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ABSTRACT

Income Taxation and Hours Worked in Different Types of Entrepreneurship*

We investigate the effect of personal income tax (PIT) rates on the number of hours entrepreneurs work weekly. Using the rotating panel data from the Annual Social and Economic Supplement of the Current Population Survey from 2003 to 2019, we estimate instrumental variable regressions in first differences to exploit changes in the tax code for identification. We distinguish between self-employed owners of incorporated versus unincorporated businesses and examine their differential responses. The findings reveal that higher individual-specific marginal PIT rates increase the hours worked among entrepreneurs with incorporated businesses, which could be explained by the availability of tax avoidance strategies. Among unincorporated entrepreneurs, we find a significant response to PIT rates in hours worked only for those who work 50 or more hours per week.

JEL Classification: H24, H25, J22, J23, L26

Keywords: income taxes, entrepreneurship, self-employment, labor supply, incorporated, unincorporated

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1. Introduction

Entrepreneurship is essential for innovation and economic development (Schumpeter, 1934), and policymakers have long regarded entrepreneurial activity as crucial for economic growth (Murphy et al., 1991; Wennekers and Thurik, 1999; Acs and Audretsch, 2005). The effort entrepreneurs put into their ventures in terms of the number of hours worked is more critical for economic growth than the number and rate of entrepreneurs because the latter include side and lifestyle businesses, whereas fully dedicated entrepreneurs drive more influential innovation (Bruce et al., 2015). Entrepreneurs have substantial flexibility in changing their work hours compared to paid employees, who are restricted by typically rigid employment contracts. Income taxes have been considered a potential policy instrument that may affect entrepreneurship. If income taxes impact the supply of entrepreneurial work hours, considering such effects would be an essential step toward developing an optimal tax policy. We provide the first study to estimate the impact of personal income tax (PIT) rates on the number of work hours for two types of entrepreneurs: those owning incorporated and unincorporated businesses.

As it is primarily done in prior research, we use self-employment (with or without employees and with or without partners) as a proxy for entrepreneurship. However, it is important to consider the significant heterogeneity among the self-employed. Following Levine and Rubinstein (2017), we distinguish between self-employed individuals owning incorporated and unincorporated businesses. Entrepreneurs starting incorporated businesses are more likely to rely on cognitive abilities and engage in innovative activities, whereas entrepreneurs running unincorporated businesses are likelier to perform tasks requiring manual skills (Astebro and Tag, 2017).[1] These two types of entrepreneurs also differ in terms of income taxation. The income of

[1] See also Can and Fossen (2022) for the separation of self-employment using the American Community Survey.

entrepreneurs with unincorporated businesses is subject to the PIT. Entrepreneurs owning an incorporated business can choose a C-corporate form (e.g., C-corporation) or a pass-through entity form (e.g., S-corporation), which determines the type of income tax paid. Pass-through income is taxed under PIT rules, whereas the business profits of C-corporations are first taxed using the corporate income tax (CIT) rules, and then distributions or realized capital gains are subject to the PIT.

The PIT may affect entrepreneurship at the extensive margin (the number of entrepreneurs, or whether to be or become an entrepreneur)[2] and the intensive margin (scale of entrepreneurial activity, such as work hours, hiring, investment, income, and effort),[3] which reflects the quality and the speed of growth (Da Rin et al., 2010). Changes in the number of work hours are a measure of intensive margin adjustments of labor supply to taxation that affect earnings, tax revenues, and efficiency costs of taxation. Most of the PIT and entrepreneurship literature investigates extensive-margin responses to PIT rates, with inconclusive results. In contrast, intensive-margin responses have been relatively unexplored in the literature (Bruce et al., 2020).[4] The existing literature's focus on tax effects on the number of entrepreneurs is a shortcoming because positive economic effects on innovation, growth, and job creation are not expected from a larger number of self-employed workers but from the subset of entrepreneurs who are investing significant work hours and effort to grow their businesses (Shane, 2009; Van Praag and Van Stel, 2013).

[2] See Bruce (2000); Gentry and Hubbard (2000); Schuetze (2000); Bruce (2002); Cullen and Gordon (2007); Gurley-Calvez and Bruce (2008); Fossen (2009); Fossen and Steiner (2009); Hansson (2012); Wen and Gordon (2014); Arulampalam and Papini (2021); Can (2022) for some of the extensive margin studies in the income taxation and entrepreneurship literature.

[3] Carroll et al. (2000a) analyze the effects of income taxes on entrepreneurs' use of labor. Carroll et al. (2000b) and Fossen et al. (2020) investigate the effects of tax rate changes on entrepreneurial investment. Bruce et al. (2015), Bruce and Glenn (2016), Bruce et al. (2019), and Bosch and de Boer (2019) analyze tax effects on small business income.

[4] Bruce et al. (2020) provide a recent and excellent survey on the taxation and entrepreneurship literature. For prior surveys, see Schuetze and Bruce (2004); Gale and Brown (2013); and Clingingsmith and Shane (2015).

Estimates of the responsiveness of labor supply to taxation are crucial for optimal tax policy design because a significant reduction in entrepreneurial labor supply would imply a deadweight loss of taxation. Wage-and-salary workers are mainly unresponsive to taxation at the intensive margin as many wage-and-salary jobs have a fixed contracted number of hours, and it is not easy to negotiate the hours as an employee (Tazhitdinova, 2022). Entrepreneurs have more flexibility than paid employees to change their work hours in response to tax rate changes. We contribute to the tax responsiveness of labor supply literature by focusing on entrepreneurs, i.e., the segment of workers who are most likely to respond at the intensive margin.

To estimate the effects of individual-specific PIT rates, we use an instrumental variable (IV) strategy based on rotating panel data from the Annual Social and Economic Supplement (ASEC) of the Current Population Survey (CPS), focusing on entrepreneurs. Our identification relies on the variation over time in individual-specific marginal PIT rates due to tax policy changes, including the Tax Cuts and Jobs Act that took effect in 2018. We calculate the individual marginal PIT rates using the National Bureau of Economic Research's (NBER) Internet TAXSIM model, including itemized deductions. The estimated IV coefficients imply that higher marginal PIT rates have a significant and important positive effect on the hours worked by incorporated entrepreneurs. Marginal PIT rates do not have an overall meaningful impact on unincorporated entrepreneurs, but we find a positive effect of marginal PIT rates on work hours among the unincorporated entrepreneurs who work 50 or more hours.

The rest of this paper is organized according to the following roadmap. In the second section, we review the income taxation and entrepreneurship literature and the literature on the effects of taxation on labor supply in terms of hours worked. We also provide an overview of the income taxation rules for incorporated and unincorporated businesses in the United States and

briefly present a theoretical model of entrepreneurial work hours choice. The third section describes and discusses our data. In the fourth section, we present our empirical model and estimation strategy. In the fifth section, we show the empirical findings for the full sample and for interesting subsamples, along with robustness checks. We discuss our findings in the context of the literature in the sixth section and conclude in the seventh section.

2. Background and theory

2.1. Previous literature

In a series of papers, Carroll et al. (2000a, 2000b, 2001) investigate PIT effects on the growth of small firms' receipts, hiring additional labor, and making capital investments. Their findings suggest that higher marginal PIT rates decrease the activities of existing entrepreneurs. Heim (2010) and DeBacker et al. (2019) find that reported self-employment income positively correlates with marginal tax rate cuts. Saez (2010) finds that self-employed bunch significantly more than paid employees at kink points of the earned income tax credit (EITC) schedule, indicating they are more responsive to taxation. Chetty et al. (2013) report that the self-employed bunch at the first EITC kink point by manipulating their self-employment income to maximize the EITC refund. Fossen et al. (2020) analyze the relationship between personal income taxation and the share of own business equity in the asset portfolios of entrepreneurs in Germany. They find a positive effect of higher PIT rates on investment in an own business at the extensive margin, but a negative effect at the intensive margin, and rationalize this with tax avoidance. Further studies analyze aggregated data. Using dynamic panel estimation at the state level, Bruce et al. (2015) estimate entrepreneurial productivity, measured as nonfarm proprietors' income per person. They report a negligible impact of personal income taxation on entrepreneurial productivity. Bruce and Deskins (2012) find that higher top PIT rates are related to a decrease in the state share of

entrepreneurial stock. Bruce and Glenn (2016) use the ratio of nonfarm proprietors' income over total personal income and the fraction of self-employed workers among all workers as intensive margin measures of entrepreneurial activity at the aggregate level. Bruce et al. (2019) examine the effects of different categories of state-level government expenditures. Overall, these studies mostly find limited and mixed results, concluding that state tax policy does not significantly influence entrepreneurial performance. Our first contribution is to examine, using individual-level panel data, how far PIT rate changes trigger a reaction of a crucial intensive margin indicator that has been neglected so far in the entrepreneurship and income taxation literature: the number of hours worked among existing entrepreneurs.

By analyzing time allocation (Becker, 1965), we also contribute to the more general labor supply and taxation literature. An extensive body of literature has analyzed labor supply responses of paid employees to taxation both at the extensive margin (participation in the labor market) and at the intensive margin (number of hours worked); see Keane (2011, 2022) for excellent surveys. Eissa and Liebman (1996) find that the 1987 expansion of the EITC did not significantly impact the hours worked by single women with children who are already in the labor force. Other studies examining the effects of tax changes on hours worked by single mothers report that work hours rise as net-of-tax rates increase (Meyer and Rosenbaum, 2001; Gelber and Mitchell, 2012). Cahuc and Carcillo (2014) examine the detaxation of overtime pay in France and find no significant impact on the number of overtime hours. Bargain et al. (2014) and Bick et al. (2019b) conduct country-level analyses of the response of work hours to nonlinearities in taxation for married individuals. Tazhitdinova (2022) examines moonlighting and finds that tax breaks incentivize increased hours worked among paid employees in Germany. Sigaard (2023) analyzes work hours in administrative data to connect the literatures on labor supply and the elasticity of taxable income.

Compared to prior studies that use paid employees, we examine how far the PIT rate affects the number of hours worked among entrepreneurs. The prior literature largely neglected this group, although entrepreneurs are expected to be particularly responsive to taxation because they are more flexible. To identify responses in hours worked for entrepreneurs, we use an instrumental variable strategy and utilize exogenous variation from all tax rate changes from 2003-2019 by simulating individual-specific tax rates rather than relying on a particular tax reform (Eissa and Hoynes 2004), long-term tax variations (Blundell et al., 1998) or particular nonlinearities in taxation (Bargain et al., 2014; Bick et al., 2019b).

2.2. Income taxation of incorporated and unincorporated entrepreneurs

The personal and corporate income tax codes could affect the hours worked by entrepreneurs. Progressive tax rates can reduce incentives for entrepreneurship by reducing the reward for successful outcomes (Gentry and Hubbard, 2000). Conversely, income taxes with loss offset provision[5] or tax rate progressivity can smooth risky after-tax income and serve as insurance for risk-averse agents when they engage in risk-taking activities such as entrepreneurship (Domar and Musgrave, 1944; Cullen and Gordon, 2007). Another important consideration is that self-employment offers more opportunities for tax avoidance and evasion strategies relative to paid employment, for example, through income underreporting, reclassification of taxable income, or the use of loss-offset provisions (De Mooij and Nicodeme, 2008; Kleven et al., 2011; Bruce et al., 2020; Fossen et al., 2020). This may make entrepreneurial activity relatively more attractive when tax rates are high.

C-corporations and pass-through entities: In addition to PIT rules, CIT rules may also affect the hours worked. Self-employed workers owning an unincorporated business (e.g., sole

[5] Loss-offset provisions allow self-employed workers to utilize their business losses to offset income from other sources or other periods (deducting losses from the PIT base).

proprietorships, partnerships, independent contractors) pay PIT and no CIT. Entrepreneurs owning an incorporated business can choose a C-corporate form (e.g., C-corporation) or a pass-through entity form (e.g., S-corporation), which impacts the type of income tax paid (Barro and Wheaton, 2020). Pass-through indicates that business income passes through to the owner's individual tax base and is taxed under PIT rules (Luna and Murray, 2010; Giroud and Rauh, 2019). For C-corporations, business profits are taxed using the CIT rate. Then, the net profits can be retained in the business or distributed to the shareholders, who pay their PIT on the distributions. Another business form is the limited liability company (LLC), which can be unincorporated or incorporated. In the latter case, it can be subject to the CIT (Giroud and Rauh, 2019; IRS, 2022).[6] If CIT rates are lower than PIT rates, entrepreneurs can choose a C-corporate form to minimize the taxation of profits, or they can choose pass-through taxation to maximize the deduction value in the case of business losses (Cullen and Gordon, 2007).

