Does Taxing Business Owners Affect Their Employees? Evidence from a Change in the Top Marginal Tax Rate

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Abstract

This paper analyzes the role of the firm in mediating responses to income taxation. The majority of business income in the United States is earned by pass-through entities. I study how a recent increase in the top marginal personal income tax rate faced by pass-through business owners affected the compensation of their employees. I use a new linked owner-firm-employee dataset and panel difference-in-differences methods to compare the earnings of employees in similar firms, but whose owners were differentially exposed to the tax change. I estimate that approximately 18 cents per dollar of new tax liability was passed through to employee earnings. This resulted from lower earnings growth among employees attached to their firms, not compositional changes in employment. The results show behavioral responses to the business income taxation embedded in the personal income tax system and imply that the incidence of the personal income tax was not fully borne by those directly subject to the tax change.

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1 Introduction

Increasingly, business income in the United States is taxed subject to personal income tax rates. In 1980, the majority of non-sole-proprietorship businesses were organized as C-corporations which are taxed at the entity level subject to the corporate tax system; these corporations accounted for over 90% of business income. By 2015, the two major types of pass-through businesses, S-corporations and partnerships, accounted for over 80% of non-sole-proprietorship businesses, over 50% of business income, and 37% of employment across all major industries. The income of these businesses is not taxed at the entity level, but instead is taxed subject to the personal income tax rates of the firm owners. Additionally, pass-through businesses owners are disproportionately at the top of the income distribution. Of those in the top 1% of the income distribution, 57% have some pass-through business income, reaching 78% for those in the top 0.1% (Smith et al. (2019)). Given the size of the pass-through business sector and the amount of pass-through income concentrated at the top of the income distribution, it is increasingly important to understand how owners of these businesses respond when analyzing top marginal personal income tax rates. In particular, changes in the top marginal tax rate can elicit responses which reflect a combination of behavioral responses to personal income taxation and to business income taxation.

This paper uses new linked owner-firm-employee tax microdata to analyze the role of the firm in mediating responses to changes in personal income tax rates. In particular, I study how changes in the top marginal tax rate faced by pass-through business owners affect the compensation of their employees. To do so, I use panel difference-in-differences methods to estimate the sign and magnitude of these within-firm spillovers by comparing the earnings of employees in similar firms but whose owners were differentially exposed to a recent increase in the top marginal tax rate. I then conduct a welfare analysis to help interpret the implications of cross-tax-bracket earnings spillovers associated with the business taxation embedded in the personal income tax system.

I analyze a recent increase in the top marginal tax rate in the United States, the American Taxpayer Relief Act of 2012 (ATRA). ATRA increased top marginal personal income tax rates while leaving the tax rate schedule and tax base essentially unchanged at lower income levels. The simplicity of this reform makes it particularly well suited for estimating spillover effects from changes in the top marginal tax rate to the earnings of employees in lower tax brackets.

To conduct the empirical analysis, I develop a linked owner-firm-employee dataset created from the universe of administrative tax records. I focus on S-corporations, which are a corporate form of pass-through businesses that are required to have at most 100 owners, all of which must be non-institutional U.S. persons. The dataset links firms to their owners and firm owners to their individual tax records. The ability to observe the total income of the firm's owners - both the business income and total household income - enables me to trace changes in the tax position of the firm's business income in response to changes in personal income tax rates. Additionally, the tax data allow me to link each firm to its employees. Using this link, I am able to estimate the relationship between the (change in) tax position of the owners and the (change in) compensation of the employees in the firm. I use the firm's income tax return information to control for non-tax

differences between firms, which provides a key component of my identification strategy.

Different models of business income taxation offer different, and often competing, predictions about the incidence of the tax on the earnings of employees in the taxed firms. Classic models of corporate tax incidence, such as those in Harberger (1962) and Kotlikoff and Summers (1987), focus on long-run capital adjustment and generally predict no direct within-firm transmission of owner tax liabilities to employee earnings. In contrast, labor market models where employee wages differ from their marginal product can predict within-firm earnings responses. To develop the intuition, I present generalized versions of two commonly used labor market models characterized by rent-sharing between owners and employees to show that when there is some surplus to be shared, there is room for the tax rate faced by business owners to affect the wages paid to employees. These models help establish a foundation for my empirical strategy, which leverages variation across firms in exposure to the tax change to identify within-firm spillovers. Ultimately, I show that the predicted sign and magnitude of potential spillovers depend on the underlying features of the labor market and the tax system, so it is an empirical question as to whether, and how, changes in the top marginal personal income tax rate affect employee earnings.

To estimate the effect of the tax increase, I develop an identification strategy which compares the earnings of similar workers in similar firms but whose owners were taxed differently as a result of the reform. The defining feature of pass-through entities is that the business income is taxed at the personal income tax rates of firm owners. Therefore, two firms with the same level of taxable business income may face different marginal and average tax rates depending on the total household income of the firm owners. This allows me to compare similar firms in terms of income, size and industry that were differentially exposed to the tax increase. Employees in firms whose owners were subject to the tax increase were exposed to the rate change through their firms but saw no direct changes to the tax treatment of their personal income. If none of the burden of the tax increase was shifted to employees, the earnings of employees should be unaffected by changes to the income tax treatment of the firm owners. If there were within-firm spillovers, employees in more exposed firms would see differential earnings patterns relative to workers in non-exposed firms following the tax change. I show that this identifying variation mitigates many of the standard concerns that arise when estimating behavioral responses to tax reforms.

I then use a panel difference-in-difference (DD) design to provide direct evidence of within-firm spillovers in response to the tax increase. I find that when firm owners are more exposed to the tax increase, their employees exhibit lower relative earnings growth following the tax change. The result is robust to various measures of exposure to the tax change and various sets of firm-level controls. The estimated elasticity of earnings with respect to the firm owners' marginal tax rate is -0.10. The interpretation of this result depends on whether the observed earnings responses were attributable to changes in the workforce composition or whether they reflect changes in the compensation paid to the same, or similarly skilled, employees. I find no differential extensive margin employment response among firms more exposed to the tax change, nor do I find evidence of changes in the skill composition of the workforce in response to the tax reform. Instead, I find

that the majority of the earnings response was attributable to lower relative earnings growth among firm "stayers," or those who were employed at the time of the tax change and remained with the firm following the tax change. This suggests that the observed spillovers represent lower wages paid to the same employees and can be interpreted as pass-through[1] of the owners' tax liability to employee earnings.

I estimate the direct effect of an exogenous $1 increase in the business tax liability on the firm's wage bill and find that approximately 15-18 cents per dollar of new tax liability were passed through to employee earnings. Additionally, I find no evidence of a change in production or productivity for more exposed firms. The results imply that owners passed a share of the increased tax burden through to employees, but also that the majority of the burden may have been borne by the business owners themselves, at least in the medium run.

Heterogeneity analysis shows that the earnings response was not constant across employees in exposed firms or across firms. The responses were concentrated among those in the lower half of their firm's earnings distribution, implying that the burden may be disproportionately borne by lower skilled employees. I also find that firms in states with more slack labor markets exhibited larger spillovers in response to the tax change. Together, these results suggest that labor market frictions may affect the ability of owners to pass the burden of business income taxation onto employees, and more generally that the incidence of business income taxation may be mediated by underlying features of the labor market.

The results show behavioral responses to the business income taxation embedded in the personal income tax system leading to within-firm, cross-tax-bracket earnings spillovers. They provide some of the some of the first direct empirical evidence of the incidence of the top marginal personal income tax rate on the earnings of lower-bracket workers not directly subject to the top rate. Additionally, the results provide new estimates of the incidence of taxation of pass-through businesses in the U.S., which constitute the large majority of small and medium sized businesses, across all major industries.

In the final section I discuss the implications of the empirical results for welfare analysis. Most standard Mirrleesian analyses of optimal personal income taxation assume that the entire incidence of the personal income tax is borne by households facing the given tax rate. The evidence presented in this paper suggests that this is not necessarily the case. I present a simple model of marginal welfare analysis and show that when there are cross-tax-bracket spillovers, the ETI of those facing the top rate is not a sufficient statistic for the welfare analysis of a change in the top rate. One must also know the extent of the spillover, or how the pre-tax distribution of surplus between owners and employees changes in response to a tax change. When the pre-tax surplus shifts from employees to owners, the taxable income response of top-bracket households will understate the welfare loss associated with a change in their tax rate. The analysis also highlights that the labor

[1]Note, this use of "pass-through" is distinct from the descriptor of the business type used previously. Here I use pass-through as a standard economic term to describe how changes in a firm-level income variable affect the wages of employees in the firm. In contrast, a pass-through entity/firm/business describes a legal structure for a business that pays no taxes, but instead the owners pay the business's taxes through their personal tax return.

market mechanisms which mediate the response to the tax change have implications for the equity and efficiency of personal income taxation.

The remainder of the paper is organized as follows. Section 2 discusses the institutional background, including ATRA and the administrative data. Section 3 presents labor market models that can predict within-firm earnings responses to business income taxation. Section 4 discusses the identifying variation and empirical strategy. Section 5 presents the results, documenting the differential earnings responses of employees in more exposed firms, and contains heterogeneity analyses. Section 6 provides direct estimates of pass-through from owner taxation to employee earnings. Section 7 examines the welfare implications of the empirical results and Section 8 concludes.

1.1 Related Literature

This paper is related to three broad strands of literature in public and labor economics. The first is the literature estimating behavioral responses to changes in personal income taxation and the estimation of the elasticity of taxable income (ETI). Using difference-in-difference (DD) methods with panel data has been the standard for using tax reforms to estimate the behavioral responses to personal income taxation (Feldstein (1995), Auten and Carroll (1999), Gruber and Saez (2002), Kleven and Schultz (2014)), including two recent papers estimating the ETI of top income earners using the same tax reform as in this paper (Saez (2016), Kawano, Weber and Whitten (2016)). I use a panel DD estimation approach to isolate cross-firm variation in the exposure of workers to changes in the tax rates faced by firm owners. By comparing the earnings responses of workers in lower tax brackets, who are not directly exposed to the rate change and are in the same part of the income distribution, I avoid many of the endogeneity issues that typically plague DD estimates of responses to tax reforms.

