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Do Only Tax Incentives Matter? Labor Supply and Demand Responses to an Unusually Large and Salient Tax Break

Alisa Tazhitdinova*

Abstract

I explore labor supply responses to an unusually large and salient notch generated by the "Mini-Job" program in Germany. Using administrative data, I document three findings. First, despite the unusually large magnitude of incentives, earnings elasticities are modest, even after accounting for frictions. Second, the observed response cannot be fully attributed to labor supply alone; rather, the observed outcomes are highly dependent on the availability of jobs and, so are strongly influenced by labor demand incentives. Third, I show that these firm incentives are likely driven by the fact that mini-job workers receive lower fringe-benefit payments.

JEL Classification: H20, H22, H24, H31, H32, J22, J23, J32, J38
Keywords: Payroll Tax, Income Tax, Earnings Elasticity, Fringe Benefits

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Large literatures in public finance and labor economics estimate elasticities of labor supply by observing individuals' responses to tax changes and other financial incentives. These studies often attribute the relatively modest elasticity estimates to frictions or lack of salience.[1] Individuals are unable and unwilling to respond because adjustments costs are large and learning about the rules is time-consuming, while incentives to change one's working hours are weak; therefore, corresponding welfare losses are small (Chetty et al. (2011); Chetty (2012)). Thus, the ideal approach would estimate the frictionless elasticity of labor supply – a structural parameter – by studying extremely large and salient tax changes that generate sufficiently strong incentives to overcome frictions.

In this paper, I estimate labor supply responses in one such setting, where information and adjustment frictions are plausibly small relative to an unusually large and salient discontinuous change in total tax liability – a notch – that is an order of magnitude larger than any incentives previously studied. This large notch is generated by the "Mini-Job" program in Germany, which affects a large number of workers: approximately 7.3 million individuals, or 18% of the German labor force, hold mini-jobs. Understanding the seeming popularity of mini-jobs is important because similar types of policies have been proposed in Spain and in the UK. It has been further argued that the flexibility of the German labor market system, particularly the existence of mini-jobs, is the reason why Germany fared better in the Great Recession than other countries (Burda and Hunt (2011)).

The mini-job program aims at increasing the labor supply of low-income individuals through means of income and social security tax breaks. Earnings below the mini-job threshold, set at €325 to €400 per month during the studied period, are exempt from income tax and the employee portion of social security taxes, while earnings above the threshold are not. Thus, in 1999, an average woman's monthly tax liability increased by €147, or 45% of her income, if her earnings exceeded the €325 threshold by one euro, while the combined social security and income tax marginal tax rates increased by 37 percentage points. These tax incentives are, by far, the largest ever studied – in comparison, the largest notch considered in Kleven and Waseem (2013) is 2.5%. The

[1] A meta analysis of reform-based studies of taxable income elasticities by Neisser (2017) reveals an average estimate of 0.4, while bunching studies summarized by Kleven (2016) find elasticities of less than 0.03.

largest kink study, Paetzold (2019), looks at a 38.33 percentage point increase in tax. Because notches affect total tax liability rather than a portion of liability above the threshold, they generate much stronger incentives than kinks. Among difference-in-differences studies, e.g., Gelber (2014) or Kleven and Schultz (2014), the largest tax changes typically happen at the top bracket, where labor responses are limited and avoidance responses prevail.

Several other features make this setting ideal for learning about labor supply responses. First, mini-job rules are salient and well known by German workers, as they are frequently discussed in the media, and are commonly advertised on job boards. Moreover, the threshold is nominally fixed, so it rarely changes. Second, because the mini-job threshold is low, it affects labor decisions of part-time workers, who are likely to be more flexible in choosing their working hours. Finally, the mini-job threshold applies to third-party reported wage earnings rather than taxable income, potentially making it better suited to estimating labor supply rather than avoidance responses. With the exception of Earned Income Tax Credit (EITC) studies, most previous quasi-experimental literature analyzes taxable income.

Using administrative data on the labor histories of a 2% sample of the German population, I find large and sharp bunching at the mini-job threshold that is persistent over time and across demographic groups and that follows the threshold precisely. To estimate the magnitude of the behavioral response, I extend the methodological approaches of Saez (2010) and Kleven and Waseem (2013) to frameworks with large discontinuous marginal and average tax rate changes. The approach accounts separately for bunching due to a kink and bunching due to a notch, thus generating an unbiased estimate of the earnings responses. Elasticity point estimates range from 0.08 to 0.18 for women and from 0.07 to 0.36 for men, depending on the year. My analysis generates four main findings.

First, while the estimated elasticities are several times larger than those previously estimated using the bunching method, they are still smaller than most estimates from the labor literature (Kleven (2016); Keane (2011)).[2] While this

[2] Labor literature employs a variety of approaches to estimate labor supply elasticities, including both reduced and structural methods. Keane (2011) determines a simple average of 0.31 across all studies examined. Similar to studies of elasticity of taxable income, these studies range in the magnitude of incentives considered: from relatively small early expansions of the

finding is consistent with previous studies, it is surprising because of the setting, that is: the notch incentives are extremely large, apply to part-time workers, and are very salient. Although some workers may not be aware of tax schedules and for this reason fail to bunch at the income tax kink points, most German workers are aware of the mini-job threshold. Nonetheless, for all demographic groups I observe many individuals in the strictly dominated region. To gauge the magnitude of frictions, I use the approaches of Kleven and Waseem (2013) and Chetty (2012) to generate bounds on the structural elasticities of labor supply. The first approach generates a lower bound on the structural elasticity by accounting for the share of individuals who report earnings in the strictly dominated region. The second approach generates an upper bound by assuming that individuals do not change their working hours unless, by doing so, they reduce their lifetime welfare by more than 1%. Both methods predict tight bounds for women: structural elasticities under Kleven and Waseem (2013) are below 0.43, and the Chetty (2012) upper bound is at most 0.33. Since the first bound is higher than the second, the results imply that individuals experience very large frictions that are greater than 1% of lifetime welfare. These findings are also consistent with a recent study by Gudgeon and Trenkle (2017), who use changes in the mini-job threshold to estimate adjustment costs, finding that individuals are willing to forgo an average of €30-€40 per month (i.e. approximately 10% of monthly earnings) to avoid the hassle of changing working hours or jobs to bunch at the mini-job threshold.

Second, I find that even the observed response cannot be fully attributed to labor supply alone; rather, the observed outcomes are strongly affected by labor demand responses. First, I document large bunching among individuals with multiple jobs who do not qualify for tax breaks. Second, I also estimate higher elasticities for demographic groups with weaker tax incentives, suggesting that forces beyond tax incentives determine bunching. For example, elasticity estimates of single individuals jump dramatically when the magnitude of the notch decreases and remain large for more than 5 years after the tax change. Elasticities of males often appear larger than those of females, in sharp contrast to most previous studies (Keane (2011)). Finally, I find larger bunching for workers employed at small firms, suggesting that some part of the response may

EITC to larger life-cycle wage and tax variation.

be driven by evasion. For example, earnings in excess of the mini-job threshold may be paid under the table. Overall, these findings suggest that bunching is at least partially determined by firms' decisions to offer mini-jobs, and that labor demand responses affect elasticity estimation.

Third, I focus on firms and provide suggestive evidence that mini-jobs may be attractive to firms because firms can pay mini-job workers lower fringe benefits. Using firm and household surveys that provide information on employees' working hours, I find that mini-job workers have similar employment durations to regular part-time workers, but are paid differently. Mini-job workers receive smaller yearly bonuses and fewer vacation days, and are paid approximately 6% higher gross wages than regular part-time workers. While these findings may not have a causal interpretation due to the lack of exogenous assignment, they are consistent with survey evidence documenting that many mini-job workers report not receiving government-mandated benefits such as sick days and vacation pay, and that mini-job workers are often unaware of these rights or too scared to report violations (Bachmann et al. (2012); Wippermann (2012)).

Overall, the results of this study show that individuals experience very large adjustment costs and are not able to fully respond even to large and salient financial incentives. Instead, individual responses are highly dependent on the availability of suitable jobs. Thus, firm preferences and incentives play a key role in determining labor supply responses and should be accounted for when estimating labor supply elasticities.

While the studied setting provides many advantages, the estimated elasticities describe the behaviors of a relatively narrow group of individuals, so may not accurately represent preferences of individuals at higher income levels or in other institutional settings. Other than differences in the ability to respond, mini-job workers may differ in their willingness to respond, for example, due to a differential degree of labor force attachment or due to career concerns. In this regard, mini-job workers may be similar to workers in alternative work arrangements (Katz and Krueger (2019)), and other highly flexible environments (Angrist et al. (2017), Mas and Pallais (2019)). Therefore, the setting provides an excellent environment to study workers interested in small jobs with flexible hours.

Finally, this study contributes to a small literature that studies mini-job workers.[3] The closest study, by Gudgeon and Trenkle (2017), investigates workers' adjustment to mini-job threshold changes and shows that insufficient labor demand can account for about 18% of non-adjustment in the first post-reform year. In contrast to this study, which measures labor supply responses to the mini-job threshold across years and demographic groups, Gudgeon and Trenkle study the transitional dynamics of a sample of married women using firm panel data and focusing on 2003 and 2013 reforms. The authors' findings are complementary to the results of this paper and provide further evidence that firm preferences and incentives play a key role in determining labor supply responses.

The rest of the paper is organized as follows: Sections 1 and 2 describe institutional setting and data sources respectively. In Section 3, I estimate elasticities of earnings with respect to net-of-tax rates, compare my results to previous literature, and empirically investigate wages and fringe benefits. Section 4 concludes.

1 Institutional Setting

Table 1 summarizes mini-job rules and corresponding tax incentives. Marginal employment, or *mini-jobs*, has existed in Germany since 1977. From 1999 until April 2003, marginal employment included jobs in which employees earned less than €325 per month and worked fewer than 15 hours per week.[4] The employer paid a 22% social security tax, while the employee was exempt from *both* social security and income taxes. The mini-job threshold applied to the sum of earnings, and if these earnings exceeded the mini-job threshold, employees were subject to regular social security contributions (a combined 42%, split equally between

[3] Carrillo-Tudela et al. (2018) explore overall labor market responses to Hartz reforms; Galassi (2018) studies compositional changes in labor demand, and Tazhitdinova (2019) studies moonlighting responses to the 2003 reform. Finally, Steiner and Wrohlich (2005) and Caliendo and Wrohlich (2010) use SOEP to study the effect of the 2003 reform on labor supply outcomes.

[4] There are two types of marginal employment (*geringfügige Beschäftigung*) in Germany: employment with earnings below the mini-job threshold (which are the focus of this paper), and short-term marginal employment (*kurzfristige Beschäftigung*), which is not subject to an earnings limit but is limited in duration to 50 working days or two months per year. This second type of employment is significantly less popular than mini-jobs and is not the focus of this paper.

employees and employers) and income taxes on their *entire* earnings. Thus, while the tax liability of firms barely changed at the threshold (dropping from 22% to 21%), the €325 threshold represented a large notch for employees, particularly for married women with high-earning spouses because of the joint taxation.[5]

The Hartz II reforms, introduced on April 1, 2003, increased the employer mini-job SS rate from 22% to 25%, abolished the hour constraint, and increased the monthly earnings limit to €400.[6] In addition, the reform smoothed the social security (SS) notch by substituting it with a kink – the total SS tax liability smoothly increased from 25% to 42% and was fully phased in upon reaching €800. However, the phasing-out liability was split unequally: when crossing the €400 threshold, employers' SS tax liability immediately fell from 25% to 21%. This decrease was fully offset by an increase in employees' tax liability, resulting in a small jump of 4% at the limit and a higher marginal SS rate of 38%.

The reform, however, did nothing to smooth the tax notch in the income tax liability of married individuals: the reduced rate did not apply to income taxes. The mini-job contribution rate was further increased to 30% on July 1, 2006, but the €400 threshold remained intact until April 1, 2012, at which point the €400 and €800 thresholds were increased to €450 and €850 respectively.

The mini-job threshold applies to monthly earnings, and individuals are allowed to exceed the threshold occasionally without losing the tax benefits. Hence, for example, a one-time yearly bonus would not push a mini-job worker into a regular category. Beyond tax liability, mini-jobs and regular jobs are subject to the same labor regulations. However, surveys of mini-job workers reveal that many of them report not receiving government-mandated benefits such as sick pay and vacation pay and that they are either unaware of these rights or afraid to report the violations (Bachmann et al. (2012); Wippermann (2012)). Finally, while employers pay "social security" taxes on mini-job earnings, these contributions do not qualify mini-job workers for benefits (pension, unemployment credits, and

[5] In Germany, married couples are taxed based on their joint income, though there is no marriage penalty – the income schedule for married couples is based on brackets that are twice the size of those of single individuals. However, spouses may elect to be taxed separately.

[6] While multiple mini-jobs are still added up to determine one's social security tax liability, individuals who hold at least one job paying more than €400 can now hold an additional job tax-free (see Tazhitdinova (2019)). In this study, I focus on individuals whose mini-jobs are their primary employment.

Table 1: Mini-Job Rules, Social Security Tax Rates, Income Tax Notches and Marginal Tax Rates

		Mini-Jobs		Regular Jobs									
	Mini-job	Employer	Employee	Employer	Employee	Income Tax							
	Threshold	SS Tax	SS tax	SS Tax	SS Tax	Women				Men			
						Notch	s.d.	MTR	s.d.	Notch	s.d.	MTR	s.d.
1999	€325	22%	0%	21%	21% on full z	€80	(39)	25%	(12)	€31	(42)	11%	(15)
2000	€325	22%	0%	21%	21% on full z	€76	(37)	24%	(12)	€29	(40)	11%	(14)
2001	€325	22%	0%	21%	21% on full z	€71	(35)	22%	(11)	€25	(35)	10%	(13)
2002	€325	22%	0%	21%	21% on full z	€71	(35)	22%	(11)	€25	(35)	10%	(13)
2003	€400	25%	0%	21%	38% on $z >$€400[a]	€87	(50)	22%	(13)	€32	(46)	10%	(14)
2004	€400	25%	0%	21%	38% on $z >$€400[a]	€82	(48)	21%	(12)	€28	(42)	9%	(13)
2005	€400	25%	0%	21%	38% on $z >$€400[a]	€80	(47)	20%	(12)	€27	(41)	9%	(12)
2006	€400	30%	0%	19.5%	28.5% on $z >$€400[b]	€88	(42)	24%	(11)	€34	(45)	11%	(13)
2007	€400	30%	0%	19.5%	28.5% on $z >$€400[b]	€88	(42)	24%	(11)	€34	(45)	11%	(13)
2008	€400	30%	0%	19.5%	28.5% on $z >$€400[b]	€88	(42)	24%	(11)	€34	(45)	11%	(13)
2009	€400	30%	0%	19.5%	28.5% on $z >$€400[b]	€87	(41)	24%	(11)	€33	(44)	10%	(13)
2010	€400	30%	0%	19.5%	28.5% on $z >$€400[b]	€86	(41)	24%	(11)	€34	(45)	10%	(13)

Notes: This table shows the size of the mini-job threshold (in posted earnings), the social security taxes due for mini-jobs and regular jobs, and the average and standard deviation of income tax notch and marginal tax rate experienced by individuals at the mini-job threshold. z denotes individuals' monthly earnings. *Notch* is the average lump-sum payment of income tax that an individual must make upon exceeding the mini-job threshold. *MTR* is the average marginal income tax rate at the mini-job threshold. For single individuals, spousal income is set to zero. Spousal income includes labor earnings, as well as social security pensions. For further details, see Section 2 and Appendix A.2. [a] The employee SS rate decreases to 21% once earnings z exceed €800 per month. [b] The employee SS rate decreases to 19.5% once earnings z exceed €800 per month. *Data*: Author's calculations using Socio-Economic Panel (SOEP), version 30.

medical insurance) on *their own*. However, mini-job workers can obtain medical insurance through their spouse or, if they are under age 18 or are students under age 25, their parents. Furthermore, all mini-job workers may qualify for non-contributory unemployment assistance or means-tested social support, which provides individuals with monthly stipends and medical insurance.

In 2010, approximately 7.3 million individuals, or 24% of working-aged women and 12% of working-aged men, held mini-jobs. Most mini-jobs are in the same industries and occupations as other part-time employment: retail trade, accommodations, food services, etc. Most mini-job workers are employed for less than one year (Figure 5), earn between €5 and €10 per hour (Figure E.17), and work between 10 and 15 hours per week (Figure E.17).

2 Data Description

The main source of data is the weakly anonymous Sample of Integrated Labor Market Biographies (SIAB, Years 1975 - 2010).[7] The SIAB provides information on employment, job search, and receipt of unemployment benefits for a 2% sample of *wage earners* in Germany from 1975 until 2010. However, information on mini-job workers, the main subject of this study, is only available starting in 1999. Employment histories consist of end-of-the-year notifications, along with notifications submitted when an employee is hired or terminated, or when employment is interrupted. If no changes are made to the employment relationship, then only one notification is recorded per year. Otherwise, multiple notifications, which are precise to the day, are recorded. The data provide basic demographic and establishment characteristics. Unfortunately, marital status and number of children are known only for benefit recipients and those engaged in job search. Summary statistics are available in Table A.9.

Since the mini-job threshold applies to combined earnings, I estimate elasticities based on average monthly earnings. For individuals with multiple employment periods, I focus on the period of longest employment and disregard any

[7] 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, by remote data access. For a detailed data description, see vom Berge et al. (2013).

jobs that do not overlap with the "main" episode by at least five days. I then calculate the average monthly earnings as the sum of earnings from all employment divided by the number of months in the "main" spell. The core sample is restricted to individuals in regular and marginal jobs who are not receiving unemployment benefits; other types of workers, such as trainees, casual workers, etc., are dropped. Unless otherwise noted, I further restrict the sample to individuals aged 31 through 54. First, some secondary and postsecondary students receive funding through the Federal Training Assistance Act (BAföG). While students are allowed to hold part-time jobs, BAföG stipends are withdrawn euro per euro when earnings exceed €400 per month. Second, individuals in partial retirement or on disability insurance, which are most commonly claimed starting at age 55, become subject to an earnings test on their benefits when their earnings exceed €400.

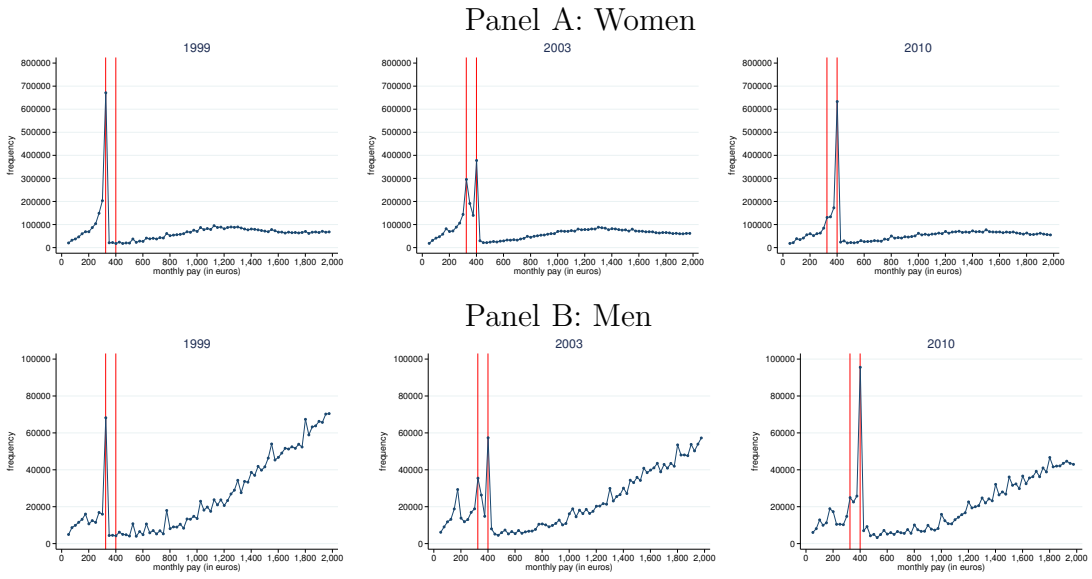
Due to joint taxation of married couples, the size of the tax notch and marginal tax rate change at the mini-job threshold depend on spousal earnings. Since the SIAB data do not contain information on spousal earnings, I estimate the income tax notch and the marginal tax rate in Table 1 using the German Socio-Economic Panel (SOEP). When calculating spousal incomes, I take two types of earnings into account: labor earnings (regular and self-employed) and social security pensions (old-age, disability, and widowhood). Further, using the results from Doerrenberg et al. (2017), I assume that individuals can claim 20% of their earnings as deductions (for details, including sample sizes, see Appendix A.2). Table 1 shows that women experience the largest income tax notch at the threshold, ranging from €71 to €88 depending on the year. Men experience a smaller income notch at the threshold, ranging from €25 to €34.

3 Behavioral Responses to the Mini-Job Threshold

In this paper, I differentiate among gross, posted, and net earnings and wages. Posted earnings represent actual paid amounts, including employee SS and income taxes but excluding employer SS taxes. On the other hand, gross earnings include all taxes, while net wages exclude all taxes. Because mini-job threshold applies to posted earnings, I start the analysis by documenting distributions of posted

earnings over time. However, when calculating elasticities, I use distributions of gross earnings in order to properly account for differences in employer SS taxes. I assume that all social security and income taxes are fully passed through to the employee. This assumption is consistent with the empirical findings in Section 3.3.

Figure 1: Earnings in 1999, 2003, 2010



Notes: This figure shows the distribution of monthly wage earnings (posted) of women and men in 1999, 2003, and 2010. The vertical red lines identify the mini-job thresholds: €325 prior to 2003 and €400 thereafter. *Data*: Sample of Integrated Labour Market Biographies (SIAB) 1975 - 2010, Nuremberg 2013.