Incorporation: Self-employed individuals can decide to incorporate their business for multiple reasons, such as legal protection and tax considerations. An entrepreneur might also choose not to incorporate due to more complex paperwork and disclosure requirements (Prakash, 2020) and higher costs (Harroch, 2021; Lejour and Massenz, 2021). Furthermore, liability protection is not assured if the corporate veil is pierced (Jimerson and Snell, 2016), e.g., when lenders demand personal guarantees from the entrepreneur. Some states also impose a minimum capital amount and a minimum number of people for forming a corporation (Wolters Kluwer N.V., 2022). Forming an LLC is a simpler process than incorporating the business, and an entrepreneur can choose to limit liability without incorporating by forming an unincorporated LLC or a sole

[6] Limited liability entities include limited liability companies (LLCs) and limited liability partnerships (LLPs). There are single-member and professional LLCs. LLCs can be subject to CIT rates by the decision of the owner (Luna and Murray, 2010; Murray, 2020).

proprietorship with another limited liability type (IRS, 2022). The share of incorporated businesses has increased from 2005 to 2019 (Can, 2022), and some of the reasons for this development include decreasing costs and higher ease of incorporating (Shane, 2015).

Major tax reforms: Our data period includes major PIT rate changes, in particular, the 2003 Jobs and Growth Tax Relief Reconciliation Act (JGTRRA), which decreased, for example, the top marginal federal PIT rate from 38.6% to 35%, the 2012 American Taxpayer Relief Act (ATRA), which increased it to 39.6%, and the 2017 TCJA, which decreased it to 37%. These reforms and state PIT rate changes provide large income tax rate variation for our estimations. The TCJA also reduced the maximum CIT rate from 35 percent to a flat 21 percent (Dowd et al., 2020).

2.3. Theory of tax effects on hours choice

We briefly present a standard labor supply model adapted to entrepreneurship following Carroll et al. (2001). For simplicity, we do not include hired input labor in the model to focus on hours worked by the entrepreneur (e). Labor supply, i.e., the choice of hours worked, affects utility. We consider an individual entrepreneur maximizing the utility function:

$$\mathrm{U}(c, e), \tag{1}$$

where c is consumption that includes leisure, subject to the budget constraint:

$$c = \mu F(e) + A. \tag{2}$$

For any given entrepreneur, A is defined as non-labor income, and μ is the tax price that is defined as one minus the tax rate. We assume that the output of the entrepreneurial business is determined by the production function $F(e)$, and the entrepreneur remains in the business without any time limit. The entrepreneurial output generates entrepreneurial income (with the price normalized to one). More entrepreneurial income allows more consumption, which creates higher

utility. Entrepreneurs choose their work hours e to maximize utility, yielding the first-order condition:

$$\mu U_c F_e + U_e = 0 \tag{3}$$

To determine the impact of a change in tax price on an entrepreneur's work hours, the first-order condition implies:

$$\frac{de}{d\mu} = \frac{-\{U_c F_e + [F(e)][\mu U_{cc} F_e + U_{ce}]\}}{\mu U_c F_{ee} + 2\mu U_{ce} F_e + \mu^2 U_{cc} F_e^{\,2} + U_{ee}}. \tag{4}$$

The net effect of the tax price on hours worked is ambiguous due to the well-known conflict of income and substitution effects. As tax rates increase (and μ is decreased), the magnitude of the income effect's positive impact on hours worked due to having less disposable income may or may not exceed the magnitude of the substitution effect's negative impact on hours worked due to higher-taxed working time. Some tendencies can be deducted (Carroll et al., 2001): as the share of entrepreneurial business profits used to finance consumption ($\frac{\mu F_e}{c}$) increases, the marginal utility of consumption (U_c) will become more important for the decision to supply entrepreneurial labor to the business. In this case, the substitution effect will likely exceed the income effect, and the effect of the tax rate on hours worked is likely to be negative. At the same time, the faster the marginal utility of consumption declines (U_{cc}), the less likely it is that additional profits will increase the hours worked in the business.[7] The theoretical ambiguity of the effect of the income tax rate on the hours worked by entrepreneurs calls for an empirical estimation.

[7] The entrepreneurial effort decision may also be partially based on procedural utility gained from an entrepreneur's activities (Carroll et al., 2001; Benz and Frey, 2008). In our estimation, we deal with unobserved time-invariant individual tastes for entrepreneurship by taking first differences over time.

3. Data

3.1. ASEC microdata and macroeconomic variables

We use the annual March supplement (ASEC) of the CPS from 2003 to 2019 to examine the effects of taxation on hours worked in entrepreneurship. The dataset is provided by the Census Bureau and distributed as IPUMS-CPS (Flood et al., 2022). The CPS-ASEC is a survey of households and individuals for every US state and the District of Columbia collected annually in March. It provides information on employment, self-employment, detailed income components, hours worked, industry, region, and a wide set of socio-demographic characteristics of the respondents.

Our sample begins in 2003 because the industry codes changed significantly in this year (IPUMS-CPS, 2023), and we end our sample in 2019 because of the potential of nonrandom attrition and nonresponse bias in the 2020 survey wave due to the Covid-19 pandemic (Rothbaum and Bee, 2021). We limit the sample to individuals of prime working age (21-64) who report that their longest main job was self-employment (with or without employees and with or without partners) in the calendar year before the ASEC interview. Some of the self-employed individuals also have secondary wage-and-salary jobs in the data. We do not include any individuals who report some self-employment income from other work if their longest main job held during the previous year was wage and salary. We can distinguish between self-employed individuals with an incorporated and an unincorporated business, while it is unobserved whether an incorporated entrepreneur is subject to the CIT (Hipple, 2010; Hipple and Hammond, 2016). However, it has been documented that CIT rates apply to only a small number of small businesses (Bruce et al., 2020); hence, PIT rates are likely to have a larger influence on the allocation decision of weekly

work hours of entrepreneurs than CIT rates. Therefore, we focus our analysis on the PIT, but also control for the CIT.

In an interview in March of year *t*, respondents are asked how many hours they usually worked per week in the previous calendar year, *t*-1, and there are detailed questions on the components of before-tax income in the previous calendar year (*t*-1), including income from wages and salaries as well as business income. There is also a question about the usual number of hours worked currently (at the time of the interview in *t*), but we do not use this question in this analysis because it is important to align the information on work hours with the income information, which pertains to *t*-1.[8]

Individuals in the sampled households are interviewed in March for two successive years for the ASEC. New households enter the panel every year and exit the panel after the second interview a year later. This short rotating panel structure of the data allows us to observe the change in the number of hours usually worked per week for each individual from one year to the next, as well as the change in before-tax income. For example, let the two years when an individual is interviewed be denoted *t* and *t*+1, then we observe the change in work hours and income from *t*-1 to *t*. The questions on the demographic characteristics, such as education, refer to the current situation at the time of the interview, so we observe them for *t* and *t*+1. An individual must be observed as self-employed in both years *t*-1 and *t* to be included in our analysis.

We merge the individual-level data with aggregate economic control variables. We obtain each state's unemployment rate and population by year from the Federal Reserve Bank of St. Louis (FRED, 2023a; FRED, 2023b). The Bureau of Economic Analysis (BEA, 2023) provides real GDP values by state and year. We also use the House Price Index (HPI) from the Federal Housing

[8] The correlation between the current and the previous year's weekly work hours is 0.74.

Finance Agency (FHFA, 2023). The Tax Foundation (2023b, 2023c) and Tax Policy Center (2023a) provide the state and federal statutory CIT rates. Tabulated itemized deductions by income levels based on tax return data are obtained from the Internal Revenue Service (IRS, 2023). We merge these data to the ASEC data by the state of residence of an individual and the year prior to the interview, *t*-1, which is the year the individual hours and income information pertains to.

3.2. Hours worked variable

The weekly hours worked variable in the CPS data is considered reliable, and recent research has utilized the variable (Cociuba et al., 2018; Bick et al., 2019a; Lee et al., 2023). Cociuba et al. (2018) conduct an alternative calculation of hours using the US aggregate weeks worked measure from Bick et al. (2019a), and they do not find any significant differences. Frazis and Stewart (2010) attempt to reconcile differences in the hours worked variables in the CPS data and the Current Employment Statistics data. They find that the discrepancy between the two datasets arises due to differences in the workers covered, differing definitions of multiple job holders, and the hours concepts in these data (hours worked vs. hours paid). American Time Use Survey (ATUS) data (Flood et al., 2023) include randomly selected exiting survey participants from the CPS data. Insolera et al. (2019) compare the time per week values for different types of activities between the ATUS data and Panel Study of Income Dynamics (PSID), and they find that the amount of time spent on the activities is similar, and the largest difference occurs for leisure hours.

Still, one might wonder how accurate the hours worked information in the ASEC is particularly for entrepreneurs, given that entrepreneurs may not need to track their hours. The ASEC question on worked hours asks for "usual" work hours. To check the validity of the hours information for entrepreneurs, we compare the average work hours of entrepreneurs in our sample

(as reported in Table 1) based on the ASEC (survey data) with entrepreneurs in the ATUS (time-use data), which requires respondents to closely track and report their time spent in various activities. Between 2003 and 2019 and for ages 21-64, the ATUS data show the average weekly hours as 41.69, 45.69, and 39.39 for any type of self-employment, incorporated self-employment, and unincorporated self-employment, respectively. Overall, the hours are similar to the averages in Table 1, with slightly more hours reported in ASEC compared to ATUS, consistent with results found by Hyytinen and Ruuskanen (2007). The fact that we find only small differences between the survey and the time use data is reassuring. Entrepreneurs seem to have a good sense of how many hours they work. Moreover, in survey data, entrepreneurs have no obvious reason to systematically underreport or overreport the work hours (unlike income information in tax returns). Overall, the hours worked variable seems to be a reliable measure in the ASEC data.

3.3. Potential misreporting of self-employment income

In our study, we use income to calculate the individual-specific marginal tax rates, and as a control variable. Self-employed workers could underreport their earnings, not only in administrative tax data but also in survey data (Hurst et al., 2014). As for the potential income underreporting, Abraham et al. (2021) analyze self-employment income information by comparing CPS-ASEC survey data and administrative tax data for the same individuals. They find that more than half of the sample claiming CPS-ASEC self-employment income between 1996-2015 did not report self-employment income for the same year on their tax returns and vice versa.[9] Furthermore, the rising rates of self-employment activity and income in the US in recent years that are present

[9] Abraham et al. (2021) provide evidence on miscategorization of self-employed income, such as reporting self-employment income as a wage-and-salary worker (also see Collins et al., 2019). As for earlier research, see Pissarides and Weber (1989) for a study on income underreporting for self-employment, using data from the UK. Using Canadian data, Lemieux et al. (1994) build a survey to obtain a measure for noncompliance by analyzing the aggregate-level income-expenditure gap in the underground economy. Clotfelter (1983) and Joulfaian and Rider (1998) find that as marginal tax rates decrease, the underreported self-employment income falls.

in the administrative tax data were not present in the survey, which led to speculation of whether the survey captures the presence of gig work (Abraham et al., 2017).[10] Using IRS returns, Garin et al. (2022) show that the reported income of gig workers does not explain the rise in self-employment activity and income. In contrast, the self-reported income of individuals in the EITC phase-in range explains the rise. Importantly, Imboden et al. (2023) find that the evasion and avoidance activity in administrative data (Slemrod and Weber, 2012) is absent in survey (ASEC) data. They report that self-employed workers, who bunch at the first EITC kink in the administrative tax data, mostly do not bunch in the survey data.[11]

Hence, while the incentive to underreport income in administrative tax data is obvious, underreporting in survey data is expected to be lower. If there is underreporting of income in the ASEC survey data, we may underestimate the calculated marginal tax rate due to the progressive tax schedule. However, by taking the first difference in our econometric estimation, we eliminate any time-invariant level of income underreporting and solely rely on changes over time; hence, the first differences in the marginal tax rate would still provide useful estimates. Income underreporting would be more problematic if we attempted to compare the income of the self-employed to paid employees, who are less likely to underreport their income as their wage and salary income is reported to tax authorities by their employers (Imboden et al., 2023). Considering that we only analyze a sample of the self-employed, we do not expect systematic differences in misreporting within the sample.

[10] Abraham et al. (2017) suggested that gig on-demand non-employee work could have been reported as part-time work rather than primary work. We do not include self-employed individuals who do not report self-employment as their primary and longest job in our sample.

[11] Starting in 2011, electronic payments received by businesses were reported through the Form 1099-K (Slemrod et al., 2017). It has been found that Form 1099-K increased tax compliance on average (Adhikari et al., 2021) but was not very effective in increasing tax compliance for small firms that are likely evaders (Slemrod et al., 2017).

3.4. Descriptive statistics

Figure 1 shows the average weekly work hours of the self-employed individuals in our sample from 2002 to 2018 and the subsamples of the incorporated and unincorporated self-employed. The figure shows that the self-employed owning incorporated businesses work significantly more hours than those owning unincorporated businesses. This is consistent with the conjecture that incorporated entrepreneurs are, on average, more ambitious and growth-oriented (Levine and Rubinstein, 2017). The figure also reveals that work hours among the self-employed dropped during the financial and economic crisis in 2008 and have not recovered. In addition, the figure provides the statutory top marginal PIT rate. This is the sum of the federal and average state marginal PIT rate in the highest income bracket (Tax Policy Center, 2023b). The effects of the 2003 JGTRRA, the 2012 ATRA, and the 2017 TCJA mentioned above on the top marginal PIT rate are clearly visible. The large changes in the statutory combined top PIT rate demonstrate some of the variation over time coming from federal and state tax reforms, which we use for identification in the econometric analysis. A clear pattern of correlation between the top statutory PIT rates and the work hours of the self-employed does not emerge. In the following, instead of top statutory PIT rates, we will analyze individual-specific marginal PIT rates that take into account the income bracket an individual is in and other relevant circumstances of the taxpayer, such as the joint tax filing status of married couples. It is also important to control for relevant individual- and state-level factors such as education and real GDP per capita.