Recent theoretical and empirical work investigates the implications of labor market imperfections for optimal personal income taxation. Piketty, Saez and Stantcheva (2014) adapt the standard Mirrleesian optimal tax model to include three types of responses to progressive income taxation: a "true" labor supply response, an evasion or avoidance response and a wage bargaining response. They provide suggestive evidence of a rent-sharing elasticity and use their estimates to show how the rent-sharing response can affect optimal top rates. Papers by Lockwood, Nathanson and Weyl (2017) and Rothschild and Scheuer (2016) also explore how the presence of rents in the labor market affects the patterns of optimal marginal tax rates. I expand on this work by using linked owner-firm-employee microdata to directly estimate cross-bracket spillovers from an increase in the top marginal tax rate and discuss the welfare implications of the empirical results.

Second, this paper speaks to the literature on the incidence of business income taxation. In canonical studies of the incidence of corporate taxation, the incidence is determined by long-run capital accumulation incentives, substitutability of capital and labor and relative capital and labor mobility across jurisdictions, sectors or industries (Harberger (1962), Bradford (1978), Kotlikoff and Summers (1987)). Depending on the combination of these features, the models can predict that capital bears the full burden of the tax, that labor bears the full burden, or anything in between.

These studies use general equilibrium models and do not predict within-firm responses to tax rates faced by specific business owners.

A recent literature has focused on the role of the domestic labor market in determining the incidence of corporate taxation. Papers by Felix and Hines Jr. (2009) and Arulampalam, Devereux and Maffini (2012) use wage bargaining models as a basis for estimating the direct effect of corporate income taxation on employee earnings. Fuest, Peichl and Siegloch (2018) show how a variety of models where firms have wage setting power can imply direct effects of corporate taxation on wages and estimate the effect of corporate tax changes across districts in Germany on employee earnings. Each of these papers finds that employees bear some of the burden of corporate taxation. A related body of literature analyzes how firms mediate responses to other tax rates. Benzarti and Carloni (2019) estimate pass-through of changes in VAT rates in France and Saez, Schoefer and Seim (2017) use firm-level variation to investigate earnings and employment responses to employment taxation in Sweden and find that wages in firms most exposed to the reform respond in a way consistent with rent-sharing. I contribute to this research by analyzing how employee earnings respond to the business income taxation embedded in the personal income tax system. I use a new identification strategy to provide estimates of the size and magnitude of the earnings responses and investigate the channels by which they occur. These represent some of the first direct estimates of the incidence of the taxation of pass-through businesses, which constitute the vast majority of small and medium sized businesses in the United States.

Third, a large literature has found evidence of rent-sharing in the labor market and that employee earnings can respond to firm-specific shocks (see Manning (2011) and Card et al. (2018) for recent reviews). Additionally, work on the role of the firm in income inequality (Abowd, Kramarz and Margolis (1999), Card, Heining and Kline (2013), Song et al. (2018)) has found variation in earnings of similarly skilled workers across firms, consistent with rent-sharing. Kline et al. (2018) estimate firm-specific pass-through from an exogenous increase in operating revenue associated with receiving a successful patent award and find significant earnings responses, consistent with surplus being shared between owners and employees. I expand on this literature by investigating how the tax system interacts with labor market models associated with rent-sharing and show that underlying labor market institutions have implications for the incidence of business income taxation and, therefore, for the equity-efficiency trade-off of income taxation.

2 Institutional Background and Data

2.1 2013 Tax Reform: Increased Taxation at the Top

In 2013 the U.S. saw a tax increase for high-income taxpayers. The tax cuts for top income earners established by the Economic Growth and Tax Relief Reconciliation Act of 2001 (EGTRRA), commonly referred to as "the Bush tax cuts," were repealed on January 2, 2013. Upon President Obama's reelection in November 2012 there was a general consensus that there would be some form of repeal of the Bush tax cuts on top earners, but exactly how the rates would change or at

what income thresholds was not known until the passing of the American Taxpayer Relief Act of 2012 (ATRA) on January 2.

The main feature of the ATRA was to add a new top tax bracket which increased the marginal tax rate from 35% to 39.6% on ordinary income and from 15% to 20% on dividends and realized long-term capital gains. The new top bracket started at $400,000 for single filers, $425,000 for heads of household and $450,000 for married joint filers. These income thresholds corresponded roughly to the top 1% of the household income distribution at the time. A second feature of the ATRA was a provision which reduced itemized deductions by 3% of AGI up to a cap of 80% of AGI for those with AGI above $250,000 for single filers, $275,000 for heads of household and above $300,000 for married joint filers. Saez (2016) documents the change in aggregate tax rates for various groups of top earners resulting from the individual components of the 2013 reforms and estimates that the combination of reforms effectively raised the top marginal tax rate on very high income Americans, those near the top 1% of the income distribution, by approximately 9.5 percentage points for capital income and 6.5 percentage points for labor income.[2] Importantly for the identification strategy used in this paper, those in lower tax brackets saw essentially no change in the taxation of their personal income, while those at the top of the income distribution saw substantial increases in their marginal tax rates on ordinary and investment income.

2.2 Taxation of Pass-Through Businesses

Businesses in the United States can elect to be taxed as C-corporations or as pass-through businesses for federal tax purposes. The business income of C-corporations is taxed under the corporate income tax. Dividends paid to U.S. shareholders are taxed at the individual level upon distribution and any capital gains from the sale of shares are also taxed at the individual level at rates generally lower than ordinary income. Businesses that elect to organize as pass-through businesses such as S-corporations, partnerships, LLC's and sole proprietorships are not subject to the corporate tax system. Business profits or losses are "passed through" to the personal tax returns of the business owners and then taxed subject to the personal income tax system. Therefore, for pass-through business owners changes in the personal income tax rate are effectively changes in the tax rate on the business income of their firms.

S-corporations, which are the focus of the empirical analysis, comprise over 60% of non-sole-proprietorship pass-through businesses and account for approximately 50% of pass-through income and 70% of employment in pass-throughs. They, like all corporations, have limited liability, but also have specific restrictions on their ownership structure; they can have at most 100 owners and all owners must be US citizens or residents and not business entities. Additionally, there can only be a single class of equity such that all income flows through pro rata to the owners according to their

[2] In the same year, the Affordable Care Act (ACA) surtax came into effect. The surtax applied to the labor and investment income of high income households. Non-passive profits, such as ordinary business income from S-corporations, are considered neither investment nor labor income, so were exempt from the ACA surtax. For a detailed discussion of the tax changes faced by high income households in 2013 see Saez (2016).

ownership shares and is taxed in the year earned independent of any distributions of dividends.[3] These rules make S-Corporations particularly well-suited for this study because they allow the linkage of all owners to their firms using the tax data. Therefore, I can track the tax treatment of the business income of each firm by observing the business income and the total taxable income of each owner.

S-corporation owners can be either active or passive, where active owners are shareholder-employees and passive owners do not perform substantive labor for the firm. Guidance on the IRS website states, "S corporations must pay reasonable compensation to a shareholder-employee in return for services that the employee provides to the corporation before non-wage distributions may be made to the shareholder-employee." Active owners have some discretion over how much "reasonable compensation" to pay themselves and how much they receive as profits. Owners must pay employment taxes on the amounts received as wage and salary earnings, but not on profits, creating an incentive to minimize the former in favor of the latter. Because of this, my baseline definition of owners' business income is the sum of net profits and wage and salary income received from the firm they own.

2.3 Administrative Data

I create a linked owner-firm-employee dataset using deidentified administrative tax records at the IRS. The analysis dataset is balanced panel of S-corporations from 2006 to 2015. I draw a 20% random sample of masked Employer Identification Numbers (EINs) from all S-corporations that file a business income tax return (Form 1120S) in year 2012. To create a balanced panel, I keep firms that existed continuously from 2006 to 2015, where "existed" is defined as filing Form 1120S and reporting non-zero income in each year. Second, I restrict the sample to firms with at least five employees in each year, where an employee is defined as anyone receiving a W-2 from a firm in a given year. This restriction eliminates approximately 60% of the remaining firms, but only a small percentage of S-corporation employees.[4] The resulting sample includes approximately 86,000 firms and 4 million employees per year.

For each sampled firm, I use data reported on the annual firm income returns, Form 1120S. The income return line items are used directly or to create productivity measures. Firm production variables include: i) revenues: operating revenue minus returns, ii) profits: operating revenues minus costs, excluding passive income, where costs are the sum of inputs including costs of goods sold, employee and owner wage compensation, rent, interest, and capital asset tax depreciation; and iii) value-added: operating revenues minus costs, not including officer and employee compensation. I also use per employee productivity measures, dividing each measure by the number of employees in the firm in that year. Other firm-level variables collected from the tax return include the 6-digit NAICS code[5] and the state the firm is registered in.

[3] Distributions of dividends are untaxed, removing the "double taxation" associated with the corporate tax system.

[4] If instead I focus on firms with at least one non-owner employee each year, the restriction would still eliminate 40% of firms.

[5] For the purposes of the empirical analysis, I convert the reported 6-digit code to the corresponding 2-digit NAICS

The firm income tax returns are linked to every employee who was issued a W-2 with positive wage and salary income in each sample year. For employees, wage and salary income from the W-2 information report is added to the dataset, as is annual income and demographic information. Information on the age and sex of the taxpayer come from social security records which are used to validate taxpayer identification numbers. Employees are linked to their household tax return (Form 1040) to obtain taxable income, adjusted gross income (AGI) and information on filing status (single or married), number of dependents, and the state in which the individual lives. Reported taxable income and filing status are used to determine the tax bracket the household falls into and therefore who is subject to the tax rate changes. The firm's wage bill is the sum of wage and salary earnings of all employees. I define a full-time employees at firm j as those receiving at least one quarter of full-time wages at the federal minimum wage, *(wage and salary*$_{jt} \geq$ *13 weeks* $\times$ *35 hours/week* $\times$ *federal minimum wage ($/hour))*.

