3,779,734	3,761,823	3,761,823	3,250,419	3,235,804	3,235,804
Treatment Group: Individuals with Primary Earnings of (€3000,€4000) in Jan-Mar 2003						
Treat × After	0.70***	0.67***	0.67***	1.77***	1.64***	1.62***
	(0.07)	(0.07)	(0.07)	(0.13)	(0.13)	(0.13)
Pre-reform Mean Outcome	2.03	2.03	2.03	2.03	2.03	2.03
N of Observations	1,627,796	1,619,327	1,619,327	1,402,467	1,395,430	1,395,430
Demographic Controls	no	yes	yes	no	yes	yes
Year, Quarter FE	no	yes	yes	no	yes	yes
Individual FE	no	no	yes	no	no	yes

Notes: Control group: individuals with primary monthly earnings of more than €4000 in January-March 2003. Demographic controls: gender, age, state, and occupation. Short term: April 2001 through March 2005, inclusive. Long term: April 2001 through March 2003 and January 2009 through December 2010, inclusive. Standard errors clustered by individual. For more details see Section 3.2.

Table 4: Take Up of Secondary Jobs (Approach 2)

Outcome:	Short Term				Long Term	
100 if holds secondary job (€0,€400]	(1)	(2)	(3)	(4)	(5)	(6)
Treatment Group: Individuals with Primary Earnings of (€400,€1000]						
Treat × After	3.70***	2.59***	2.22***	7.74***	7.24***	6.84***
	(0.23)	(0.24)	(0.28)	(0.33)	(0.44)	(0.67)
Pre-reform Mean Outcome	4.51	4.51	4.51	4.51	4.51	4.51
N of Observations	546,030	544,016	544,016	545,939	544,055	544,055
Treatment Group: Individuals with Primary Earnings of (€1000,€3000)						
Treat × After	1.99***	1.08***	0.64***	3.15***	3.08***	2.94***
	(0.19)	(0.21)	(0.24)	(0.27)	(0.34)	(0.46)
Pre-reform Mean Outcome	2.67	2.67	2.67	2.67	2.67	2.67
N of Observations	3,513,863	3,497,072	3,497,072	3,322,229	3,307,451	3,307,451
Treatment Group: Individuals with Primary Earnings of (€3000,€∞)						
Treat × After	0.95***	0.13	-0.22	0.79***	-0.25	-1.9
	(0.19)	(0.22)	(0.256)	(0.27)	(0.41)	(0.71)
Pre-reform Mean Outcome	1.44	1.44	1.44	1.44	1.44	1.44
N of Observations	1,838,904	1,829,444	1,829,444	1,974,069	1,963,652	1,963,652
Demographic Controls	no	yes	yes	no	yes	yes
Year, Quarter FE	no	yes	yes	no	yes	yes
Individual FE	no	no	yes	no	no	yes

Notes: Control group: individuals with primary monthly earnings of less than €162 in the current year. Demographic controls: gender, age, state, and occupation. Short term: April 2001 through March 2005, inclusive. Long term: April 2001 through March 2003 and January 2009 through December 2010, inclusive. Standard errors clustered by individual. For more details see Section 3.2.

Table 5: Take Up of Secondary Jobs (Approach 3)

Outcome:	Short Term		Long Term	
log(N of individuals with Secondary Job)	(1)	(2)	(4)	(5)
Treatment Group: Individuals with Primary Earnings of (€1000,€3000)				
Treat × After	0.79***	0.53***	0.91***	1.02***
	(0.06)	(0.07)	(0.04)	(0.14)
Treat × After × t		0.22***		-0.04
		(0.05)		(0.04)
Treat × t		0.02		0.09
		(0.04)		(0.04)
Implied effect in pp	2.11		2.43	
	(0.16)		(0.11)	
Mean Outcome Treatment Group 2002	2.67	2.67	2.67	2.67
N of Observations	36	36	34	34
Treatment Group: Individuals with Primary Earnings of (€3000,€∞)				
Treat × After	0.75***	0.49***	0.99***	1.71***
	(0.07)	(0.10)	(0.04)	(0.13)
Treat × After × t		0.22***		-0.13***
		(0.07)		(0.04)
Treat × t		0.02		0.02
		(0.05)		(0.04)
Implied effect in pp	1.08		1.43	
	(0.1)		(0.06)	
Mean Outcome Treatment Group 2002	1.44	1.44	1.44	1.44
N of Observations	36	36	34	34

Notes: Short term: January 2001 through June 2005, inclusive. Long term: January 2001 through March 2003 and January 2009 through December 2010, inclusive. Control group: number of secondary jobs with monthly earnings of more than €1000. For more details see Section 3.1.