Figures 2, 3, and 4 are binned scatter plots with fitted quadratic regression curves that show the positive association between hours worked per week and annual income for any type of self-employment, incorporated self-employment, and unincorporated self-employment. As it is apparent from the figures, average income is higher for incorporated self-employment than for

unincorporated self-employment for any number of hours worked (note the different scales). One can also see that annual income grows with hours worked approximately linearly, suggesting an almost constant or only slightly decreasing hourly earnings rate.

Before we estimate the causal effect of the individual-specific marginal PIT rate on hours worked per week by the self-employed, Figures 5, 6, and 7 show the raw associations in the data for the three self-employment samples. The figures reflect a positive relationship for incorporated self-employment, and a negative association for unincorporated self-employment. Negative marginal tax rates occur when income falls within the increasing credit section of the EITC schedule; we observe this for unincorporated self-employed, who often have low income. We do not control for any other variables or take the endogeneity of the tax rates into account in these figures. We address endogeneity and include covariates in our econometric IV estimations.

Table 1 provides the mean characteristics in the samples of all self-employed and those with incorporated and unincorporated businesses. The female share among the self-employed is only 32% and even lower among the incorporated self-employed. Only 4% of the self-employed are Black business owners. The self-employed owning incorporated businesses are much more likely to have a college degree (48%) in comparison to those owning unincorporated businesses (32%), and they have significantly higher annual income, confirming results from the literature (Levine and Rubinstein, 2017). The incorporated self-employed face higher marginal PIT rates on average than the unincorporated due to their higher income.

4. Methodology

4.1. Empirical model

We intend to estimate the effect of individual-level marginal PIT rates on the number of hours per week that self-employed individuals work. We separately analyze hours worked among

the incorporated self-employed, unincorporated self-employed, and any type of self-employed (i.e., the total of incorporated and unincorporated self-employed), based on the respective samples. The following Equation 5 shows our basic model for an individual *i* and year *t* (that the information belongs to):

$$Hours\ worked_{it} = \beta_1 Marginal\ tax\ rate_{it} + \kappa_i + \gamma_t + \xi_{it}, \quad (5)$$

where κ_i and γ_t are unobserved individual and time fixed effects, and ξ_{it} is the remaining error term. The individual fixed effect captures unobserved tastes for entrepreneurial work and leisure, and the time fixed effect general unobserved aggregate changes in these tastes, for example, due to the business cycle. To estimate the equation, we take first differences between years *t* and *t*-1 ($\Delta x_{it} = x_{it} - x_{i,t-1}$) for hours worked and marginal PIT rates (which are reported at years *t*+1 and *t* in the survey data):

$$\Delta Hours\ worked_{it} = \beta_1 \Delta Marginal\ tax\ rate_{it} + \Delta\gamma_t + \beta_2 X_{it} + \alpha_s + \Delta\varepsilon_{it}. \quad (6)$$

Eq. (6) above is equivalent to Eq. (5) with the substitution: $\Delta\xi_{it} = \beta_2 X_{it} + \alpha_s + \Delta\varepsilon_{it}$. X_{it} represents control variables and α_s state fixed effects. We thus allow levels of control variables and state fixed effects to capture part of the variation in the differenced original error term. The unobserved individual fixed effects (κ_i) are eliminated from Eq. (6) due to the first differencing. We are primarily interested in the coefficient β_1, which captures the effect of the marginal PIT rate on hours worked. We report heteroscedasticity robust standard errors throughout the paper.

4.2. Addressing endogeneity

The change in the marginal PIT rate is endogenous in Eq. (6), even after eliminating individual fixed effects, because the marginal PIT rate is a function of an individual's chosen behavior. If an individual adjusts the number of hours worked in year *t*, this is likely to affect the individual's taxable income in *t*, which may push the individual into a different tax bracket of the

progressive PIT schedule. Hence, the individual's marginal PIT rate at year *t* changes mechanically due to the individual's adjustment of work hours.

We address this endogeneity using an IV strategy, where identification is based on state and federal level variation over time in PIT schedules from 2002 to 2018 in the United States. The IV strategy is similar to that used by Carroll et al. (2000a), Gruber and Saez (2002), and Fossen et al. (2020). The endogenous explanatory variable $\Delta Marginal\ tax\ rate_{it}$ is obtained by calculating the marginal PIT rate for each individual in *t* and in *t*-1, based on the individual's relevant income components and the tax rules applicable in *t* and *t*-1, respectively, and then taking the difference. We need an instrument that significantly explains the variation in the personal PIT rate difference and is uncorrelated with unobserved determinants of hours worked. To calculate the IV, we simulate marginal PIT rates using an individual's income in year *t*-1 (inflated to year *t*) and tax rules in year *t*, instead of using income in *t* along with tax rules in *t*. From this we subtract the individual's marginal PIT rate using income at year *t*-1 and tax rules at year *t*-1. This calculation provides the part of the marginal PIT rate change between the years *t*-1 and *t* that is solely due to alterations in state and federal tax rules, as we do not use endogenous income in *t* to calculate the instrument. Table 2 summarizes the construction of the tax instrument.

Because we use (inflated) income from *t*-1 to calculate the marginal PIT rate in *t* for the instrument, any changes in individual income that are due to an individual's behavioral changes, in particular due to adjustments in the number of hours worked, are stripped off the instrument. We assume that changes in the state and federal PIT schedules are exogenous to the individual. There is sufficient individual-level variation in the instrument even after controlling for state and year fixed effects because the same state and federal tax reforms affect different individuals very differently depending on which tax bracket they are in, and this depends on their marital status,

the income of the spouse, and other family circumstances that influence the individual marginal PIT rate. Note that we control for marital status, the number of children, family income etc., as well as individual fixed effects by taking first differences, so only the differential impact of exogenous state and federal tax reforms on different individuals is used for identification.

4.3. Simulation of PIT rates

We simulate the individual-specific marginal PIT rates, including those needed to construct the IV, for all the years of our analysis, by using the National Bureau of Economic Research's (NBER) latest version 35 of the Internet TAXSIM model, a comprehensive and widely used tax calculator for federal and state PIT rates (Feenberg and Coutts, 1993).[12] In contrast to earlier versions of TAXSIM, version 35 implements the innovation that it separately inputs the income from wage-and-salary and income from self-employment, leading to accurate simulations in our context. An important advantage of the ASEC survey is that it separately reports all major income components, which makes it possible to calculate marginal PIT rates precisely and to use all the variation in the exposure of individuals to tax reforms that stems from their income and family situation.[13]

For our TAXSIM application, we closely follow the income tax and entrepreneurship literature (Butrica and Burkhauser, 1997; Bruce, 2000; Moore, 2003; Gurley-Calvez and Bruce, 2008, 2013; and Can, 2022). Each observation is assigned one of three possible tax filing statuses based on ASEC variables: single and head of household, married with joint taxation, or married with separate taxation. In case of married individuals, we obtain the spouse's income and age by

[12] See also https://users.nber.org/~taxsim/taxsim35/.
[13] Specifically, in the TAXSIM calculations we use the simulation year, state of residency, marital status, income from wage-and-salary, income from self-employment, spouse's income from wage-and-salary, spouse's income from self-employment, age, spouse's age, dividend income, interest income, number of children, social security income, pension and retirement income, unemployment benefits, income from transfers, and property tax payments.

using pointers provided in the IPUMS distribution of the CPS-ASEC. Table 3 shows which individual variables from CPS-ASEC or average variables by income group from IRS tables (as explained in the next section) we use to input into the TAXSIM calculations.

The Census Bureau internally uses an alternative tax model that generates tax rates and liabilities using information from the CPS-ASEC data and the publicly available IRS Statistics of Income, the American Housing Survey, and the State Tax Handbook (O'Hara, 2004; Webster, 2011; Lin, 2022).[14] The Census Bureau makes individual tax rates and tax liabilities obtained from their tax model available with the ASEC data. However, we use TAXSIM instead because the instrument calculation is essential for our identification strategy, so we need to be able to run our own tax simulations using income in *t*-1 in conjunction with tax rules in *t*. For consistency, we use TAXSIM for all our tax rate calculations.

4.4. Itemized deductions

Although CPS-ASEC provides income components in more detail than most other data sources available, there are no variables covering itemized deductions such as mortgage expenses.[15] Butrica and Burkhauser (1997) and Can (2022) assign zero to itemized deductions input in TAXSIM, which implies assuming the standard deduction for each observation. Bruce (2000) imputes itemized deductions from the Ernst & Young and University of Michigan Tax Research Database for six different groups in his data based on filing status (single, married, head of household) and status of self-employment, using a Tobit model.

[14] Bakija (2014) provides another income tax simulator.

[15] The PSID elicits itemized deductions in certain years, but not from every respondent. For the respondents who did not answer the itemization questions, the amount of income itemized is predicted by PSID (Butrica and Burkhauser, 1997). A disadvantage of the PSID in comparison to the ASEC is its smaller sample size, and it is only available biannually since 1998.

Since itemization is important for self-employed workers (Bruce, 2000), we impute itemized deductions based on average amounts by adjusted gross income bracket and year that are publicly available in the IRS Statistics of Income (SOI) summary data (Meyer et al., 2020).[16] We use the sum of the individual's wage-and-salary and business income and the spouse's wage-and-salary and business income as a proxy for the adjusted gross family income, following Bruce (2000). Utilizing average amounts of standard deductions from the SOI files per income bracket and year, we impute itemized deductions for each individual, namely real estate taxes paid, mortgage and medical expenses, and miscellaneous deductions, to calculate the marginal PIT rates using TAXSIM (see Table 3).[17]

4.5. CIT rates

The labor supply of self-employed workers in terms of hours worked could also be influenced by CIT rates. The CPS-ASEC data and TAXSIM do not provide variables or calculations for the CIT rates. Our study follows De Mooij and Nicodeme (2008), Ferede (2013), and Can (2022) and uses the statutory combined state and federal marginal CIT rates. For the self-employed with incorporated businesses, we assign marginal CIT rates (federal plus state rates) for each observation, by state of residency, based on the sum of the individual's and the spouse's business income, assuming that this sum approximately reflects the profit of the business.[18] For the self-employed with unincorporated businesses, the CIT rate is set to zero.

[16] Meyer et al. (2020), Jones and Ziliak (2022), and Imboden et al. (2023) link CPS-ASEC with IRS data to examine the EITC.

[17] We also perform a robustness check setting the itemized deductions in TAXSIM to zero instead of imputing itemized deductions. This implies the assumption that every taxpayer uses the standard deduction. As a result, the standard errors of the relevant coefficients increase, implying that using itemized deductions is important to calculate more realistic tax rates. Reassuringly, the 95% confidence intervals of the coefficients on the marginal PIT rate change estimated in this robustness check include the point estimates from our main estimation in Table 4.

[18] Liu (2014) uses one-year lagged per capita property tax as the instrument for CIT for the US data in 1904-1919. Da Rin et al. (2011) use multiple instruments for CIT following the political economy literature. In the our setting, it is highly likely that that property taxes could directly affect hours worked in self-employment, as businesses pay property

As mentioned, some incorporated businesses such as S-corporations are not subject to the CIT, but we do not observe the detailed organizational form. The CIT rate might be relevant for the work hours allocation of incorporated business owners even if an incorporated business only pays PIT because paying the CIT is an option that incorporated business owners have by switching the legal form from S-corporation to C-corporation. Transitioning between S-corporation and C-corporation and vice versa is even possible ex-post after profits or losses are observed (Cullen and Gordon, 2007). We might underestimate the effect of the CIT on those who are actually paying the CIT, but we are primarily interested in the effect of the PIT on hours worked, and the CIT rate serves as a control variable in these estimations. Like with the PIT rate, we take the first difference in the CIT rates between the years *t* and *t-1* and use this difference as a control variable in our regressions (subsumed in X_{it} in Eq. 6). The CIT rate is largely exogenous to the individual, given that the CIT is not as progressive and therefore does not depend on income as much as the PIT. On average, between 2002 and 2018, only 13 states had progressive CIT schedules compared to 34 states with progressive PIT schedules (Tax Foundation, 2023a; Tax Foundation, 2023b; Tax Policy Center, 2023a).