S-corporations are required to file a Schedule K-1 on behalf of each active and passive owner. The Schedule K-1 reports the owner's share of firm income in each year. To identify S-corporation owners, I match each sampled firm with all filed Schedule K-1 reports. To each owner, I link the same income and demographic information as that obtained for employees. Active owners (owner-employees) are defined as those that receive a W-2 from the firm that they own. Owners which receive no W-2 from their firms are passive owners. For active owners, I define "total income" derived from their firm as the sum of their wage and salary income and their business income reported on Schedule K-1. Active owners are required to pay themselves "reasonable wages," but have room to decide how much to compensate themselves in wages and how much to take in business income, so the sum of these income sources is a good metric for the total income derived from owning the firm. Together, the analysis sample comprises a linked firm-owner-employee panel which includes individual income variables for all individual owners and employees of each sampled firm in each year from 2006 to 2015, as well as firm-level income, productivity and characteristic variables.

Table 1 shows the characteristics of the firms in the sample. Comparing the characteristics of this sample to those presented in Table 1 of Smith et al. (2019), this sample appears very representative of the universe of S-corporations in the U.S. I use a balanced panel because controlling for pre-reform characteristics of the firm is an important component of my identification strategy. Using a balanced panel could introduce selection bias if firms in the treatment or control group are more likely to exit the sample following the tax change. In Appendix Table A.1 I show that there is no evidence of differential attrition from the sample if I allow "treatment" and "control" firms, those with and without top-bracket owners, to exit the sample following the tax reform in 2012, so using a balanced panel is not likely to introduce selection bias.[6]

code. This is done to ensure that cell sizes are not too small.

[6]In analyses not presented here, I repeat the main analyses using an unbalanced sample that allows firms to exit following the tax change and the results are effectively unchanged.

3 Models of Spillovers: Taxation of Firm Owners and Wage-Setting

There are a number of models one could use to analyze how a change in the personal income tax rate faced by business owners would affect the earnings of workers, many of which would lead to different, and sometimes contradictory, predictions. First, in the standard Mirrleesian model of personal income taxation, the individual facing a given income tax rate bears the entire burden of the tax; there are no spillovers to the income or behavior of other individuals. In this paper I focus on the potential for the taxation of business income embedded in the personal income tax to lead to spillovers, implying an incidence of the personal income tax on workers in lower tax brackets.

In classic models of capital income taxation, the incidence is determined by long-run capital accumulation incentives, substitutability of capital and labor and relative capital and labor mobility across jurisdictions, sectors or industries (Harberger (1962), Kotlikoff and Summers (1987)). Depending on the combination of these features, the models can predict that capital bears the full burden of the tax, that labor bears the full burden, or anything in between. These models generally assume perfect competition in product and labor markets and use general equilibrium models to analyze changes in the long-run market equilibria and would not predict within-firm responses to tax rates faced by specific business owners.

Another class of models of business taxation predicts that the taxation of specific business owners can affect the earnings of employees in their firms. Piketty, Saez and Stantcheva (2014) develop a model where a change in the top marginal tax rate can affect the earnings of employees in lower tax brackets by changing the marginal incentives of business owners, managers or executives to engage in bargaining over rents. A higher marginal tax rate reduces the incentive to engage in costly bargaining activities, thus leaving more rents on the table to be shared with employees. Therefore, this model predicts that an increase in the top marginal tax rate leads to higher employee earnings.

Labor market models with rent-sharing between owners and employees can predict that the taxation of business owners will lead to lower employee earnings. These models include those with non-perfect competition in the labor market (e.g. search and bargaining, union bargaining, or monopsony models) as well as models with perfect competition but other information asymmetries or costs (e.g. incentive pay, efficiency wages, specific human capital). Fuest, Peichl and Siegloch (2018) discuss a number of such models, showing how business taxes can affect the earnings of employees in the taxed firm. These models differ in their underlying assumptions, but each involves rent-sharing such that employees are earning above their reservation wages, thereby leaving room for the taxation of the firm to affect the earnings of employees at that firm.

Various models offer competing predictions about whether we would expect any short or medium run effects of business taxation on employee earnings, if so, in what direction, and by what channel – within-firm or market-wide. Therefore, it is ultimately an empirical question as to whether, and how, changes in the top marginal personal income tax rate will affect employee earnings. The purpose of this paper is not to select the "correct" model and identify the parameters in that model, but rather to present key empirical facts on the channels by which the taxation of pass-through business owners affect the earnings of employees.

In this section I analyze the relationship between the taxation of business income and employee earnings for two commonly used models of rent-sharing: models with bargaining and wage posting models. Whether the models predict negative, null or positive earnings responses to a change in business income taxation depends on the model and on the parameters which represent the underlying features of the tax system and labor market. I use the models to develop intuition about the features of the tax system and labor market which can mediate the relationship between business taxation and employee earnings, and to provide a foundation for my empirical strategy which uses variation across firms in exposure to a tax change to identify within-firm earnings responses to the owners' income taxation.

3.1 The Firm Owner's Problem

I start with a version of the firm problem that includes taxation of business income. In order to focus narrowly on the relationship between earnings and taxation, I use a simple model where firms have a general firm-specific production function which may include a firm-specific product price. The firm maximizes after-tax profits π_j,

$$\pi_j = Q_j(L(s), K) - \sum_s w_j(s)L(s) - \alpha\rho K - \mathbf{T}(Q_j(L(s), K) - \sum_s w_j(s)L(s) - (1-\alpha)\rho K)), \qquad (1)$$

where $Q_j(\cdot)$ is the firm j specific production function with the arguments $L(s)$ representing the labor inputs for each skill level s and K representing capital. The firm-specific wage paid to employees of skill level s is $w_j(s)$, ρ is the opportunity cost of capital, and α is a parameter governing how capital income returns are subject to the business tax rate. If capital returns are fully deductible from the tax base, $\alpha = 0$, but if they are less than fully deductible (e.g. capital is funded by equity of the business owners) and the outside option capital investment of the owners does not face the same tax rate as the business income (e.g. dividend or capital gain returns), then $\alpha > 0$. Net profits are taxed according to a general non-linear income tax function $\mathbf{T}(\cdot)$, which I will treat as a graduated progressive income tax as with the U.S. personal income tax.[7]

When $\alpha > 0$ this set-up differs from a framework where all labor and capital costs are deductible from the tax base, i.e. full expensing. With full expensing and a labor market with no rent-sharing, taxation of business income should have no affect on the earnings of employees in a static model. Employees earn their competitive wage, equal to their marginal product, and firm owners choose labor to maximize profits taking the wages as given. In this context of a cash flow tax, the firm's optimal labor choice is independent of the tax rate, so the wage rate and earnings are independent of the tax on profits in partial equilibrium.[8] In the following subsections I discuss deviations from

[7] Active owners also supply labor to their firms and pay themselves wages. I omit this in Eq. (1) for ease of notation. Assuming that owners' wages are deductible from the firm's tax base, this ommision has no impact on the analysis that follows. Even when less than fully deducitble, the resulting formulas change only slightly and the inclusion does not affect any of the qualitative implications. The amount that an owner decides to pay herself as "reasonable compenstaion," deductable from the tax base, could be another margin of response to a change the owner's tax rate. I do not model this potential income shifting response in the subsequent subsections, but it is not ruled-out in the empirical analysis.

[8] In the long-run higher taxes on business income can disincentivize capital investment and accumulation thus decreasing the marginal returns to labor and therefore the wage rate. In the horizon that I study it is unlikely that these

this standard case, where there is some surplus shared between owners and workers.

3.2 Two Classes of Models with Rent-Sharing

3.2.1 Models with Bargaining

Here I analyze a model where owners and a worker bargain over the surplus produced by a specific firm-worker match. In this class of models, the firm and employee agree to a match, then wages are set such that the employee receives a fixed share of the after-tax match surplus generated by the employment relationship. The distribution of surplus between owners and the employee is determined by a parameter representing the relative bargaining power of the worker. Standard models of frictional labor markets like the search and matching models of Pissarides (2000) and Hall and Milgrom (2008) display this feature, as do collective bargaining models. Wages are set according to

$$w_j^* = \underset{w}{argmax} \left[\theta ln(w_j - b) + (1-\theta) ln P_j\right], \tag{2}$$

where P_j is the share of firm profits π_j in Eq. (1) attributable the hiring or retention of the employee. Formally, $P_j = q_j - w_j - \alpha\rho k - T(q_j - w_j - (1-\alpha)\rho k)$ where q_j is the marginal revenue product of hiring the employee, k is the capital investment necessary to equip the employee, or the average capital per worker of the employee's skill type, $K(s)/L(s)$, and $T(\cdot)$ is the average tax liability associated with the profits generated by workers of that skill type. The exogenous parameter θ represents the bargaining power of the worker, and b is the worker's reservation wage.[9] As $\theta \to 1$ workers have more bargaining power. Firm owners set employee wages according to Eq. (2). Taking the first-order condition of the maximand with respect to wages provides,

$$\frac{\partial}{\partial w_j} = \frac{\theta}{w_j - b} - \frac{(1-\theta)(1-\tau)}{(1-t)(q_j - w_j - (1-\alpha)\rho k) - \alpha\rho k},$$

where t is the average tax rate and τ is the marginal tax rate, or $\mathbf{T}'(\cdot)$. Solving for the equilibrium wage gives:

$$w_j^* = \frac{(1-\theta)(1-\tau)b + \theta((1-t)(q_j - (1-\alpha)\rho k) - \alpha\rho k)}{(1-\theta)(1-\tau) + \theta(1-t)}. \tag{3}$$

The numerator is a weighted combination of the reservation wage, b, and the after-tax product of the employee's labor, $(1-t)(q_j - (1-\alpha)\rho k) - \alpha\rho k$, weighted by the relative bargaining power of the firm and workers. The denominator is a bargaining power weighted function of the net-of-marginal and average tax rates. Eq. (3) shows that, in general, the equilibrium wage is a function of both the average and marginal tax rates.