Table 6: Changes in Primary Earnings

	Short Term			Long Term		
	(1)	(2)	(3)	(4)	(5)	(6)
Outcome: change in primary earnings in € from previous year						
Treat × After	-32.41	-22.39	25.10	-24.44	-29.38	-138.6**
	(25.63)	(24.69)	(27.66)	(35.13)	(37.20)	(70.00)
Mean Outcome Treatment Group 2002	30.29	30.29	30.29	30.29	30.29	30.29
Outcome: 100 if primary earnings decreased by €300-€450						
Treat × After	1.15	1.24	1.23	0.27	0.30	-0.28
	(0.94)	(0.94)	(1.6)	(0.95)	(0.97)	(2.72)
Mean Outcome Treatment Group 2002	3.36	3.36	3.36	3.36	3.36	3.36
N of Observations	61,499	61,363	61,363	50,914	50,841	50,841
Demographic Controls	no	yes	yes	no	yes	yes
Year, Quarter FE	no	yes	yes	no	yes	yes
Individual FE	no	no	yes	no	no	yes

Notes: Treatment group – individuals with new secondary jobs paying less than €400 per month. Control group – individuals with new secondary jobs paying more than €400 per month. Sample selection – individuals with new secondary jobs and primary earnings of at least €600 in the target quarter and over €1000 a year ago. Short term: April 2001 through March 2005. Long term: April 2001 through March 2003 and January 2009 through December 2010, inclusive. Standard errors clustered by individual. For more details see Section 4.2

Table 7: Changes in Primary Earnings

	Short Term			Long Term		
	(1)	(2)	(3)	(4)	(5)	(6)
Outcome: change in primary earnings in € from previous year						
Treat × After	1.64	-0.05	-1.59	1.55	2.24	3.69
	(6.57)	(4.64)	(5.04)	(7.09)	(5.28)	(5.99)
Mean Outcome Treatment Group 2002	-60.30	-60.30	-60.30	-60.30	-60.30	-60.30
Outcome: 100 if primary earnings decreased by €300-€450						
Treat × After	-1.17	-1.10	-1.28	-1.32	-1.41	-1.66*
	(0.83)	(0.79)	(0.84)	(0.96)	(0.91)	(1.00)
Mean Outcome Treatment Group 2002	6.84	6.84	6.84	6.84	6.84	6.84
N of Observations	305,473	304,274	304,274	276,316	275,281	275,281
Demographic Controls	no	yes	yes	no	yes	yes
Year, Quarter FE	no	yes	yes	no	yes	yes
Individual FE	no	no	yes	no	no	yes

Notes: Treatment group – individuals with new secondary jobs paying less than €400 per month. Control group – individuals with no secondary jobs. Sample selection – individuals with new secondary jobs and primary earnings of at least €400 and not more than €1000 in the target quarter and more than €400 a year ago. Short term: April 2001 through March 2005. Long term: April 2001 through March 2003 and January 2009 through December 2010. Standard errors clustered by individual. For more details see Section 4.2

APPENDIX

A Theoretical Framework

Consider an individual maximizing utility function

$$U = c - \frac{1}{1+1/\varepsilon}\left(h_1 + h_2\right)^{1+1/\varepsilon} \tag{11}$$

subject to a budget constraint

$$c = (1-\tau_1)w_1h_1 + (1-\tau_2)w_2h_2. \tag{12}$$

Solving for optimal working hours under various assumptions generates the following results.

Result 1. *If* $(1-\tau_1)w_1 \geq (1-\tau_2)w_2$ *and working hours are unconstrained, optimal working hours are* $(h_1^*, h_2^*) = (w_1^{\varepsilon}(1-\tau_1)^{\varepsilon}, 0)$.

Result 2. *If* $(1-\tau_1)w_1 \geq (1-\tau_2)w_2$ *and main-job hours are constrained with* $h_1 \leq \bar{h}_1 < w_1^{\varepsilon}(1-\tau_1)^{\varepsilon}$ *or* $h_1 = \bar{h}_1 < w_1^{\varepsilon}(1-\tau_1)^{\varepsilon}$*, then optimal working hours are* $(h_1^*, h_2^*) = \left(\bar{h}_1, \max\{0, w_2^{\varepsilon}(1-\tau_2)^{\varepsilon} - \bar{h}_1\}\right)$.