Panels A and B in Figure 1 show the distributions of monthly *posted* wage earnings of women and men aged 31 through 54 (exclusive of employer SS taxes) for 1999, 2003, and 2010 (other years are shown in Figures A.10-A.11). Each point shows the number of individuals in a €25 bin, scaled to represent the German population in that year from a 2% representative sample. The vertical red lines identify mini-job thresholds: €325 prior to 2003 and €400 thereafter. Both men and women show strong responses to tax incentives in the form of sharp bunching at the threshold. Bunching is concentrated just below the threshold, with no excess mass above the threshold, consistent with the existence of a notch. The positive mass to the right of the threshold in 1999 (when all individuals experienced a large notch) indicates that some individuals experienced very large

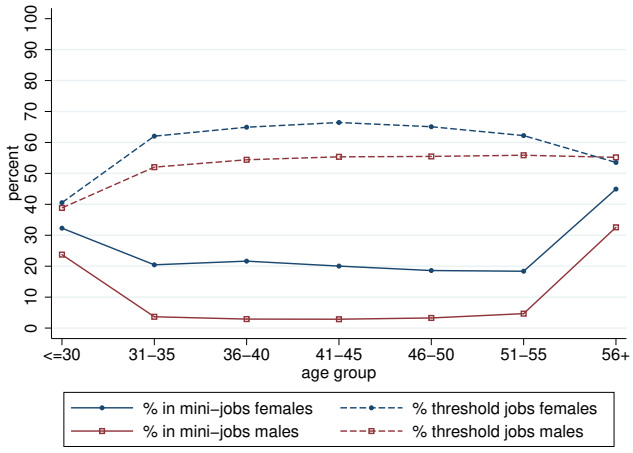
frictions and were not able to adjust their working hours as needed. Bunching is substantially larger for women than for men, which is consistent with women experiencing stronger incentives to bunch because of joint taxation. When the threshold increased from €325 to €400 on April 1, 2003, bunching adjusted quickly but not immediately. In the year of the change, 2003, there was substantial bunching at the old and the new thresholds. However, the bunching at the old threshold may simply reflect individuals who worked only part of the year when the threshold was set at €325. By the end of 2004, roughly one third of the excess mass remained at the old threshold, underscoring the importance of frictions (see Appendix Figures A.10-A.11 and Gudgeon and Trenkle (2017) for a detailed analysis).

Figure 2 shows the percent of males and females who held mini-jobs in 2006-2010 by five-year age bins. In addition, Figure 2 shows what percent of these mini-jobs paid between €300 and €400. For both men and women, mini-jobs are most popular among young adults and retirees; however, these tendencies are less pronounced among women. For all age groups, 50-70% of jobs represent at-the-threshold jobs. At-the-threshold jobs are more commonly taken by middle-aged individuals, especially among women. Full earnings distributions by gender and income are available in the appendix.

To estimate elasticities, I follow the bunching approach pioneered by Saez (2010) and Kleven and Waseem (2013), which allows researchers to calculate the elasticity of income with respect to the net-of-tax rate by estimating the excess mass at the kinks and notches of the tax schedule. While kinks and notches both lead to bunching, they have different implications for the shape of the counterfactual earnings distribution – a hypothetical earnings distribution in the absence of tax changes. A kink leads to a leftward shift in the distribution of earnings, resulting in no missing mass to the right of the threshold. A notch, on the other hand, generates a strictly dominated region of earnings to the right of the threshold; therefore, leading to a missing mass. Thus, in the presence of a notch and a kink, a correctly fitted counterfactual distribution is fitted such that only the portion of total bunching attributed to the notch equals the missing mass to the right of the threshold.[8] To account for this, I estimate the elasticities using a

[8] This differs from the approach of Kleven and Waseem (2013), who equate the total bunch-

Figure 2: Share of Mini-Job Workers



Notes: This figure shows the percent of individuals who held mini-jobs in 2006-2010 (solid lines), as well as the percent of individuals among mini-job holders who held €300 to €400 jobs (dashed lines). *Data*: Sample of Integrated Labour Market Biographies (SIAB) 1975 - 2010, Nuremberg 2013.

modified approach, described in detail in Appendix A.1. I start with an elasticity guess e^0 and calculate a predicted proportion of bunching due to the notch $\pi^0_{notch} \equiv 1 - B^0_{kink}/B^0_{total}$. Next, I generate a counterfactual distribution by fitting a high-degree polynomial to the observed density, excluding a region around the mini-job threshold. The polynomial is fit in such a way as to equate the proportion of excess mass *due to the notch*, π^0_{notch}, to the missing mass to the right of the threshold. Next, I adjust the estimated counterfactual distribution rightward until the area under the entire counterfactual density equals the area under the observed distribution. I do this to account for the fact that the excess mass *due to the kink* comes from individuals moving from points of the distribution to the right of the threshold. An estimate of bunching $\hat{B}^0_{total}$ for the elasticity guess e^0 is then calculated as the difference between this adjusted counterfactual and the observed distribution. The estimated amount of bunching pins down an elasticity of earnings with respect to the net-of-tax rate $\hat{e}^0$ through the equation derived by Kleven and Waseem (2013). If the elasticity estimate $\hat{e}^0$ matches the initial guess

ing to the missing mass. This approximation is appropriate in the presence of small changes in the marginal tax rate, but may lead to biased estimates in the presence of large kinks.

e_0, the initial guess is correct and estimation stops. If the estimated elasticity does not match the guess – i.e., $\hat{e}^0 \neq e^0$ – I update the guess to $e^1 = \hat{e}^0$ and repeat calculations for the new guess. I proceed with these iterations until a fixed point is achieved, such that $\hat{e}^k = e^k$, which pins down the elasticity of earnings.

Since the relationship between the amount of bunching and individuals' incentives and preferences is nonlinear for notches, the presented approach estimates elasticities based on the average earnings response of these individuals (Appendix A.1). In this setting, individuals experience heterogenous incentives because of the varying magnitude of income tax notches, and it is plausible that these individuals vary in their preferences. A reduced form approximation suggests that these forms of heterogeneity are likely to result in a downward bias; however, a precise calculation is not possible.[9]

Table 2 summarizes elasticity estimates and the corresponding excess masses; the actual fits of the counterfactual distributions are available in Appendix A.3. As employer SS taxes differ between mini-job and regular workers, I calculate elasticities by fitting a 7th-degree polynomial to the empirical distribution of gross earnings, and by using changes in marginal tax rates that apply to *gross earnings*.[10] The tax changes used to estimate elasticities in Table 2 are summarized in Appendix Table A.5. The estimation procedure starts with an initial guess of elasticity $e_0 = 0.01$ and iterates until a fixed point is reached. Bootstrap standard errors are based on 1000 iterations and account for the iterative approach. Appendix A.3 shows the results are robust to the choice of income bin width, the lower bound of the exclusion region z_l and the degree of the polynomial.

[9] The reduced form bunching formula of Kleven and Waseem (2013) shows that bunching due to a notch ΔT at threshold K in presence of heterogeneous elasticities with distribution $\psi(K, e)$ is equal to $B = \int_e \sqrt{\frac{eK\Delta T}{1-t_1}}\psi(K,e)de = \sqrt{\frac{K\Delta T}{1-t_1}}\int_e \sqrt{e}\psi(K,e)de \leq \sqrt{\frac{e_K K\Delta T}{1-t_1}}$, where the last step follows from Jensen's inequality and e_K denotes the average elasticity. Derivations for notch heterogeneity are similar.

[10] Assuming that wages reflect all labor costs, an individual earning €400 at a mini-job in 2010 would have had to work more hours than a person earning €400 in a regular job because the employer-paid social security tax rate for mini-jobs was approximately 10% higher than for regular jobs. The empirical distributions are generated by multiplying reported posted earnings of mini-job workers by $1 + \tau_{Mini}$ and earnings of regular employees by $1 + 0.5\tau_{Full}$. Since $\tau_{Mini} > \tau_{Full}$, there are a small number of regular employees whose gross earnings fall in the interval $(K(1 + 0.5\tau_{Full}), K(1 + \tau_{Mini})]$. These individuals are dropped, so that all observations below the gross mini-job threshold $K(1+\tau_{Mini})$ correspond to observations below the official posted mini-job threshold K.

Table 2: Elasticity Estimates

	Women				Men			
	e	s.e.(e)	b	s.e.(b)	e	s.e.(e)	b	s.e.(b)
1999	0.08	(0.02)	14.35	(1.10)	0.07	(0.05)	8.36	(1.56)
2000	0.11	(0.03)	15.08	(1.46)	0.09	(0.05)	8.81	(1.57)
2001	0.16	(0.05)	16.48	(1.92)	0.11	(0.07)	8.83	(2.27)
2002	0.12	(0.04)	14.59	(1.48)	0.10	(0.06)	8.58	(1.61)
2003	0.08	(0.02)	12.67	(1.03)	0.20	(0.05)	9.33	(1.45)
2004	0.15	(0.03)	15.16	(1.74)	0.21	(0.07)	8.88	(1.80)
2005	0.14	(0.02)	14.28	(1.51)	0.19	(0.04)	8.18	(0.94)
2006	0.14	(0.02)	14.29	(0.99)	0.16	(0.04)	7.89	(1.00)
2007	0.14	(0.03)	14.24	(1.14)	0.27	(0.06)	10.59	(1.34)
2008	0.13	(0.02)	13.78	(1.53)	0.27	(0.10)	10.73	(2.34)
2009	0.18	(0.03)	16.18	(2.55)	0.36	(0.06)	12.43	(1.46)
2010	0.17	(0.02)	15.31	(1.65)	0.34	(0.08)	11.99	(1.81)

	1999-2002		2003-2005		2006-2010	
	e	s.e.(e)	e	s.e.(e)	e	s.e.(e)
Singles	0.15	(0.05)	0.57	(0.26)	0.55	(0.19)
Women under 31	0.18	(0.04)	0.22	(0.03)	0.20	(0.02)
Women 31-44 y.o.	0.07	(0.04)	0.08	(0.01)	0.11	(0.01)
Women 45-54 y.o.	0.14	(0.05)	0.14	(0.04)	0.13	(0.02)
Women over 54	0.54	(0.09)	0.81	(0.17)	0.76	(0.11)
Men under 31	0.15	(0.02)	0.39	(0.04)	0.40	(0.04)
Men 31-44 y.o.	0.04	(0.05)	0.36	(0.09)	0.21	(0.06)
Men 45-54 y.o.	0.17	(0.06)	0.58	(0.15)	0.38	(0.07)
Men over 54	0.47	(0.08)	0.56	(0.08)	0.46	(0.06)

Notes: This table shows elasticities of earnings with respect to net-of-tax rate, along with corresponding bunching estimates by gender, year, age and marital status. Corresponding tax changes used to estimate elasticities are shown in Table A.5. *Data*: Sample of Integrated Labour Market Biographies (SIAB) 1975 - 2010, Nuremberg 2013, author's calculations.

3.1 Elasticity Estimates and Comparison to the Previous Literature

The top panel of Table 2 shows that yearly elasticity point estimates range from 0.08 to 0.18 for women and from 0.07 to 0.36 for men. Excess bunching, however, shows smaller variation, ranging from 12.67 to 16.48 for women and from 7.89 to 12.43 for men.[11] Both sets of elasticities show an upward trend, with larger elasticities in 2007 – 2010 than in 1999 – 2002.[12]

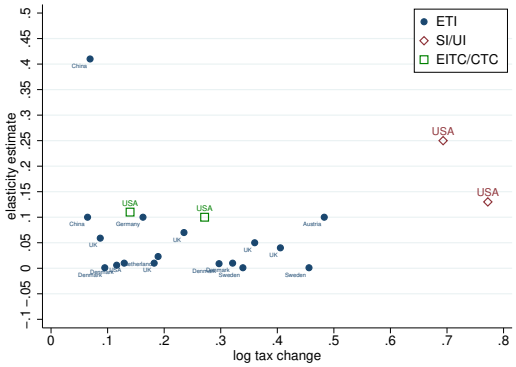
To better evaluate the magnitude of the response, Figures 3(a) and (b) compare elasticity estimates to estimates from previous bunching studies of wage-earners: panel (a) shows estimates from kink studies, while panel (b) focuses on notches. Apart from the large estimates of elasticities of taxable income (ETI) for China (He et al. (2018)) and large responses to social insurance kinks (Le Barbanchon (2015), Gelber et al. (2017)), bunching estimates based on kinks fall below 0.1. Notch studies provide slightly higher estimates, but report estimates of structural elasticities, obtained by inflating the amount of bunching by the share of nonresponsive individuals in the strictly dominated region. Therefore, these studies account for the presence of frictions. In contrast, in Table 2, I calculate elasticities based on the observed bunching alone. Overall, relative to previous bunching studies, including those for Germany, the estimates in Table 2 are large and confirm the theoretical prediction that stronger incentives lead to larger elasticity estimates; hence, allowing for a more precise estimation of true structural elasticities of labor supply. Nonethless, the estimates in this paper are of a similar magnitude or smaller than those in the labor literature: Keane (2011) reports an average elasticity of 0.31 across more than 100 studies. Thus, despite the very large nature of tax incentives and part-time work arrangements, many individuals still fail to respond and bunch.

[11] Elasticity for year 2003 is estimated based on new rules.

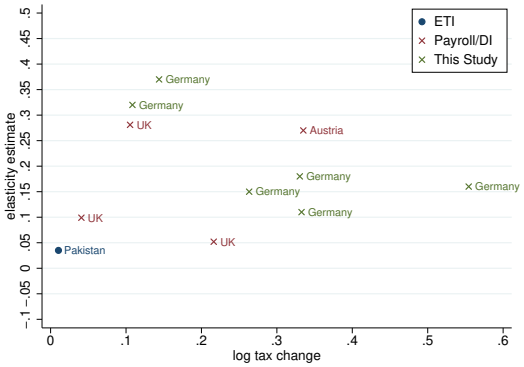
[12] It is possible that bunching in 1999-2002 is small because some individuals were constrained by the 15-hour weekly limit on mini-jobs that existed in those years. However, this explanation for the upward trend is unlikely for two reasons. First, given the large magnitude of the notch, an optimal response to the 15-hour rule would be to reduce one's working hours to 15 hours per week, rather than having to work long hours and pay higher taxes. This would result in diffused bunching below the threshold, and hence, would be included in the estimation procedure. Second, if individuals exceeded the mini-job threshold in 1999-2002 because of the 15-hour constraint, they should have started to bunch once the constraint was lifted in 2003. Yet, overlapping pre- and post- reform distributions suggests that the density to the right of the mini-job threshold remained unchanged.

Figure 3: Elasticity Comparison with Previous Studies

(a) Studies Using Kinks



(b) Studies Using Notches



Notes: For details about included studies, see Appendix B. ETI stands for elasticity of taxable income. Log tax change is defined as $log(1-t_1) - log(1-t_2)$.

While mini-job workers experience unusually large incentives at the mini-job threshold, the population of interest – mini-job workers – and the institutional features otherwise closely relate to the previous literature summarized in Figure 3. First, workers in Germany show similar levels of ETI as in other countries (see Figure D.13 and Schchtele (2016)). Second, mini-job workers are highly comparable to other part-time workers in the USA (Saez (2010); Mortenson and Whitten (2018)), the UK (Tazhitdinova (2015); Adam et al. (2017)), and Austria (Paetzold (2019)). However, many of the previous studies estimated elasticities of *taxable income* rather than of wage earnings, thus estimating joint real and avoidance responses. Doerrenberg et al. (2017) show that the elasticity of taxable income in Germany is 2-3 times larger than the elasticity of earnings exclusive of deductions. Since mini-job threshold applies to wage earnings alone, the estimates in this study measure real responses of individuals and any collusive behavior between individuals and firms. Unfortunately, it is impossible to observe to what extent such collusion happens in practice. On one hand, individuals who work at smaller establishments show larger bunching (Table A.11), but on the other hand, this evidence is confounded by the fact that smaller firms may prefer mini-job workers because of lower administrative costs and higher flexibility.

An additional important observation from Figures 3 (a) and (b) is that while

the magnitude of labor supply response appears to be positively correlated with the magnitude of tax incentives, the relationship is rather weak. This suggests that factors beyond financial incentives may determine labor supply outcomes: for example, salience, adjustment costs, or availability of jobs.

To understand how frictions affect the magnitude of response, I employ the bunching-hole method of Kleven and Waseem (2013) to estimate structural elasticities that account for the presence of frictions. In addition, I extend the bounding approach of Chetty (2012) to notches in Appendix C. The results are summarized in Table 3. The bunching-hole approach estimates structural elasticities by accounting for the share of unresponsive individuals: elasticities are estimated based on inflated bunching $B/(1-a)$ instead of observed bunching B. Fraction a measures the share of individuals who report earnings in the strictly dominated region. Since the incentives to bunch and overcome frictions are stronger the closer one's desired earnings are to the threshold, the bunching-hole method generates a lower bound on structural elasticities. The bounding approach of Chetty (2012), on the other hand, assumes that individuals are willing to forgo, at most, some small share of their welfare to avoid the cost of changing their working hours. This approach requires researchers to specify how much welfare workers might be willing to forgo. In Table 3, I assume that individuals do not change their working hours unless by doing so they reduce their lifetime welfare by more than 1%. Overall, the two methods predict tight bounds for women: structural elasticities under the bunching-hole method are below 0.43 and the Chetty (2012) upper bound is 0.33 or smaller. The setting therefore allows for precise estimation of true frictionless elasticities for women. These results are similar to the estimates of Gudgeon and Trenkle (2017), who use the approach of Gelber et al. (2017) to estimate friction costs and structural elasticities by exploiting threshold changes. The results for men are more noisy. The bunching-hole method is sensitive to the counterfactual fit and sometimes results in much larger bounds than the Chetty (2012) approach.

3.2 Elasticity Heterogeneity

If the large magnitude of estimated elasticities is the result of individuals' preferences, we should observe substantially smaller bunching for individuals who

Table 3: Elasticity Estimates: Bunching-Hole Method and Bounds on Frictions

	Women				Men			
	e	e_{B-H}	lb(e)	ub(e)	e	e_{B-H}	lb(e)	ub(e)
1999	0.08	0.25	0.04	0.17	0.07	0.76	0.03	0.19
2000	0.11	0.30	0.06	0.22	0.09	0.64	0.04	0.22
2001	0.16	0.38	0.09	0.30	0.11	1.06	0.06	0.26
2002	0.12	0.29	0.07	0.24	0.10	1.10	0.05	0.24
2003	0.08	0.32	0.04	0.16	0.20	0.92	0.11	0.41
2004	0.15	0.34	0.09	0.27	0.21	0.43	0.12	0.44
2005	0.14	0.28	0.09	0.25	0.19	0.34	0.10	0.42
2006	0.14	0.32	0.08	0.27	0.16	0.34	0.08	0.41
2007	0.14	0.33	0.08	0.27	0.27	0.71	0.15	0.62
2008	0.13	0.29	0.07	0.26	0.27	0.82	0.15	0.62
2009	0.18	0.43	0.11	0.33	0.36	0.81	0.20	0.79
2010	0.17	0.39	0.10	0.32	0.34	0.82	0.19	0.75

	1999-2002				2003-2005				2006-2010			
	e	e_{B-H}	lb(e)	ub(e)	e	e_{B-H}	lb(e)	ub(e)	e	e_{B-H}	lb(e)	ub(e)
Singles	0.15	0.50	0.07	0.43	0.57	0.57	0.27	1.31	0.55	0.55	0.07	0.43
Women under 31	0.18	0.22	0.10	0.37	0.22	0.31	0.13	0.44	0.20	0.29	0.10	0.50
Women 31-44 y.o.	0.07	0.24	0.04	0.16	0.08	0.25	0.04	0.16	0.11	0.29	0.06	0.22
Women 45-54 y.o.	0.14	0.35	0.08	0.26	0.14	0.32	0.09	0.25	0.13	0.30	0.07	0.26
Women over 54	0.54	0.68	0.34	0.95	0.81	1.03	0.53	1.32	0.76	1.03	0.46	1.36
Men under 31	0.15	0.26	0.07	0.41	0.39	0.39	0.19	0.95	0.4	0.52	0.17	1.45
Men 31-44 y.o.	0.04	0.94	0.00	0.13	0.36	1.51	0.19	0.79	0.21	0.65	0.11	0.47
Men 45-54 y.o.	0.17	0.75	0.09	0.37	0.58	1.25	0.33	1.12	0.38	0.71	0.21	0.83
Men over 54	0.47	0.53	0.27	0.95	0.56	0.62	0.32	1.08	0.46	0.51	0.24	1.04

Notes: This table shows elasticities of earnings with respect to net-of-tax rate, structural elasticities estimated using Kleven and Waseem (2013) bunching-hole method, and corresponding lower and upper bounds on structural elasticities based on the approach of Chetty (2012) by gender, year, age and marital status. Corresponding tax changes used to estimate elasticities are shown in Table A.5. *Data*: Sample of Integrated Labour Market Biographies (SIAB) 1975 - 2010, Nuremberg 2013, author's calculations.

experience smaller tax changes at the mini-job threshold. On the other hand, if the large bunching is due to firms readily offering mini-job positions, at-the-threshold jobs will be "diffused" across population groups, and we will see substantial bunching regardless of individuals' tax incentives. To investigate how the magnitude of the response changes with individuals' incentives, I divide the sample into several groups: individuals with multiple jobs; single individuals; women and men of different ages. The results described below show that at-the-threshold jobs are readily available in the labor market and are often held by individuals who have small incentives to bunch (e.g., singles, men) or no incentive at all (individuals with multiple jobs before 2003).[13]

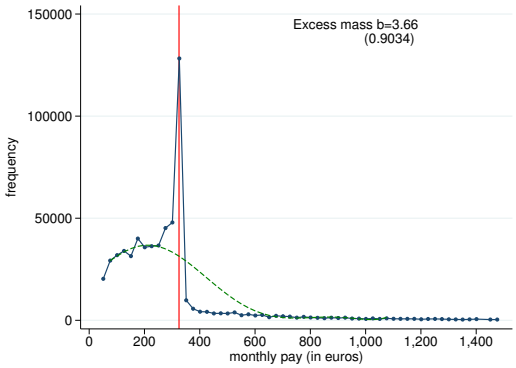
Figure 4 shows substantial bunching at the mini-job threshold in the distribution of *secondary* earnings from 1999 – 2002. Prior to 2003, the mini-job threshold applied to cumulative earnings; therefore, individuals who had a regular job had no incentive to limit their secondary earnings to the mini-job threshold, as doing so would not reduce their tax bill. This bunching was termed "firm bunching" by Chetty et al. (2011) and is direct evidence of firm responses to the mini-job threshold.[14] It is important to note that this bunching cannot be attributed to inattention or lack of information – these secondary jobs were held for an average of eight months, which should give sufficient opportunity to observe taxes withheld from paychecks. As well, most of these secondary jobs are also not a result of "grandfathering" of previously held primary mini-jobs into secondary job status (see Appendix Figure A.9, which restricts the sample to individuals with large primary incomes prior to obtaining a secondary job.)