4.6. Further control variables

Income control variables in levels are included in the empirical specification. The tax rates are a nonlinear function of income and have a discontinuous schedule (Carroll, 1998). To account for potential nonlinear income effects, we use family income, which is the sum of the individual's and the spouse's wage-and-salary income and business income, and construct a 5-piece spline in

taxes, and the property tax rates varies only across states and time unlike the individually calculated personal income tax rate and its instrument.

family income that we include in our regressions (Gruber and Saez, 2002; Weber, 2014; Fossen et al., 2020).[19]

Moreover, we control for individual characteristics known to influence entrepreneurship (Parker, 2018). Age accounts for life-cycle effects and the work experience component of human capital, and some evidence points to an inverse U-shaped age effect (Auten and Carroll, 1999). Age squared is included as a regressor to allow for a potential nonlinear pattern. To control for formal education as another component of human capital, a set of dummy variables capturing an individual's highest educational attainment is employed: having less than a high school degree (omitted base category), having a high school degree, having some college education without completing the degree, and having a college degree. We include a dummy for marital status, as married individuals potentially experience more risk-sharing and social support. The number of children is also incorporated in the empirical model, as childcare responsibilities might affect work hours. We also include race dummy variables, i.e., black, white (omitted), and other race, and a female dummy variable. In addition, we incorporate a set of indicator dummies for the type of industry that a self-employed individual works in, as different industries may experience differential trends in work hours (see Table 1). Metropolitan areas can have a higher degree of economic and social interaction and agglomeration benefits than rural areas; hence, we also include a dummy indicating residency in a metro area.

At the state level, the unemployment rate and real GDP per capita control for changing business opportunities and regional business cycles. Moreover, the state GDP per capita and unemployment rate, along with the industry controls and the CIT rate, jointly control for the local

[19] Income splines also control for mean-reversion and a potential widening in the distribution of work hours and income (Gruber and Saez, 2002).

business climate. We proxy for wealth fluctuations, in particular the severity of the Great Recession, by including the House Price Index.[20]

4.7. Heterogeneity analysis

We analyze potential heterogeneity in the effect of tax rate changes on changes in weekly hours concerning two dimensions: formal education and the level of hours worked. Entrepreneurs with a high level of education are an interesting subgroup because these may be the more innovative entrepreneurs (e.g., Gentry and Hubbard, 2005). We split the sample into entrepreneurs with a 4-year bachelor's degree or higher, and those with lower education. As for hours worked, it has been reported that entrepreneurs typically work at least 50 hours (Cooper et al., 1988; Ferris, 2007; McCann, 2018). Hence, we split the sample into entrepreneurs who work at least 50 hours per week and those who work less (based on hours worked in year *t-1*). Note that as our dependent variable is the *changes* in hours, for this heterogeneity analysis, we need to assume that the changes in hours are not confounded by the sample splits based on the *levels* of hours.

5. Empirical Results

5.1. Main estimation

Table 4 reports the main IV estimation results obtained from regressing the change in weekly hours worked in self-employment on the change in the marginal PIT rates. The three columns show results based on all self-employed and the subsamples of the incorporated and unincorporated self-employed. The estimated coefficient on the marginal PIT rate change for incorporated self-employed individuals is statistically significant at the 1% level. As the marginal PIT rate is measured in percent in our data, the estimated coefficient indicates that increasing the marginal PIT rate by 10 percentage point increases the number of hours worked per week among

[20] We use the HPI with 2000 base. Giroud and Mueller (2017) use housing value data from Zillow.com to proxy for the severity of the recession. We use the HPI because of missing values in Zillow data for Montana and North Dakota.

the incorporated self-employed by 2.84 hours on average, which is 6.2% of their average weekly work hours. Given the mean marginal PIT rate of 24% among the incorporated self-employed, this corresponds to an elasticity of 0.15, which means that a 10% increase in the marginal tax rate (relative to the mean) increases the weekly work hours by 1.5%. The positive causal effect of the PIT rate on hours worked for incorporated self-employed identified here is consistent with the raw data association shown in Figure 6.

In contrast, marginal tax rate changes do not significantly affect the number of hours worked per week in unincorporated self-employment, with a point estimate close to zero, or in the sample combining both types of self-employment. Thus, the causal effect of the PIT rate on the hours worked by unincorporated self-employed is zero, although the raw data suggests a negative association in Figure 7. This highlights the importance of dealing with the endogeneity of the marginal PIT rate and including control variables in our econometric estimation. The CIT coefficient is not statistically significant in any of the columns.

The instrument is not weak, as shown by the Effective *F*-statistics (Montiel Olea and Pflueger, 2013) at the bottom of the table, which are well above the two-stage least squares (TSLS) critical value of 37.4 for a weak instrument threshold of 5% (using a significance level of 5%). Thus, the null hypothesis of weak instruments is rejected, and the instrument is a strong predictor of the endogenous tax rate (Pflueger and Wang, 2015). Table A1 in the appendix shows the full first-stage results, with the endogenous individual-level marginal PIT rate change as the dependent variable. The coefficient of the simulated tax instrument has the expected positive sign and is significant at the 1% level, again supporting the relevance of the instrument.

Concerning the control variables, we find in Table 4 that unincorporated self-employed individuals work more hours when the unemployment rate is higher, when they have some college

or a college degree, and when they are older (at decreasing marginal rates). Incorporated entrepreneurs work fewer hours in their business per week when they have more children. In the income taxation and entrepreneurship literature, studies based on survey data (Bruce, 2000; Schuetze, 2000; Hansson, 2012; Can, 2022) mostly find statistically significant impacts of age, marital status, and education on the probability of becoming self-employed. Our dependent variable, the change in hours worked, is different, and our sample does not include paid employees. Variables explaining the choice of being self-employed do not necessarily also explain the choice of hours worked conditional on being self-employed.

5.2. Heterogeneity effects by education and hours worked

To analyze heterogeneous effects, we first split the sample into individuals with high and lower levels of formal education. The results for individuals with a 4-year college degree are reported in Table 5, and for those with less education in Table 6. The estimated coefficient of the marginal PIT rate for incorporated self-employed is 0.346 and significant at the 5% level in the sample with the higher level of education, but only 0.263 and significant at the 10% level in the sample with the lower level of education. This indicates that the incorporated self-employed with higher education levels react more strongly to taxation than those with lower education levels. The marginal PIT rate has no significant effect on the hours worked among the unincorporated self-employed in either education group.

Second, we analyze whether the effects of PIT rate changes on changes in hours worked are heterogeneous regarding the initial level of hours worked. Table 7 shows the estimation results for the entrepreneurs who work 50 or more hours per week. The PIT rate coefficient is statistically significant and positive for all three types of self-employment. A 10 percentage point increase in

the marginal PIT rate increases the weekly hours worked by 2.80 hours for incorporated self-employment and by 2.82 for unincorporated self-employed.

Table 8 shows the estimation results for the entrepreneurs who work fewer than 50 hours. Here, the PIT rate coefficient is statistically insignificant for each of the three types of self-employment. Thus, the results in the full sample are mostly driven by those entrepreneurs who work 50 hours or more. As the incorporated self-employed work more hours on average than the unincorporated self-employed (Table 1), the incorporated self-employed are more likely to work 50 hours or more, so it is plausible that the PIT rate effect remains significant in the sample including all incorporated self-employed, but not in the sample including all unincorporated self-employed in Table 4.

5.3. Alternative models

We run a first robustness check altering how we model potentially nonlinear income effects. In our main model, we use a 5-piece spline of income. In the robustness check, we use a third-degree polynomial of income instead (Gruber and Saez, 2002; Saez, 2003; Fossen et al., 2020). A comparison of the results shown in Table A2 in the appendix with the main results in Table 4 reveals that the estimated coefficients on the tax rates are not sensitive to the functional form choice.

Next, we build up our full model step by step to see how sensitive the key coefficient of the PIT rate change is to the inclusion of different sets of control variables. Tables A3, A4, and A5 show the results for all self-employed, incorporated, and unincorporated self-employed individuals. We begin by including only marginal PIT and CIT rates and then successively add state-level controls, individual-level controls, income splines, industry dummy variables, and state and year fixed effects. Lastly, we replace the state and year fixed effects with state times year fixed

effects. This controls for unobserved shocks that hit all individuals in any state in any year. Identification of the tax effects is then solely based on within-state differences in exposure of individuals to tax reforms due to individual characteristics such as being in different tax brackets, taxpayer status, dependents, etc. The results in the three tables show that the estimated coefficients of the PIT rate changes obtained from the different model specifications are very similar to our main estimates in Table 4, indicating robustness.

Lastly, we also use the OLS estimator for comparison with our IV estimator. An important problem of the OLS estimator is that it does not account for the endogeneity of the marginal PIT rate; thus, comparing the OLS results to the IV results informs us about the size of the endogeneity bias of the OLS estimate. Table A6 shows the OLS results. When using OLS, the estimated size of the coefficient on the marginal PIT rate for the incorporated self-employed becomes smaller, but the coefficient remains statistically significant at the 1% level. The coefficient for any type of self-employment becomes statistically significant at the 1% level when using OLS, and the coefficient for unincorporated self-employment remains insignificant. The differences between the OLS and IV results suggest the presence of endogeneity bias in the OLS estimates, which underlines the importance of the IV strategy.

6. Discussion

6.1. Hours choice for incorporated entrepreneurs

Our study shows that an increase in the marginal PIT rate increases the number of hours worked by self-employed owners of incorporated businesses, holding the CIT rate constant. The tax effect is stronger for individuals with a 4-years college degree than for individuals with lower education levels, and it is only significant for those who work 50 or more hours per week. The estimated positive effect of marginal PIT rates on hours worked by incorporated self-employed

individuals is consistent with recent microdata evidence on extensive margin responses (Tazhitdinova, 2020; Can, 2022).

Why do self-employed workers with incorporated businesses work more hours when the PIT rate increases? The first potential explanation is provided by the standard labor supply model adapted to entrepreneurship (Carroll et al., 2001), as outlined in Section 2.3 of this paper: the income effect outweighs the substitution effect. In other words, the reduction in disposable income through higher taxes leads to an increase in hours worked to compensate for the income loss, and this effect is stronger than the disincentive to work due to higher-taxed labor income.

A second potential explanation is tax avoidance (Kleven et al., 2011; Bruce et al., 2020; Fossen et al., 2020). While profits of S-corporations are passed through and subject to the owner's PIT, the PIT affects owners of C-corporations only when the owners pay themselves a salary, distribute the earnings to themselves, or when they sell the business. If the profits are retained within the C-corporation of the same owner, they are not subject to the PIT. Therefore, self-employed individuals running an incorporated business have substantial discretion over when the PIT is applied and over which portion of their accumulated profits. Incorporated entrepreneurs could take advantage of the extensive tax avoidance opportunities by working more hours when marginal PIT rates are higher. They may shift business profits from the PIT base to the CIT base to benefit from relatively lower CIT rates (Cullen and Gordon, 2007), or they may scale up their business to engage more in income underreporting (Bruce et al., 2020).

Third, risk-averse self-employed workers may be induced to work more when there is more risk-sharing with the government. The government shares more risk with entrepreneurs through loss-offset provisions and the progressive tax schedule when PIT rates are higher (Domar and Musgrave, 1944; Cullen and Gordon, 2007), as the US tax system enables self-employed workers

to utilize their business losses to offset tax payments on personal income sources (Gordon and Sarada, 2018). This insurance effect works counter to the expectation that higher and more progressive tax rates reduce incentives to pursue high earnings through entrepreneurship (Gentry and Hubbard, 2000).

6.2. Hours choice for unincorporated entrepreneurs

Our main results indicate that marginal PIT rates do not affect the hours worked by self-employed owners of unincorporated businesses. While our result concerning work hours is novel, it is consistent with prior studies finding that state tax policy does not significantly impact other intensive margin indicators of unincorporated self-employment, such as nonfarm proprietors' income and employment (Bruce et al., 2015; Bruce and Glenn, 2016; Bruce et al., 2019).

The self-employed with unincorporated businesses tend to be less innovative, earn relatively less income, and are less likely to hire workers than those with incorporated businesses. Among the unincorporated self-employed, important motivations for being self-employed may be the difficulty of finding wage-and-salary employment (Astebro and Tag, 2017; Levine and Rubinstein, 2017; Fossen, 2020) or nonpecuniary benefits such as autonomy on the job (Hurst and Pugsley, 2011). These motives might be more important for unincorporated self-employed workers than monetary incentives, which might explain why they do not respond significantly to taxation.

Our heterogeneity analysis reveals that the unincorporated self-employed who initially work 50 hours or more per week respond to an increase in taxes by increasing their hours worked significantly. Unincorporated entrepreneurs who work 50 hours or more may be more similar to incorporated entrepreneurs in the sense that they are more motivated by monetary incentives. Then analogous potential explanations for this behavior may apply to them, i.e., the income effect outweighing the substitution effect; tax evasion, e.g., through income underreporting, which may

be easier to hide in larger operations; or the insurance effect through loss-offset provisions and tax progressivity.