Now suppose instead of (12) individuals face the following budget constraint:

$$c = (1-\tau_1)w_1h_1 + w_2h_2 - T(h_2), \text{ with } T(h_2) = \begin{cases} 0 & \text{if } w_2h_2 \leq K \text{ and } w_1h_1 \geq M \\ \tau_2 w_2 h_2 & \text{if } w_2h_2 > K. \end{cases} \tag{13}$$

Result 3. *If main-job hours are unconstrained and* $(1-\tau_1)w_1 \geq w_2$ *then optimal working hours are* $(h_1^*, h_2^*) = (w_1^{\varepsilon}(1-\tau_1)^{\varepsilon}, 0)$.

Result 4. *If main-job hours are unconstrained and* $(1-\tau_2)w_2 < (1-\tau_1)w_1 < w_2$

then optimal working hours are

$$(h_1^*, h_2^*) = \begin{cases} \left(w_1^{\varepsilon}(1-\tau_1)^{\varepsilon} - \frac{K}{w_2}, \frac{K}{w_2}\right) & \text{if } w_1^{\varepsilon+1}(1-\tau_1)^{\varepsilon} \geq M + K \\ \left(\frac{M}{w_1}, \max\{w_2^{\varepsilon} - \frac{M}{w_1}, K\}\right) & \text{if } M < w_1^{\varepsilon+1}(1-\tau_1)^{\varepsilon} < M + K \\ (w_1^{\varepsilon}(1-\tau_1)^{\varepsilon}, 0) & \text{if } w_1^{\varepsilon+1}(1-\tau_1)^{\varepsilon} \leq M. \end{cases}$$

Result 5. *If main-job hours are constrained with* $h_1 \leq \bar{h}_1$ *and* $(1-\tau_2)w_2 < (1-\tau_1)w_1 < w_2$*, then optimal working hours are*

$$(h_1^*, h_2^*) = \begin{cases} \left(w_1^{\varepsilon}(1-\tau_1)^{\varepsilon} - \frac{K}{w_2}, \frac{K}{w_2}\right) & \text{if } w_1^{\varepsilon+1}(1-\tau_1)^{\varepsilon} \geq M + K \text{ and } w_1^{\varepsilon}(1-\tau_1)^{\varepsilon} - \frac{K}{w_2} \leq \bar{h}_1 \\ \left(\frac{M}{w_1}, \max\{w_2^{\varepsilon} - \frac{M}{w_1}, K\}\right) & \text{if } M < w_1^{\varepsilon+1}(1-\tau_1)^{\varepsilon} < M + K \text{ and } \frac{M}{w_1} \leq \bar{h}_1 \\ (w_1^{\varepsilon}(1-\tau_1)^{\varepsilon}, 0) & \text{if } w_1^{\varepsilon+1}(1-\tau_1)^{\varepsilon} \leq M \text{ and } w_1^{\varepsilon}(1-\tau_1)^{\varepsilon} \leq \bar{h}_1. \end{cases}$$

Otherwise,

$$(h_1^*, h_2^*) = \begin{cases} \left(\bar{h}_1, \frac{K}{w_2}\right) & \text{if } \bar{h}_1 \geq \frac{M}{w_1}, \quad w_1^{\varepsilon+1}(1-\tau_1)^{\varepsilon} \geq M+K \\ & \quad \text{and } w_2[w_2^{\varepsilon}(1-\tau_2)^{\varepsilon} - \bar{h}_1] < K < w_2(w_2^{\varepsilon} - \bar{h}_1) \\ \left(\bar{h}_1, (1-\tau_2)^{\varepsilon} w_2^{\varepsilon} - \bar{h}_1\right) & \text{if } w_2[w_2^{\varepsilon} - \bar{h}_1] \geq K \text{ and } \bar{h}_1 \geq \frac{M}{w_1} \\ \left(\bar{h}_1, \max\{0, w_2^{\varepsilon}(1-\tau_2)^{\varepsilon} - \bar{h}_1\}\right) & \text{if } \bar{h}_1 < \frac{M}{w_1} \end{cases}$$