The upper panel of Table 2 shows that elasticities of men are often larger than elasticities of women. While different elasticities may reflect different underlying structural elasticities, most previous studies find larger elasticities for females than males (Keane (2011)). At the same time, elasticities in later periods – when the magnitude of the notch decreases – are larger than in earlier periods. The lower panel of Table 2 documents similar surprising findings for other demographic groups (graphical evidence available in Appendix A.3): the

[13] Corresponding tax incentives are shown in Appendix Table A.5.

[14] Starting from 2003, individuals with a regular job are allowed to hold one-mini job tax-free. This reform led to a large increase in take up of secondary jobs, with a large number of these jobs being at-the-threshold jobs (Tazhitdinova (2019)).

Figure 4: Bunching in the Distribution of Secondary Earnings



Notes: This figure shows the distribution of *posted* earnings in a secondary job for individuals who concurrently hold a "regular" and a secondary job, where a regular job is defined as a job that pays more than €325 in 1999-2002. The distribution shown is the average across 1999-2002. *Data*: Sample of Integrated Labour Market Biographies (SIAB) 1975 - 2010, Nuremberg 2013.

first row shows the elasticity estimates for a selected sample of plausibly single individuals.[15] As mini-job earnings alone are too low to qualify for income taxes, for singles, bunching at the mini-job threshold identifies responses to SS liability only. The results show reasonable elasticity estimates from 1999 – 2002 when single individuals experienced a large SS notch. However, when the SS notch was substantially reduced (2003 – 2010), the elasticity estimates tripled, reflecting a similarly large number of individuals in at-the-threshold jobs, despite a decrease in tax incentives to bunch. Importantly, the large bunching persisted in 2006-2010, well after the 2003 reform, suggesting that this result is not driven by temporary inattention or inertia as in Gelber et al. (2017). Next, elasticities by age groups are also consistent with the job-diffusion prediction: individuals

[15] The SIAB provides information on individuals' marital status only when they apply for unemployment insurance (UI) benefits or register with an employment agency. For this reason, my sample of "single" individuals includes workers who have applied for UI or registered with an employment agency at least twice during 1999-2010 and who reported being single on their applications. I then assume that these individuals had the same marital status *in between* the reports. To minimize the impact of selection (individuals are selected based on their unemployment or job search experience), I further require that these individuals have a three-year gap between UI applications and include only the years in which individuals did not receive UI benefits.

that experience relatively small incentives to stay below the threshold show larger elasticities than individuals with stronger incentives. For example, women and men under age 31 or over age 55 appear to be much more responsive to tax incentives than individuals aged 31-54.

To summarize, the results show bunching among individuals with no incentives, unusually high elasticities among individuals with weaker financial incentives to stay below the mini-job threshold, and an increase in elasticities for the same demographic groups when tax incentives decrease. These findings suggest that the observed response cannot be fully attributed to labor supply alone. Rather, the observed outcomes are strongly influenced by firms' decisions to offer mini-jobs.

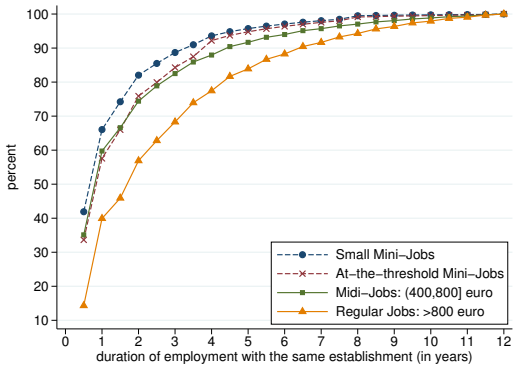
3.3 Firm Incentives

So far, I have assumed that job choice is driven exclusively by tax considerations. However, it is possible that mini-jobs and regular jobs differ in other aspects than taxes. First, I consider whether mini-jobs and regular jobs differ in dismissal costs. I assume that the employment spell is terminated if the individual quits the labor force or switches to a different establishment, or if employment is interrupted for more than 30 days. The results suggest that at-the-threshold mini-job workers enjoy similar job durations as regular workers with earnings just above the threshold, as shown in Figure 5, which plots the cumulative distributions of employment durations based on the SIAB data. Therefore, it is unlikely that mini-jobs are attractive to firms because of lower dismissal costs.

Second, I explore the differences in wages and fringe benefits among mini-job and regular workers. I employ a new dataset: the 2006 and 2010 waves of the Structure of Earnings Survey (Verdienststrukturerhebung or VSE).[16] To create the VSE, the German Federal Statistical Offices survey a large sample of

[16] The VSE is not representative of the German population since only firms with ten or more employees are surveyed. Moreover, the data do not include information on family structure or individuals' incentives to hold mini-jobs. For this reason, I also use a household survey (German Socio-Economic Panel or SOEP) that is representative of the population and includes detailed family structure (see Appendix E.2). The disadvantages of SOEP are its small sample size and that it is more likely to suffer from measurement error because all information is self-reported. Nonetheless, the results are robust to the choice of data.

Figure 5: Employment Duration by Type



Notes: This figure shows the cumulative distribution function of job durations, calculated as the time spent at any given establishment with employment breaks of less than 30 days. Job types are defined by monthly earnings in the first year of employment. Small Mini-jobs are employments with monthly earnings of less than mini-job threshold minus €25. At-the-threshold mini-jobs are – employments with monthly earnings within €25 euros of the mini-job threshold. *Data*: Sample of Integrated Labour Market Biographies (SIAB) 1975 - 2010, Nuremberg 2013.

firms with ten or more employees in selected industries.[17] The VSE contains information on the employees themselves (age, sex, experience, training); their jobs (mini-job identifiers, working hours, overtime hours, posted and net earnings, bonuses, number of vacation days); and firms' characteristics (number of employees, industry, applicable bargaining agreements, geographical location). I restrict the core sample to individuals working more than one hour but not more than 45 hours per week, aged 16 to 80, earning between €50 and €1500 per month. Appendix Table E.12 provides summary statistics.

I use two approaches to estimate a wage and fringe benefit differential between mini-job and regular workers. First, I restrict the sample to individuals with plausibly similar skills. A reasonable proxy for skills is income itself: individuals earning similar incomes are likely to have similar abilities. Thus, I restrict the

[17] VSE 2006 included businesses operating in mining and quarrying; manufacturing; energy and water supply; construction; trade; maintenance and repair of motor vehicles and personal and household goods; hotels and restaurants; transport, storage and communications; financial intermediation; real estate, renting and business activities; education, health and social work; other public and personal services sectors. VSE 2010 added employees working in public administration, defense and social security.

sample to a narrow window around the mini-job threshold, $[K-€25, K+€100]$, and then estimate the difference between mini-job workers' and regular part-time workers' outcomes controlling for observables.[18] Second, I use income as a proxy for skills by including a second-degree polynomial of income. In this case, I restrict the sample to jobs with earnings under €1,500 per month.

The two specifications can be summarized by the equation

$$\log(w_{if}) = \alpha_0 + \beta_0 \cdot \text{Mini}_{if} + \alpha_1 \cdot D_{if} + \alpha_2 \cdot D_{if}^2 + \beta_1 \cdot D_{if} \cdot \text{Mini}_{if} + \beta_2 \cdot D_{if}^2 \cdot \text{Mini}_{if} + \mathbf{X}_i' \cdot \gamma + \mathbf{F}_f' \cdot \theta + u_{if}, \quad (1)$$

where w_{if} defines the outcome of interest for individual i working at establishment f; Mini_{if} indicates whether the job that the individual holds is a mini-job; $\mathbf{X}$ is a vector of individual controls; and $\mathbf{F}$ is a vector of firm controls. $D_{if} \equiv (Y_{if}-K)/K$ measures the percentage difference between individuals' income Y_{if} and the mini-job threshold K. Other than gross, posted and net wages, w_{if} also measures bonuses, the number of full-time equivalent vacation days for which the individual qualifies, and the total labor costs of each worker – a sum of gross wages, bonuses and vacation pay. The coefficient of interest, β_0, captures the discontinuity of wages or fringe benefits at the mini-job threshold.

A natural concern of specification (1) is that individuals might select into mini-jobs based on unobserved preferences or abilities. Alternatively, only certain types of jobs – the qualities of which are not observed by the researcher – might be allowed under the mini-job status. Therefore, the results of this section do not have a causal interpretation because the mini-job status is not exogenously assigned. In practice, mini-jobs and part-time workers appear to be potential substitutes: mini-jobs are most prevalent within occupations and industries typical of part-time work.

The results are available in Table 4. Columns (1) through (5) focus on a narrow window of earnings around the mini-job threshold: only individuals earning between €375 to €500 per month are included. As a robustness check, I include linear income trend in columns (4) and (5). Columns (6) through (9) extend

[18] Note that a slightly larger window is used to the right of the threshold because the number of observations is smaller.

Table 4: The Effect of Mini-Job Status on Wages, Bonuses and Vacation Days (Firm Survey VSE)

	Monthly Income €375–€500					**Monthly Income €50–€1500**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent Variable: Log(Hourly Gross Wage)									
Mini-Job	0.060	0.091	0.057	0.088	0.062	0.094	0.095	0.062	0.070
	(0.007)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.004)	(0.004)	(0.004)
Dependent Variable: Log(Hourly Posted Wage)									
Mini-Job	-0.017	0.014	-0.019	0.012	-0.014	0.016	0.017	-0.015	-0.007
	(0.007)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.004)	(0.004)	(0.004)
Dependent Variable: Log(Hourly Net Wage)									
Mini-Job	0.173	0.191	0.151	0.150	0.147	0.219	0.231	0.174	0.182
	(0.007)	(0.006)	(0.005)	(0.006)	(0.006)	(0.006)	(0.004)	(0.005)	(0.004)
Dependent Variable: Yearly Bonus									
Mini-Job	-141.561	-80.246	-81.099	-60.706	-94.085	-134.388	-108.769	-112.651	-89.406
	(5.195)	(4.434)	(4.628)	(4.834)	(5.120)	(7.427)	(6.115)	(5.744)	(6.112)
Dependent Variable: Vacation Days									
Mini-Job	-6.244	-3.776	-3.041	-1.894	-2.543	-6.951	-5.843	-4.548	-3.948
	(0.320)	(0.171)	(0.170)	(0.170)	(0.210)	(0.274)	(0.138)	(0.291)	(0.220)
Dependent Variable: Log(Hourly Gross Wage incl. Bonus and Vacation Pay)									
Mini-Job	-0.017	0.053	0.019	0.055	0.015	0.015	0.033	-0.011	0.008
	(0.009)	(0.006)	(0.005)	(0.006)	(0.007)	(0.008)	(0.004)	(0.006)	(0.005)
Firm FE	No	Yes	Yes	Yes	No	No	Yes	No	Yes
Individual Controls	No	No	Yes	Yes	Yes	No	No	Yes	Yes
Firm Controls	No	No	No	No	Yes	No	No	Yes	No
Linear Wage Trend	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Quadratic Wage Trend	No	No	No	No	No	No	No	Yes	Yes
Number of Observations	107,239	107,239	107,239	107,239	107,239	887,183	887,183	887,183	887,183

Notes: This table shows the coefficients from regressing the listed dependent variables on a mini-job indicator variable. Standard errors are clustered by firm. Individual controls include male indicator, age group indicators, company tenure, education indicators, occupational status and occupation indicators, and year indicators. Firm controls include industry indicators, geographical indicators, number of male and female workers, indicators of applicable collective agreements, and indicators of whether a firm is part of a larger enterprise, whether a firm works in handcrafts, and whether a firm is publicly traded. Linear and quadratic trends include both linear/quadratic terms and their interactions with the mini-job indicator. *Data*: FDZ der Statistischen Ämter des Bundes und der Länder, Verdienststrukturerhebung, 2006 and 2010, author's calculations.

the window and include individuals earning between €50 and €1500 per month. Table 4 provides the results for several dependent variables: logarithm of hourly gross, posted and net wages; yearly bonus (in euros); the number of full-time equivalent vacation days; and the logarithm of total labor expenditures calculated as the sum of all yearly payments divided by total yearly hours. Consistent with graphical evidence available in Appendix E, Table 4 shows that gross and net wages are, respectively, 6–9% and 15–23% higher for mini-job workers than for regular employees, while posted wages are approximately equal. At the same time, mini-job workers receive €60–100 smaller yearly bonuses and two to three fewer vacation days than regular employees. These results are robust across all nine specifications. Including firm fixed effects in columns (2), (3), (4), (7) and (9) increases the wage differential but reduces the differences in fringe benefits; the likely explanation is that, on average, firms that hire mini-job workers are more "frugal" and pay lower wages and smaller fringe benefits. Finally, the last dependent variable incorporates fringe benefits (bonuses and vacation pay) into a measure of total labor costs and shows that accounting for bonuses and vacation pay does not equate the labor expenditures on mini-job workers and regular employees, but it does reduce the difference substantially. Unfortunately, the VSE does not provide information on all fringe benefits received by employees. For example, payments for sick days, statutory holidays, and maternity leave are not included. However, surveys often document that mini-job workers often do not receive many such benefits (Bachmann et al. (2012); Wippermann (2012)).

The last row of Table 4 shows that the total labor expenditures for each type of worker are approximately equal, suggesting that mini-job and regular workers are close to perfect substitutes. The results furthermore suggest that the higher gross wages earned by mini-job workers offset the lower fringe benefits they receive. Moreover, Table 4 suggests that the incidence of mini-job tax breaks falls fully on the workers. If this were not the case, the gross or posted wages of mini-job workers would be lower than those of regular workers, the opposite of the findings in Table 4. Finally, if selection were an important factor, and if workers were negatively (positively) selected into mini-job status, they would be likely to receive both lower (higher) wages and lower (higher) fringe benefits. This is not consistent with the findings in Table 4.

To summarize, the results in Table 4 suggest that employers find mini-jobs attractive because they are able to provide these workers with lower fringe benefits. The lower benefits, however, are at least partially offset by the higher gross wages these workers receive. Thus, in addition to a change in tax treatment, gross wages and fringe benefits (e.g. vacation pay and yearly bonuses) also change at the threshold. How do these findings affect the estimates of elasticities in Section 3.1? The answer to this question depends on how individuals value fringe benefits. If individuals assign an actuarially fair value to fringe benefits and total gross wages correctly reflect differences in employer fringe benefits, then elasticity estimates are correct. On the other hand, if the fringe benefits are not valued by workers and the total labor costs are not equalized, it follows that, in addition to tax-induced notch and kink individuals experience a further notch due to differences in wages, so elasticity estimates are biased upward. Vacation pay and bonus payments, as well as other benefits that mini-job workers appear not to receive, according to survey evidence from Bachmann et al. (2012) and Wippermann (2012) – sick day pay, statutory holiday pay, maternity pay and company training – are mostly monetary benefits and therefore likely to be valued fully. Therefore, since the distribution of earnings used to estimate elasticities in Section 3.1 is inclusive of bonus payments, as well as vacation, sick day and statutory pay, elasticities estimated in Section 3.1 should provide accurate estimates of the elasticities of earnings with respect to the net-of-tax rate.

4 Conclusion

This paper estimates labor supply responses to a large and salient notch generated by the "Mini-Job" program in Germany. The results suggest that individuals experience large frictions, and are willing to forgo more than 1% of lifetime welfare to avoid adjusting their labor supply: despite large and salient incentives, many workers choose employment with suboptimal earnings. High friction costs thus make labor supply responses highly dependent on the availability of suitable jobs. I investigate firm incentives and show that mini-jobs are likely to be attractive to firms because they can avoid paying mini-job workers common fringe benefits, such as vacation pay and bonuses. The findings thus stress the importance of

firm preferences and incentives for the equilibrium outcomes of labor markets and suggest that researchers should put effort into differentiating between labor demand and labor supply responses. This is particularly important in light of the recent findings of Azar et al. (2018), who document a high level of labor market concentration and employer market power in many commuting zones in the U.S.

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APPENDIX FOR ONLINE PUBLICATION

A Elasticity Estimation

A.1 Elasticity Estimation Procedure

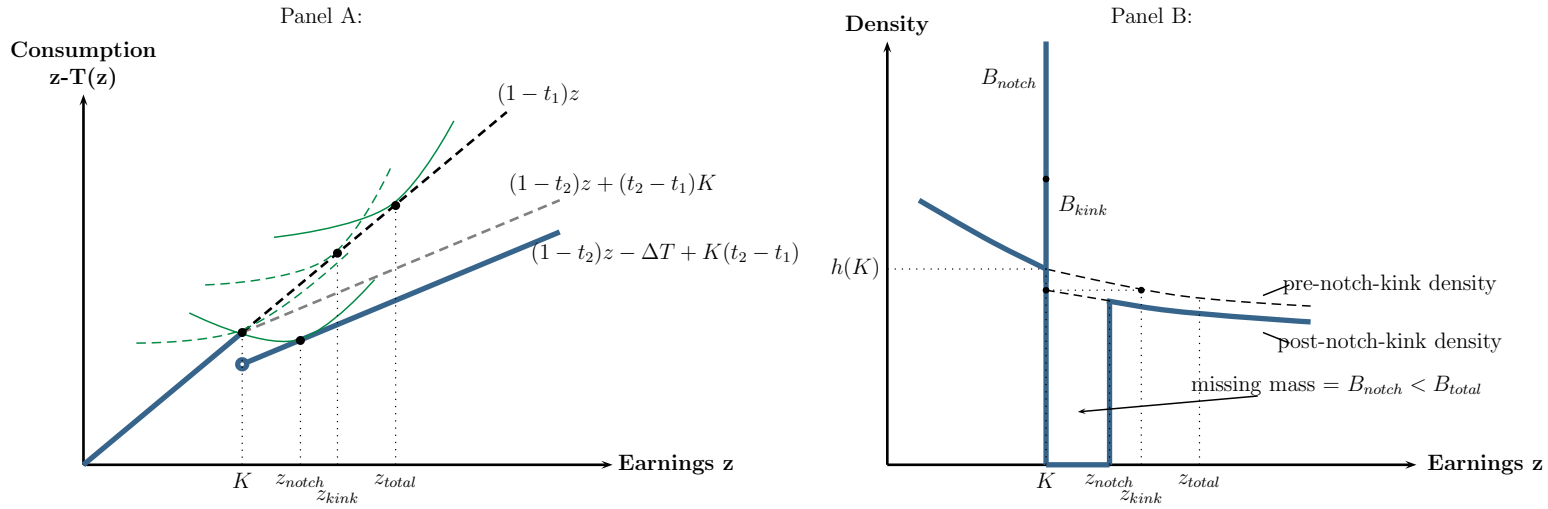
Assume that individuals maximize quasi-linear utility functions $u(c,z) = c - \frac{n}{1+1/\varepsilon}\left(\frac{z}{n}\right)^{1+1/\varepsilon}$, that are increasing in consumption c and decreasing in before-tax income z subject to a budget constraint $c = z - T(z)$. For simplicity of exposition, I assume that the heterogeneity in incomes z stems only from the heterogeneity in abilities imbedded in utility functions $u(c,z)$ and extend the analysis to a more general case at the end of this section. Let individuals' tax liability $T(z)$ depend on their gross income z:

$$T(z) = \begin{cases} t_1 z & \text{if } z \leq K \\ \Delta T + t_1 K + t_2(z-K) & \text{if } z > K, \end{cases} \tag{2}$$

where t_1 and t_2 are marginal tax rates below and above some fixed threshold K and ΔT is a lump-sum tax individuals must pay whenever their earnings exceed K. The tax schedule thus presents a combined kink-notch at K, where $t_2 - t_1$ determines the size of the kink, and ΔT the size of the notch.

Figure A.6 illustrates the differential effects of kinks and notches on labor supply. Panel A shows the budget constraint (2), drawn in bold. The increase in the tax rate from t_1 to t_2 rotates the budget constraint at the threshold, resulting in a dashed line. Individuals who wish to earn between K and z_{kink} under the tax rate t_1 would instead bunch and earn income K when the tax rate increases to t_2. Thus, the kink generates some bunching as shown in Panel B and leads to a parallel leftward shift of the distribution of earnings. At the same time, the discrete increase in the tax liability generated by the pure notch ΔT shifts the budget constraint downward from the dashed line to a bold line, as shown in Panel A of Figure A.6. This notch creates a region of strictly dominated incomes, so that no individual would choose to earn between K and z_{notch}. The notch thus leads to further bunching at the threshold K and generates a hole in the final distribution of incomes, as shown in Panel B with a bold curve.

Figure A.6: Budget Constraint in Presence of Kink and Notch



Notes: Panel A shows the budget constraint of an individual whose marginal tax rate increases from t_1 to t_2 and who must pay a lump-sum tax ΔT at the threshold K. Panel B shows the corresponding distribution of earnings in the presence of such a tax schedule.

Individuals who wish to earn between K and z_{kink} under tax rate t_1 would instead bunch and earn income K when the tax rate increases to t_2. The cutoff z_{kink} is chosen as the highest income an individual could have earned under the budget constraint with slope $1-t_1$ and have his indifference curve tangent to the budget constraint with slope $1-t_2$ at the threshold K. The indifference curves of such an individual are shown as dashed green curves. Thus, the kink will generate some bunching as shown in Panel B and lead to a parallel leftward shift of the distribution of earnings. The notch will further create a region of strictly dominated incomes, so that no individual would choose to earn between K and z_{notch}. The cutoff z_{notch} is chosen such that an individual is indifferent between working more and earning z_{notch} and working less and earning K. The indifference curves of this person are shown as solid green curves. The notch will thus lead to further bunching at the threshold K and generate a hole in the final distribution of incomes, as shown in Panel B with a bold blue curve. The size of the hole to the right of the threshold will not be equal to the entire amount of bunching, but will only account for the bunching generated by the notch. Panels A and B of Figure A.6 show that the missing mass does not equal to the entire bunching but only to the portion attributed to the notch. Therefore, to construct a credible counterfactual distribution, one must determine what proportion of bunching is to be attributed to the kink rather than to the notch.

Kleven and Waseem (2013) show that the total bunching is given by

$$B_{total} \approx \Delta z_{total} \cdot h(K), \tag{3}$$

where $h(K)$ denotes the counterfactual density at the threshold K and Δz_{total} solves

$$\left(\frac{1}{1+\Delta z_{total}/K}\right)\left(\frac{1-t_2}{1-t_1}+\frac{\Delta T/K}{1-t_1}\right)-\frac{1}{1+1/\varepsilon}\left(\frac{1}{1+\Delta z_{total}/K}\right)^{1+1/\varepsilon} - \frac{1}{1+\varepsilon}\left(1-\frac{t_2-t_1}{1-t_1}\right)^{1+\varepsilon}=0. \tag{4}$$

Setting $\Delta T = 0$, one can approximate the amount of bunching due to the kink as in Saez (2010):

$$B_{kink} \approx \Delta z_{kink} \cdot h(K) = \left[\left(\frac{1-t_1}{1-t_2}\right)^{\varepsilon} - 1\right] \cdot K \cdot h(K). \tag{5}$$

Equation (3) thus relates the amount of total bunching at the threshold, B_{total}, to the elasticity of earnings with respect to net-of-tax rate, ε, while equations (3) and (5) together specify the proportions of total bunching attributable to the kink and the notch.