6.3. Comparison to the labor supply literature

The broader literature on taxation and labor supply in terms of hours worked by paid employees generally finds a significantly negative or statistically insignificant association (see Section 2.1). In contrast, we find a positive and significant effect for incorporated entrepreneurs and observe no significant reaction for unincorporated entrepreneurs, except those working 50 hours or more. This comparison shows that entrepreneurs' intensive labor supply reaction to income taxation differs substantially from that of paid employees. In light of this comparison, the explanations based on tax avoidance and evasion and risk sharing with the government seem particularly plausible because entrepreneurs differ substantially from paid employees in these respects. Entrepreneurs self-report their income, whereas the income of paid employees is reported by their employers, and entrepreneurs can often shift income between personal income and corporate income tax bases, which provides them with much bigger opportunities for tax avoidance and evasion. Furthermore, the income of entrepreneurs is substantially more volatile and riskier than wage and salary income, so risk sharing with the government is more valuable for entrepreneurs. Relative to these two explanations, the potential explanation that the income effect outweighs the substitution effect seems less plausible because there is no apparent reason why these effects should differ substantially between paid employees and entrepreneurs.

7. Conclusion

We provide the first study investigating the impact of marginal personal income tax rates on the number of hours worked weekly by different types of entrepreneurs, using hours as an intensive margin indicator of their labor supply. Our estimations show how self-employed

individuals owning unincorporated and incorporated businesses react to taxation differently. The analysis is based on individual-level rotating panel data from the CPS-ASEC covering 2003 to 2019. We use NBER's TAXSIM model to simulate individual-specific marginal PIT rates and address the tax rate endogeneity by using tax reforms as instruments.

The results show that an increase in the marginal PIT rate increases the number of work hours for self-employed individuals with incorporated businesses. This effect is stronger among individuals with a 4-year college degree (or higher) or who initially work 50 hours or more weekly. While marginal PIT rates do not significantly affect hours worked for self-employed workers with unincorporated businesses in general, we find a positive effect among the unincorporated entrepreneurs who work 50 or more hours. When we combine the samples of incorporated and unincorporated self-employed individuals, no statistically significant impact can be detected (except for those working 50 or more hours), highlighting the importance of distinguishing between different types of entrepreneurs when analyzing tax effects.

While policymakers may wish to encourage hours worked in entrepreneurial activity, especially if it is innovative, this effort would be wasteful if the additional time spent in self-employment primarily served the purpose of tax avoidance. Therefore, an important avenue for future research is to advance our understanding of the mechanisms potentially explaining the tax effects we document in this paper, and in particular, more research is needed on the role played by tax avoidance and evasion. Future studies should also aim to collect additional data on owners of subcategories of incorporated businesses, such as C-corporations and S-corporations, to identify the impacts of taxation on work intensity in more precisely defined organizational forms. We hope that the initial evidence presented in this paper encourages future research in these directions.

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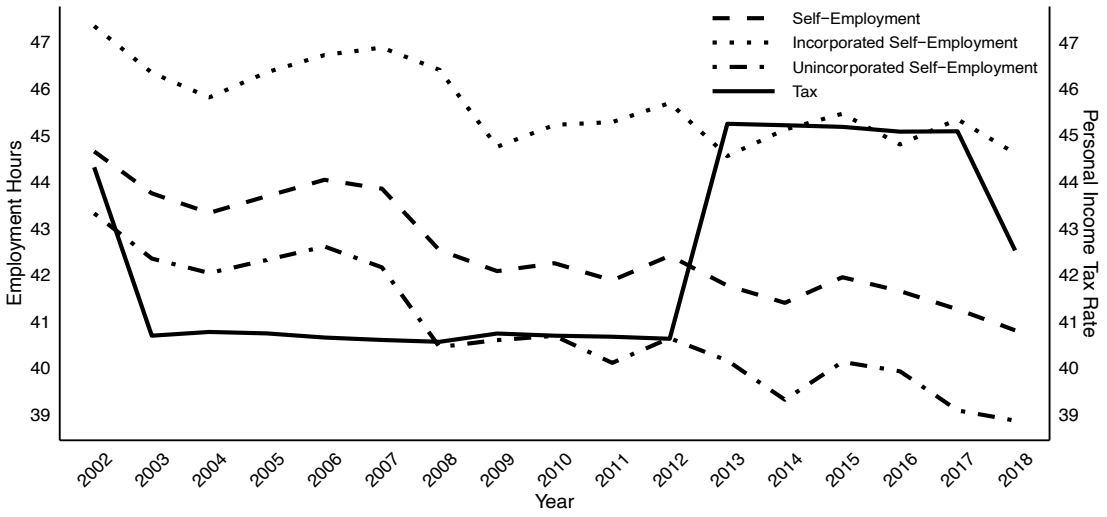
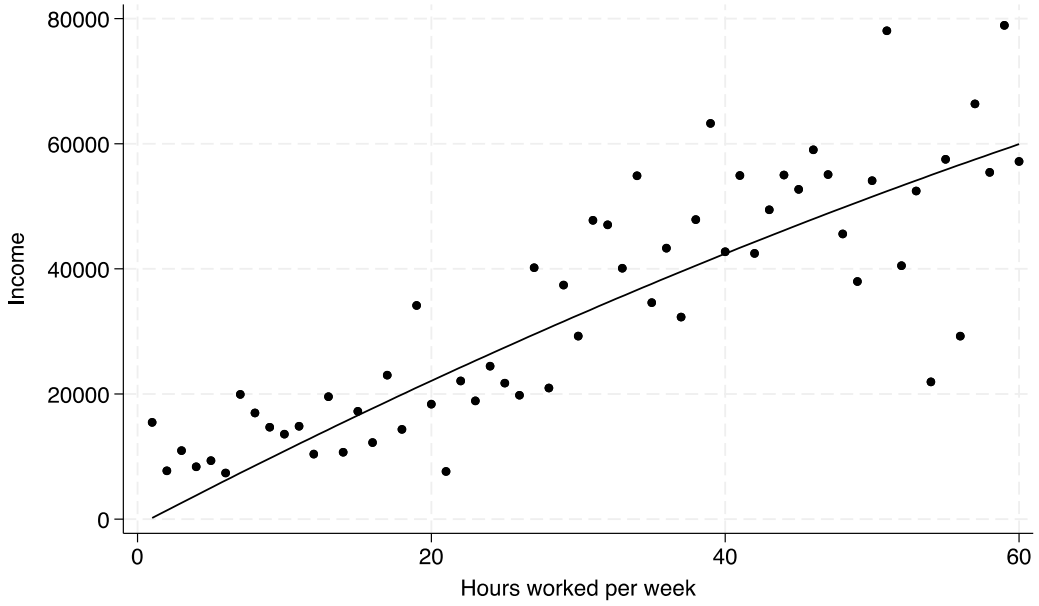
Figures

Figure 1: Hours in Self-Employment and Personal Income Tax Rate



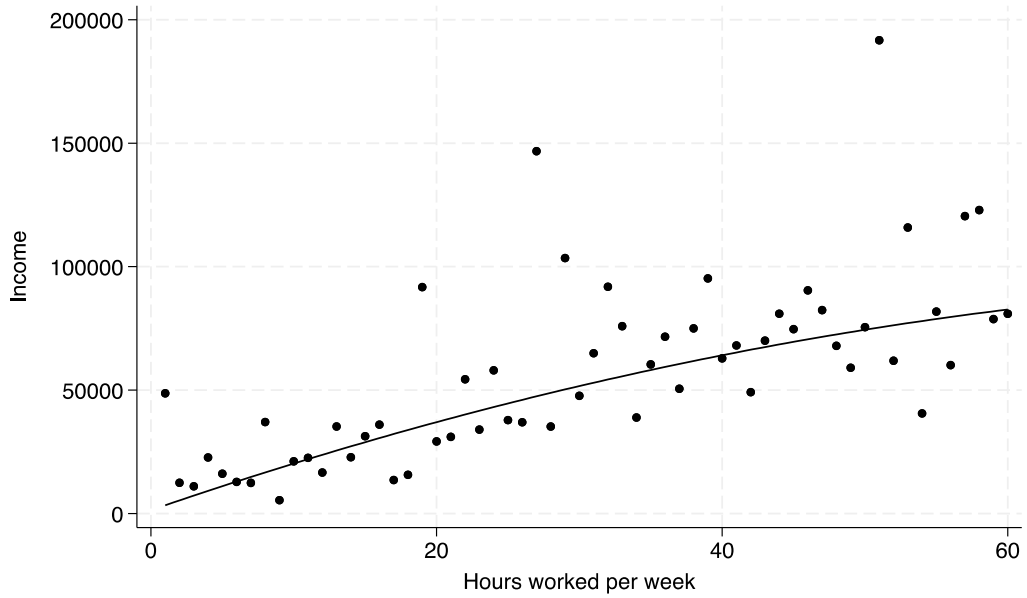
Notes: The figure shows the weekly work hours for self-employment (incorporated+unincorporated), incorporated self-employment and unincorporated self-employment. Personal income tax rate is the summation of federal and average state personal income tax rates for the highest income tax bracket. **Sources:** Tax Foundation, Tax Policy Center, and CPS-ASEC.

Figure 2: Income and Hours in Any Type of Self-Employment



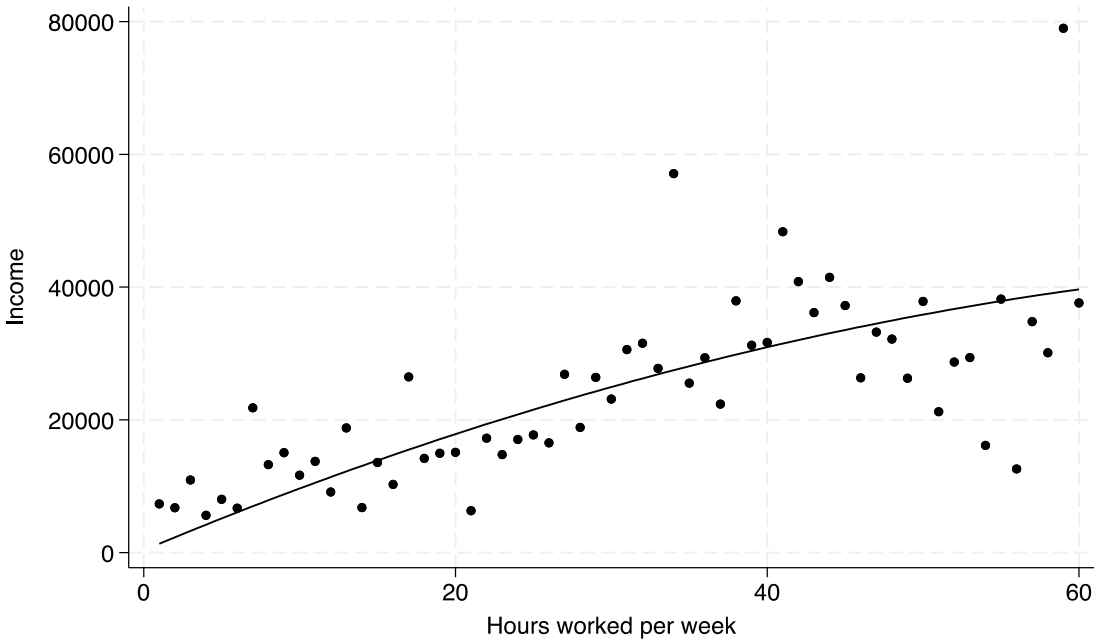
Notes: The figure shows a binned scatter plot and a quadratic regression curve of the weekly work hours and annual income for any type of self-employment (incorporated+unincorporated). Income is adjusted to 1999 dollars. **Source:** CPS-ASEC.

Figure 3: Income and Hours in Incorporated Self-Employment



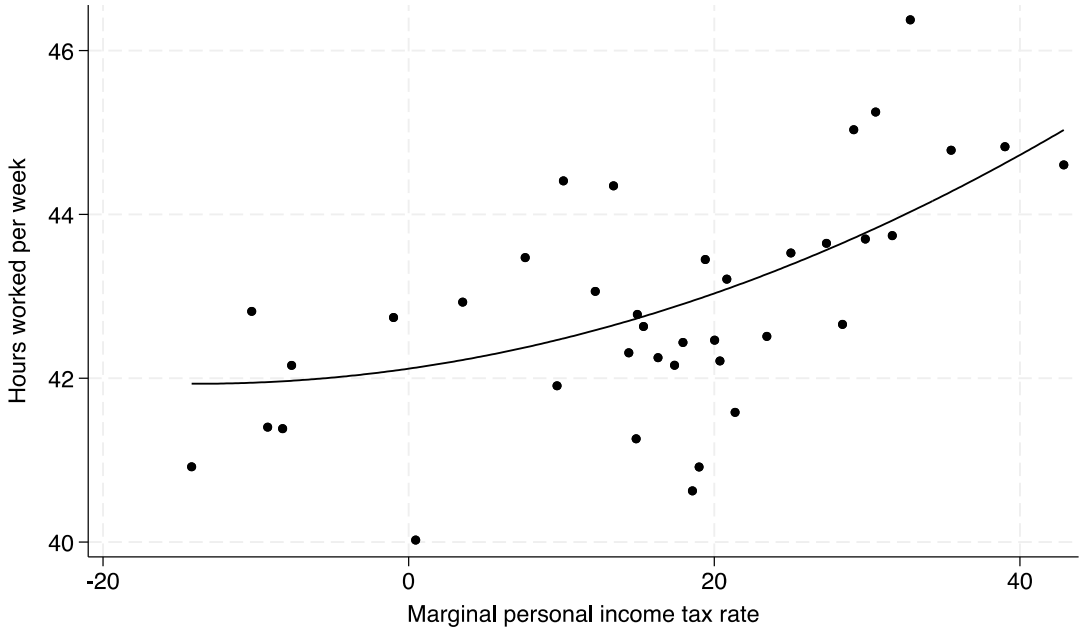
Notes: The figure shows a binned scatter plot and a quadratic regression curve of the weekly work hours and income for incorporated self-employment. Income is adjusted to 1999 dollars. **Source:** CPS-ASEC.