In certain special cases, this equation is straight forward to evaluate. As θ approaches 0, the workers have no bargaining power and the equilibrium wage is simply the reservation wage b, and

capital accumulation factors are important. I am not able to directly observe firm investment in my data, but in Section 5.4 I investigate responses of firm income and deduction line-items and find no significant responses.

[9] The term inside the brackets of Eq. (2) is the log transformation of the maximand in a standard Nash bargaining problem, $(w-b)^{\theta}(P)^{1-\theta}$.

therefore not a function of the tax faced by owners. As θ approaches 1, the workers have all of the bargaining power and the equilibrium wage approaches $w = q_j - (1-\alpha)\rho k - \alpha\rho k/(1-t)$, such that workers earn their after tax product of labor, which is a function of the average tax rate but not the marginal tax rate, and is decreasing in the average tax rate as long as $\alpha > 0$. In the case of a linear tax, the marginal tax rate equals the average tax rate and the equilibrium wage is:

$$w_j^* = (1-\theta)b + \theta\left(q_j - (1-\alpha)\rho k - \frac{\alpha\rho k}{(1-t)}\right). \tag{4}$$

In this case, wages are decreasing in the tax rate as long as $\alpha > 0$.

In the general case with a non-linear tax rate and where $0 < \theta < 1$, the size and direction of the earnings response to an increase in the top marginal tax rate will depend on the parameters of the model. Taking the derivative of w_j^* given in Eq. (3) with respect to the marginal tax rate provides,[10]

$$\frac{\partial w_j^*}{\partial \tau} = \frac{(1-\theta)(w_j^* - b) - \theta(q_j - w_j^*)\frac{\partial t}{\partial \tau}}{\theta(1-t) + (1-\theta)(1-\tau)}, \tag{5}$$

where $w_j^*(\theta, b, t, \tau, \alpha, \rho)$ is the equilibrium wage given the parameters of the model. The sign of the earnings response to an increase in the marginal tax rate is determined by the sign of the numerator and can be positive or negative depending on the parameters in the model.[11] Specifically, the sign depends on the bargaining weight θ, the change in the average tax rate associated with the change in the marginal tax rate, $\partial t/\partial \tau$, and where the equilibrium wage is relative to the worker's reservation wage and marginal revenue product, conditional on θ.

It is instructive to examine the role of the term $\partial t/\partial \tau$ to discuss the opposing incentives associated with the marginal and average tax rates. An increase in the marginal tax rate, holding the average tax rate fixed, leads to an *increase* in the offered wage, which can be seen by setting $\partial t/\partial \tau = 0$. All else equal, a higher marginal tax rate reduces the benefit to owners of a marginal reduction in the offered wage. On the other hand, an increase in the marginal tax rate generally coincides with an increase in the average tax rate creating an offsetting affect. All else equal, a higher average tax rate leads to a *decrease* in the offered wage because it leaves a smaller after-tax surplus to be shared between owners and workers (a smaller "pie") , and as long as workers share any of the surplus ($\theta > 0$) the workers bear some of the burden. When there is a differential between the average and marginal tax rates, as in a gradated tax system where $\tau < t$, there is tension between the competing incentives. As the the differential shrinks and the average tax rate approaches the marginal tax rate, the affect of the average tax rate is more likely to dominate and the earning responses is more likely to be negative; a larger differential moves toward the marginal incentive dominating and a higher likelihood of a positive earnings response.[12] When the marginal tax rate

[10]The details of this derivation are provided in Appendix B.

[11]The sign of the denominator is positive under the assumptions $\theta \in (0, 1)$ and $0 \leq \tau \leq t < 1$.

[12]The incentive associated with the marginal tax rate is similar to that discussed in Piketty, Saez and Stantcheva (2014). In their model executives or managers can choose to change the pre-tax distribution of surplus at a cost, and a higher marginal tax rate decreases the incentive to engage in costly bargaining, resulting in higher employee earnings. Here I assume that θ is fixed, but we see that the incentive associated with an increase in the marginal tax rate is in the

equals the average tax rate, $\partial t/\partial \tau = 1$, the earnings effect will be negative as long as $\alpha > 0$, as seen in Eq. (4). Additionally, when there is a higher θ, representing more employee bargaining power, an increase in the marginal tax rate is more likely to be associated with a reduction of earnings, an affect which is increasing in the associated change in the average tax rate. As more surplus is shared with the workers, they also bear a larger burden of the smaller "pie."

In this model changes in the tax rate faced by business owners can directly affect the earnings of employees in the taxed firm. Whether there are positive, negative or null earnings responses depends on features of the tax system and labor market. With a linear tax, the model predicts an increase in the marginal tax rate is associated with a decrease in employee earnings, as long as returns to capital are not fully deductible. If capital returns are fully deductible, or face the same tax rate if invested elsewhere, then employee wages are not a function of the business tax. In a graduated tax system, as the marginal and average tax rates diverge the earnings response associated with the linear case can switch signs such that a higher marginal tax rate is associated with an increase in employee earnings. That the earnings response may be a function of the change in tax liability, as governed by the average tax rate, has implications for my empirical strategy. When estimating the pass-through of the tax increase to employee earnings in Section 6, I estimate the earnings response using cross-firm variation in the associated increase in business tax liability.

3.2.2 Wage Posting Models

In wage posting models, a form of monopsony model, employees have heterogeneous preferences over working at firms which offer different workplace environments. This heterogeneity leads to wage dispersion across firms even among workers of similar skills. While, in the previous set of models surplus was generated from search frictions or collective bargaining power, in wage posting models workplace differentiation and preference heterogeneity of workers imply an upward sloping labor supply curve which creates market power for the employer.

In this model, the quantity of labor is determined by the wage set by the firm. I assume that the firms do not observe the individual workers' reservation wages, but know the distribution of preferences for the continuum of workers. Therefore, firms cannot perfectly price discriminate by offering each worker their firm-specific reservation wage. Instead each firm hires workers of a given skill by posting a wage that is public knowledge and hiring anyone of a that skill level willing to accept that wage. The last worker hired is indifferent to taking the job, but the inframarginal workers hired will obtain some surplus from the match which they gain from the hidden information about their true reservation wage. Let the elasticity of labor supply with respect to the posted wage be η, such that $L = w^{\eta}$. Substituting this into Eq. (1), and taking the first order condition with respect to the wage gives:

$$w_j^* = \frac{\eta}{1+\eta}\left[q_j - (1-\alpha)\rho k - \frac{\alpha \rho k}{1-\tau}\right]. \tag{6}$$

same direction. But, with the bargaining model, the total amount of after-tax surplus, as governed by the average tax rate, creates a countervailing effect.

Eq. (6) shows that the equilibrium offered wage is a function of the elasticity of labor supply to the firm, the worker's marginal revenue product, the opportunity cost of capital and the marginal tax rate. A higher marginal tax rate is associated with lower offered wages as long as $\alpha > 0$; if $\alpha = 0$ then the equilibrium wage is not a function of the tax. Unlike the bargaining model, the equilibrium wage is only a function of the marginal tax rate, τ , and not the average tax rate.[13] In a wage posting, the firm's decision is whether or not to raise the wage in order to grow the firm; a higher marginal tax rate reduces the marginal benefit to growing the firm. In contrast, in the bargaining model the distribution of surplus is determined *ex post* for a given size and employment level.

3.3 Discussion

This section shows that two commonly used models of rent-sharing can predict within-firm spillovers from business income taxation to employee earnings. In both models, the presence of the earnings response depends on there being some sharing of surplus between owners and employees. As discussed in the introduction to this section, there are also other models with competing predictions as to the relationship between business income taxation and employee earnings. Ultimately, it is an empirical question whether there are within-firm earnings responses to increases in firm owners' marginal tax rate, and what the sign and magnitude of such responses would be.

The wage equations presented here motivate an empirical approach that uses cross-firm variation in firm owners' exposure to an increase in the top marginal personal income tax rate to estimate the effect on earnings of employees in taxed firms. Studies that estimate the magnitude of rent-sharing commonly use cross-firm exposure to income or productivity shocks (see Card et al. (2018) for a review). I use regression specifications similar to the standard rent-sharing regression approach, but estimate the effect of an exogenous tax change. As described in the following section, the use of tax variation, as opposed to a productivity shock, helps mitigate many of the standard endogeneity concerns that otherwise arise.

4 Empirical Strategy: Estimation of Within-Firm Spillovers

In this section I describe how I use the rules of pass-through business taxation to identify within-firm spillovers in response to ATRA and discuss how the identification strategy alleviates a number of the typical issues associated with estimating behavioral responses to tax reforms.

4.1 Identifying Variation

The ideal strategy for identifying within-firm spillovers - changes in employee compensation resulting from changes in the tax rate faced by firm owners - would be to randomly select two groups of firms, assign a higher marginal tax rate to one group of owners and then simply compare the

[13] The derivation of the wage equation can be found in Appendix B

subsequent wages offered by the firms in the two groups. We could then attribute any observed changes in worker compensation to the causal effect of the tax change because randomization would imply that the firms would be otherwise identical on average. Unsurprisingly, governments are not keen on randomly assigning tax rates, so we must find quasi-experiments that approach this ideal. An established literature estimating behavioral responses to marginal tax rates has developed methods for approximating this experiment using tax reforms as quasi-experiments. One particular challenge to this approach is finding an appropriate control group. Rate changes often occur all at once for the entire economy and generally occur differentially across different portions of the income distribution. The main challenge this poses is that the rate change depends directly on the tax unit's income level, and households or firms with different income levels are not likely to be on average "otherwise identical."