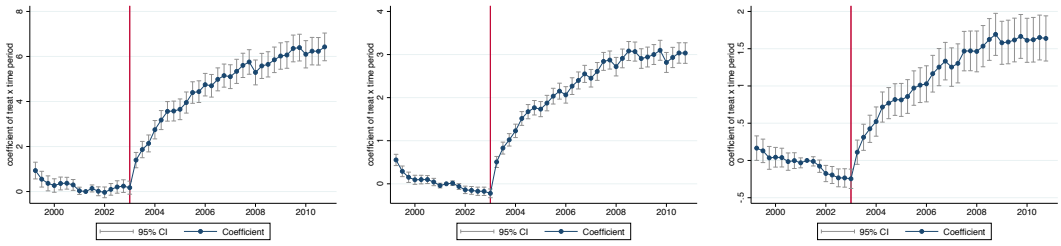
Result 6. *If main-job hours are constrained with* $h_1 = \bar{h}_1$ *and* $(1-\tau_2)w_2 < (1-\tau_1)w_1 < w_2$*, then optimal working hours are*

$$(h_1^*, h_2^*) = \begin{cases} \left(\bar{h}_1, \min\left\{w_2^{\varepsilon} - \bar{h}_1, \frac{K}{w_2}\right\}\right) & \text{if } K > w_2[w_2^{\varepsilon}(1-\tau_2)^{\varepsilon} - \bar{h}_1] \text{ and } \bar{h}_1 \geq \frac{M}{w_1} \\ \left(\bar{h}_1, w_2^{\varepsilon}(1-t_2)^{\varepsilon} - \bar{h}_1\right) & \text{if } K \leq w_2[w_2^{\varepsilon}(1-\tau_2)^{\varepsilon} - \bar{h}_1] \text{ and } \bar{h}_1 \geq \frac{M}{w_1} \\ \left(\bar{h}_1, \max\{0, w_2^{\varepsilon}(1-t_2)^{\varepsilon} - \bar{h}_1\}\right) & \text{if } \bar{h}_1 < \frac{M}{w_1} \end{cases}$$

B Appendix Tables and Figures

Figure B.1: Parallel Trends Test (Approach 1)

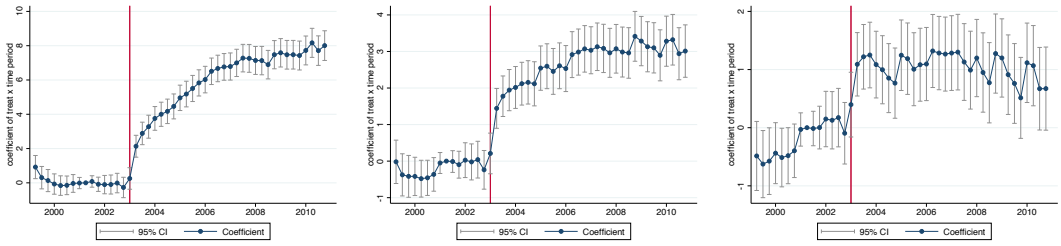
(a) €400-€1000 (b) €1000-€3000 (c) €3000-€4000



Notes: This figure shows the coefficient and 95% confidence interval for the time period indicators interacted with treatment variable. First quarter of 2001 is omitted. The vertical red line identifies the tax reform. *Source*: Sample of Integrated Labour Market Biographies (SIAB) 1975 - 2010, Nuremberg 2013.

Figure B.2: Parallel Trends Test (Approach 2)

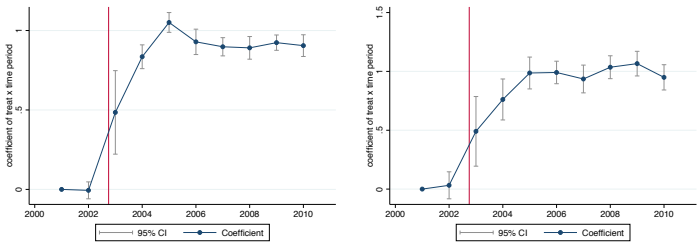
(a) €400-€1000 (b) €1000-€3000 (c) €3000+



Notes: This figure shows the coefficient and 95% confidence interval for the time period indicators interacted with treatment variable. First quarter of 2001 is omitted. The vertical red line identifies the tax reform. *Source*: Sample of Integrated Labour Market Biographies (SIAB) 1975 - 2010, Nuremberg 2013.