Figure 4: Income and Hours in Unincorporated Self-Employment



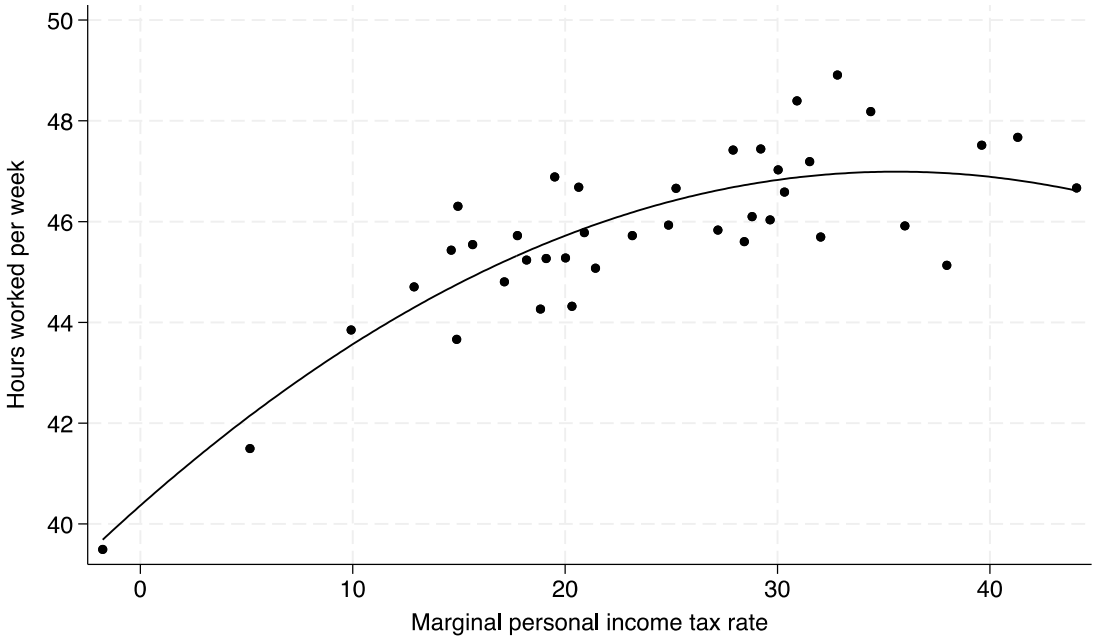
Notes: The figure shows a binned scatter plot and a quadratic regression curve of the weekly work hours and income for unincorporated self-employment. Income is adjusted to 1999 dollars. **Source:** CPS-ASEC.

Figure 5: Hours Worked and Marginal Tax Rates for Any Type of Self-Employment



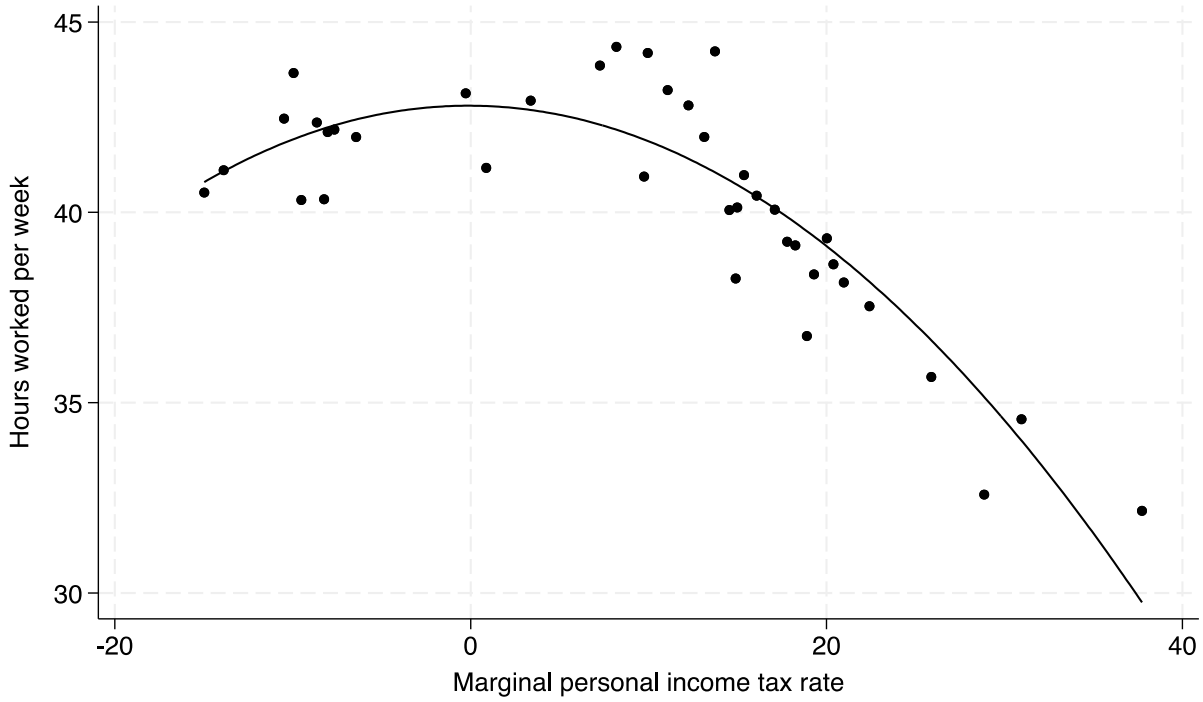
Notes: The figure shows a binned scatter plot and a quadratic regression curve of individual-specific marginal PIT rates and weekly work hours for any type of self-employment (incorporated+unincorporated). **Source:** CPS-ASEC.

Figure 6: Hours Worked and Marginal Tax Rates for Incorporated Self-Employment



Notes: The figure shows a binned scatter plot and a quadratic regression curve of individual-specific marginal PIT rates and weekly work hours for incorporated self-employment. **Source:** CPS-ASEC.

Figure 7: Hours Worked and Marginal Tax Rates for Unincorporated Self-Employment



Notes: The figure shows a binned scatter plot and a quadratic regression curve of individual-specific marginal PIT rates and weekly work hours for unincorporated self-employment. **Source:** CPS-ASEC.

Tables

Table 1: Mean Characteristics (CPS-ASEC 2003-2019)

Independent variable	Self-employed (Incorp+Unincorp)	Self-employed (incorporated)	Self-employed (unincorporated)
Weekly hours worked	42.73	45.79	41.10
Marginal PIT rate (%)	10.41	24.07	3.09
Less than high school	0.05	0.03	0.06
High school	0.28	0.22	0.31
Some college	0.28	0.25	0.29
College degree	0.38	0.48	0.32
Age	48.15	48.31	48.07
Female	0.32	0.26	0.36
Married	0.76	0.81	0.73
Number of children	1.04	1.10	1.01
Black	0.04	0.03	0.03
White	0.90	0.91	0.90
Other race	0.06	0.06	0.07
Metropolitan area	0.72	0.79	0.68
Family income	89,336	126,738	69,308
RGDP per capita	52,026	52,035	52,022
Unemployment rate	5.94	6.01	5.91
House price index	143.07	143.28	142.96
Industry:			
Industry unknown	0.10	0.04	0.13
Mining, manufact. & utilities	0.04	0.06	0.03
Construction	0.18	0.18	0.18
Wholesale & retail trade	0.10	0.14	0.09
Transport. & information	0.04	0.05	0.04
Financial services	0.07	0.08	0.06
Profess. & business services	0.19	0.21	0.18
Educat. & health services	0.10	0.08	0.10
Leisure & hospitality	0.06	0.06	0.05
Other services	0.08	0.06	0.10
Observations	49,676	17,324	32,352

Notes: The marginal personal income tax rates are the sum of the individual-specific state and federal marginal income tax rates. Family income is in ten thousand dollars.

Table 2: Tax Instrument Construction

Endogenous Marginal PIT Rate Change = a-b		
	a	b
Tax Rules	*t*	*t*-1
Income	*t*	*t*-1
Tax Instrument = c-d		
	c	d
Tax Rules	*t*	*t*-1
Income	*t*-1 (inflated to *t*)	*t*-1

Notes: *t* represents year.

Table 3: List of TAXSIM Input Variables and Corresponding CPS-ASEC and IRS SOI Variables

TAXSIM input variables	CPS-ASEC and IRS SOI Variables
TAXSIM ID	Individual's I.D. (cpsidp)
Tax year	Tax year (year)
State	Residency indicator for 50 states and D.C. (statefip)
Marital status	Tax filing status (marst): i) Single or head of household ii) Joint/married iii) Separate/married
Age exemptions	Age of the individual (age)
Age of the spouse	Age of the spouse (sploc and pernum)
Dependent exemptions	Number of children (nchild)
Wage-and-salary income	Wage-and-salary income (incwage)
Business income	Business income (incbus)
Wage-and-salary income of the spouse	Wage-and-salary income of the spouse (sploc and pernum)
Business income of the spouse	Business income of the spouse (sploc and pernum)
Social Security benefits	Received Social Security payments (incss)
Taxable pensions	Income from pension or retirement sources (incretir)
Dividend income	Income from stocks and mutual funds (incdivid)
Interest received	Received interest from interest on savings, funds, bonds, treasury notes, or other investments (incint)
Unemployment compensation	Received state and federal unemployment compensation (incunemp)
Transfer income	Summation of i) Received worker compensation (incwkcom) ii) Received veteran's payments (incvet) iii) Received survivor's benefit (incsurv) iv) Received child credit (incchild)
Itemized deductions:	
Real estate taxes paid	Obtained from IRS SOI files (proptax)
Mortgage and medical expenses	Obtained from IRS SOI files (mortgage)
Miscellaneous deductions	Obtained from IRS SOI files (otheritem)

Notes: The variables are individual variables from CPS-ASEC if not otherwise mentioned. The variable names in the data are provided in parentheses. For the publicly available IRS Statistics of Income, see https://www.irs.gov/statistics/soi-tax-stats-individual-statistical-tables-by-size-of-adjusted-gross-income#_grp2.

Table 4: Main IV Results

Independent variables	Self-employment (incorp. + unincorp.)	Self-employment (incorporated)	Self-employment (unincorporated)
Marginal PIT rate change	0.0566	0.284***	0.0471
	(0.0516)	(0.105)	(0.0621)
Marginal CIT rate change	0.0288	0.012	
	(0.0235)	(0.0176)	
Unemployment rate	0.441***	0.321	0.513***
	(0.131)	(0.212)	(0.184)
Real GDP per capita	0.0496	0.0811	0.0249
	(0.0405)	(0.0710)	(0.0534)
House price index	0.00243	0.0144	-0.00574
	(0.00783)	(0.0132)	(0.0108)
High school	0.434	-0.0456	0.629
	(0.424)	(0.955)	(0.517)
Some college	0.587	0.311	0.878*
	(0.436)	(0.966)	(0.529)
College	0.723	-0.929	1.410***
	(0.461)	(1.000)	(0.546)
Age	0.157*	-0.00437	0.233**
	(0.0863)	(0.155)	(0.114)
Age squared	-0.00194**	-0.000109	-0.00284**
	(0.000949)	(0.00169)	(0.00126)
Female	0.0571	0.0800	-0.0490
	(0.198)	(0.326)	(0.278)
Married	0.251	0.353	0.217
	(0.263)	(0.476)	(0.320)
Number of children	-0.0238	-0.253*	0.0899
	(0.0807)	(0.146)	(0.111)
Black	-0.589	1.389	-1.038
	(0.544)	(1.045)	(0.693)
Other race	0.0735	0.00939	0.00661
	(0.390)	(0.642)	(0.560)
Metropolitan area	-0.00510	-0.114	0.115
	(0.235)	(0.422)	(0.303)
5-piece income spline	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes
State and year fixed effects	Yes	Yes	Yes
R^2	0.006	0.008	0.008
Effective *F*-statistic	540.1	123.6	550.9
Elasticity w.r.t. PIT rate change	0.013	0.149	0.004
Observations	24,838	6,819	14,333

Notes: We estimate instrumental variable models. The dependent variable is the change in the weekly number of work hours from one year to the next. We use the samples of self-employed individuals with any type of business (Column 1), with an incorporated business (Column 2), or with an unincorporated business (Column 3). Heteroscedasticity robust standard errors are in parentheses. Stars (***/**/*) indicate significance at the 1%/5%/10% levels.