To estimate elasticity ε, I start with a guess of elasticity, e^0, and calculate predicted proportion of bunching due to the notch, $\pi^0_{notch} \equiv 1 - B^0_{kink}/B^0_{total}$ using equations (3) and (5). Next, I identify a counterfactual distribution by estimating the following regression:

$$C_j = \sum_{i=0}^{q} \beta_i \cdot (Z_j)^i + \sum_{i=z_l}^{z_u} \gamma_i \cdot \mathbf{1}[Z_j = i] + \varepsilon^0_j, \tag{6}$$

where C_j represents the number of individuals in income bin j, Z_j is the average income level in bin j, q is the order of the polynomial which is fitted to the counts, and z_l and z_u determine the size of the excluded region around the mini-job threshold, such that $z_l < K \leq z_u$.[19] The counterfactual distribution is defined by the predicted values from (6) omitting the dummies: $\hat{C}^0 = \sum_{i=0}^{q} \hat{\beta}^0_i \cdot (Z_j)^i$. Excess mass $\hat{B}^0$ and missing mass $\hat{M}^0$ are calculated as the difference between observed empirical density counts C_j and estimated counterfactual counts $\hat{C}^0_j$ in the earnings intervals $(z_l, K]$ and $(K, z_u]$ respectively: $\hat{B}^0 = \sum_{j=z_l}^{K}(C_j - \hat{C}^0_j) =$

[19] Here I assume that bunching will fall into the interval $[z_l, K]$ because individuals are unable to precisely locate at the threshold. As having income just above the threshold would still subject a worker to a lump-sum tax notch, the excess mass will be located strictly to the left of the threshold. The interval $(K, z_u]$ determines the interval of earnings where the observed distribution will lie below the counterfactual distribution.

$\sum_{j=z_l}^{K} \hat{\gamma}_j^0$ and $\hat{M}^0 = \sum_{j=K}^{z_u}(\hat{C}_j^0 - C_j) = -\sum_{j=K}^{z_u} \hat{\gamma}_j^0$. The lower bound of the excluded region z_l is estimated visually.[20] To estimate z_u, I make use of the fact that the amount of bunching due to the notch should be equal to the missing mass to the right of the threshold. I start by setting $z_u = K+1$ and keep increasing z_u by one bin until the estimated excess mass due to the notch equals the estimated missing mass, i.e. until $\pi_{notch}^0 \cdot \hat{B}^0 = \hat{M}^0$.

The resulting counterfactual, $\hat{C}_j^0$, does not account for the fact that the excess mass due to the kink comes from individuals moving from the points of distribution to the right of the threshold, and therefore $\hat{B}^0$ resulting from (6) may over- or underestimate the true excess mass. To correct for this, I adjust the estimated counterfactual distribution rightward until the area under the counterfactual equals the area under the empirical distribution.[21] The final estimate of bunching for the elasticity guess e^0 is then calculated as $\hat{B}^0 = \sum_{j=z_l}^{K}(C_j - \hat{C}_j) = \sum_{j=z_l}^{K} \hat{\gamma}_j$ where $\hat{C}_j = \sum_{i=0}^{q} \hat{\beta}_i (Z_j)^i$ are the adjusted fitted values from regression (6). In line with the previous research, see Chetty et al. (2011) and Kleven and Waseem (2013), I define a measure of total excess bunching $\hat{b}$:

$$\hat{b}^0 \equiv \frac{\hat{B}^0}{\hat{h}(K)} = \frac{\hat{B}^0}{\sum_{j=z_l}^{K} \hat{C}_j/(K - z_l + 1)}. \tag{7}$$

The elasticity of earnings with respect to the net-of-tax rate can then be calculated by substituting $\Delta z_{total} = \frac{\hat{B}^0}{\hat{h}(K)}$ into equation (4). The described calculations provide an elasticity estimate $\hat{e}^0$ based on the original guess e^0. Provided the estimated elasticity does not match the guess, i.e. $\hat{e}^0 \neq e^0$, I update the guess to $e^1 = \hat{e}^0$ and repeat the calculations for the new guess. I proceed with these iterations until a fixed point is achieved, such that $\hat{e}^k = e^k$ for some k.

Standard errors are calculated using a parametric bootstrap procedure where a large number of estimated vector of errors ε_j are drawn from (6) with replacement. The new errors are used to generate a large number of earnings distributions and, employing the technique above, corresponding estimates of $\hat{e}$. Standard errors are defined as the standard deviation of the distributions of elasticities $\hat{e}$. The bootstrap procedure takes into account both iterative processes: it incorporates both a search for an optimal missing mass and a search for a fixed point elasticity.

Elasticity formulas derived in (3) and (5) assume that elasticities are constant

[20] This is a standard approach in bunching methodology. While such selection might sound ambiguous, in practice it is not. Bunching around the threshold is very sharp, and within well-defined bounds. For discussion see Kleven (2016).

[21] Recall Figure A.6: the original density shifts leftward, reflecting weaker incentives to supply labor. This adjustment effectively corrects for the shift of the counterfactual due to the kink.

across individuals. Suppose ability and elasticities are jointly distributed according to some distribution $\psi(z, e)$. Then $h(K) = \int_e \psi(K, e)de$. From (3) follows that bunching due to a notch ΔT is equal to $B_{notch} = \int_e \Delta z_{total}(e)\psi(K, e)de = h(K)\mathbb{E}[\Delta z_{total}]$. Therefore, if there is heterogeneity in the population, bunching measures average earnings response, which is then converted into a measure of elasticity. It is not possible to precisely predict the bias that this imposes on elasticity estimates, given the nonlinearity of (4). However, one can use the reduced form formula of Kleven and Waseem (2013) to gage the direction of the bias: $B_{notch} = \int_e \sqrt{\frac{eK\Delta T}{1-t_1}}\psi(K, e)de = \sqrt{\frac{K\Delta T}{1-t_1}}\int_e \sqrt{e}\psi(K, e)de \leq \sqrt{\frac{e_K K\Delta T}{1-t_1}}$, where the last step follows from Jensen's inequality. Therefore, if there is heterogeneity in the population, the estimated elasticities will represent the lower bound on the magnitude of true behavioral response. Derivations and implications are similar if there is variation in the magnitude of the notch ΔT.

A.2 Income Tax Notch and Marginal Tax Rate Calculations

Let τ_{Mini} denote the prevailing mini-job social security rate that employers must pay on mini-job earnings, τ_{Full} determine the full social security tax rate that is split equally between employers and employees, τ_{Income} refer to the marginal income tax rate and ΔT_{Income} to the lump-sum change in income tax liability at the mini-job threshold K.[22] Note that legally the threshold K applies to *posted* earnings – wages paid to the workers by firms before income taxes and the employee portion of social security taxes are withheld. However, because the employer taxes differ below and above the threshold, I focus on changes in gross earnings. The budget constraint (2) in terms of *gross* earnings prior to April 1, 2003 can be summarized as

$$T(X_g) = \begin{cases} \frac{\tau_{Mini}}{1+\tau_{Mini}} \cdot X_g & \text{if } X_g \leq \bar{K} \\ \Delta T_{income} + \frac{(\tau_{Full}+\tau_{Income})\bar{K}}{1+0.5\tau_{Full}} - \frac{(\tau_{Mini}+\tau_{Income})\bar{K}}{1+\tau_{Mini}} & \\ \quad + \frac{\tau_{Mini}}{1+\tau_{Mini}} \cdot \bar{K} + \frac{\tau_{Full}+\tau_{Income}}{1+0.5\tau_{Full}}(X_g - \bar{K}) & \text{if } X_g > \bar{K}, \end{cases} \tag{8}$$

where $\bar{K} \equiv (1 + \tau_{Mini})K$. Equation (8) shows that mini-jobs are exempt from income and employee-paid social security taxes, while both types of taxes are due upon crossing the mini-job threshold.[23]

[22] I separate the income tax into lump-sum and marginal tax rate portions because Germany has continuously progressive marginal tax rates. Therefore, income tax rate τ_{Income} is not fixed. Thus, ΔT_{Income} gives the true value of income tax due when the *posted* income equals the mini-job threshold K, while τ_{Income} approximates the marginal tax rate at the threshold.

[23] Since jobs with monthly *posted* earnings below the mini-job threshold are exempt from income taxes and the employee portion of social security contributions, *gross* wages X_g below

After the 2003 reform, tax schedule (2) becomes

$$T(X_g) = \begin{cases} \frac{\tau_{Mini}}{1+\tau_{Mini}} \cdot X_g & \text{if } X_g \leq \bar{K} \\ \Delta T_{Income} + \left(\frac{1}{1+0.5\tau_{Full}} - \frac{1}{1+\tau_{Mini}}\right)(2\tau_{Full} - \tau_{Mini} + \tau_{Income})\bar{K} & \\ \quad + \frac{\tau_{Mini}}{1+\tau_{Mini}}\bar{K} + \frac{2\tau_{Full}-\tau_{Mini}+\tau_{Income}}{1+0.5\tau_{Full}}(X_g - \bar{K}) & \text{if } X_g > \bar{K}, \end{cases} \tag{9}$$

where $\bar{K} \equiv K(1 + \tau_{Mini})$. Equation (9) shows the decrease in the size of the notch that occurs at the mini-job threshold because the social security liability has been reduced.[24]

Equations (8) and (9) thus specify how marginal and average tax rates change at the mini-job threshold. To calculate the average income tax notches and the marginal tax rates presented in Table 1, I use a 95% extract from the longitudinal version of the Socio-Economic Panel (SOEP), version 30.[25] I restrict my sample to individuals who reported posted wage earnings between [€300,€325] in 1996–2003 or [€375,€400] in 2004–2013. I restrict my sample to workers in mini-jobs earning in a narrow €25 bracket below or at the threshold for two reasons. First, we are interested in estimating the tax notch and marginal tax rate at the threshold, so the narrowest window should offer the most accurate estimates of these tax incentives. Second, despite the self-reported nature of the data, most individuals report earning the threshold amount, closely resembling distributions observed in the SIAB data. Third, increasing the size of the bracket to €50 or €75 decreases the size of the estimated notch. Therefore, elasticity calculations present a lower bound on labor earnings elasticities with respect to the net of social security and income tax rates. To calculate the income tax notch, I first calculate the amount of income tax the household must pay if the individuals remain in mini-jobs, i.e. $T(12 \cdot Y_i^{spouse})$. Second, I calculate the amount of income tax due should the individual get a regular job that pays a salary equal to the mini-job threshold, i.e. $T(12 \cdot (Y_i^{spouse} + K))$ and the corresponding marginal tax rate associated with income $12 \cdot (Y_i^{spouse} + K)$. The income tax notch is then calculated as the

the mini-job threshold are subject to a total tax $T(X_g) = \tau_{Mini} \cdot X_p = \frac{\tau_{Mini}}{1+\tau_{Mini}} \cdot X_g$. Prior to April 1, 2003, posted wages X_p above the mini-job threshold were subject to a total tax $T(X_g) = \Delta T_{income} + \tau_{Full} X_p + \tau_{Income} \cdot (X_p - K) = \Delta T_{income} + \tau_{Full} \frac{X_g}{1+0.5\tau_{Full}} + \tau_{Income}\left(\frac{X_g}{1+0.5\tau_{Full}} - K\right)$, where ΔT_{Income} is the lump-sum amount of income tax a person must pay when earning precisely K, and τ_{Income} is the MTR at K.

[24] Starting April 1, 2003, employees pay reduced social security rates when their earnings exceed the mini-job threshold, but remain under €800. The total tax liability for posted wages X_p is $T(X_g) = [K\frac{\tau_{Mini}}{\tau_{Full}} + (2 - \frac{\tau_{Mini}}{\tau_{Full}})(X_p - K)] \cdot \tau_{Full} + \tau_{Income} X_p = \frac{2\tau_{Full}-\tau_{Mini}+\tau_{Income}}{1+0.5\tau_{Full}} X_g - 2K(\tau_{Full} - \tau_{Mini}) + \Delta T_{Income} - \tau_{Income} K$.

[25] In accordance with German law, only a 95% random sample can be provided to researches from outside the European Union.

difference between the two tax amounts, $T(12 \cdot (Y_i^{spouse} + K)) - T(12 \cdot Y_i^{spouse})$.

Ideally, one would want to observe the spousal income of all mini-jobbers for every year, and calculate tax notches and marginal tax rates accordingly. Unfortunately, such administrative data is not available. The SOEP data contains spousal earnings, but sample sizes are small, with only 170-350 observations per year. To improve the quality and consistency of estimates across years, I consider three approaches to calculating income tax notches and MTRs. First, I calculate the true average in year j by restricting the sample to mini-job workers in year j only. Next, I expand the sample to also include mini-job workers in recent years. Under the second approach, I calculate income tax notch based on spousal incomes of individuals who held mini-jobs in 1999-2002 for years 1999 through 2002, 2003-2005 for years 2003 through 2005 and 2006-2010 for years 2006 through 2010 (preferred specification). The third approach mimics the second approach but further expands the sample by including mini-job workers from 1999 through 2010. All three approaches use actual tax schedules in the target year to calculate income tax rates.

I further consider four definitions of spousal income. The first, and simplest, only includes spouse's labor earnings, including those from self-employment. The second definition includes social security pensions in addition to labor earnings: old-age, disability, and widowhood. Note that prior to 2005, statutory pensions were not subject to income tax. Starting in 2005, 50% of the pension is subject to income tax, and this percentage share increases by 2 percentage points every year. While the majority of pensioners in Germany rely on statutory pension only, some individuals also receive income from private pensions. Thus, the third definition of income also includes private pensions: supplementary civil servant pension income, company pensions, private pensions and pension income from "other" sources as reported in SOEP. Taxation of private pensions varies, but for simplicity I assume that the entire amount of pension is subject to income tax. I also include household asset income from interest, dividends, or rent. Again, taxation of financial income depends on the income source, but for simplicity the entire amount is assumed to be subject to income tax. Whenever any of the additional income information is missing, it is set to zero; however, observations with missing spousal labor income have been dropped. My preferred definition of income is the second specification that includes both labor and social security income. I choose not to include financial earnings and private pensions since these are not accurately reported in the survey data, so are likely to introduce more bias. Following Doerrenberg et al. (2017), I assume that individuals can claim 20% of their earnings as deductions. As a robustness check, I also consider a more conservative assumption that individuals only take advantage of the wage-related expenses deduction ("Werbungskosten") and other deductible expenses deduction ("Sonderausgabenpauschbetrag") (see Table A.10). The estimates of

tax notches and marginal tax rate changes used to calculate elasticities in Table 2 are shown in Table A.5.

Table A.5: Magnitude of Tax Changes Used to Calculate Elasticities in Table 2

		Women			Men		
		t_1	t_2	ΔT	t_1	t_2	ΔT
	1999	0	0.37	147.39	0	0.26	98.01
	2000	0	0.37	143.36	0	0.26	96.01
	2001	0	0.35	138.31	0	0.25	91.98
	2002	0	0.35	138.31	0	0.25	91.98
	2003	0	0.47	97.71	0	0.37	41.12
	2004	0	0.46	92.58	0	0.36	36.99
	2005	0	0.45	90.45	0	0.36	35.99
	2006	0	0.37	113.55	0	0.26	54.94
	2007	0	0.37	113.55	0	0.26	54.94
	2008	0	0.37	113.55	0	0.26	54.94
	2009	0	0.37	112.55	0	0.25	53.58
	2010	0	0.37	111.55	0	0.25	54.58
'99-'02	under 31	0	0.27	103.04	0	0.18	70.74
	31-44 y.o.	0	0.37	149.39	0	0.25	97.98
	45-54 y.o.	0	0.36	138.34	0	0.26	95.01
	over 54	0	0.27	107.04	0	0.22	80.87
'03-'05	under 31	0	0.38	43.26	0	0.30	10.93
	31-44 y.o.	0	0.48	103.84	0	0.32	21.33
	45-54 y.o.	0	0.46	92.58	0	0.32	22.33
	over 54	0	0.35	41.86	0	0.32	24.33
'06-'10	under 31	0	0.25	52.58	0	0.10	52.54
	31-44 y.o.	0	0.39	122.26	0	0.28	64.65
	45-54 y.o.	0	0.36	113.19	0	0.25	51.58
	over 54	0	0.27	67.29	0	0.23	47.52
'99-'02	Singles	0	0.17	66.71			
'03-'05		0	0.29	7.8			
'06-'10		0	0.17	17.03			

Notes: This table shows the values of t_1, t_2 and ΔT from (2) used to calculate elasticities in Table 2. For further details see Appendix A.2. *Data*: Socio-Economic Panel (SOEP), version 30.

Tables A.6 and A.7 compare notches and tax rates by definition of income, relying on the 2nd sample approach (using 1999-2002, 2003-2005, 2006-2010 samples). As expected, the notch and the marginal tax rate are smallest when only labor earnings are included. The magnitude of the notch increases as pension and asset incomes are included. Nevertheless, the differences are very small and have negligible effect on the magnitude of elasticities. Note that the income definition matters more for women than men, since spouses of women are more likely to have various types of income.

Table A.8 compares income tax notches and marginal tax rates by sample selections using the preferred definition of income (labor plus social security earnings minus 20% deductions). The first column shows calculations of the "true income" notches and tax rates. The results are quite very volatile across years. The second column is based on spousal earnings of mini-job workers in the corresponding groups of years 1999-2002, 2003-2005 and 2006-2010. Finally, the third column includes all mini-job workers from the years 1999-2010. Table A.8 shows that the estimated tax rates and notches are very similar across all three specifications for both men and women, despite chosen samples. The estimates for men rely on a very small sample size. Perhaps for this reason, the estimates in the first two samples appear to be very small in 2003-2005. For robustness, I use the "All Years" estimates for these years in my elasticity calculations (see Table 1).

Table A.6: Income Tax Notches and MTRs. Women: Comparison of Income Definitions

		Deductions: 20% of Gross Income						**Deductions: Basic**	
		Labor Only		**Labor + SS**		**Labor + SS Pensions + Assets**		**Labor + SS**	
Notch	MTR	Notch	MTR	Notch	MTR	Notch	MTR	Notch	MTR
by year:	1999	80	24	80	25	81	25	83	25
	2000	76	23	76	24	77	24	81	25
	2001	71	21	71	22	72	22	75	23
	2002	71	21	71	22	72	22	75	23
	2003	87	21	87	22	90	23	92	23
	2004	82	20	82	21	84	22	88	22
	2005	80	20	80	20	83	21	86	22
	2006	88	22	88	24	90	24	94	25
	2007	88	22	88	24	90	24	94	25
	2008	88	22	88	24	90	24	94	25
	2009	87	22	87	24	88	24	94	25
	2010	86	21	86	24	88	24	92	25
1998-2002:	under 31	35	10	35	12	34	11	35	12
	31–44 years old	78	24	78	24	79	24	78	24
	45–54 years old	67	20	67	22	68	22	67	22
	over 54	37	11	37	12	38	12	37	12
2003-2011:	under 31	32	8	32	10	30	9	30	9
	31–44 years old	87	21	87	22	90	22	90	22
	45–54 years old	75	19	75	20	78	21	78	21
	over 54	30	8	31	8	32	8	32	8

Notes: This table shows the average income tax notch and the marginal tax rates experienced by women at the mini-job threshold. *Notch* is the average lump-sum payment of income tax an individual must make upon exceeding the mini-job threshold. *MTR* is the average marginal tax rate at the mini-job threshold. For single individuals, spousal income is set to zero. For further details see Appendix A.2. *Data*: Socio-Economic Panel (SOEP), version 30.

Table A.7: Income Tax Notches and MTRs. Men: Comparison of Income Definitions

		Deductions: 20% of Gross Income						**Deductions: Basic**	
		Labor Only		**Labor + SS**		**Labor + SS Pensions + Assets**		**Labor + SS**	
Notch	MTR	Notch	MTR	Notch	MTR	Notch	MTR	Notch	MTR
by year:	1999	31	10	31	11	31	11	34	11
	2000	29	10	29	11	29	10	32	11
	2001	25	9	25	10	24	9	28	10
	2002	25	9	25	10	24	9	28	10
	2003	13	4	13	4	12	4	15	5
	2004	11	3	11	3	9	3	13	4
	2005	10	3	10	3	9	3	12	3
	2006	34	10	34	11	33	11	39	12
	2007	34	10	34	11	33	11	39	12
	2008	34	10	34	11	33	11	39	12
	2009	33	9	33	10	32	10	38	12
	2010	34	9	34	10	33	10	36	12
1998-2002:	under 31	4	1	4	1	5	1	4	1
	31–44 years old	27	10	27	10	27	10	27	10
	45–54 years old	26	9	26	10	24	10	26	10
	over 54	13	5	13	5	16	6	13	5
2003-2011:	under 31	2	1	2	1	2	1	2	1
	31–44 years old	11	3	11	3	9	3	11	3
	45–54 years old	13	4	13	4	12	3	13	4
	over 54	15	4	15	4	14	4	15	4

Notes: This table shows the average income tax notch and the marginal tax rates experienced by men at the mini-job threshold. *Notch* is the average lump-sum payment of income tax an individual must make upon exceeding the mini-job threshold. *MTR* is the average marginal tax rate at the mini-job threshold. For single individuals, spousal income is set to zero. For further details see Appendix A.2. *Data*: Socio-Economic Panel (SOEP), version 30.