As detailed in Section 2, pass-through business income is not taxed separately at the entity level, but is taxed as part of the total taxable income of the business owners and is therefore taxed according to their personal income tax rates. This means that there can be two firms with identical business income, but the income is taxed at different rates because the tax rate is based on the total household income of the business owner, not the business income itself. As an illustrative example, suppose in 2012 Firm A and Firm B both have net business income of $250,000 and, for simplicity, that each firm has only one owner. Suppose the owner of Firm A receives all of her taxable income from her firm, so her total taxable income is $250,000 and her marginal tax rate is 35%. The owner of Firm B is married and her spouse makes $500,000 a year. Because of the joint taxation of income, her total household taxable income is $750,000 and she also faces a marginal tax rate of 35%. Following ATRA, Firm B's owner is subject to the new higher top marginal tax rate of 39.6% while Firm A's tax rate does not change. This is just one example of the source of identifying variation I will use; not all variation will come from spousal earnings. More generally, the variation comes from all of the taxable non-business income of the firm owners' households.

Figure 1 presents an example of the identifying variation in the data and somewhat mirrors the situation described in the previous paragraph. The figure shows how tax rates and liabilities change for firms with (approximately) $250,000 in business income as a function of the owner's non-business income. On the y-axis is the change in marginal tax rate or tax liability on business income associated with the change in the top marginal tax rate under ATRA, and on the x-axis is the non-business taxable income of the firm owner. For simplicity, these figures are depicted for the subset of firms with single owners, for which there is a very clear mapping between the owners' taxable income and tax rate faced. Total taxable income is the sum of non-business income (on the y-axis) and taxable business income, set to $250,000. The blue line in Panel A shows that owners with $250,000 in business income and less than $200,000 in non-business income face no change in their marginal tax rate, while owners with more than $200,000 in non-business income face an increase in their marginal tax rate on business income. The red line in Panel B represents the same exercise, but plots on the y-axis the change in total tax liability on business income. This figure illustrates the continuous variation in new taxes owed on business income, as a function of the amount of business

income subject to the new higher rate, even for businesses earning identical amounts of taxable income. For households with over $450,000 in non-business income, all of the business income is subject to the new top rate so the change in liability is exactly $11,500 *($250,000×0.046)*. Panel C visualizes the variation in the data for firms with approximately $250,000 business income, between $225,000 and $275,000; each blue circle represents an average of ten firms. There are many firms whose owners have less than $200K in non-business income but also many with more than $450K, and substantial variation in between. When we consider that this variation exists at all levels of business income, and that for firms with multiple owners the variation depends on the combination of business and non-business income of all owners, this implies substantial variation in tax changes across similar firms. In the next subsection I discuss how this identifying variation is leveraged for estimating within-firm spillovers using non-business income as a shifter.

4.2 Estimation

I use difference-in-differences (DD) methods for estimating within-firm spillovers in response to the variation in the tax change faced by business owners. There are three standard issues that can bias the estimation of the behavioral responses to tax changes. First, changes in marginal tax rates generally affect those at different parts of the income distribution differently. If there are differential counterfactual trends in income growth among people at different parts of the income distribution absent the reform, this will bias the DD estimator of the response. This issue in not likely to pose a threat in my setting because I compare the earnings of individuals over the same range of the income distribution, all below the top marginal tax rate, but who are working in firms whose owner are taxed differently. Second, often changes in tax rates are accompanied by changes in the tax base which can confound direct comparisons of reported income pre- and post-reform. This is not a major threat because employees below the top marginal rate did not experience any direct change in the tax treatment of their income as a result of the reform, neither a change in rates or base.[14]

The third challenge is that marginal tax rates are endogenous to individual decisions that affect reported income. With a graduated tax schedule there will be a correlation between changes in tax rates faced and reported income even absent any tax reform or any behavioral responses. To address this issue, as is standard practice in the ETI literature, I will use the predicted, or mechanical, change in the owner's tax rate to isolate the exogenous variation induced by the tax change. It is calculated by comparing the tax rate faced prior to the reform to the tax rate that the individual would face following the reform had their real taxable income remained exactly at the pre-reform level. Formally, the predicted change in the (log) tax rate can be calculated as $ln(\tau_t(y_{t-1}^{own})/\tau_{t-1}(y_{t-1}^{own}))$, where the pre- and post-reform tax rates, τ_{t-1} and τ_t, are applied to the

[14] Additionally, because I am comparing the earnings of employees in the same part of the income distribution, changes to the base for this group would affect employees in both exposed and unexposed firms similarly. If this were the case, any differences between the treatment and control earnings post reform would still be attributable to the tax change faced by the firm owners, though this would affect the interpretation of the estimated parameters.

owner's pre-reform income level, y_{t-1}. The predicted rate is a function only of pre-reform income so this removes any endogeneity from changes in reported income.

A second form of endogeneity is mean reversion, the tendency for those with high (low) taxable income to report lower (higher) taxable income in the following year absent any change in tax incentives. Therefore, when tax changes affect those at different parts of the income distribution, the observed change in reported earnings following the reform will be a combination of the behavioral response to the reform and the natural mean reversion in taxable income.

Formally, mean reversion comes from the transitory component of income. Consider a general process that determines employee earnings,

$$\Delta ln(w_{jt}) = \epsilon \Delta ln(1-\tau^p) + \Delta ln(\mu_{jt}) + \Delta ln(v_{jt}),$$

where w_{jt} is the earnings of employees in firm j, $(1-\tau^p)$ is the predicted net-of-tax rate on owner income, ϵ is the elasticity of employee earnings with respect to the predicted change in the net-of-tax rate, μ_{jt} is the permanent component of employee earnings at firm j in year t, and ν_{jt} is the transitory component of employee earnings. Without further controls, $\Delta ln(\mu_{jt}) + \Delta ln(v_{jt})$ would comprise the error term in a regression of the change in log earnings on the predicted change in log tax rate.

The change in predicted tax rate is an exogenous regressor which can be used for unbiased estimation of earnings response if it is uncorrelated with the error term, or if $\mathbb{E}[\Delta ln(1-\tau^p)'(\Delta ln(\mu_{jt}) + \Delta ln(v_{jt}))] = 0$. Recall $\Delta ln(1-\tau^p)$ is only a function of the tax change and the baseline reported income of the owner, y^{own}_{jt-1}. For pass-through business owners, taxable income is composed of both business income and non-business income. Let $y^{own}_{jt-1} = Z_{jt-1} + \Omega_{jt-1}$ where Z_{jt-1} is the owner's reported business income in the pre-reform year and the Ω_{jt-1} is the owners non-business income. The necessary condition for exogeneity of the tax variable is, $\mathbb{E}[(Z_{jt-1}+\Omega_{jt-1})'(\Delta ln(\mu_{jt}) + \Delta ln(v_{jt}))] = 0$. The error term must be uncorrelated with the baseline business and non-business income of the owner.

Models with rent-sharing, such as those analyzed in Section 3, would imply that the firm's level of business income, Z_{jt-1}, can be correlated with the earnings of employees at that firm either through a permanent component - higher productivity firms pay higher wages - or through a transitory component - demand or productivity shocks are passed through to wages. If higher earning firms pay more in *levels*, but the log *growth* of earnings are the same across high and low earning firms, then there is no endogeneity associated with the baseline business income. If the earnings of employees at firms with different levels of business income grow at different rates, or there is mean reversion in earnings associated with transitory shocks to business income, then there will be endogeneity associated with the baseline level of business income and it will become necessary to include baseline business income controls. Because I am estimating within-firm earnings responses, potentially associated with rent-sharing, the ability to control for baseline business income is key to unbiased estimation.

Studies designed to estimate the ETI often use baseline income controls to help isolate ex-

ogenous variation in the tax rate.[15] Estimation of the ETI using DD methods requires controls for smooth functions of baseline income and identification of the tax change comes from the non-linear relationship between income and the tax change. Because of this, estimating the response to a single tax reform where the rate change depends on the position in the income distribution becomes very difficult, and estimates can be sensitive to the functional form of the baseline income controls (Saez, Slemrod and Giertz (2012)). As depicted in Figure 1, for pass-through businesses, there can be substantial variation in exposure to the rate change even for firms with identical business income through the variation in the owner's non-business income. Therefore, I am able to control very flexibly for baseline business income without destroying identification,[16] and my estimates are not very sensitive to the functional form of the baseline income control, as I show Section 5.

After controlling for baseline business income, estimation of the effect of the tax change will be unbiased if baseline non-business income is uncorrelated with the error term conditional on baseline business income, or $\mathbb{E}[(\Omega_{jt-1})'(\Delta ln(\mu_{jt}) + \Delta ln(v_{jt}))|Z_{jt-1}] = 0$. This is also the exclusion restriction for the validity of non-business income as an instrumental variable. Again, this does not require that owners' non-business income is uncorrelated with the level of employee earnings, only that there are not systematically differential earnings growth rates for employees in firms with similar business income, but whose owners have different levels of non-business income. This assumption cannot be directly tested, but I assess the validity of this assumption by examining whether the conditional trends in earnings are parallel in the pre-reform period. I must also assume that there is no mean reversion associated with non-business income, or that owners do not pass known transitory shocks to non-business income onto employee earnings conditional on business income. I am not able to control for baseline non-business income to purge this sort of potential mean reversion because controlling for both business and non-business income would indeed destroy the identifying variation. Therefore, I regard this as the primary untestable identifying assumption of the proposed estimation strategy. I believe this is a reasonable assumption as models of profit maximization generally would not predict any such correlation. I ultimately include an even richer set of firm-level baseline controls to help ensure the exogeneity of the predicted tax rate variable.