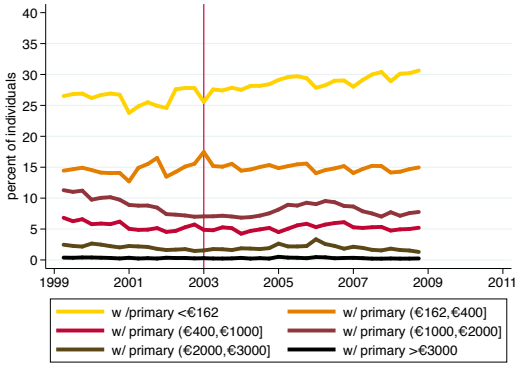
Figure B.3: Parallel Trends Test (Approach 3)

(a) €1000-€3000 (b) €3000+



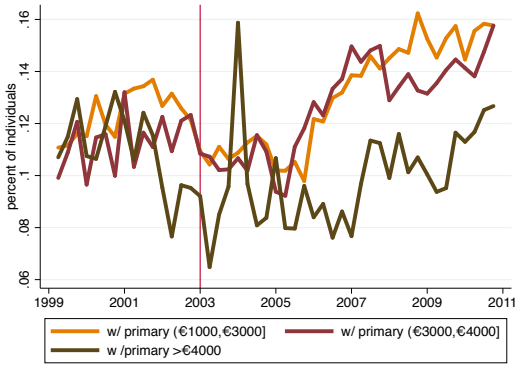
Notes: This figure shows the coefficient and 95% confidence interval for the time period indicators interacted with treatment variable. First quarter of 2001 is omitted. The vertical red line identifies the tax reform. *Source*: Sample of Integrated Labour Market Biographies (SIAB) 1975 - 2010, Nuremberg 2013.

Figure B.4: Income Group Switches



Notes: This figure plots the share of individuals who hold primary employment with earnings of less than €162, between €162 and €400, etc, 2 years after earning €162 or less. The vertical red line identifies the tax reform. *Source*: Sample of Integrated Labour Market Biographies (SIAB) 1975 - 2010, Nuremberg 2013.

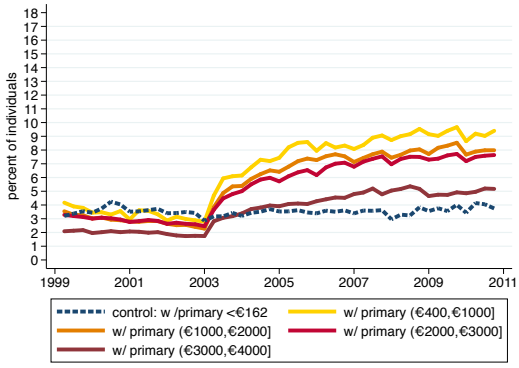
Figure B.5: €1000+ Secondary Job Holding Rates by Primary Earnings



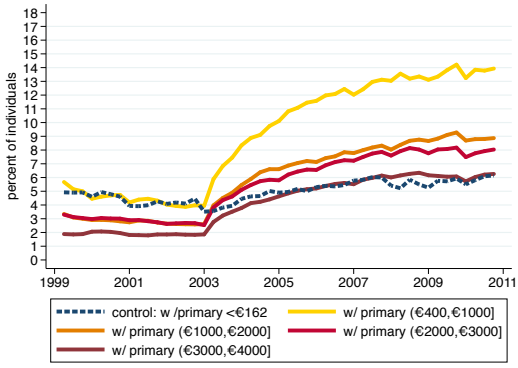
Notes: This figure plots the share of individuals who hold secondary jobs with earnings of more than €1000, in percent. *Source*: Sample of Integrated Labour Market Biographies (SIAB) 1975 - 2010, Nuremberg 2013.