Table A.8: Income Tax Notches and MTRs: Comparison of Sample Selections

	Women:											
	True Average				**1999-02, 2003-05, 2006-10**				**All Years**			
	Notch	MTR	N	Income	Notch	MTR	N	Income	Notch	MTR	N	Income
1999	83	27	119	2260	80	25	892	2274	81	26	2322	2494
2000	74	23	254	2161	76	24	892	2274	78	25	2322	2494
2001	72	22	259	2294	71	22	892	2274	73	24	2322	2494
2002	70	21	260	2355	71	22	892	2274	73	23	2322	2494
2003	82	21	207	2334	87	22	562	2497	90	24	2322	2494
2004	83	21	174	2511	82	21	562	2497	85	23	2322	2494
2005	85	22	181	2708	80	20	562	2497	83	22	2322	2494
2006	86	22	193	2660	88	24	868	2722	83	22	2322	2494
2007	86	25	188	2660	88	24	868	2722	83	22	2322	2494
2008	86	24	177	2632	88	24	868	2722	83	22	2322	2494
2009	92	25	167	2904	87	24	868	2722	82	22	2322	2494
2010	87	23	143	2761	86	24	868	2722	80	22	2322	2494
	Men:											
	True Average				**1999-02, 2003-05, 2006-10**				**All Years**			
	Notch	MTR	N	Income	Notch	MTR	N	Income	Notch	MTR	N	Income
1999	12	4	10	276	31	11	49	778	32	12	133	836
2000	20	8	14	567	29	11	49	778	30	11	133	836
2001	50	17	14	1532	25	10	49	778	25	10	133	836
2002	24	11	11	713	25	10	49	778	25	10	133	836
2003	32	9	8	773	13	4	25	326	32	10	133	836
2004	10	4	7	309	11	3	25	326	28	9	133	836
2005	0	0	10	71	10	3	25	326	27	9	133	836
2006	35	11	13	1093	34	11	59	1036	27	9	133	836
2007	47	19	11	1418	34	11	59	1036	27	9	133	836
2008	39	10	12	1108	34	11	59	1036	27	9	133	836
2009	27	8	12	874	33	10	59	1036	26	9	133	836
2010	27	7	11	914	34	10	59	1036	26	8	133	836

Notes: This table shows the average income tax notch and the marginal tax rates experienced by women, ages 31 through 54 inclusive, at the mini-job threshold. *Notch* is the average lump-sum payment of income tax an individual must make upon exceeding the mini-job threshold. *MTR* is the average marginal tax rate at the mini-job threshold. *N* is the number of observations used to calculate the average marginal tax rate, income notch and average spousal income. *Income* is the average income of a spouse of a mini-job worker earning [€K-25,€K] per month, where *K* denotes the mini-job threshold. For single individuals, spousal income is set to zero. Spousal income includes labor earnings, as well as social security payments. For further details see Appendix A.2. *Data*: Socio-Economic Panel (SOEP), version 30.

A.3 Counterfactual Fits and Robustness Checks

Summary statistics for the SIAB data are available in Table A.9.

The elasticity estimation procedure relies on several parameters: (a) the bin width used to generate the observed distribution, (b) the degree of the polynomial that is fit to the observed distribution, (c) the width of the estimation window, and (d) the width of the bunching window. Of these parameters, (a) – (c) are chosen by the researcher, while (d) is estimated visually. For empirical distributions in €25 bins, $z_l = 4$ in 1999–2002, $z_l = 7$ in 2003–2006, $z_l = 6$ in 2007–2010 for women, and $z_l = 3$ in 1999–2002, $z_l = 5$ in 2003–2005, $z_l = 4$ in 2006–2010 for men. For empirical distributions in €12.5 bins, $z_l = 8$ in 1999–2002, $z_l = 14$ in 2003–2005, $z_l = 14$ in 2006–2010 for women, and $z_l = 6$ in 1999–2002, $z_l = 10$ in 2003–2005, and $z_l = 8$ in 2006–2010 for men. Parameter (c) – the width of the estimation window – identifies which part of the observed distribution is used to estimate the counterfactual distribution. A window that is too short will make estimation of the counterfactual imprecise, while too large of a window can put too much emphasis on the global, rather than local fit of the counterfactual. In this study, the estimation window is bounded on the left by zero, since no individuals report earning negative wages. I choose to limit the estimation window to the right by €1750 for men and women, but the results are not sensitive to most choices for the estimation window.

In Table A.10 I show how elasticity estimates vary with (a) the bin width used to generate the observed distribution, and (b) the degree of the polynomial fitted. For convenience, specification (1) repeats the results from Table 2. Specifications (1), (2) and (4) show the amount of bunching b (recall definition (7)) and elasticity e estimated using an empirical distribution of €25 bins, while specification (3) uses distribution of €12.5 bins.[26] Specifications (1), (2) and (3) use a 7th degree polynomial to construct the counterfactual, while (4) uses a 6th degree polynomial. Finally, specifications (1), (3) and (4) use the preferred definition of income (labor plus social security minus 20% deductions), while specification (2) assumes that individuals can only claim basic deductions "Werbungskosten" and "Sonderausgabenpauschbetrag". Overall, Table A.10 confirms that the elasticity estimates are robust across specifications, though some variation is present.

Figures A.7 and A.8 show distributions of posted earnings for men and women across age groups. Figure A.9 shows the distributions of secondary earnings for individuals with new secondary jobs in 1999-2002, and who previously earned more than €400 per month. Figures A.10, A.11, and A.12 show the counterfactual fits for women, men, and singles. Table A.11 shows the amount of bunching

[26] Note that the amount of bunching b is inversely proportional to the bin size, so to compare bunching amounts, the result of specification (3) should be divided by 2 to be comparable to the amount of bunching from specifications (2)–(4).

and elasticities for men and women working at firms with various number of employees.

Table A.9: Summary Statistics

	All	**Women**			**Men**		
	All incomes z	All incomes z	z <€2000	z <€325/€400	All incomes z	z <€2000	z <€325/€400
Full Sample							
Age $\leq$ 30	1,397,909	703,259			694,650		
31 $\leq$ Age $\leq$ 44	2,635,514	1,256,118			1,379,396		
45 $\leq$ Age $\leq$ 54	1,695,988	855,330			840,658		
Age $\geq$55	975,620	479,388			496,232		
Core Sample:							
31 $\leq$ Age $\leq$ 54	4,331,502	2,111,448	1,309,534	412,783	2,220,054	447,157	67,336
1999	357,602	171,053	113,728	31,130	186,549	42,984	4,058
2000	372,665	179,529	118,179	34,137	193,136	42,736	4,418
2001	378,455	182,971	118,010	34,080	195,484	41,767	4,599
2002	372,357	181,487	114,520	33,020	190,870	38,603	4,703
2003	368,071	179,824	112,401	35,420	188,247	37,714	5,998
2004	363,682	178,051	111,204	37,247	185,631	37,396	6,833
2005	352,162	171,962	105,612	35,910	180,200	35,095	6,416
2006	350,434	171,380	104,833	35,939	179,054	34,464	6,234
2007	354,846	173,125	104,764	35,306	181,721	34,505	5,898
2008	357,306	174,747	103,911	34,439	182,559	34,084	5,863
2009	353,724	174,459	102,520	34,055	179,265	34,275	6,273
2010	350,198	172,860	99,852	32,100	177,338	33,534	6,043
Singles Sample:	129,607						

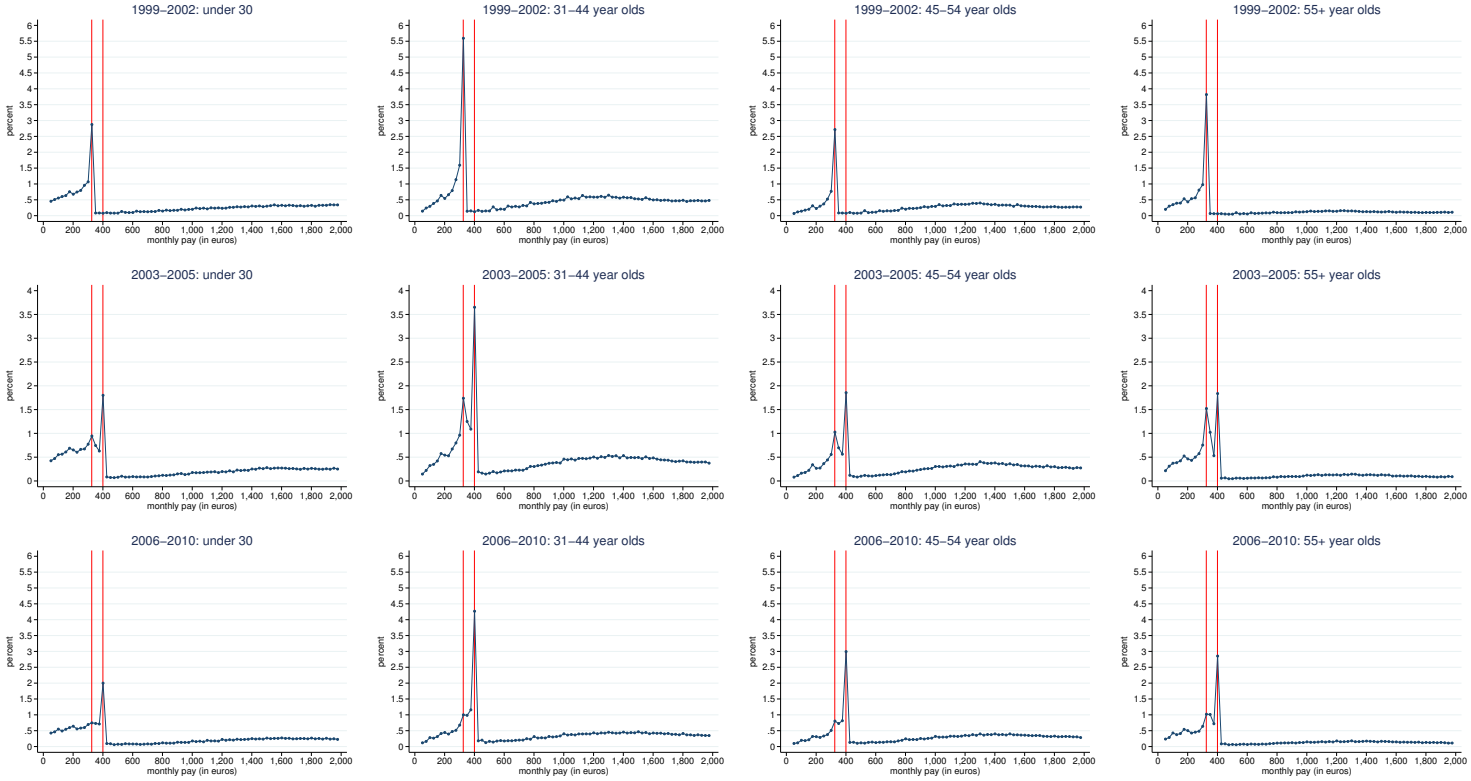
Notes: This table shows summary statistics for the SIAB data. *Data*: Sample of Integrated Labour Market Biographies (SIAB) 1975 - 2010, Nuremberg 2013.

Table A.10: Elasticity Estimates Robustness Check

Year	(1) Baseline				(2) Basic Deductions				(3) Bins €12.5				(4) Degree 6			
	b	s.e.(b)	e	s.e.(e)	b	s.e.(b)	e	s.e.(e)	b	s.e.(b)	e	s.e.(e)	b	s.e.(b)	e	s.e.(e)
Women:																
1999	14.35	1.10	0.08	0.02	14.35	1.06	0.07	0.02	23.69	1.10	0.02	0.02	12.66	0.92	0.04	0.02
2000	15.08	1.46	0.11	0.03	15.08	1.67	0.09	0.04	27.04	1.74	0.07	0.02	14.17	1.80	0.09	0.03
2001	16.48	1.92	0.16	0.05	16.48	1.81	0.15	0.04	27.64	1.52	0.10	0.02	14.25	0.84	0.11	0.02
2002	14.59	1.48	0.12	0.04	14.59	1.17	0.10	0.03	28.67	1.64	0.11	0.02	13.80	0.79	0.10	0.02
2003	12.67	1.03	0.08	0.02	12.67	1.06	0.07	0.02	23.90	1.36	0.07	0.01	12.89	0.84	0.09	0.02
2004	15.16	1.74	0.15	0.03	15.16	1.81	0.13	0.03	24.33	1.45	0.09	0.02	15.36	1.13	0.15	0.02
2005	14.28	1.51	0.14	0.02	14.28	1.25	0.12	0.02	23.68	1.11	0.09	0.01	15.69	0.87	0.17	0.02
2006	14.29	0.99	0.14	0.02	14.29	1.36	0.12	0.02	25.78	1.39	0.11	0.02	14.32	0.59	0.14	0.01
2007	14.24	1.14	0.14	0.03	14.24	1.05	0.12	0.02	30.88	1.53	0.16	0.02	14.50	1.66	0.14	0.02
2008	13.78	1.53	0.13	0.02	13.78	1.87	0.11	0.04	27.98	4.55	0.13	0.02	14.97	0.70	0.15	0.02
2009	16.18	2.55	0.18	0.03	16.18	2.49	0.16	0.03	30.01	2.04	0.16	0.02	15.75	2.91	0.17	0.05
2010	15.31	1.65	0.17	0.02	15.31	1.29	0.15	0.02	29.89	1.29	0.16	0.02	19.21	4.00	0.26	0.07
Men:																
1999	8.36	1.56	0.07	0.05	8.36	1.35	0.06	0.04	16.05	2.40	0.06	0.03	8.11	0.94	0.06	0.03
2000	8.81	1.57	0.09	0.05	8.81	2.75	0.08	0.09	16.14	2.15	0.07	0.04	7.29	1.17	0.04	0.03
2001	8.83	2.27	0.11	0.07	8.83	1.85	0.10	0.06	16.05	2.94	0.08	0.05	7.51	1.74	0.06	0.05
2002	8.58	1.61	0.10	0.06	8.58	1.40	0.09	0.05	18.35	2.30	0.12	0.04	7.30	1.16	0.05	0.04
2003	9.33	1.45	0.20	0.05	11.52	3.09	0.25	0.09	20.73	3.28	0.24	0.06	9.08	1.27	0.20	0.04
2004	8.88	1.80	0.21	0.07	11.37	2.38	0.28	0.08	30.02	5.07	0.44	0.09	7.59	1.43	0.16	0.05
2005	8.18	0.94	0.19	0.04	8.41	1.37	0.17	0.05	19.93	2.90	0.26	0.05	8.39	1.02	0.20	0.04
2006	7.89	1.00	0.16	0.04	8.06	1.05	0.14	0.04	14.95	1.71	0.14	0.03	9.15	0.97	0.21	0.04
2007	10.59	1.34	0.27	0.06	10.59	1.37	0.24	0.05	16.77	2.31	0.18	0.05	10.55	0.91	0.27	0.04
2008	10.73	2.34	0.27	0.10	10.73	2.31	0.25	0.09	24.30	3.02	0.33	0.06	14.45	2.06	0.43	0.09
2009	12.43	1.46	0.36	0.06	12.43	1.61	0.32	0.06	17.55	2.51	0.20	0.05	12.30	1.55	0.36	0.07
2010	11.99	1.81	0.34	0.08	11.99	1.77	0.31	0.07	21.32	2.88	0.28	0.06	10.61	2.36	0.28	0.10

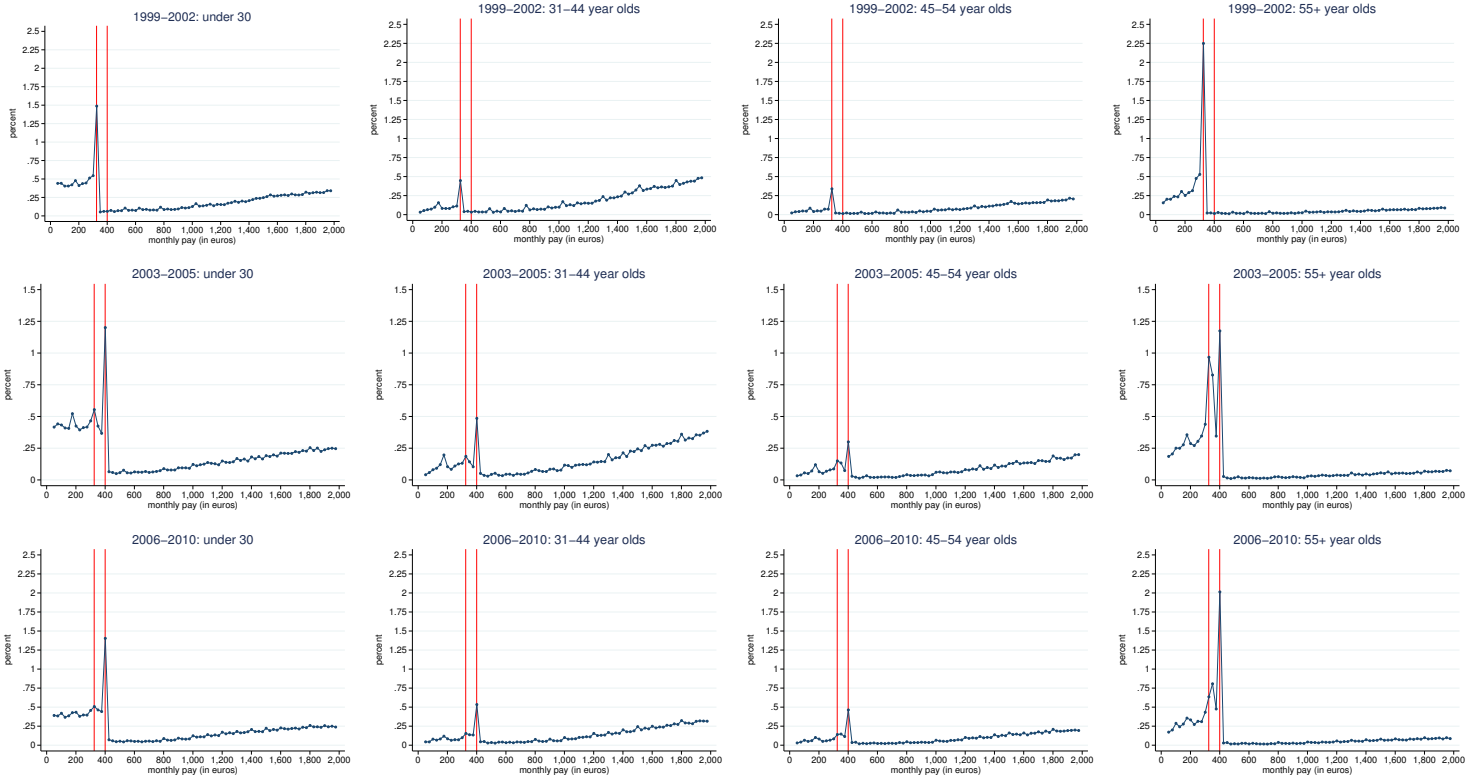
Notes: Excess bunching and elasticities are estimated using the procedure outlined in Section A.1. In specifications (1) and (2), I fit the 7th degree polynomial to an empirical distribution of the *gross* earnings by €25 bins. In specification (3), I fit a 7th degree polynomial to the empirical distribution of *gross* earnings by €12.5 bins. In specification (4), I fit a 6th degree polynomial to the distribution by €25 bins. Bootstrap standard errors are based on 100 iterations. *Data*: Sample of Integrated Labour Market Biographies (SIAB) 1975 - 2010, Nuremberg 2013.

Figure A.7: Earnings: Women by Age Group



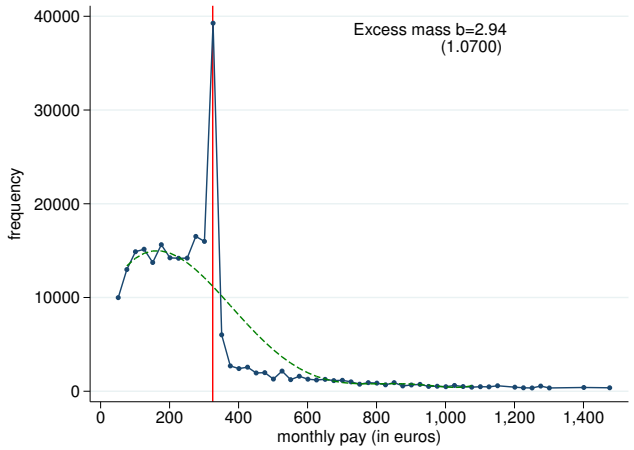
Notes: This figure shows the distribution of monthly wage earnings (posted) of women by age group in 1999-2002, 2003-2005 and 2006-2010. Each point shows the number of individuals in an €25 bin divided by the total number of females in that year group. The vertical red lines identify the mini-job thresholds: €325 prior to 2003 and €400 thereafter. *Data*: Sample of Integrated Labour Market Biographies (SIAB) 1975 - 2010, Nuremberg 2013.

Figure A.8: Earnings: Men by Age Group



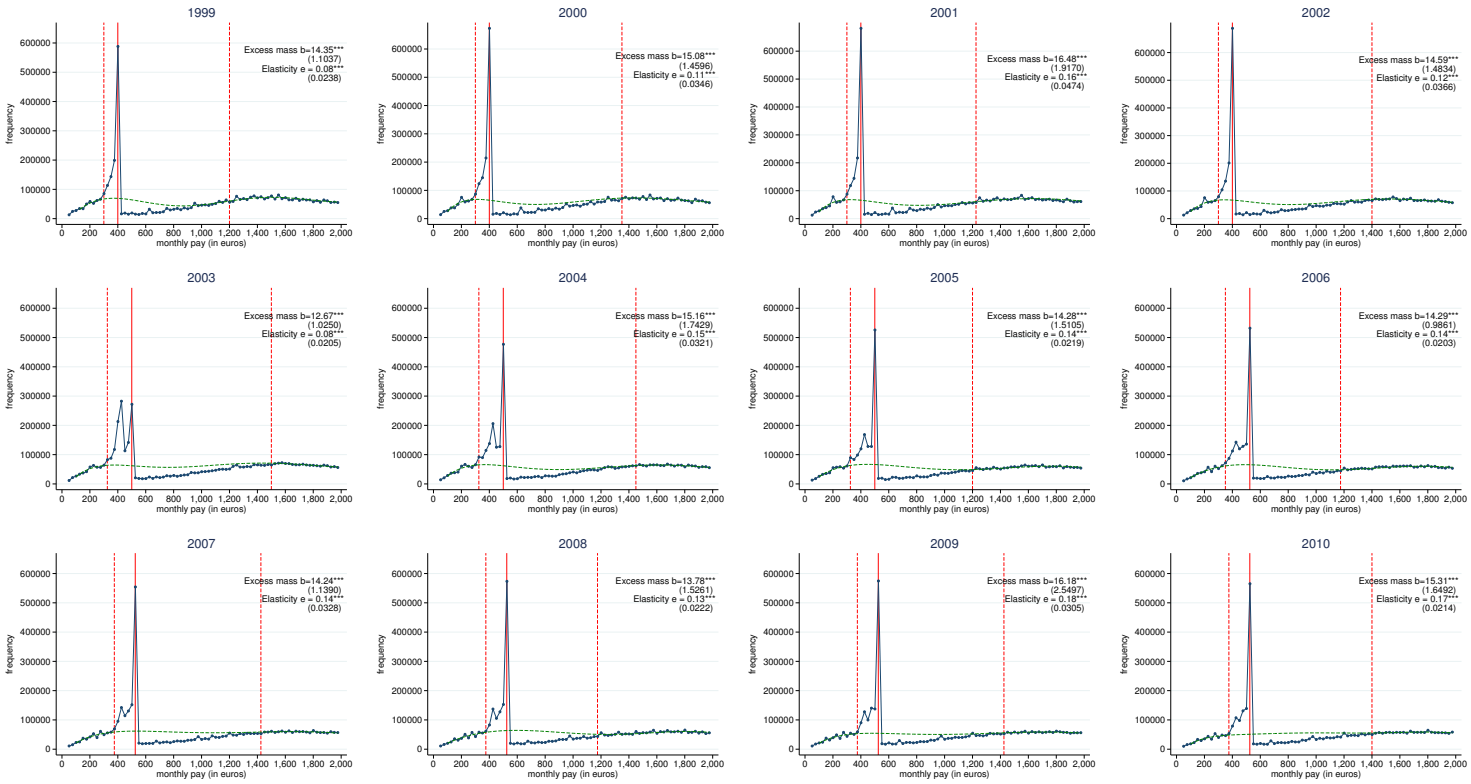
Notes: This figure shows the distribution of monthly wage earnings (posted) of men by age group in 1999-2002, 2003-2005 and 2006-2010. Each point shows the number of individuals in an €25 bin divided by the total number of males in that year group. The vertical red lines identify the mini-job thresholds: €325 prior to 2003 and €400 thereafter. *Data*: Sample of Integrated Labour Market Biographies (SIAB) 1975 - 2010, Nuremberg 2013.