5 Results: Within-Firm Earnings Responses

In this section I provide direct evidence of within-firm earnings responses to a change in the top marginal personal income tax rate faced by pass-through business owners. The average earnings of employees in firms whose owners experienced a tax hike grew more slowly than the earnings of employees in similar, unexposed firms following the tax change. There were no apparent extensive margin employment responses to the tax change. Nearly all of the earnings response was concen-

[15] See for example Auten and Carroll (1999) and Gruber and Saez (2002).

[16] For example, in theory I could include a fixed effect for every dollar of baseline business income ($1,$2,. . . , $1mil, . . .) and still retain identifying variation, as within each dollar amount of business income we would expect there to be variation in the tax rates faced by the owner attributable to variation in non-business income. In standard ETI studies, this would eliminate all identifying variation.

trated among stayers, employees who were with the firm at the time of the tax change and remained with the firm. Additionally, there is no evidence that the response was a result of a decrease in average production or productivity among more exposed firms. Together, this suggests that the average earnings response was associated with the pass-through of the taxation of firm owners to the wages of employees. I conduct heterogeneity analysis and find heterogeneous responses among workers in different portions of their firm's income distribution and by the tightness of the labor market.

5.1 Description of Exposed and Unexposed Firms and Workers

Table 1 shows summary statistics separately for the full sample of firms and for firms with top-bracket owners. About 23% of firms in the sample have at least one top-bracket owner. Unsurprisingly, firms with top-bracket owners are larger in terms of employees and production than the average firm. Perhaps surprisingly, the difference is attenuated when looking at productivity as measured by value-added per worker and profitability, (*profits / revenues*). Additionally, the average earnings of employees in firms with top-bracket owners are higher than those for the average firm, but there is substantial overlap in the distributions. Despite the size and earnings differentials, the distribution of the labor share, measured as (*wage bill / value-added*) or (*wage bill / revenues*), is very similar across groups. Appendix Tables A.2 and A.3 show that there is substantial overlap between firms with and without top-bracket owners within industry and state, respectively.

The baseline differences between firms with and without top-bracket owners highlight the importance of using firm-level controls to help ensure estimates are not confounded by non-tax shocks to large versus small firms at the time of the tax change. Panel B of Table 1 investigates how effective firm-level controls are at balancing the mean characteristics of these firms. This panel shows the conditional mean differences between firms with and without top-bracket owners after controlling for baseline (2012) characteristics of the firm. The controls are the same as those used in the main regression specifications that follow, and include indicators for deciles of net business income, deciles of value-added per worker, 2-digit industry, firm-size categories and state. These controls go a long way in balancing the mean characteristics. Conditional average earnings are less than $1,000 different and the difference in average firm size is only three employees, therefore the average wage bills between these sets of firms are also similar. The average difference in production, measured in value-added, is still significant though very much reduced, and the difference in productivity is almost null. Because of the residual average differences, it remains important to assess the validity of the DD estimation strategy by evaluating the pre-reform earnings trends.

5.2 Within-Firm Spillovers

5.2.1 Flexible Difference-in-Differences

In this section I use firm-level variation in firm owners' exposure to the tax change to estimate within-firm spillovers to the earnings of employees. Employee earnings are defined as the annual

W-2 wage and salary income received from the issuing firm in that year. I create firm-level treatment variables, $exposure_j$, which are measures of how exposed the firm was to changes in the top marginal tax rate through the firm owners. Employees in firms with no top-bracket owners were not exposed to the tax change while employees in firms with top-bracket owners were exposed.

I begin by using a flexible difference-in-difference (DD) method comparing the average earnings in exposed (treatment) and unexposed (control) firms relative to a pre-reform year. This specification helps to assess the validity of the comparison of workers in more and less exposed firms by allowing us to observe whether trends in reported earnings in these sets of firms moved in parallel prior to the reform. The regression specification is:

$$ln(y_{jt}) = \alpha + \sum_{s \neq 2012} (\beta_s exposure_j + \Omega_s f(z_{j2012}) + \Gamma_s X_{j2012}) \times year_{s=t} + \delta_t + \psi_j + \nu_{jt} \qquad (7)$$

where the outcome is log average earnings of full-time employees in firm j and β is the DD estimator of the differential in average earnings between more and less exposed firms relative to base-year 2012. I use a fixed definition of treatment based on having top-bracket owners in the pre-reform period.[17] I include a firm fixed effect, ψ_j, to isolate within-firm variation, which purges any potential systematic time-invariant differences between firms with and without top-bracket owners. As discussed in Section 4, I control flexibly for the firm's baseline business income, $f(z_{j2012})$. My baseline specification includes non-parametric indicators for deciles of the 2012 distribution of business income. I also include a vector of firm-level baseline characteristics, X_{j2012}, which include industry fixed effects (2-digit NAICS), indicators for the state in which the firm is registered and indicators for deciles of the value-added per worker distribution. Firm-level characteristics are flexibly interacted with year in order to allow for differential time paths for firms with different pre-reform characteristics. Finally, I include year fixed effects, δ_t, which capture the conditional time-path of average earnings for the control firms. The regressions are weighted by the baseline number of employees to simulate an individual-level regression with a firm-level treatment.

Figure 2 shows results from the estimation of specification Eq. (7). For the baseline estimates, the $exposure_j$ variable is an indicator equal to one for firms with any top-bracket owner(s) in each year from 2010-2012 and zero for firms with no top-bracket owners in those years. This definition ensures that I am comparing firms which where most likely to be persistently affected by the tax reform relative to those which were least likely to be affected. By defining treatment purely in the pre-reform years, the results from these specifications can be considered intent-to-treat (ITT) estimates of the response to the tax reform.[18]

Panels A shows the adjusted time path of average employee earnings in exposed and unexposed firms relative to 2012. The time path for control firms is represented by the coefficients on the year

[17] "Top-bracket" is defined according to the new top-bracket post reform, even in pre-reform years. For example, in 2010 an owner is considered to be in the top-bracket if they have (real) taxable income such that they would be in the new top-bracket established in 2013.

[18] As discussed in Kawano, Weber and Whitten (2016), the ITT gives a lower bound for the treatment on the treated (TOT) parameter when owners may switch tax brackets across years. The ITT represents the TOT if all cross-bracket switching is a result of unanticipated behavioral responses to the rate change.

fixed effects, $\hat{\delta}_t$, and the time path for the treatment group is the sum of the coefficients $\hat{\beta}_t$ and the coefficient on the year fixed effect, $\hat{\delta}_t$, for each year t. The figure displays a clear pattern. The conditional time-paths of employee earnings were nearly identical in the pre-reform years and then diverged starting in 2013, following the tax reform. Starting in 2013, the workers in treatment firms saw lower relative earnings growth which continued through 2015. Panel B shows the same results, but plots the year specific DD coefficients and includes the 95% confidence intervals. The trends are flat prior to 2013, then diverge starting in 2013 and the difference in relative earnings is significant at the 5% level in 2014 and 2015. These figures show that employees in more exposed firms did not experience nominal decreases in their earnings, but instead experienced lower relative earnings growth following the tax reform. Going forward I will often present only the DD estimates, but it is important to recall that negative coefficients do not represent nominal decreases in earnings, but lower earnings relative to the counterfactual represented by the control firms.

5.2.2 First Difference Estimates and Robustness

In order summarize responses using a single point estimate, I use a first-difference specification based on the framework established in Eq. (7). The specification is of the form:

$$\Delta ln(y_{jt}) = \alpha + \sum_t \beta_{t-1} exposure_{jt-1} + \gamma_t f(z_{jt-1}) + \Gamma_t X_{jt-1} + \delta_{t-1} + e_{jt}, \tag{8}$$

where y_{jt} is the average earnings of full-time employees at firm j in year t; $exposure_{jt-1}$ is a measure of how exposed the firm was to the tax change in base year $t-1$, so β_{t-1} represents the ITT estimator of the treatment effect; $f(z_{jt-1})$ is a flexible function of base period business income; X_{jt-1} are baseline firm-level characteristics; and δ_t are base-year fixed effects. All estimates represent within-firm differences, thereby controlling for any fixed firm-level characteristics. The baseline specification uses three-year differences, as is standard in the ETI literature to estimate medium-run responses to tax changes.

First, I explore the robustness of the within-firm spillover results to the inclusion of various baseline controls. Each column of Table 2 represents a specification using different combinations of baseline firm characteristics. The third row reports the DD estimator of the effect of exposure to the tax change on average employee earnings, $\hat{\beta}_{2012-2015}$. Since I have a long panel, I use pre-period differences as a placebo test for the parallel trends assumption, similar to that in the flexible DD specification. The results are reported in the first two rows, testing whether being a firm with a top-bracket owner, defined by the new top bracket established in 2013, implied a differential change in earnings between years 2006-2009 or 2009-2012. We expect no differential change in log earnings between more or less exposed firms in the years prior to the tax change because prior to 2013 an owner having more or less than $450,000 in taxable income was an arbitrary distinction.

Table 2 shows that the specification is quite robust to the inclusion of baseline firm characteristics after controlling for deciles of baseline business income. Also, we see that the specification passes the placebo tests - there are no clear systematic differences in the earnings growth prior to

the tax change. Table 3 shows robustness to the functional form of the baseline income controls, and shows that the earnings response is quite robust across specifications. The estimates are very stable whether I control for net income in 2012 and 2011 or the average of the two years, and if I use splines in base period net income instead of indicators for income decile.

Table 4 shows robustness across various definitions of the $exposure_{jt-1}$ variable. The first column repeats the baseline $exposure_{jt-1}$ definition; the second column defines $exposure_{jt-1}$ as an indicator equal to one if *all* owners are in the top bracket in the base year and zero if no owners are in the top bracket. The third column defines $exposure_{jt-1}$ as the share of firm owners that are in the top bracket in the base year. The fourth column provides a very clean experiment using the subsample of firms with only one owner and defining $exposure_{jt-1}$ as an indicator for whether that owner is in the top bracket or not. The estimated effect is very consistent across definitions of $exposure_{jt-1}$, and there is no evidence of differential pre-trends prior to the tax change.