Table 5: IV Results (using the subsample with a 4-year bachelor's degree or higher)

Independent variables	Self-employment (incorp. + unincorp.)	Self-employment (incorporated)	Self-employment (unincorporated)
Marginal PIT rate change	0.0713	0.346**	0.0400
	(0.0783)	(0.174)	(0.0938)
Marginal CIT rate change	0.0393	-0.00103	
	(0.0365)	(0.0220)	
Unemployment rate	0.558***	0.420	0.463
	(0.198)	(0.285)	(0.316)
Real GDP per capita	0.123**	0.0950	0.190**
	(0.0612)	0.420	0.463
House price index	0.0108	0.0262	-0.00925
	(0.0117)	(0.0178)	(0.0176)
Age	0.258*	0.0340	0.543***
	(0.144)	(0.231)	(0.197)
Age squared	-0.00302*	-0.000427	-0.00616***
	(0.00156)	(0.00249)	(0.00215)
Female	-0.0235	0.193	-0.182
	(0.280)	(0.447)	(0.417)
Married	0.410	-0.199	0.529
	(0.407)	(0.714)	(0.549)
Number of children	-0.300**	-0.255	-0.265
	(0.124)	(0.192)	(0.196)
Black	-1.188	0.212	-0.898
	(0.913)	(1.350)	(1.269)
Other race	0.117	-0.184	0.455
	(0.538)	(0.794)	(0.886)
Metropolitan area	-0.257	-1.224*	0.406
	(0.414)	(0.639)	(0.572)
5-piece income spline	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes
State and year fixed effects	Yes	Yes	Yes
Effective *F*-statistic	148.1	44.0	159.2
Observations	9,429	3,385	4,464

Notes: We estimate instrumental variable models using the subsample of individuals with a 4-year bachelor's degree or higher. The dependent variable is the change in the weekly number of work hours from one year to the next. We use the samples of self-employed individuals with any type of business (Column 1), with an incorporated business (Column 2), or with an unincorporated business (Column 3). Heteroscedasticity robust standard errors are in parentheses. Stars (***/**/*) indicate significance at the 1%/5%/10% levels.

Table 6: IV Results (using the subsample with education below a 4-year bachelor's degree)

Independent variables	Self-employment (Incorp+Unincorp)	Self-employment (incorporated)	Self-employment (unincorporated)
Marginal PIT rate change	0.0558	0.263*	0.0545
	(0.0692)	(0.134)	(0.0819)
Marginal CIT rate change	0.0252	0.0333	
	(0.0308)	(0.0288)	
Unemployment rate	0.407**	0.211	0.553**
	(0.173)	(0.317)	(0.227)
Real GDP per capita	0.0157	0.0849	-0.0383
	(0.0535)	(0.113)	(0.0657)
House price index	-0.00135	0.00792	-0.00285
	(0.0105)	(0.0205)	(0.0137)
High school	0.458	-0.212	0.704
	(0.432)	(0.975)	(0.523)
Some College	0.500	0.0702	0.866
	(0.452)	(0.992)	(0.540)
Age	0.122	-0.00854	0.128
	(0.108)	(0.209)	(0.139)
Age squared	-0.00157	-0.000199	-0.00166
	(0.00121)	(0.00232)	(0.00154)
Female	0.119	0.00940	0.0814
	(0.282)	(0.487)	(0.379)
Married	0.200	0.875	0.0926
	(0.340)	(0.654)	(0.391)
Number of children	0.119	-0.216	0.193
	(0.106)	(0.221)	(0.135)
Black	-0.215	2.741	-1.084
	(0.675)	(1.686)	(0.812)
Other race	0.0474	0.445	-0.224
	(0.554)	(1.107)	(0.714)
Metropolitan area	0.0393	0.643	-0.0231
	(0.287)	(0.558)	(0.357)
5-piece income spline	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes
State and year fixed effects	Yes	Yes	Yes
Effective *F*-statistic	398.7	79.4	407.3
Observations	15,409	3,434	9,869

Notes: We estimate instrumental variable models using the subsample of individuals with education below a 4-year bachelor's degree. The dependent variable is the change in the weekly number of work hours from one year to the next. We use the samples of self-employed individuals with any type of business (Column 1), with an incorporated business (Column 2), or with an unincorporated business (Column 3). Heteroscedasticity robust standard errors are in parentheses. Stars (***/**/*) indicate significance at the 1%/5%/10% levels.

Table 7: IV Results (using the subsample with 50 or more weekly work hours)

Independent variables	Self-employment (incorp. + unincorp.)	Self-employment (incorporated)	Self-employment (unincorporated)
Marginal PIT rate change	0.166*	0.280*	0.282**
	(0.0916)	(0.151)	(0.132)
Marginal CIT rate change	0.0878**	0.00615	
	(0.0423)	(0.0238)	
Unemployment rate	0.613***	0.302	0.787**
	(0.226)	(0.334)	(0.344)
Real GDP per capita	0.0719	0.0776	0.112
	(0.0682)	(0.109)	(0.0923)
House price index	-0.00139	-0.00178	-0.00767
	(0.0138)	(0.0204)	(0.0211)
High school	1.153	-0.905	2.297**
	(0.843)	(1.535)	(1.083)
Some college	1.066	-0.478	1.972*
	(0.865)	(1.550)	(1.098)
College	1.630*	-1.695	3.864***
	(0.898)	(1.601)	(1.121)
Age	0.421***	0.0536	0.491**
	(0.153)	(0.230)	(0.221)
Age squared	-0.00482***	-0.000952	-0.00560**
	(0.00168)	(0.00251)	(0.00244)
Female	-2.603***	-1.796***	-3.051***
	(0.431)	(0.615)	(0.672)
Married	0.148	0.595	0.451
	(0.453)	(0.643)	(0.607)
Number of children	-0.0439	-0.427**	0.244
	(0.134)	(0.216)	(0.204)
Black	-1.965**	-0.502	-1.913
	(0.964)	(1.491)	(1.474)
Other race	-0.430	-0.247	-0.736
	(0.682)	(1.056)	(1.107)
Metropolitan area	0.347	0.207	0.679
	(0.411)	(0.629)	(0.568)
5-piece income spline	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes
State and year fixed effects	Yes	Yes	Yes
Effective *F*-statistic	183.36	68.99	129.54
Observations	9,156	3,183	4,572

Notes: We estimate instrumental variable models using the subsample of individuals with 50 or more work hours. The dependent variable is the change in the weekly number of work hours from one year to the next. We use the samples of self-employed individuals with any type of business (Column 1), with an incorporated business (Column 2), or with an unincorporated business (Column 3). Heteroscedasticity robust standard errors are in parentheses. Stars (***/**/*) indicate significance at the 1%/5%/10% levels.

Table 8: IV Results (using the subsample with fewer than 50 weekly work hours)

Independent variables	Self-employment (incorp. + unincorp.)	Self-employment (incorporated)	Self-employment (unincorporated)
Marginal PIT rate change	0.00709	0.141	-0.00215
	(0.0523)	(0.127)	(0.0563)
Marginal CIT rate change	0.00394	0.0207	
	(0.0236)	(0.0226)	
Unemployment rate	0.0982	0.115	0.118
	(0.144)	(0.235)	(0.197)
Real GDP per capita	0.0515	0.0661	0.0152
	(0.0440)	(0.0842)	(0.0576)
House price index	0.000974	0.0153	-0.00755
	(0.00852)	(0.0152)	(0.0113)
High school	1.150***	0.873	0.981*
	(0.436)	(1.023)	(0.519)
Some college	1.290***	1.259	1.208**
	(0.448)	(1.038)	(0.535)
College	0.956**	0.585	0.583
	(0.479)	(1.075)	(0.561)
Age	0.239***	0.302*	0.258**
	(0.0916)	(0.180)	(0.117)
Age squared	-0.00297***	-0.00366*	-0.00321**
	(0.00101)	(0.00197)	(0.00130)
Female	-1.611***	-1.854***	-1.581***
	(0.210)	(0.359)	(0.288)
Married	0.146	0.0872	0.0144
	(0.284)	(0.616)	(0.334)
Number of children	0.0581	-0.286*	0.177
	(0.0890)	(0.166)	(0.117)
Black	0.0359	2.861**	-0.968
	(0.586)	(1.169)	(0.714)
Other race	0.588	-0.0897	0.671
	(0.427)	(0.674)	(0.588)
Metropolitan area	-0.412	-0.166	-0.507
	(0.254)	(0.493)	(0.318)
5-piece income spline	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes
State and year fixed effects	Yes	Yes	Yes
Effective *F*-statistic	356.02	56.26	431.65
Observations	15,682	3,636	9,761

Notes: We estimate instrumental variable models using the subsample of individuals with fewer than 50 work hours. The dependent variable is the change in the weekly number of work hours from one year to the next. We use the samples of self-employed individuals with any type of business (Column 1), with an incorporated business (Column 2), or with an unincorporated business (Column 3). Heteroscedasticity robust standard errors are in parentheses. Stars (***/**/*) indicate significance at the 1%/5%/10% levels.

Online Appendix: Supplementary Tables

Table A1: First-Stage Regression Results for Main IV Estimations

Independent variables	Self-employment (Incorp+Unincorp)	Self-employment (incorporated)	Self-employment (unincorporated)
Tax Instrument	0.677***	0.575***	0.749***
	(0.0291)	(0.0517)	(0.0319)
Marginal CIT rate change	-0.439***	-0.0705***	
	(0.00691)	(0.0132)	
Unemployment rate	-0.0241	-0.102	-0.0351
	(0.106)	(0.162)	(0.120)
Real GDP per capita	-0.000618	0.0107	-0.0167
	(0.0322)	(0.0519)	(0.0355)
House price index	-0.00362	-0.00295	-0.00594
	(0.00638)	(0.00969)	(0.00735)
High school degree	1.334***	1.471**	0.207
	(0.284)	(0.749)	(0.263)
Some college	1.958***	1.576**	0.701**
	(0.293)	(0.753)	(0.276)
College	3.486***	3.166***	1.157***
	(0.305)	(0.749)	(0.301)
Age	0.368***	0.531***	0.239***
	(0.0644)	(0.107)	(0.0689)
Age squared	-0.00416***	-0.00583***	-0.00260***
	(0.000713)	(0.00116)	(0.000770)
Female	-0.559***	-0.223	-0.209
	(0.167)	(0.255)	(0.201)
Married	2.307***	2.375***	0.610***
	(0.203)	(0.345)	(0.204)
Number of children	0.118*	0.109	0.116*
	(0.0645)	(0.112)	(0.0687)
Black	-1.224***	-1.640**	-0.530
	(0.394)	(0.709)	(0.427)
Other race	-0.526*	-0.706	-0.00397
	(0.313)	(0.477)	(0.376)
Metropolitan area	0.783***	0.640**	0.243
	(0.179)	(0.295)	(0.197)
5-piece income spline	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes
State and year fixed effects	Yes	Yes	Yes
Observations	24,838	6,819	14,333

Notes: The table shows the first-stage results for the main IV estimations reported in Table 4. The dependent variable is the change in the marginal PIT rate from one year to the next. We use the samples of self-employed individuals with any type of business (Column 1), with an incorporated business (Column 2), or with an unincorporated business (Column 3). Heteroscedasticity robust standard errors are in parentheses. Stars (***/**/*) indicate significance at the 1%/5%/10% levels.

Table A2: IV Results (using family income polynomials)

Independent variables	Self-employment (incorp. + unincorp.)	Self-employment (incorporated)	Self-employment (unincorporated)
Marginal PIT rate change	0.0537	0.296***	0.0462
	(0.0526)	(0.114)	(0.0617)
Marginal CIT rate difference	0.0273	0.0143	
	(0.0237)	(0.0182)	
Unemployment rate	0.444***	0.313	0.515***
	(0.131)	(0.212)	(0.184)
Real GDP per capita	0.0499	0.0781	0.0248
	(0.0405)	(0.0712)	(0.0534)
House price index	0.00246	0.0141	-0.00571
	(0.00783)	(0.0133)	(0.0108)
High school	0.407	0.0261	0.602
	(0.420)	(0.946)	(0.514)
Some college	0.565	0.358	0.860
	(0.431)	(0.959)	(0.525)
College	0.701	-0.911	1.416***
	(0.455)	(0.993)	(0.543)
Age	0.156*	-0.0145	0.235**
	(0.0860)	(0.158)	(0.114)
Age squared	-0.00193**	-9.53e-06	-0.00286**
	(0.000944)	(0.00172)	(0.00126)
Female	0.0551	0.0841	-0.0441
	(0.198)	(0.326)	(0.278)
Married	0.216	0.413	0.182
	(0.247)	(0.454)	(0.309)
Number of children	-0.0190	-0.258*	0.0908
	(0.0809)	(0.147)	(0.111)
Black	-0.581	1.399	-1.029
	(0.543)	(1.043)	(0.693)
Other race	0.0631	-0.0243	-0.0136
	(0.389)	(0.639)	(0.560)
Metropolitan area	-0.00571	-0.109	0.124
	(0.234)	(0.423)	(0.302)
Family income	-0.0628	0.188*	-0.139***
	(0.0489)	(0.106)	(0.0511)
Family income squared	0.000616	-0.00331*	0.00223
	(0.000805)	(0.00182)	(0.00145)
Family income cubed	-1.50e-06	1.48e-05*	-1.15e-05
	(3.13e-06)	(7.75e-06)	(9.12e-06)
Industry dummies	Yes	Yes	Yes
State and year fixed effects	Yes	Yes	Yes
Effective *F*-statistic	513.1	99.9	540.1
Observations	24,838	6,819	14,333

Notes: We estimate instrumental variable models using income polynomials instead of income splines. The dependent variable is the change in the weekly number of work hours from one year to the next. We use the samples of self-employed individuals with any type of business (Column 1), with an incorporated business (Column 2), or with an unincorporated business (Column 3). Heteroscedasticity robust standard errors are in parentheses. Stars (***/**/*) indicate significance at the 1%/5%/10% levels.