Figure A.9: Distributions of Secondary Jobs: Select Sample



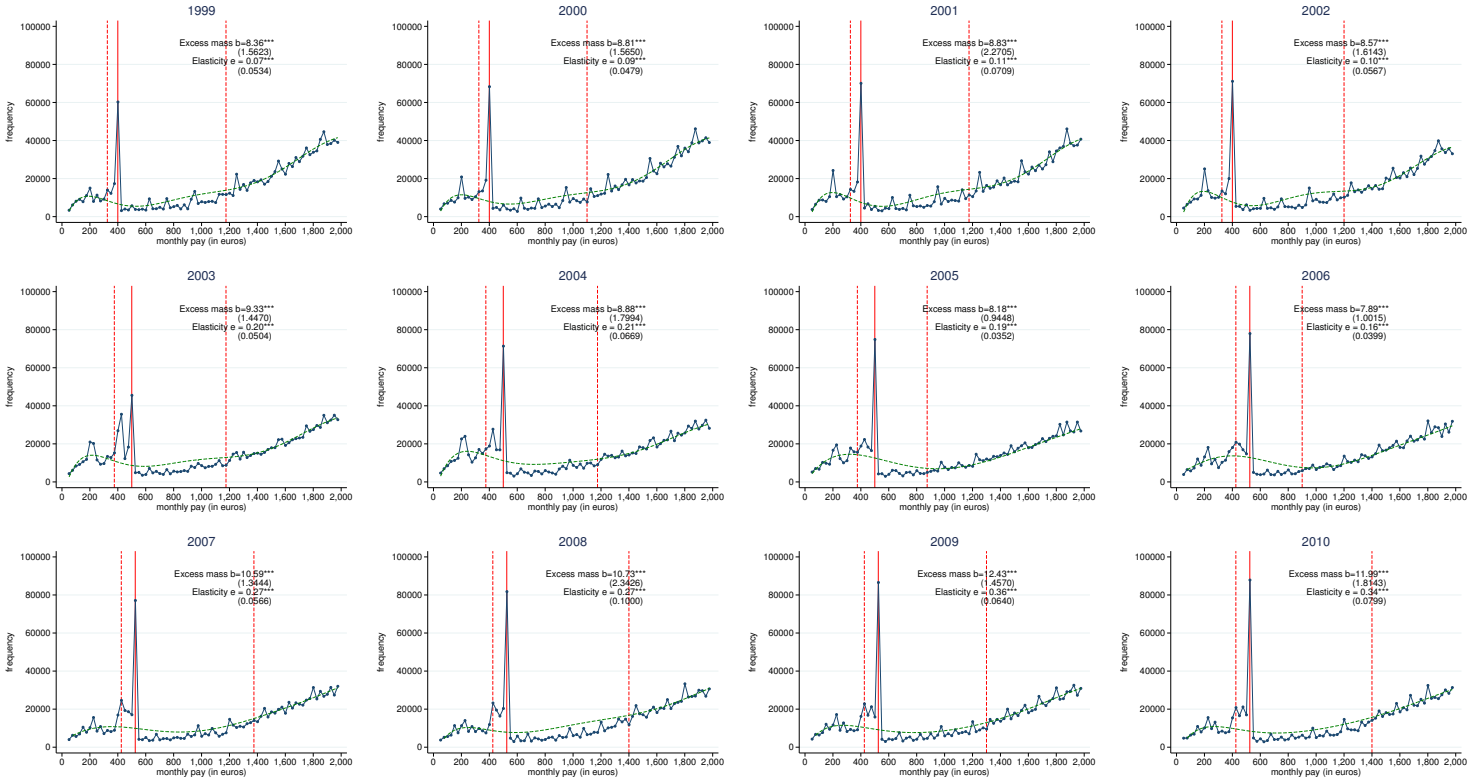
Notes: This figure shows the distribution of monthly wage earnings (posted) in secondary jobs in 1999-2002 for individuals who earned >€400 before obtaining a secondary job. The vertical red lines identify the €325 mini-job threshold. *Data*: Sample of Integrated Labour Market Biographies (SIAB) 1975 - 2010, Nuremberg 2013.

Figure A.10: Counterfactual Fits: Women



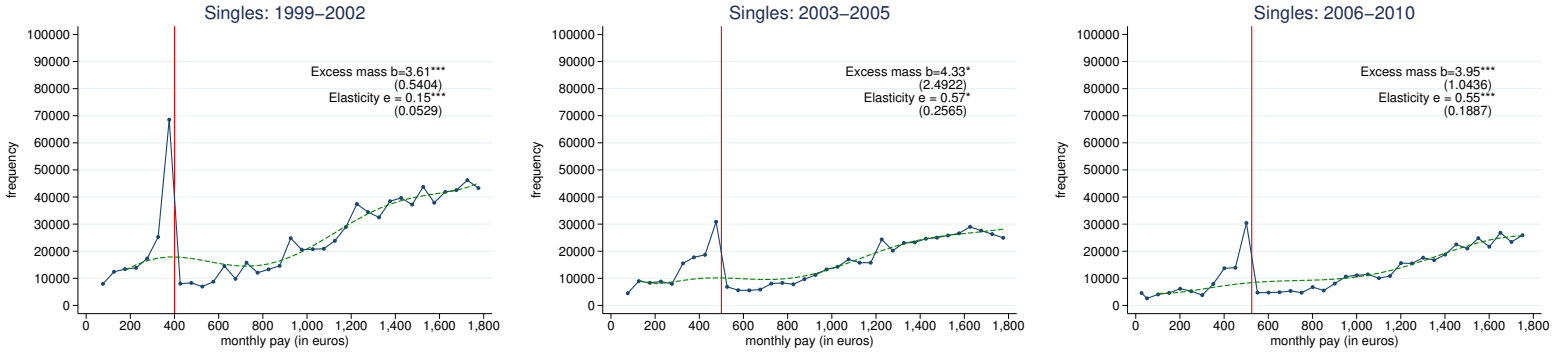
Notes: Excess bunching and elasticities are estimated using the procedure outlined in Section A.1. I fit the 7th degree polynomial to the empirical distribution of *gross* earnings by €25 bins. The lower exclusion region z_l is determined visually: for women $z_l = 4$ in 1999–2002, $z_l = 7$ in 2003–2006, $z_l = 6$ in 2007–2010. The estimation procedure starts with an initial guess of elasticity $e_0 = 0.01$ and iterates until a fixed point is reached. Bootstrap standard errors are based on 1000 iterations. The solid red line marks the mini-job threshold and the dashed red lines identify the exclusion region $[z_l, z_u]$. *Data*: Sample of Integrated Labour Market Biographies (SIAB) 1975 - 2010, Nuremberg 2013.

Figure A.11: Counterfactual Fits: Men



Notes: Excess bunching and elasticities are estimated using the procedure outlined in Section A.1. I fit the 7th degree polynomial to the empirical distribution of *gross* earnings by €25 bins. The lower exclusion region z_l is determined visually: for men, $z_l = 3$ in 1999–2002, $z_l = 5$ in 2003–2005, $z_l = 4$ in 2006–2010. The estimation procedure starts with an initial guess of elasticity $e_0 = 0.01$ and iterates until a fixed point is reached. Bootstrap standard errors are based on 1000 iterations. The solid red line marks the mini-job threshold and the dashed red lines identify the exclusion region $[z_l, z_u]$. *Data*: Sample of Integrated Labour Market Biographies (SIAB) 1975 - 2010, Nuremberg 2013.

Figure A.12: Earnings: Single Individuals



Notes: This figure shows the distribution of monthly wage earnings (posted) of single individuals in 1999-2002, 2003-2005 and 2006-2010. Each point shows the number of individuals in an €25 bin divided by the total number of individuals in that year group. The vertical red lines identify the mini-job thresholds: €325 prior to 2003 and €400 thereafter. *Data*: Sample of Integrated Labour Market Biographies (SIAB) 1975 - 2010, Nuremberg 2013.

Table A.11: Heterogeneity of Elasticities by Firm Size

		1999-2002					2003-2005					2006-2010				
		N	b	s.e.(b)	e	s.e.(e)	N	b	s.e.(b)	e	s.e.(e)	N	b	s.e.(b)	e	s.e.(e)
Women:	All	657,415	13.67	(0.84)	0.08	(0.02)	473,495	14.68	(1.02)	0.14	(0.02)	750,399	14.54	(1.11)	0.14	(0.02)
	$<$ 5 employees	76,282	15.28	(3.89)	0.12	(0.07)	56,191	20.46	(7.39)	0.25	(0.1)	89,064	19.6	(7.64)	0.26	(0.12)
	$\geq$ 5 employees	581,133	13.6	(0.59)	0.08	(0.01)	417,304	13.16	(0.32)	0.11	(0.01)	661,335	13.49	(0.26)	0.12	(0.01)
	$\geq$ 10 employees	503,501	12.91	(0.57)	0.06	(0.01)	360,056	12.39	(0.27)	0.09	(0.01)	570,860	12.84	(0.24)	0.11	(0.01)
	$\geq$ 20 employees	430,468	12.61	(0.5)	0.05	(0.01)	305,798	11.45	(0.27)	0.07	(0.01)	481,845	12.09	(0.22)	0.09	(0.01)
Men:	All	525,836	8.57	(1.66)	0.09	(0.05)	349,281	10.97	(2.05)	0.28	(0.07)	528,256	11.98	(1.46)	0.33	(0.06)
	$<$ 5 employees	38,469	7.77	(2.33)	0.06	(0.07)	27,936	10.37	(2.25)	0.26	(0.08)	43,133	14.9	(3.1)	0.46	(0.13)
	$\geq$ 5 employees	487,367	9.3	(1.33)	0.11	(0.05)	321,345	10.79	(2.1)	0.28	(0.08)	485,123	11.09	(1.26)	0.29	(0.05)
	$\geq$ 10 employees	444,688	9.15	(1.27)	0.11	(0.04)	291,332	8.94	(1.99)	0.21	(0.07)	437,802	10.14	(1.22)	0.25	(0.05)
	$\geq$ 20 employees	386,960	9.43	(1.14)	0.12	(0.03)	252,110	9.22	(1.55)	0.22	(0.06)	376,588	10.35	(1.16)	0.26	(0.05)

Notes: This table shows elasticities of earnings with respect to net-of-tax rate by firm size. The results show that responses are stronger at firms with fewer employees, but differences are not very large. *Data*: Sample of Integrated Labour Market Biographies (SIAB) 1975 - 2010, Nuremberg 2013.

B Literature Review

Adam et al. (2017): UK, based on IFS Working Paper W17/14. Taxable income elasticities are provided in Table 2. The 2010/2011 estimate of bunching at the £150,000 kink is based on a tax change from 0.4 to 0.5 and results in an elasticity of 0.01. The 2013/2014 estimate of bunching at the £150,000 kink is based on a tax change from 0.4 to 0.45 and results in an elasticity of 0.059. The 2010/2011 estimate of bunching at the £100,000 kink is based on a tax change from 0.4 to 0.6 and results in an elasticity of -0.004. The 2013/2014 estimate of bunching at the £100,000 kink is based on a tax change from 0.4 to 0.6 and results in an elasticity of 0.04. Table 3 shows elasticities based on notches at the Lower Earnings Limits: 0.052 in 1983-85 (notch of %), 0.281 in 1986-89 (notch of %), and 0.099 in 1990-98 (notch of 4%).

Le Barbanchon (2015): USA, based on the January 28, 2016 paper. Elasticity estimates from Appendix Table 8 use logs to calculate tax changes at the earnings threshold in the partial unemployment insurance scheme. Elasticity estimates of 0.13, 0.092 and 0.063 for Idaho, Louisiana and New Mexico, respectively. Tax rates increase from 0 to 0.538, 0.554 or 0.606 (kinks) are reported in Table 4.

Bastani and Selin (2014): Sweden, tax changes provided in Table 1, elasticity estimates shown in Figures 3 and 5, discussed in Section 5.1. Estimate from 1998 is based on a tax change from 0.364 to 0.597 (kink), resulting in a log change of 0.456 and an elasticity of 0.001. Estimates from 1999-2005 are based on tax changes ranging between 0.321 and 0.345 (kink), resulting in an average tax change of .34 and an elasticity of 0.001.

Chetty et al. (2011): Denmark, tax changes shown in Figure 9 of NBER WP 15617. The five points correspond to estimates from tax reforms and bunching at the middle bracket tax cutoff from 1994-1996 (log tax change of 9. 5%), the middle bracket tax cutoff from 1997-2001 (log tax change of 11. 6%), the top bracket tax cutoff in 1994, 1997, and 1998 (log tax change of 29. 7%), and the top tax cutoff in 1995-1996 and 1999-2001 (log tax change of 32.1%). The corresponding elasticities are .001, .006, .01, .009. Note that the authors find the highest elasticity for married women who are professionals – 0.06.

Dekker et al. (2016): Netherlands, based on Discussion Paper 05-2016. Marginal tax changes from 0.42 to 0.52 (kink) in 2003 to 2013 resulting in an elasticity of 0.023 discussed in Section 5.

Gelber et al. (2017): USA, based on the version from August 2014. Individuals receiving Social Security benefits are subject to Annual Earnings Tax (AET) when their earnings exceed the AET threshold. In 1982-1990, the benefit reduction rate (BRR) was 50%, later reduced to 33.33%. Elasticity estimates based on the Saez (2010) approach are shown in Figure 9 and range between 0.2 and 0.32 in 1982-1990. Higher elasticities are obtained once frictions are accounted for.

He et al. (2018): China, based on the January 10, 2018 draft. Marginal tax changes from 0.2 to 0.25 in 2009-2011 at 20000 RMB resulting in an elasticity of 0.1, from 0.2 to 0.25 in 2011-2013 at 9000 RMB resulting in an elasticity of 0.09, and from 0.25 to 0.3 in 2011-2013 at 35000 RMB resulting in an elasticity of 0.41 (see Figure 1 and 2).

Kleven and Waseem (2013): Pakistan, tax changes and elasticities shown in Figure 5 and Table 3. The notches at 400K, 500K, and 600K lead to tax rate jumps of 1 percentage point and structural elasticities (bunching whole method) of 0.024, 0.035, and 0.034. The notch at 700K leads to a 1.5 percentage tax jump and an elasticity of 0.001.

Mortenson and Whitten (2018): USA, based on the January 2016 working paper. Only documents elasticities for single wage earners at the first kink of the EITC, because elasticities for married wage earners are zero, so are the elasticities at the second kink of the EITC. At the first kink of the EITC, the tax subsidy decreases from 0.4 to 0, resulting in a log tax change of 0.2715 (Table 2) and elasticities of 0.1, 0.08 and 0.04 in 2014 for single wage earners with 1, 2 and 3 children respectively (Table 4). Other than the first kink of the EITC, the authors find bunching at the 2nd statutory kink and the Child Tax Credit (CTC) refundability plateau kink, reported in Table 5. I focus on the CTC bunching among families with 1 child as it generates the highest elasticities of 0.11 for single wage earners and 0.04 for married wage earners (log tax change of 0.1397). The second statutory kink generates elasticities of 0.01 for single wage earners and 0 for married wage earners (log tax change of 0.1293).

Paetzold (2019): Austria, based on University of Salzburg Working Paper No. 2017-01. Marginal tax changes from 0 to 0.3833 (kink) in 2005-2011 resulting in an elasticity of 0.1, discussed in Section 5.

Ruh and Staubli (2019): Austria, based on the December 2017 draft. Disability insurance recipients lose on average €125 upon crossing the €439 SGA threshold; additionally, their MTR increases by 18% or more. The elasticity estimate of 0.27 in Table 2 is adjusted for frictions and based on the earnings

response of the marginal buncher.

Schchtele (2016): Germany, based on the September 4, 2016 working paper. The marginal tax rate increases from 0 to 0.15 (kink) in 2007, resulting in elasticities of 0.1 for joint filers and 0.06 for single filers, discussed in Section 4.2.

Tazhitdinova (2015): UK, based on the November 12, 2015 version. The marginal tax rate increases from 0 to 0.3 in 2003-2007 and from 0 to 0.21 in 2009-2010, resulting in elasticities of .05 and .07.

For the graphs shown in Figure 3, I keep the largest elasticity per tax change per study. For example, Schchtele (2016) reports elasticities for the same kink for both single and joint filers. Since the elasticity for joint filers is larger, I show that observation. Note that the elasticities are extremely similar, so this does not generate a bias in exposition. For studies that estimate elasticities at different tax kinks, all observations are included. For notches, the graph shows the magnitude of the notch (again as a log change), rather than a change in MTRs, in cases where the two are different.

C Elasticity Bounds

Kinks and notches can be incorporated into the bounding framework of Chetty (2012) by assuming that individuals would have behaved according to the counterfactual distribution if the tax remained at the below-the-threshold level. From (4), it follows that the estimated elasticity $\hat{\varepsilon}$ must satisfy

$$\left(\frac{1}{z_B/z_A}\right)\left(\frac{1-t_2}{1-t_1}+\frac{\Delta T/z_A}{1-t_1}\right)-\frac{1}{1+1/\hat{\varepsilon}}\left(\frac{1}{z_B/z_A}\right)^{1+1/\hat{\varepsilon}} - \frac{1}{1+\hat{\varepsilon}}\left(1-\frac{t_2-t_1}{1-t_1}\right)^{1+\hat{\varepsilon}}=0, \quad (10)$$

where z_B identifies earnings in the absence of the notch, while z_A identifies earnings in the presence of the notch. Since the focus is on the marginal buncher, $z_A = K$, i.e. the notch threshold. To calculate the upper bound threshold, note that the upper bound elasticity ε^U must satisfy

$$\left(\frac{1}{z_B^*/z_A^*}\right)\left(\frac{1-t_2}{1-t_1}+\frac{\Delta T/z_A^*}{1-t_1}\right)-\frac{1}{1+1/\varepsilon^U}\left(\frac{1}{z_B^*/z_A^*}\right)^{1+1/\varepsilon^U} - \frac{1}{1+\varepsilon^U}\left(1-\frac{t_2-t_1}{1-t_1}\right)^{1+\varepsilon^U}=0. \quad (11)$$

where z_B^* and z_A^* are such that $\log z_A = \log(z_A^*) + (2\varepsilon^L\delta)^{1/2}$ and $\log z_B = \log(z_B^*) - (2\varepsilon^L\delta)^{1/2}$, implying that

$$(z_B/z_A) = (z_B^*/z_A^*) \cdot e^{-2(2\varepsilon^U\delta)^{1/2}}. \tag{12}$$

Similarly, the lower bound elasticity ε^L must satisfy

$$\left(\frac{1}{z_B^*/z_A^*}\right)\left(\frac{1-t_2}{1-t_1} + \frac{\Delta T/z_A^*}{1-t_1}\right) - \frac{1}{1+1/\varepsilon^L}\left(\frac{1}{z_B^*/z_A^*}\right)^{1+1/\varepsilon^L} - \frac{1}{1+\varepsilon^L}\left(1 - \frac{t_2-t_1}{1-t_1}\right)^{1+\varepsilon^L} = 0 \tag{13}$$

with $\log z_A = \log(z_A^*) - (2\varepsilon^U\delta)^{1/2}$ and $\log z_B = \log(z_B^*) + (2\varepsilon^U\delta)^{1/2}$, resulting in

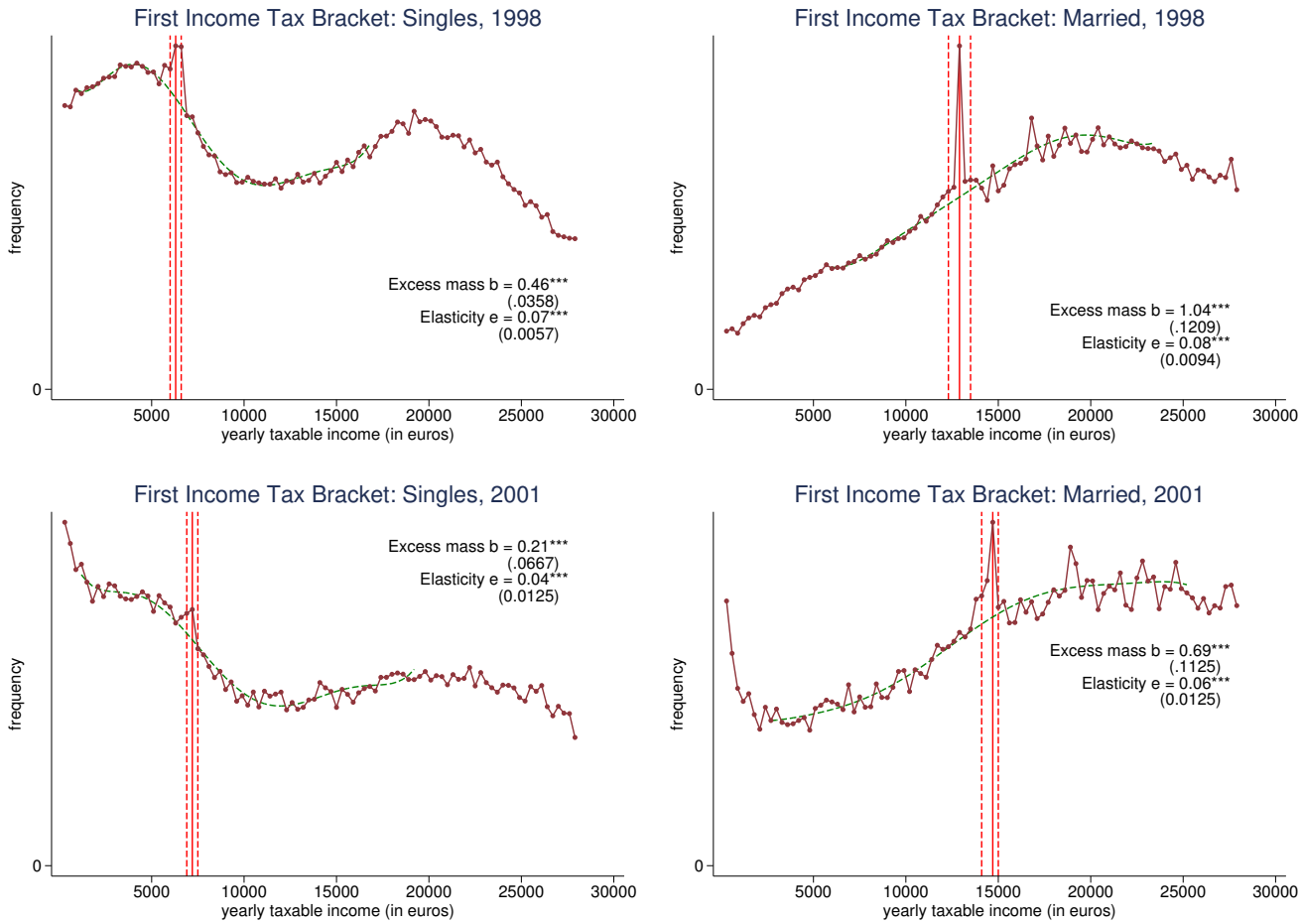
$$(z_B/z_A) = (z_B^*/z_A^*) \cdot e^{2(2\varepsilon^U\delta)^{1/2}}. \tag{14}$$

To summarize, the upper bound can be found by solving a system of equations (11), (12) and (13), while the lower bound can be determined by solving (11), (14) and (15).