The fifth column presents the DD estimate of the elasticity, the percent change in earnings in response to a one percent change in the marginal tax rate faced by the firm's owners. I define the marginal tax rate for a firm as the weighted average of the marginal tax rate faced by the owners, weighted by 2012 ownership shares. The estimated elasticity is -0.10.

I interpret the results presented in Figure 2 and Tables 2, 3 and 4 as providing consistent evidence that there was an effect of the reform on the average earnings of workers in firms more exposed to the tax change. The results suggest that, following the reform, workers in more exposed firms saw, on average, about 1% lower earnings growth than they would have were there no tax change. In the following subsections I investigate the mechanisms associated with this result, before turning to estimating the dollar-for-dollar pass-through in Section 6.

5.3 Mechanisms: Composition or Compensation?

I first investigate whether the observed earnings responses were attributable to changes in workforce composition or whether they represented changes in the compensation paid to the same, or similarly skilled, employees. This is central as to whether the lower earnings growth represents a pass-through of the tax burden to employee earnings or decreased investment in labor inputs. As an extreme case, imagine that a firm reduces wages in response to the tax hike and all employees leave the firm and immediately find new jobs at their old wage. The firm replaces those workers with lower skilled employees for whom the new lower wage matches their marginal product. In this case, none of the burden is passed on to employees, the firm simply uses less productive labor inputs.[19] To address this question, I investigate the joint employment and earnings responses to the tax change.

Any change in net employment over the period is a combination of accumulated new hires and accumulated separations. I define "incumbent" employees as those who worked for the firm in the

[19] A related potential margin of response could be to convert workers who were W-2 employees to independent contractors, either by changing their actual job in the firm or by misclassification - paying the worker as a contractor for performing the same job as before. These responses would also show-up on the extensive margin.

pre-reform year $t-1$, and I define firm "stayers" as incumbent employees who remain with the firm through post reform year t. New hires are defined as anyone who received a W-2 from the firm for the first time in some year between the base year and year t, exclusive of the base year. A small or zero observed change in net employment could mask differential extensive margin responses if the number of separations and new hires offset. Concretely, the percent change in net employment can be decomposed into the share of new hires relative to baseline employment and the separation rate of incumbent employees:

$$\frac{\Delta E_t}{E_{t-1}} = \frac{e_t^{new}}{E_{t-1}} + \frac{\Delta e_t^{incumb}}{E_{t-1}} = \frac{\text{new hires}}{E_{t-1}} - \frac{\text{separations}}{E_{t-1}}. \tag{9}$$

where E_t represents total full-time employment in year t, e_t^{new} represents the number new hires, and Δe_t^{incumb} represents the difference between the number of incumbent employees present at the firm in year $t-1$ and those who remain at the firm in year t.

The first columns of Table 5 present results from this decomposition using the first difference specification given by Eq. (8). Column 1 shows the DD estimator of the effect of the tax change on the log change in full-time employees. There is a precise zero estimate for change in net employment. Columns 2 and 3 present tests for whether the absence of a net employment response masks differential turnover. Column 2 shows that there was no differential hiring rate between treatment and control firms and Column 3 shows no significant differential in retention rates.[20]

The employment results suggest that the observed average earnings response was not attributable to differentials in the number of employees at more or less exposed firms, but it could be that the *type* of employees was changing. For example, the observed earnings response could be a result of skill-downgrading such that new hires in more exposed firms were relatively low earning and separators were relatively high earning. The percent change in the total wage bill can be decomposed into the relative change in the earnings of stayers and the differential share of earnings to paid to new hires and separators. The decomposition is given by,

$$\frac{\Delta W_t}{W_{t-1}} = \frac{\Delta w_t^{stay}}{W_{t-1}} + \frac{w_t^{new}}{W_{t-1}} - \frac{w_{t-1}^{sep}}{W_{t-1}}, \tag{10}$$

where W_t represents the wage bill in year t; w_t^{stay} represents the total earnings of "stayers," those who remained at the firm between year $t-1$ and year t; w_t^{new} represents the total earnings of new hires in year t; and w_{t-1}^{sep} is the total earnings of incumbents in year $t-1$ that separated prior to year t.

Columns 4-6 of Table 5 present estimates from this decomposition. Column 4 shows the DD estimate for the log change in total wage bill, which is very similar to to the estimated change in average wages because of the absence of a net employment response. Column 5 shows the change in the share of total earnings going to stayers. Over 90% of the estimated response in the total

[20] These results also imply that changing the classification of workers from employees to independent contractors was not a significant response to the tax change faced by the business owners.

wage bill is associated with the change in earnings going to stayers. Column 6 shows the share of the earnings response associated with differential turnover, represented by the sum of the last two terms on the right-hand-side of Eq. (10). A small and statistically insignificant portion of the response is associated with differential earnings among those leaving and entering the more exposed firms.

The results of this decomposition show that the majority of the observed average earnings response was from differential changes in earnings received by stayers in more exposed firms, with a small portion potentially attributable to skill downgrading. To highlight this point, I estimate the flexible DD specification from Eq. (7) for stayers in more or less exposed firms. Figure 3 Panel A shows the average earnings response for all stayers and shows very parallel earnings trends followed by a sudden and sustained decrease in relative earnings growth following the tax change.[21] Panel B repeats the exercise for the subset of stayers with at least three years of tenure in the base year, 2012, which I call "attached stayers," and displays a very similar result.

This evidence suggests that the earnings response in the exposed firms is primarily an intensive margin response - incumbent employees in firms whose owners experienced a tax hike experience slower relative earnings growth than do employees in similar firms but whose owners saw no change in their tax rate. That the response is concentrated among stayers implies that the observed spillovers likely represent lower wages paid to the same employees and can be interpreted as pass-through of tax liability to the earnings of employees in firms that experienced a tax hike.

5.4 Firm Production Responses

Next I test whether there is evidence of firm-level production or productivity changes in response to the tax change. Figure 4 presents DD estimates from Eq. (8), where the outcome variables are derived from line items on the firm's income tax return. In general, there is no significant change in production or productivity between firms whose owners were and were not exposed to the rate increase; there is no significant difference in gross revenue, total income, value-added or value-added per worker. There is also no significant change in the total deductions of more exposed firms, though there is a negative point estimate which may be related to the lower relative total wage bill among more exposed firms. The lack of evidence of significant changes in production or productivity further suggests that the observed earnings responses were the result of a direct effect of the taxation of owners, as opposed to a change in marginal productivity. Although I am not able to directly observe prices, the lack of evidence for a change in gross sales or income suggests that the firms may have had little ability to pass the new tax burden onto consumers through higher prices.

[21] Recall that the DD coefficients following the tax change represent a decrease in earnings relative to unexposed firms, not nominal decreases in earnings received by stayers.

5.5 Heterogeneity Analysis

5.5.1 Within-Firm Income Distribution

Here I investigate whether the earnings responses were uniform across portions of the within-firm income distribution. In the data used for this project I do not observe occupation, but differential responses across the within-firm income distribution may reflect that the burden is borne by employees of different skill types.

First, I test whether there was an aggregate change in the earnings distribution in more exposed firms. For each year I split the within-firm distribution of employee earnings into quartiles and take the average earnings in each quartile. I then use specification Eq. (8) where the outcome is the average earnings within each quartile, estimated separately by quartile. The results are presented in Panel A of Figure 5. The average earnings in the bottom three quartiles decreased in response to the tax change relative to the earnings in each quartile in the non-exposed firms. Those in the top quartile of the earnings distribution saw essentially no relative change in their earnings. This implies that, on average, the response to the tax change resulted in a relative increase in within-firm earnings inequality among more exposed firms.

Next, I locate stayers according to their position in the 2012 within-firm earnings distribution to test for differential pass-through across employees in different parts of the *pre-reform* earnings distribution. The solid black bars in Panel B represent the DD estimator by quartile for all stayers; the blue dashed lines show the estimates for attached stayers, those with at least three years of tenure in 2012. For both groups, earnings responses are concentrated in the lower half of the within-firm earnings distribution. There are significant negative DD estimates for stayers in the bottom two quartiles of the earnings distribution and precise zeros for those in the top two quartiles.

5.5.2 Differential Effects by Labor Market Conditions

The labor market models presented in Section 3 show that the presence and size of the within-firm earnings response to taxation can depend on the degree to which there is surplus in the labor market, from market or information frictions or from market power. Here I test for differential responses in tight versus slack labor markets.

I use two measures of the labor market conditions in a state, the state unemployment rate in 2012, the year prior to the reform, and a recession shock as developed in Yagan (2018) that uses the change in state unemployment rates between 2007 and 2009 to measure how hard the labor market in a state was hit by the Great Recession. Each state is ranked according to their position along these measures, and I run separate regressions for firms in these states according to their quartile in each distribution.

The first set of bars in Figure 6 presents DD estimates by rank of the 2012 unemployment rate. The point estimates are monotonically decreasing in quartiles of the state unemployment rate; the largest earnings responses are found in states with the highest unemployment rates in the year prior to the tax increases. The second set of bars present results for the recession shock measure. The

earnings responses are fairly uniform for the first three quartiles, while the estimate for the lowest quartile, representing firms in states with the smallest shock to the unemployment rate during the recession, saw almost no earnings response.

These results suggest that the magnitude of the earnings response depended on the labor market conditions around the time of the tax change, with larger spillovers in states with relatively slack labor markets. In slack labor markets employers may have more ability to pass liability through to employees as it may be more costly for incumbents to separate in response to lower earnings growth and easier for employers to replace any employees that do separate.[22]

5.5.3 Other Heterogeneity

Figure 7 presents DD estimates from Eq. (8) separately by a range of firm and employee characteristics. The top set of estimates shows responses by firm size. The response is similar across firms with fewer than 100 employees, with the largest estimated responses among medium sized firms, those with 50 to 100 employees. There is no statistically significant response among large firms, those with over 100 employees.