Table A3: IV Results for Any Type of Self-Employment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Marginal PIT rate change	0.0581	0.0562	0.0551	0.0518	0.0532	0.0566	0.0638
	(0.0437)	(0.0441)	(0.0442)	(0.0460)	(0.0460)	(0.0516)	(0.0527)
Marginal CIT rate change	0.0324*	0.0315*	0.0312*	0.0276	0.0278	0.0288	0.0318
	(0.0185)	(0.0187)	(0.0187)	(0.0209)	(0.0210)	(0.0235)	(0.0238)
Unemployment rate		0.0122	0.0229	0.0273	0.0164	0.441***	-117.1
		(0.0427)	(0.0438)	(0.0443)	(0.0443)	(0.131)	(97.06)
Real GDP per capita		-0.00577	-0.00547	-0.00496	-0.00465	0.0496	-25.16
		(0.00652)	(0.00661)	(0.00660)	(0.00660)	(0.0405)	(20.72)
House price index		-0.00238	-0.00195	-0.00117	-0.00165	0.00243	4.686
		(0.00350)	(0.00352)	(0.00355)	(0.00355)	(0.00783)	(3.642)
High school			0.288	0.388	0.446	0.434	0.329
			(0.414)	(0.421)	(0.423)	(0.424)	(0.419)
Some college			0.461	0.610	0.645	0.587	0.525
			(0.416)	(0.432)	(0.433)	(0.436)	(0.430)
College			0.487	0.812*	0.762*	0.723	0.607
			(0.401)	(0.450)	(0.453)	(0.461)	(0.456)
Age			0.128	0.150*	0.148*	0.157*	0.145*
			(0.0831)	(0.0849)	(0.0851)	(0.0863)	(0.0860)
Age squared			-0.00165*	-0.00189**	-0.00187**	-0.00194**	-0.00180*
			(0.000910)	(0.000931)	(0.000934)	(0.000949)	(0.000944)
Female			0.155	0.138	0.0374	0.0571	0.0662
			(0.182)	(0.183)	(0.197)	(0.198)	(0.197)
Married			0.0373	0.240	0.296	0.251	0.254
			(0.219)	(0.249)	(0.254)	(0.263)	(0.265)
Number of children			-0.0268	-0.0259	-0.0271	-0.0238	-0.0233
			(0.0803)	(0.0803)	(0.0804)	(0.0807)	(0.0806)
Black			-0.564	-0.610	-0.651	-0.589	-0.789
			(0.537)	(0.537)	(0.539)	(0.544)	(0.543)
Other race			-0.00182	-0.00294	-0.00697	0.0735	0.150
			(0.371)	(0.372)	(0.373)	(0.390)	(0.385)
Metropolitan area			-0.0970	-0.00343	-0.133	-0.00510	0.0640
			(0.208)	(0.218)	(0.216)	(0.235)	(0.237)
5-piece income spline	No	No	No	Yes	Yes	Yes	Yes
Industry dummies	No	No	No	No	Yes	Yes	Yes
State and Year fixed effects	No	No	No	No	No	Yes	Yes
State x Year fixed effects	No	No	No	No	No	No	Yes
Observations	24,838	24,838	24,838	24,838	24,838	24,838	24,838

Notes: We estimate instrumental variable models. The dependent variable is the change in the weekly number of work hours from one year to the next. Here we use the sample of self-employed individuals with any type of business. Heteroscedasticity robust standard errors are in parentheses. Stars (***/**/*) indicate significance at the 1%/5%/10% levels.

Table A4: IV Results for Incorporated Self-Employment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Marginal PIT rate change	0.212***	0.210**	0.208**	0.221**	0.226**	0.284***	0.261**
	(0.0822)	(0.0836)	(0.0836)	(0.0917)	(0.0923)	(0.105)	(0.116)
Marginal CIT rate change	0.00813	0.00842	0.00721	0.0109	0.0112	0.0121	0.00931
	(0.0161)	(0.0161)	(0.0161)	(0.0170)	(0.0171)	(0.0176)	(0.0175)
Unemployment rate		-0.0813	-0.0660	-0.0721	-0.0806	0.321	-51.10
		(0.0685)	(0.0703)	(0.0715)	(0.0716)	(0.212)	(132.6)
Real GDP per capita		0.000964	0.00319	0.00137	0.000693	0.0811	-9.495
		(0.0107)	(0.0107)	(0.0108)	(0.0109)	(0.0710)	(27.55)
House price index		0.00560	0.00703	0.00625	0.00631	0.0144	2.106
		(0.00619)	(0.00618)	(0.00634)	(0.00634)	(0.0132)	(4.975)
High school			0.326	0.225	0.185	-0.0456	-0.364
			(0.926)	(0.938)	(0.941)	(0.955)	(0.936)
Some college			0.817	0.640	0.561	0.311	0.0262
			(0.926)	(0.944)	(0.951)	(0.966)	(0.944)
College			-0.0371	-0.400	-0.603	-0.929	-1.073
			(0.898)	(0.968)	(0.972)	(1.000)	(0.980)
Age			0.0612	0.0208	0.00854	-0.00437	0.0212
			(0.144)	(0.149)	(0.150)	(0.155)	(0.153)
Age squared			-0.000853	-0.000419	-0.000295	-0.000109	-0.000397
			(0.00157)	(0.00163)	(0.00164)	(0.00169)	(0.00167)
Female			0.0879	0.0945	0.0488	0.0800	0.120
			(0.319)	(0.318)	(0.325)	(0.326)	(0.318)
Married			0.913**	0.616	0.615	0.353	0.650
			(0.389)	(0.446)	(0.452)	(0.476)	(0.499)
Number of children			-0.257*	-0.261*	-0.253*	-0.253*	-0.265*
			(0.144)	(0.144)	(0.144)	(0.146)	(0.146)
Black			1.036	1.113	1.091	1.389	1.266
			(1.040)	(1.050)	(1.058)	(1.045)	(1.084)
Other race			-0.0797	-0.0412	-0.0507	0.00939	-0.0653
			(0.618)	(0.620)	(0.622)	(0.642)	(0.639)
Metropolitan area			-0.166	-0.289	-0.270	-0.114	0.0473
			(0.377)	(0.390)	(0.387)	(0.422)	(0.439)
5-piece income spline	No	No	No	Yes	Yes	Yes	Yes
Industry dummies	No	No	No	No	Yes	Yes	Yes
State and Year fixed effects	No	No	No	No	No	Yes	Yes
State x Year fixed effects	No	No	No	No	No	No	Yes
Observations	6,819	6,819	6,819	6,819	6,819	6,819	6,819

Notes: We estimate instrumental variable models. The dependent variable is the change in the weekly number of work hours from one year to the next. Here, we use the sample of self-employed individuals with an incorporated business. Heteroscedasticity robust standard errors are in parentheses. Stars (***/**/*) indicate significance at the 1%/5%/10% levels.

Table A5: IV Results for Unincorporated Self-Employment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Marginal PIT rate change	0.0665	0.0530	0.0485	0.0455	0.0468	0.0471	0.0337
	(0.0512)	(0.0517)	(0.0517)	(0.0523)	(0.0521)	(0.0621)	(0.0637)
Unemployment rate		0.0802	0.0893	0.0951	0.0806	0.513***	-27.33
		(0.0600)	(0.0616)	(0.0618)	(0.0619)	(0.184)	(31.48)
Real GDP per capita		-0.0187**	-0.0196**	-0.0187**	-0.0178**	0.0249	-37.48
		(0.00896)	(0.00905)	(0.00904)	(0.00903)	(0.0534)	(36.62)
House price index		-0.00505	-0.00458	-0.00318	-0.00409	-0.00574	2.946
		(0.00480)	(0.00486)	(0.00486)	(0.00487)	(0.0108)	(2.587)
High school			0.427	0.567	0.672	0.629	0.654
			(0.508)	(0.513)	(0.515)	(0.517)	(0.512)
Some college			0.692	0.889*	0.990*	0.878*	0.966*
			(0.514)	(0.524)	(0.526)	(0.529)	(0.521)
College			1.012**	1.430***	1.499***	1.410***	1.337**
			(0.504)	(0.530)	(0.541)	(0.546)	(0.538)
Age			0.188*	0.216*	0.219*	0.233**	0.224**
			(0.112)	(0.113)	(0.113)	(0.114)	(0.113)
Age squared			-0.00235*	-0.00267**	-0.00269**	-0.00284**	-0.00271**
			(0.00123)	(0.00124)	(0.00125)	(0.00126)	(0.00124)
Female			0.0443	0.0591	-0.110	-0.0490	-0.0354
			(0.246)	(0.246)	(0.278)	(0.278)	(0.277)
Married			-0.180	0.130	0.244	0.217	0.0498
			(0.288)	(0.313)	(0.317)	(0.320)	(0.318)
Number of children			0.0966	0.0978	0.0949	0.0899	0.125
			(0.110)	(0.110)	(0.110)	(0.111)	(0.110)
Black			-0.917	-0.965	-1.023	-1.038	-1.312*
			(0.685)	(0.684)	(0.686)	(0.693)	(0.691)
Other race			-0.218	-0.209	-0.195	0.00661	-0.0408
			(0.529)	(0.530)	(0.531)	(0.560)	(0.549)
Metropolitan area			-0.0326	0.0801	-0.106	0.115	0.176
			(0.273)	(0.278)	(0.279)	(0.303)	(0.305)
5-piece income spline	No	No	No	Yes	Yes	Yes	Yes
Industry dummies	No	No	No	No	Yes	Yes	Yes
State and Year fixed effects	No	No	No	No	No	Yes	Yes
State x Year fixed effects	No	No	No	No	No	No	Yes
Observations	14,333	14,333	14,333	14,333	14,333	14,333	14,333

Notes: We estimate instrumental variable models. The dependent variable is the change in the weekly number of work hours from one year to the next. Here we use the sample of self-employed individuals with an unincorporated business. Heteroscedasticity robust standard errors are in parentheses. Stars (***/**/*) indicate significance at the 1%/5%/10% levels.

Table A6: OLS Results

Independent variables	Self-employment (incorp. + unincorp.)	Self-employment (incorporated)	Self-employment (unincorporated)
Marginal PIT rate change	0.0344***	0.0773***	-0.0153
	(0.00838)	(0.0180)	(0.0131)
Marginal CIT rate change	0.0191***	-0.00170	
	(0.00740)	(0.0158)	
Unemployment rate	0.441***	0.301	0.513***
	(0.132)	(0.210)	(0.185)
Real GDP per capita	0.0494	0.0826	0.0231
	(0.0406)	(0.0704)	(0.0536)
House price index	0.00237	0.0138	-0.00598
	(0.00784)	(0.0131)	(0.0108)
High school	0.465	0.251	0.648
	(0.418)	(0.942)	(0.518)
Some college	0.632	0.642	0.929*
	(0.423)	(0.946)	(0.527)
College	0.802*	-0.282	1.489***
	(0.426)	(0.937)	(0.542)
Age	0.166**	0.108	0.252**
	(0.0840)	(0.144)	(0.113)
Age squared	-0.00204**	-0.00133	-0.00304**
	(0.000922)	(0.00157)	(0.00125)
Female	0.0447	0.0274	-0.0613
	(0.196)	(0.324)	(0.279)
Married	0.302	0.852**	0.255
	(0.234)	(0.404)	(0.318)
Number of children	-0.0202	-0.223	0.0996
	(0.0805)	(0.144)	(0.111)
Black	-0.614	1.041	-1.069
	(0.542)	(1.037)	(0.694)
Other race	0.0616	-0.144	0.00410
	(0.390)	(0.635)	(0.561)
Metropolitan area	0.0120	0.00876	0.129
	(0.231)	(0.418)	(0.302)
5-piece income spline	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes
State and year fixed effects	Yes	Yes	Yes
Observations	24,838	6,819	14,333

Notes: We use the Ordinary Least Squares (OLS) estimator. The dependent variable is the change in the weekly number of work hours from one year to the next. We use the samples of self-employed individuals with any type of business (Column 1), with an incorporated business (Column 2), or with an unincorporated business (Column 3). Heteroscedasticity robust standard errors are in parentheses. Stars (***/**/*) indicate significance at the 1%/5%/10% levels.