D Income Tax Bunching

Using the 1998 and 2001 waves of Wage and Income Tax (Lohn- und Einkommensteuerstatistik) datasets, I estimate elasticities of taxable income around the first kink of the income tax schedule. Unfortunately, a similar exercise cannot be applied to other tax brackets because the income tax schedule in Germany consists of continuously increasing marginal tax rates. Elasticities range between 0.04 and 0.08 in Figure D.13 and are several times smaller than the elasticities estimated in Section 3.1, despite reflecting both real responses – reductions in hours worked – and potential avoidance responses – through income deductions.

Figure D.13: Behavioral Responses to the First Income Tax Kink in 1998 and 2001



Notes: These figures show the distribution of posted earnings in 1998 and 2001 for single and married individuals around the start of the first income tax bracket. In 1998, the marginal income tax rate increased from zero to 25.9% at €6,322 for single individuals, and at €12,644 for married individuals. In 2001, the marginal income tax rate increased from zero to 19.9% at €7,206 for single individuals, and at €14,412 for married individuals. *Data*: FDZ der Statistischen Ämter des Bundes und der Länder, Lohn- und Einkommensteuerstatistik Public-Use-Files, 1998 and 2001, author's calculations.

E Wage Differential

E.1 Wage Differential Robustness Checks Using VSE

The VSE 2006/2010 provides two estimates of working hours. The first estimate is based on the regular or customary hours in the survey month (October). The second measure is based on the total paid hours worked during the survey month, actual or estimated by the firm. As expected, the first measure of hours is often missing for part-time workers who do not have fixed hour schedules, but the second measure of hours is almost fully complete. I rely on the second measure of hours – hours worked in the month of survey – complemented with the first measures – regular hours – whenever missing. The results that rely on the first definition of hours are quite similar. The summary statistics are available in Table E.12. Posted and net earnings are provided in the data, and gross earnings are calculated based on the posted earnings and appropriate employer tax rates.

Before estimating equation (1) I examine visually how reported hours, wages and fringe benefits change with workers' earnings in Figure E.14. Panels A, B and C show that there is a clear increasing trend in the number of working hours, gross and posted wages but no apparent discontinuity at the mini-job threshold.[27] In contrast, panel D shows that net wages are higher for mini-job workers than regular workers, consistent with mini-job workers paying lower income and social security taxes.

Panels E and F show that mini-job workers receive substantially smaller yearly bonuses (which include holiday, Christmas and performance bonuses, severance payments, profit sharing, bonuses for improvement suggestions, allowances for inventions, and the taxable value of stock options) and are eligible for fewer full-time equivalent vacation days than regular workers. This evidence is consistent with the survey evidence of Bachmann et al. (2012) and Wippermann (2012), who find that many individuals are unaware of their rights and do not receive legally required holiday pay, sick day pay, etc.

Table E.13 considers interactions of the mini-job indicator with gender and age indicators, and indicators of collective agreements. Results suggest that the wage differential is largely not affected by gender or age. However, the wage differential is reduced by the presence of an enterprise-level agreement.

A natural concern is whether the results in Table 4 are driven by outlier observations within the 1st to 99th percentiles of gross wages. Table E.14 presents several robustness checks by repeating specifications (3), (4) and (9) of Table 4.

[27] However, in the VSE data some individuals with incomes below the mini-job threshold are regular employees, while some individuals with incomes above the threshold are mini-job workers. If one restricts the sample to individuals whose incomes and mini-job status correspond precisely, the discontinuity in gross wages at the mini-job threshold becomes apparent, see Figure E.15.

In columns (1), (2) and (7) I consider a different definition of gross wage, which includes overtime hours and pay. Since overtime hours are paid at a higher rate and are more likely to be reported for regular employees, we would expect a smaller wage differential. This is precisely what we observe in columns (1), (2) and (7) (which can be directly compared to columns (3), (4) and (9) of Table 4). The wage differential decreases by approximately 1 percentage point. Next, I restrict the sample to individuals earning gross wages of more than €6 in columns (3), (4) and (8). The results remain unchanged. Finally, I restrict the sample to individuals earning a gross wage of more than €6 but less than €15 per hour in columns (5), (6) and (9). The coefficients decrease slightly, by approximately 1 percentage point. In addition to the results shown in Table E.14, I have verified that the results are not sensitive to the earnings interval studied and inclusion of higher order wage trends. Robustness checks confirm that the results in Table 4 are not driven by the definition of hours used or due to sample selection.

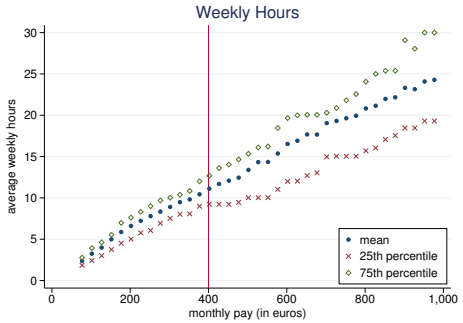
Table E.12: Summary Statistics (Firm Survey VSE)

	Income: [€50,€375] N=210,273			Income: [€375; €400] N=86,157			Income: [€400, €500] N=21,082			Income: [€500, €1000] N=186,503			Income: [€1000, €1500] N=379,117		
	mean	sd	p50	mean	sd	p50	mean	sd	p50	mean	sd	p50	mean	sd	p50
Male	0.35	0.48	0.00	0.35	0.48	0.00	0.26	0.44	0.00	0.17	0.37	0.00	0.27	0.44	0.00
Age: 26-40 year old	0.25	0.43	0.00	0.29	0.45	0.00	0.33	0.47	0.00	0.32	0.47	0.00	0.32	0.47	0.00
Age: 40-60 year old	0.36	0.48	0.00	0.39	0.49	0.00	0.45	0.50	0.00	0.54	0.50	1.00	0.54	0.50	1.00
Age: 60-65 year old	0.07	0.26	0.00	0.06	0.24	0.00	0.05	0.21	0.00	0.04	0.18	0.00	0.03	0.17	0.00
Age: $>$ 60 year old	0.10	0.30	0.00	0.12	0.32	0.00	0.05	0.22	0.00	0.02	0.13	0.00	0.00	0.07	0.00
No HS, No Voc. Tr.[a]	0.18	0.38	0.00	0.13	0.34	0.00	0.18	0.39	0.00	0.19	0.39	0.00	0.16	0.37	0.00
No HS + Voc. Tr.	0.22	0.42	0.00	0.29	0.45	0.00	0.32	0.47	0.00	0.45	0.50	0.00	0.58	0.49	1.00
HS, No Voc. Tr.	0.06	0.24	0.00	0.02	0.15	0.00	0.04	0.19	0.00	0.02	0.14	0.00	0.01	0.09	0.00
HS + Voc. Tr.	0.01	0.11	0.00	0.02	0.14	0.00	0.02	0.14	0.00	0.03	0.16	0.00	0.03	0.18	0.00
Fachhochschule	0.01	0.08	0.00	0.01	0.09	0.00	0.01	0.10	0.00	0.02	0.13	0.00	0.02	0.13	0.00
College/University	0.01	0.08	0.00	0.01	0.10	0.00	0.01	0.11	0.00	0.01	0.10	0.00	0.01	0.12	0.00
Educ. Unknown	0.51	0.50	1.00	0.52	0.50	1.00	0.42	0.49	0.00	0.28	0.45	0.00	0.19	0.39	0.00
Company Tenure[b]	47.04	67.17	24.00	44.03	58.51	25.00	73.33	98.51	37.00	94.69	107.04	57.00	105.35	110.33	66.00
Salaried Employees	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.02	0.15	0.00	0.10	0.30	0.00
Homeworkers	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.04	0.00	0.00	0.03	0.00	0.00	0.02	0.00
Part-time $<$18 h/w	1.00	0.04	1.00	1.00	0.06	1.00	0.88	0.33	1.00	0.35	0.48	0.00	0.05	0.23	0.00
Part-time $\geq$18 h/w	0.00	0.04	0.00	0.00	0.06	0.00	0.12	0.32	0.00	0.54	0.50	1.00	0.52	0.50	1.00
Skilled Hourly Employee	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.02	0.15	0.00	0.11	0.32	0.00
Civil Servants	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.04	0.00	0.01	0.11	0.00	0.02	0.14	0.00
Monthly Hours	33.25	14.14	33.00	48.11	12.15	47.00	53.38	18.71	51.50	90.49	34.44	86.60	128.17	37.34	130.35
Posted Hourly Wage	7.94	2.53	7.84	8.76	2.50	8.37	9.37	3.16	8.72	9.84	3.45	9.21	10.80	3.47	9.65
Gross Hourly Wage	10.29	3.28	10.17	11.34	3.24	10.84	11.50	3.93	10.76	11.85	4.16	11.10	13.00	4.17	11.61
Net Hourly Wage	7.88	2.57	7.72	8.66	2.51	8.26	7.97	2.96	7.54	7.50	2.70	6.95	7.73	2.42	6.96
Yearly Bonus	34.29	124.55	0.00	20.00	115.08	0.00	156.85	328.63	0.00	441.67	574.39	230.00	763.81	877.49	591.00
Vacation Days[c]	7.09	8.47	4.00	8.03	8.50	6.00	13.13	12.49	10.00	18.78	10.68	16.00	21.86	7.29	23.00
Subcompany[d]	0.41	0.49	0.00	0.32	0.47	0.00	0.39	0.49	0.00	0.44	0.50	0.00	0.47	0.50	0.00
Handcraft Business	0.05	0.21	0.00	0.08	0.27	0.00	0.05	0.22	0.00	0.05	0.21	0.00	0.04	0.21	0.00
N. of Male Empl.[e]	289.13	1714.66	26.00	68.11	396.71	21.00	225.63	1652.06	22.00	414.39	3036.00	22.00	575.93	3679.26	29.00
N. of Female Empl.[e]	334.27	1416.63	41.00	97.47	552.98	26.00	604.52	2804.48	42.00	929.78	4260.35	51.00	1402.95	5637.35	46.00

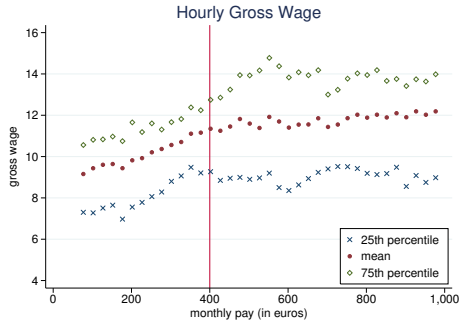
Notes: This table shows summary statistics (mean, standard deviation and median) for the combined 2006 and 2010 waves of the VSE Survey. The following categories have been omitted: 25 year old or younger, unskilled salaried workers. [a] HS stands for High School, Voc. Tr. stands for Vocational Training. [b] Company tenure is measured in months. [c] Vacation days represent the full-time equivalent number of vacation days per year based on a 5-day working week. [d] Subcompany refers to establishments that are part of larger firms. [e] Number of male and female employees at the establishment of the employee, rather than the larger firm. *Data*: FDZ der Statistischen Ämter des Bundes und der Länder, Verdienststrukturerhebung, 2006 and 2010, author's calculations.

Figure E.14: Earnings Distributions, Weekly Hours and Wages by Income (Firm Survey VSE)

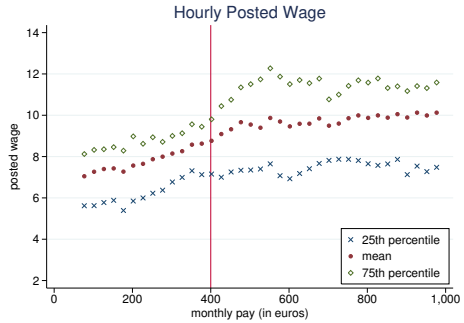
Panel A: Weekly Hours by Monthly Income



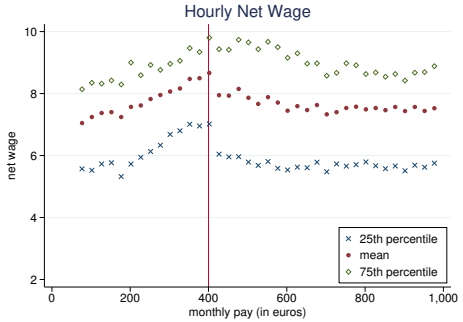
Panel B: Gross Wages by Monthly Income



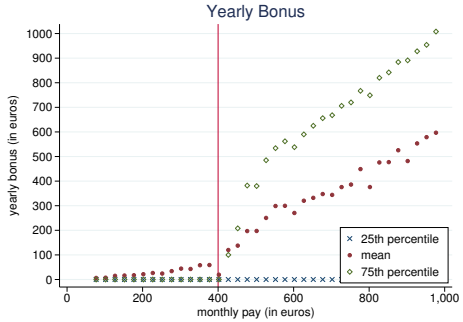
Panel C: Posted Wages by Monthly Income



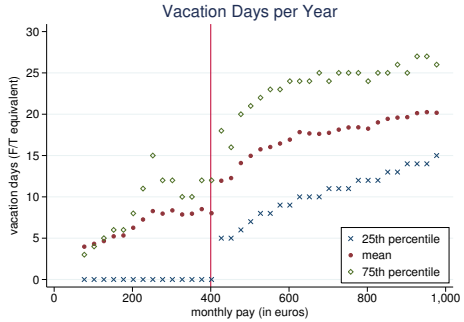
Panel D: Net Wages by Monthly Income



Panel E: Yearly Bonus by Monthly Income

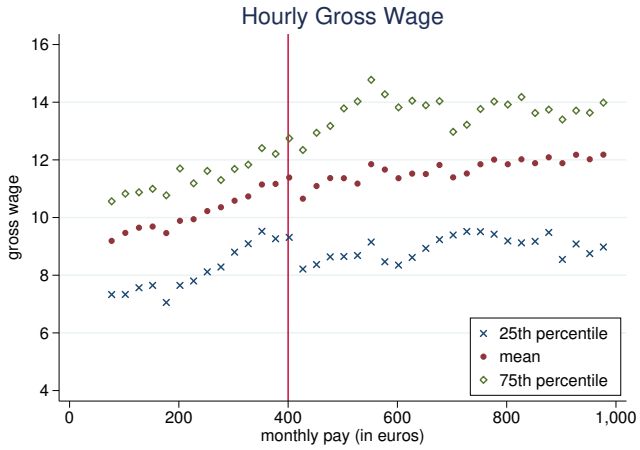


Panel F: Vacation Days by Monthly Income



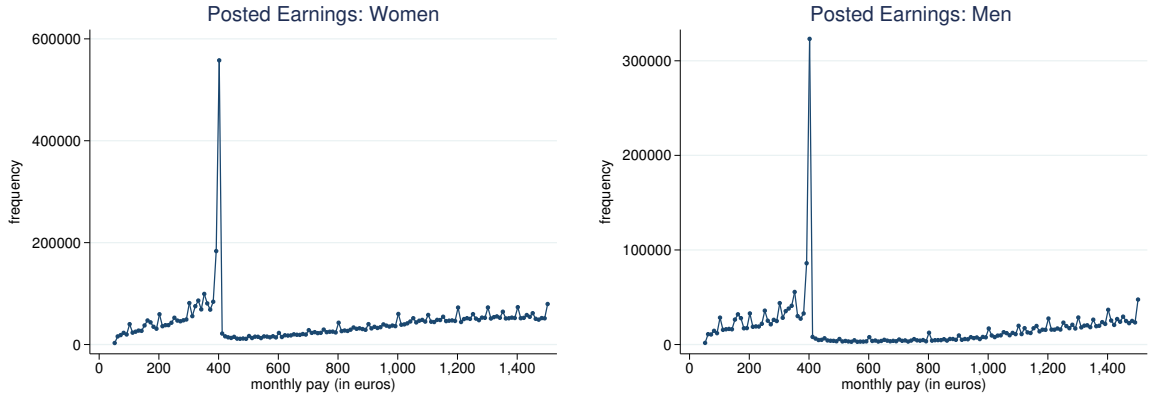
Notes: All results are based on the combined 2006 and 2010 waves of the Verdienststrukturerhebung (VSE) Survey. Panel A shows the mean, as well as the 25th and 75th percentiles of weekly hours by €25 bins of monthly pay. Panels B, C and D show the mean, as well as the 25th and 75th percentiles of hourly gross, posted and net wages by €25 bins of monthly pay. Panels E and F shows the mean, as well as the 25th and 75th percentiles of yearly bonus and the number of full-time equivalent vacation days by €25 bins of monthly pay. *Data*: FDZ der Statistischen Ämter des Bundes und der Länder, Verdienststrukturerhebung, 2006 and 2010, author's calculations.

Figure E.15: Hourly Gross Wage by Income: Subsample (Firm Survey VSE)



Notes: This figure shows the mean, as well as the 25th and 75th percentiles, of hourly gross wage by €25 bins of monthly pay in 2006 and 2010. The sample is restricted to mini-job workers with monthly posted earnings below the mini-job threshold and regular workers with monthly posted earnings above the mini-job threshold. *Data*: FDZ der Statistischen Ämter des Bundes und der Länder, Verdienststrukturerhebung, 2006 and 2010, author's calculations.

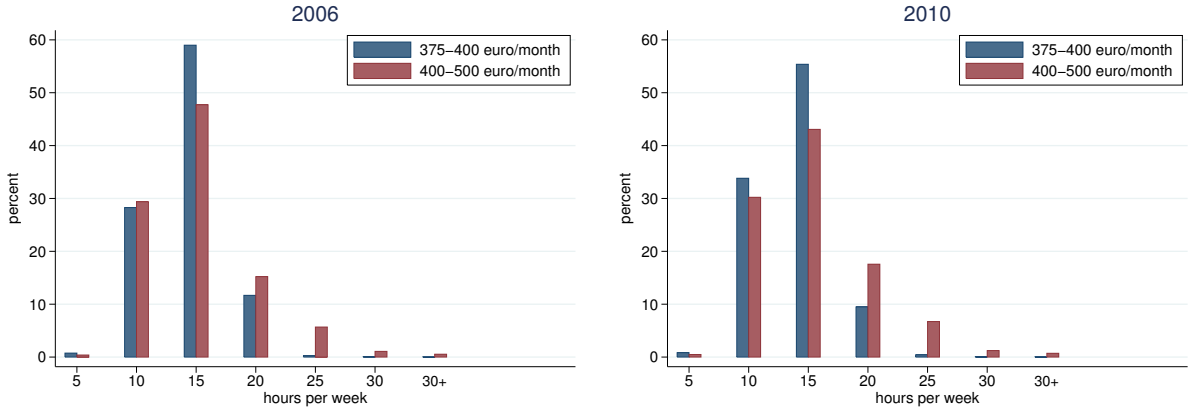
Figure E.16: Number of Jobs by Monthly Earnings (VSE)



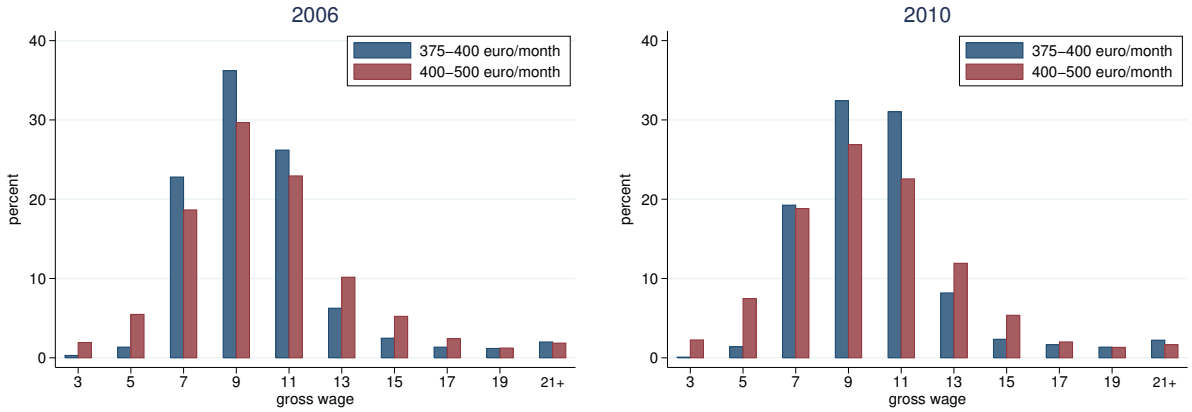
Notes: This figure shows the distribution of jobs (posted monthly earnings) for women and for men in 2006 and 2010. Each individual employment is treated as a separate observation; hence, some of these employments are "primary" jobs, while others are "secondary" jobs for individuals. *Data*: FDZ der Statistischen Ämter des Bundes und der Länder, Verdienststrukturerhebung, 2006 and 2010, author's calculations.