Figure B.6: Heterogeneity: Age

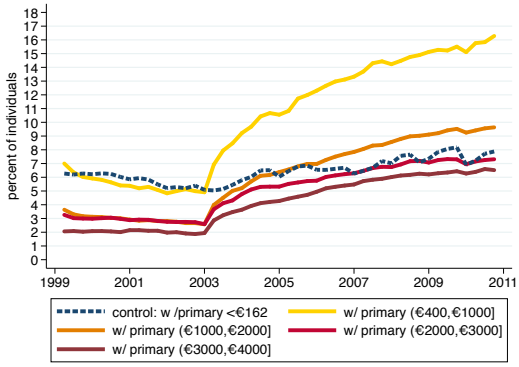
(a) Age $\leq$ 30



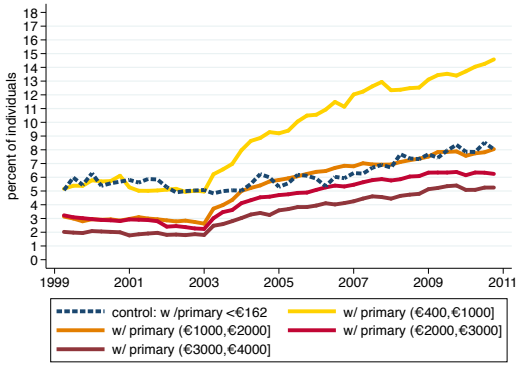
(b) 30 $<$ Age $\leq$ 40



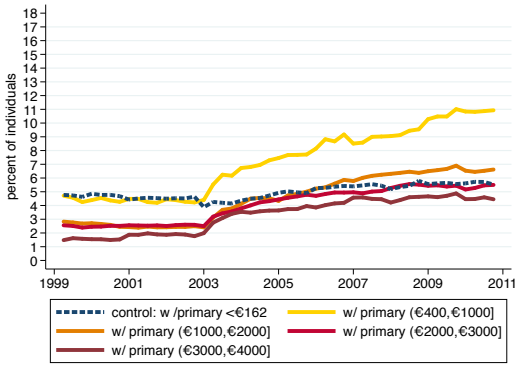
(c) 40 $<$ Age $\leq$ 50



(d) 50 $<$ Age $\leq$ 55



(e) Age $>$ 55



Notes: This figure plots the share of individuals who hold secondary jobs earning up to €400 by levels of primary earnings. The vertical red line identifies the tax reform. *Source*: Sample of Integrated Labour Market Biographies (SIAB) 1975 - 2010, Nuremberg 2013.

Table B.1: Mini-job, Social Security and Personal Income Tax Rates

	Mini-job Taxes		Regular SS Taxes		Income Tax Rates						
Year	Employee	Employer	Employee	Employer	Tax-free	First Linear Progressive Zone		Second Linear Progressive Zone		Higher Income Zone	
	Tax	Tax	Tax	Tax	Allowance	income bracket	MTR	income bracket	MTR	income bracket	MTR
1999	0	22	21	21	6,681	6,682 to 8,724	23.9 to 26.7	8,725 to 33,932	26.7 to 36.69	33,933 to 61,376	36.69 to 53[a]
2000	0	22	21	21	6,902	6,903 to 8,945	22.9 to 25	8,946 to 58,643	25 to 51	from 58,644	51
2001	0	22	21	21	7,206	7,207 to 9,249	19.9 to 23	9,250 to 54,998	23 to 48.5	from 54,999	48.5
2002	0	22	21	21	7,235	7,236 to 9,251	19.9 to 23	9,252 to 55,007	23 to 48.5	from 55,008	48.5
2003	0	25	21	21	7,235	7,236 to 9,251	19.9 to 23	9,252 to 55,007	23 to 48.5	from 55,008	48.5
2004	0	25	21	21	7,664	7,665 to 12,739	16 to 24.05	12,740 to 52,151	24.05 to 45	from 52,152	45
2005	0	25	21	21	7,664	7,665 to 12,739	15 to 23.97	12,740 to 52,151	23.97 to 42	from 52,152	42
2006	0	30	19.5	19.5	7,664	7,665 to 12,739	15 to 23.97	12,740 to 52,151	23.97 to 42	from 52,152	42
2007	0	30	19.5	19.5	7,664	7,665 to 12,739	15 to 23.97	12,740 to 52,151	23.97 to 42	from 52,152	42[b]
2008	0	30	19.5	19.5	7,664	7,665 to 12,739	15 to 23.97	12,740 to 52,151	23.97 to 42	from 52,152	42[b]
2009	0	30	19.5	19.5	7,834	7,835 to 13,139	14 to 23.97	13,140 to 52,551	23.97 to 42	from 52,552	42[b]
2010	0	30	19.5	19.5	8,004	8,005 to 13,469	14 to 23.97	13,470 to 52,881	23.97 to 42	from 52,882	42[c]

Notes: This table shows mini-job and social security taxes, income tax brackets in euros and corresponding marginal tax rates in percent for single individuals. Incomes of married individuals are added up, divided equally, and then are subjected to the same schedule. Incomes within the linear progressive zones are subject to linearly increasing marginal tax rates. [a] For incomes above €61,376 the marginal tax rate was 53%. [b] For incomes above €250,001 the marginal tax rate was 45%. [c] For incomes above €250,731 the marginal tax rate was 45%. Examples and detailed calculations of income tax are available at the Ministry of Finance website: https://www.bmf-steuerrechner.de/