Figure E.17: Hour and Wage Distributions in 2006 and 2010 (VSE)

Panel A: Hour Distributions below/above the Threshold



Panel B: Gross Wage Distributions below/above the Threshold



Notes: Panel A shows the distribution of weekly hours for mini-job workers and regular workers earning between €375 and €500 per month (posted earnings). Panel B shows the distribution of hourly gross wage for mini-job workers and regular workers earning between €375 and €500 per month (posted earnings). *Data*: FDZ der Statistischen Ämter des Bundes und der Länder, Verdienststrukturerhebung, 2006 and 2010, author's calculations.

Table E.13: The Effect of Mini-Job Status on Gross Wage (Firm Survey VSE)

	Monthly Income €375–€500			**Monthly Income €50–€1500**		
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable: Log(Hourly Gross Wage)						
Mini-Job	0.087***	0.087***	0.089***	0.066***	0.075***	0.061***
	(0.006)	(0.006)	(0.006)	(0.004)	(0.004)	(0.004)
Mini-Job x Male	0.001***			0.016***		
	(0.006)			(0.003)		
Mini-Job x Age<25		-0.011			-0.002	
		(0.009)			(0.004)	
Mini-Job x Age 40-60		0.007			-0.012***	
		(0.006)			(0.002)	
Mini-Job x Age 60-65		-0.011			0.011***	
		(0.013)			(0.004)	
Mini-Job x Age >65		0.002			-0.003	
		(0.013)			(0.006)	
Mini-Job x Industry Coll. Agr.			0.008			0.034***
			(0.010)			(0.005)
Mini-Job x Firm Coll. Agr.			-0.023			0.016
			(0.026)			(0.016)
Mini-Job x Enterprise Coll. Agr.			-0.101***			-0.056***
			(0.030)			(0.014)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Occupation Controls	Yes	Yes	Yes	Yes	Yes	Yes
Linear Wage Trend	Yes	Yes	Yes	Yes	Yes	Yes
Quadratic Wage Trend	No	No	No	Yes	Yes	Yes
Number of Observations	107,239	107,239	107,239	887,183	887,183	887,183

Notes: This table shows the coefficients from regressing the logarithm of gross wage on a mini-job indicator interacted with gender (columns 1 and 4), age (columns 2 and 5), or collective agreements (columns 3 and 6). Standard errors are clustered by firm. Individual controls include male indicator, age group indicators, company tenure, education indicators, occupational status and occupation indicators. Linear and quadratic trends include both linear/quadratic terms and their interactions with the mini-job indicator. *Data*: FDZ der Statistischen Ämter des Bundes und der Länder, Verdienststrukturerhebung, 2006 and 2010, author's calculations.

Table E.14: Robustness Checks (Firms Survey VSE)

	Monthly Income €375–€500						**Monthly Income €50–€1500**		
	Incl. Overtime		**Wage > €6**		**Wage ∈ (€6,€15]**		**Incl. Overtime**	**Wage > €6**	**Wage ∈ (€6,€15]**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent Variable: Log(Hourly Gross Wage)									
Mini-Job	0.0485***	0.080***	0.057***	0.085***	0.052***	0.074***	0.057***	0.042***	0.055***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupation Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Linear Wage Trend	No	Yes	No	Yes	No	Yes	Yes	Yes	Yes
Quadratic Wage Trend	No	No	No	No	No	No	Yes	Yes	Yes
Number of Observations	107,239	107,239	105,637	105,637	93,760	93,760	887,183	862,420	674,859

Notes: This table shows the coefficients from regressing the logarithm of gross wage on a mini-job indicator variable. Standard errors are clustered by firm. In columns (1), (2) and (7), gross wage is calculated as all monthly income (including overtime pay) divided by total hours worked (including overtime). In columns (3), (4) and (8), the sample is restricted to individuals with gross wages of more than €6 per hour. In columns (5), (6) and (9), the sample is restricted to individuals with gross wages of more than €6 per hour but less than €15 per hour. Individual controls include male indicator, age group indicators, company tenure, education indicators, occupational status and occupation indicators. Linear and quadratic trends include both linear/quadratic terms and their interactions with the mini-job indicator. *Data*: FDZ der Statistischen Ämter des Bundes und der Länder, Verdienststrukturerhebung, 2006 and 2010, author's calculations.

E.2 Wage Differential Robustness Checks Using SOEP

I also use the German Socio-Economic Panel (SOEP) introduced in Section 2. Compared to VSE, the SOEP supplies more detailed information of worker characteristics, such as working experience, citizenship status, and spousal earnings. However, the quality of the self-reported marginal employment status identifier is poor and for this reason, I identify mini-job workers based on the magnitude of self-reported income. To reduce the impact of measurement error I restrict my sample to 2004-2011, when the threshold has been set at €400 and hour requirements have been abolished. Since prior to 2003 mini-jobs were restricted to employments under 15 hours per week, including earlier years would likely bias the results substantially due to large measurement errors in hours.

Summary statistics from the SOEP are available in the Appendix Table E.15. Figure E.18 shows graphical evidence similar to Figure E.14 but relies on household survey data. The results show similar patterns but the hours reported are higher, either due to sample selection or measurement errors. It is possible that individuals working in firms with 10 employees or less (not included in the VSE) earn a lower hourly wage. Alternatively, survey respondents in the SOEP might include all hours worked, including overtime, regardless of whether they were paid for these hours or not.

The regression results from the SOEP (household survey) are available in Table E.16 and reinforce the finding that mini-job wages are higher at the threshold than regular wages. Columns (1) and (6) can be directly compared to columns (1) and (6) in Table 4, while columns (3) and (8) provide the closest comparison to columns (4) and (8) in Table 4 respectively. The gross wage differential varies between 6.5% to 13.7%, and thus is quite a bit larger in the SOEP than in the VSE. Yearly bonus appears to be smaller for mini-job workers, but not all coefficients are statistically significant.[28] In columns (2), (4), (5), (7) and (9), I control for incentives to bunch at the threshold by including the variable *individual notch*, which measures the size of the tax notch experienced by a worker at the mini-job threshold and is based on spousal earnings. Results suggest that controlling for marital status and tax incentives does not have a large effect on the wage differential. This finding is reassuring in light of my inability to control for family characteristics in Table 4, and again supports the notion that selection is unlikely to explain the differences in wages and fringe benefits.

The quality of the household data is of substantial concern because so many individuals report earning less than €5 per hour (especially among regular workers) and more than €21. Therefore the large wage differential observed in Table E.16 and Figure E.18 could be driven by outlier observations. As a robustness check, I repeat specifications (3), (5), (8) and (9) from Table E.16 in Table E.17

[28] Vacation information is not available in the SOEP.

but restrict the interval of allowed gross wages. Requiring the gross wage to be at least €3 does not have a strong effect on the estimates (see columns (1)-(2) and (7)-(8)). Requiring wages to be at least €5 per hour removes the wage differential. This result is not surprising in light of Panel B in Figure E.18: more regular workers report larger gross wages (€15 and more) than mini-job workers. Finally, restricting the sample to individuals earning between €5 and €15 makes the coefficient statistically insignificant in columns (5) and (6) and marginally significant in columns (11) and (12). The coefficients are positive but smaller than in Table E.16. The smaller magnitude of the coefficients is consistent with the presence of a negative bias, due to measurement errors, along with our inability to control for firm selection.[29] These robustness checks suggest that while the magnitude of the wage differential estimated using household data is inaccurate, the wage differential between mini-job and regular jobs is positive and statistically significant.

[29] Recall that adding firm fixed effects increases the wage gap between mini-job and regular gross wages.

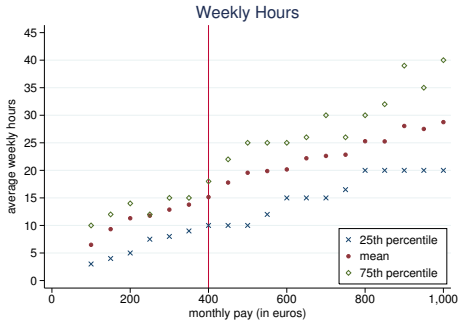
Table E.15: Summary Statistics (Household SOEP)

	Income: [€50,€375] N=11,404			Income: [€375; €400] N=2,965			Income: [€400, €500] N=2,509			Income: [€500, €1000] N=20,622			Income: [€1000, €1500] N=34,114		
	mean	sd	p50	mean	sd	p50	mean	sd	p50	mean	sd	p50	mean	sd	p50
Male	0.17	0.38	0.00	0.18	0.39	0.00	0.17	0.37	0.00	0.19	0.39	0.00	0.38	0.48	0.00
Age: 26-40 year old	0.32	0.47	0.00	0.35	0.48	0.00	0.36	0.48	0.00	0.38	0.49	0.00	0.39	0.49	0.00
Age: 40-60 year old	0.38	0.49	0.00	0.42	0.49	0.00	0.43	0.50	0.00	0.41	0.49	0.00	0.40	0.49	0.00
Age: 60-65 year old	0.08	0.27	0.00	0.06	0.23	0.00	0.04	0.20	0.00	0.03	0.17	0.00	0.02	0.15	0.00
Age: > 65 year old	0.06	0.23	0.00	0.06	0.23	0.00	0.03	0.16	0.00	0.01	0.10	0.00	0.00	0.05	0.00
Married	0.66	0.47	1.00	0.72	0.45	1.00	0.65	0.48	1.00	0.64	0.48	1.00	0.55	0.50	1.00
Partner (Not married)	0.05	0.22	0.00	0.05	0.23	0.00	0.09	0.29	0.00	0.08	0.27	0.00	0.11	0.31	0.00
No HS[a]	0.02	0.15	0.00	0.02	0.12	0.00	0.02	0.13	0.00	0.02	0.15	0.00	0.03	0.17	0.00
HS, No Voc. Tr.	0.17	0.37	0.00	0.14	0.35	0.00	0.20	0.40	0.00	0.15	0.35	0.00	0.12	0.33	0.00
HS + Voc. Tr.	0.31	0.46	0.00	0.30	0.46	0.00	0.31	0.46	0.00	0.33	0.47	0.00	0.35	0.48	0.00
Further Voc. Tr	0.38	1.11	0.00	0.42	1.14	0.00	0.38	1.07	0.00	0.40	1.03	0.00	0.41	1.00	0.00
Fachhochschule	0.02	0.14	0.00	0.03	0.17	0.00	0.03	0.16	0.00	0.02	0.13	0.00	0.02	0.14	0.00
College/University	0.05	0.21	0.00	0.06	0.23	0.00	0.05	0.22	0.00	0.07	0.25	0.00	0.06	0.24	0.00
Company Tenure[b]	68.33	88.24	33.60	69.29	86.94	36.00	83.99	91.85	48.00	85.65	95.91	48.00	99.74	100.81	64.80
Monthly Hours	57.85	38.38	43.33	70.17	37.13	65.00	95.09	48.44	86.67	124.29	44.35	117.00	155.02	34.36	173.33
Posted Hourly Wage	5.79	3.44	5.21	7.15	3.62	6.15	6.37	3.95	5.31	7.22	3.43	6.29	8.76	3.02	7.90
Gross Hourly Wage	7.14	4.30	6.40	9.14	4.64	8.00	7.62	4.75	6.29	8.63	4.13	7.51	10.46	3.65	9.38
Net Hourly Wage	5.37	3.27	4.88	6.53	3.30	6.15	4.72	2.96	3.85	4.93	2.34	4.38	5.85	1.99	5.39
Yearly Bonus	71.51	265.25	0.00	78.57	383.66	0.00	181.27	388.16	0.00	381.54	486.06	204.00	796.77	722.54	716.00
Full Time Experience	8.62	10.49	5.00	8.34	10.15	5.00	8.12	9.46	5.00	9.76	9.94	6.70	12.56	10.91	9.00
Part Time Experience	6.06	6.78	3.60	7.31	7.13	5.10	7.22	8.20	4.20	5.50	7.15	2.50	3.13	5.87	0.00
Training Matching	0.29	0.46	0.00	0.30	0.46	0.00	0.34	0.47	0.00	0.47	0.50	0.00	0.52	0.50	1.00
Firm Size: <20	0.48	0.50	0.00	0.51	0.50	1.00	0.39	0.49	0.00	0.34	0.47	0.00	0.26	0.44	0.00
Firm Size: 20-200	0.21	0.41	0.00	0.27	0.44	0.00	0.27	0.44	0.00	0.29	0.45	0.00	0.31	0.46	0.00
Firm Size: 200-2000	0.09	0.29	0.00	0.08	0.28	0.00	0.15	0.35	0.00	0.17	0.38	0.00	0.21	0.41	0.00
Firm Size: >2000	0.07	0.26	0.00	0.06	0.23	0.00	0.10	0.30	0.00	0.15	0.36	0.00	0.18	0.39	0.00

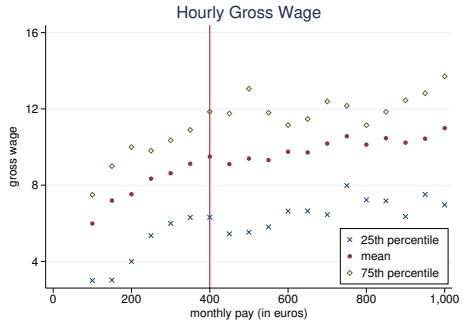
Notes: This tables shows summary statistics (mean, standard deviation and median) for the combined 2004–2011 waves of the Socioeconomic Panel (SOEP). The following category has been omitted: 25 year old or younger. [a] HS stands for High School, Voc. Tr. stands for Vocational Training. [b] Company tenure is measured in months. *Data*: Socio-Economic Panel (SOEP), version 30.

Figure E.18: Earnings Distributions, Weekly Hours and Wages by Income (Household Survey SOEP)

Panel A: Weekly Hours by Monthly Income

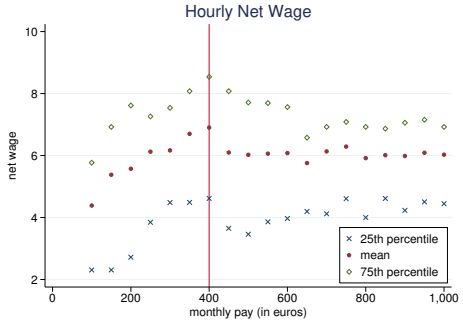


Panel B: Gross Wages by Monthly Income

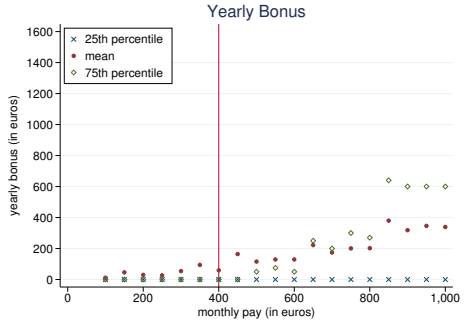


Panel C: Posted Wages by Monthly Income

Panel D: Net Wages by Monthly Income

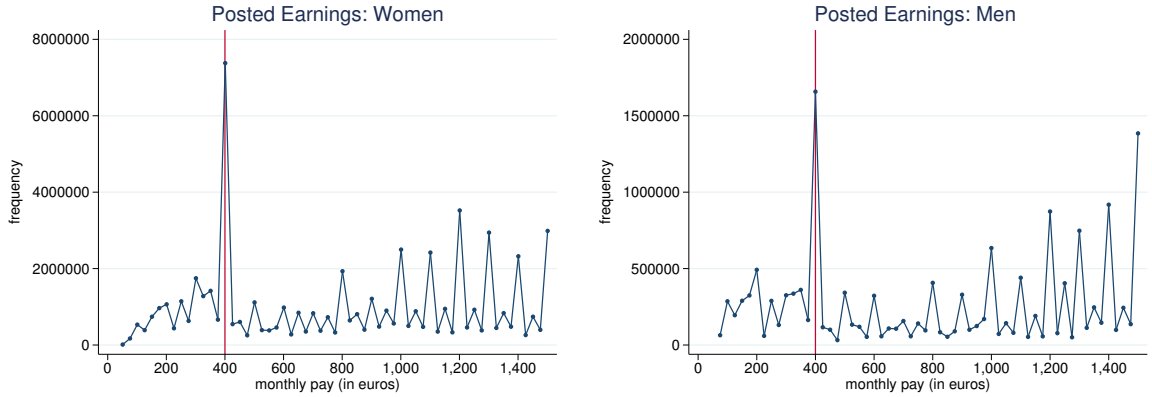


Panel E: Yearly Bonus by Monthly Income



Notes: Panel A shows the mean, as well as the 25th and 75th percentiles of weekly hours, by €25 bins of monthly pay. Panels B, C and D show the mean, as well as the 25th and 75th percentiles of hourly gross, posted and net wages, by €25 bins of monthly pay. Panel E and F show the mean, as well as the 25th and 75th percentiles of yearly bonus and the number of full-time equivalent vacation days by €25 bins of monthly pay. *Data*: Socio-Economic Panel (SOEP), version 30, author's calculations.

Figure E.19: Distribution of Earnings (SOEP)



Notes: This figure shows the distribution of posted monthly earnings for women and for men in 2004–2011. *Data*: Socio-Economic Panel (SOEP), version 30, author's calculations.

Table E.16: The Effect of Mini-Job Status on Wages and Bonuses (Household Survey SOEP)

	Monthly Income €375–€500					**Monthly Income €50–€1500**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent Variable: Log(Hourly Gross Wage)									
Mini-Job	0.086**	0.063*	0.082**	0.071**	0.130**	0.099***	0.084***	0.095***	0.089***
	(0.038)	(0.038)	(0.033)	(0.033)	(0.063)	(0.022)	(0.021)	(0.029)	(0.029)
Indiv. Notch		0.004***		-0.001	-0.001		0.007***		0.004***
		(0.001)		(0.002)	(0.002)		(0.000)		(0.001)
Dependent Variable: Log(Hourly Posted Wage)									
Mini-Job	0.017	-0.006	0.012	0.002	0.061	0.029	0.014	0.024	0.018
	(0.038)	(0.038)	(0.033)	(0.033)	(0.063)	(0.022)	(0.021)	(0.029)	(0.029)
Dependent Variable: Log(Hourly Net Wage)									
Mini-Job	0.196***	0.154***	0.185***	0.154***	0.150**	0.242***	0.229***	0.173***	0.175***
	(0.043)	(0.044)	(0.038)	(0.039)	(0.072)	(0.023)	(0.024)	(0.032)	(0.033)
Dependent Variable: Yearly Bonus									
Mini-Job	-81.028**	-78.706**	-56.620***	-55.391***	-12.622	15.406	4.508	-29.759	-37.812
	(34.184)	(35.149)	(19.129)	(19.992)	(32.167)	(20.987)	(21.785)	(28.670)	(29.062)
Indiv. Notch		-1.511*		-2.536**	-2.568**		3.707***		-0.208
		(0.842)		(1.036)	(1.032)		(0.602)		(0.779)
Dependent Variable: Log(Gros Wage incl. Bonus)									
Mini-Job	0.074*	0.052	0.073**	0.063*	0.127**	0.093***	0.076***	0.087***	0.081***
	(0.038)	(0.038)	(0.033)	(0.033)	(0.063)	(0.022)	(0.021)	(0.030)	(0.030)
Year Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Indiv. Controls (subset)	No	No	Yes	No	No	No	No	Yes	No
Indiv. Controls (full)	No	No	No	Yes	Yes	No	No	No	Yes
Firm Controls	No	No	Yes	Yes	Yes	No	No	Yes	Yes
Linear Wage Trend	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Quadratic Wage Trend	No	No	No	No	No	No	No	Yes	Yes
N	3,373	3,238	3,357	3,020	3,020	20,581	19,978	20,524	18,888

Notes: This table shows the coefficients from regressing the listed dependent variables on a mini-job indicator variable. Standard errors are clustered by individual. Individual controls (subset) include male indicator, age group indicators, company tenure, education indicators and occupation indicators. In addition to the above controls, the full set also includes marital status, presence of a partner (if not married), citizenship indicator, indicator of whether a job matches completed training, experience working full time and experience working part time. Firm controls include industry indicators and indicators of size (by number of employees). Linear and quadratic trends include both linear/quadratic terms and their interactions with the mini-job indicator. *Data*: Socio-Economic Panel (SOEP), version 30.

Table E.17: Robustness Checks (Household Survey SOEP)

	Monthly Income €375–€500						**Monthly Income €50–€1500**					
	Wage > €3		**Wage > €5**		**Wage ∈ (€5,€15]**		**Wage> €3**		**Wage > €5**		**Wage ∈ (€5,€15]**	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent Variable: Log(Hourly Gross Wage)												
Mini-Job	0.083**	0.068**	-0.016	-0.024	0.028	0.025	0.102***	0.099***	-0.006	-0.002	0.036*	0.037*
	(0.032)	(0.033)	(0.029)	(0.030)	(0.023)	(0.023)	(0.028)	(0.028)	(0.026)	(0.026)	(0.020)	(0.020)
Indiv. Notch		-0.001		-0.001		0.001		0.003***		0.003***		0.002***
		(0.002)		(0.001)		(0.001)		(0.001)		(0.001)		(0.000)

Notes: This table shows the coefficients from regressing the logarithm of gross wage on a mini-job indicator. Standard errors are clustered by individual. In columns (1), (2) and (7), the sample is restricted to individuals with gross wages of more than €3 per hour. In columns (3), (4) and (8), the sample is restricted to individuals with gross wages of more than €5 per hour. In columns (5), (6) and (9), the sample is restricted to individuals with gross wages of more than €5 per hour but less than €15 per hour. Individual controls (subset) include male indicator, age group indicators, company tenure, education indicators and occupation indicators. In addition to above controls, the full set also includes marital status, presence of a partner (if not married), citizenship indicator, indicator of whether a job matches completed training, experience working full time and experience working part time. Firm controls include industry indicators and indicators of size (by number of employees). Linear and quadratic trends include both linear/quadratic terms and their interactions with the mini-job indicator. *Data*: Socio-Economic Panel (SOEP), version 30.