I next rank all firms by their average value-added and profitability, (*profits / revenues*), in the years prior to the tax change, 2011 and 2012, and estimate the earnings response separately for terciles of this distribution. The largest responses were among firms in the second and third terciles and there was no significant response among the smallest firms in terms of value-added. There were relatively uniform responses by profitability, with slightly larger responses among more the more profitable firms. Therefore, though the magnitude of the response was larger for small and medium firms in terms of employees, the aggregate response is not driven by firms that are small in terms of economic activity. I also rank firms by the labor share of revenues, (*wage bill / revenues*) and find relatively consistent responses across terciles.

Next, I test for differential responses by whether the owner exposed to the tax change ("top owner") is an active owner or a passive owner. The first estimate ("active") shows the earnings response for firms which have an active owner who was exposed to the tax hike relative to firms with no exposed owners. The estimate is significant and slightly larger than the aggregate response. The "passive" estimate represents the response for firms that have a passive owner who was exposed to the tax change, but where the active owner(s) was not exposed to the tax change, and there is no significant earnings response among these firms. This suggests that the incidence of business taxation may depend on the ownership structure of the entity, and whether the income tax primarily affects active or passive owners.

I find no differential responses between single owner and multiple owner firms on average.

[22] A paper by Kahneman, Knetsch and Thaler (1986) and the follow-up comment by Gorman and Kehr (1992) surveyed employees and executives about when it would be considered fair for business to respond to business conditions by adjusting prices or wages. They find that 78% of individuals and 98% of executives would consider it fair to reduce the rate of wage growth in response to a shock to business profits, particularly in times of high unemployment. Both individuals and executives generally considered it fair to reduce bonuses or wage growth in response to shocks to profits, but not fair to reduce nominal wages and less fair to lay-off workers.

Among multiple owner firms, there was no significant earnings response among firms with over 5 owners, but the estimate is imprecise due to the relatively small number of firms in this category. Finally, I find no statistically significant difference in earnings responses between male and female employees, though the point estimate implies a slightly larger response among women, and is largest for women with children.

6 Pass-Through of Owner Tax Liability to Employees

In this section I estimate the pass-through from the increased taxation of S-corporation owners to employee earnings, defined as the share of an exogenous $1 increase in business tax liability borne by employees as lower earnings. To create annual measures of the tax liability, marginal tax rate and average tax rate faced by firm owners, I use a tax calculator adapted from an IRS tool for calculating federal income tax rates and liabilities. I define business tax liability as the total tax liability of the firm owners minus the tax liability that they would have owed had they earned no business income from their firm, or *T(business)=T(total)-T(non-business)*. To calculate the tax liability on non-business income, I subtract the taxable business income items from the owners' total taxable income and apply the tax calculator to the remaining non-business income.[23] I calculate the average tax rate as the tax liability divided by taxable income. To obtain a single marginal tax rate for each firm, I use a weighted average of the owners' marginal tax rates, weighted by their ownership shares in 2012.

Active owners of S-corporations receive business income from the firm, but also must pay themselves W-2 wage and salary income. IRS guidance states that active owners must pay themselves "reasonable wages" for the services performed, but in practice, owners have some discretion in exactly how much they pay themselves in wages and how much income they take in the form of profits. Given this, in the primary analysis, I define an owner's business income as the sum of the net business income and the wage and salary income received from their firm.

6.1 Pass-Through Estimates

I modify the event-study specification given in Eq. (7) by defining the right-hand-side variable of interest, $exposure_j$, as the predicted log change in tax liability of business income per worker, or *ln(T_t(business income$_{t-1}$))-ln(T_{t-1}(business income$_{t-1}$))*, where $T_t(\cdot)$ represents that tax liability per employee given the tax-system in a given year. This measures the percent change tax liability on business income were the owners' business and non-business income to remain at the pre-reform, *t-1*, level following the tax change. The coefficient on this variable, β_t, is the DD estimator for the effect of an exogenous one percent increase in business tax liability on the average earnings of lower-bracket workers. I weight each regression by firm size (number of full-time employees) in

[23] Effectively, this treats business income as the last dollars earned by the household.

2012 to simulate individual-level regressions with a firm-level treatment.[24]

Figure 8 Panel A plots event-study coefficients for the full sample of firms. The flat pre-trends show that after controlling for baseline firm characteristics, firms with a higher predicted change in tax liability had no differential earnings path prior to the tax reform. In 2013 there was a sudden and persistent decrease in relative earnings growth among employees in more exposed firms. The point estimate of -0.10 in 2015 can be interpreted as an elasticity: a 10% increase in the firm's predicted tax liability is associated with a 1% decrease in employee earnings, relative to the counterfactual earnings growth.

Panel B repeats the exercise, but for the subset of firms with at least one top-bracket owner. This leverages variation in the increased tax liability across firms, all of which were exposed to the tax change and experienced in increase in their marginal tax rate. The trends and point estimates are very similar for this subsample, though the standard errors are larger due to the reduction in sample size. This shows that the estimated pass-through responses are not purely driven by a comparison between firms with and without top-bracket owners, and suggests that the pass-through is a function of the change in tax liability, or the change in average tax rate, on business income. Additionally, this serves as a robustness test. If there were unobserved differences between firms with similar business income but with and without top-bracket owners that were changing after 2012, this could bias the estimates. But, all of these firms have at least one top-bracket owner, so this subsample includes very similar firms that experienced differential shocks to business tax liability.

Figure 8 provides estimates leveraging the full variation in tax liability as depicted in Figure 1 Panel B and supports the parallel trends assumption necessary for a causal estimate of the pass-through parameter, but it does not provide the dollar-for-dollar pass-through estimate. To do so, I convert the estimated elasticity to a dollar metric to calculate the pass-through of an exogenous $1 increase in business tax liability to employee earnings. The elasticity can be represented as

$$\varepsilon = \frac{\partial w}{\partial T}\frac{T}{W},$$

which can be rearranged to formulate the dollar-for-dollar pass-through implied by the elasticity as

$$\frac{\partial w}{\partial T} = \varepsilon \frac{W}{T}. \tag{11}$$

Table 6 presents estimates from this formulation using the estimated elasticities (row 1) evaluated at the mean wage bill and business tax liability for the sample. The first three columns show results using all full-time employees. The estimates are not very sensitive to the choice of firm-level controls, after controlling for deciles of baseline net business income. Using the preferred specification with full controls (column 3), I find an 18% pass-through. For each dollar of new

[24]The heterogeneity analysis showed variation in earnings responses by firm size, so the weighting also helps alleviate potential bias created by this heterogeneity. Empirically, weighting by firm size provides very similar results as does controlling flexibly for baseline firm size.

business tax liability, 18 cents is "paid" by employees through slower relative earnings growth.

The second set of columns repeats the exercise for the average earnings of stayers only. This gives a conservative estimate of pass-through by including only the change in earnings for a fixed set of employees who remain with the firm. The elasticities are slightly larger, but the pass-through estimates are somewhat smaller than for the full sample because the wage bill of stayers is smaller than the total wage bill. The preferred specification (column 6) shows a 15% pass-through to the earnings of stayers.

To put these estimates in context, the third row provides the sample average of the mechanical change in business tax liability experienced by firms with top-bracket owners. Applying the pass-through estimates to this statistic provides a simple calculation of the average change in the wage bill resulting from the tax reform for firms that experienced the tax change. The estimated change in wage bill is $6,000-8,000.

6.2 Robustness to Alternate Income Concepts

Next I investigate whether there is any evidence that the owners are passing the new tax liability on their non-business income onto the employees. To do so, I test whether there is differential pass-through among firms whose owners experience a larger change in tax liability on their non-business income, controlling for the change in the tax liability on business income. I modify Eq. (8), as follows:

$$\Delta ln(y_{jt}) = \alpha + \sum_t \beta_{t-1} exposure_{jt-1} + \sum_t \theta_{t-1} nonbus_{jt-1} + \gamma_t f(z_{jt-1}) + \Gamma_t X_{jt-1} + \delta_{t-1} + e_{jt}, \quad (12)$$

by including an additional right-hand-side variable, $nonbus_{jt-1}$, which is defined as the mechanical change in log tax liability on the owners' non-business income, while continuing to control for the change in log tax liability on business income.

The variation used for identification is depicted by the blue line in Figure 1 Panel D. An owner with less than $450,000 in non-business income may have a portion of their business income subject to the change in the top marginal rate. Once an owner has more than $450,000 in non-business income, all of their business income is subject to the top rate and their non-business income above $450,000 is subject to the top rate as well. Therefore, the coefficients θ_{jt-1} are only identified for firms with at least one owner with over $450,000 in non-business income.

Table 7 displays the DD estimates for the percent change in tax liability on business and non-business income, $\hat{\beta}_{2012-2015}$ and $\hat{\theta}_{2012-2015}$, in the first and second rows respectively. The first column shows results for the full sample of firms and the second for the subset of firms with at least one top-bracket owner. The results show no evidence of differential earnings responses among firms whose owners have larger changes in tax liability on their non-business income. The coefficients on the change in liability on business income are very similar to those when not controlling for the change in liability on non-business income. The coefficients on the change in liability on non-business income are all statistically insignificant and the point estimates are small and positive,

suggesting, if anything, that owners with larger changes in their non-business income tax liability pass less of the burden onto employees. The results suggest that owners are passing the tax liability on business income through to employees, but not the tax liability on the non-business income, corresponding with models of profit maximization such as those presented in Section 3.

The estimates presented in Figure 8 and Table 6 define the firm's business income as the sum of net business income and owner wage and salary income. I repeat the pass-through estimation but define business income as only the reported net business income, and present the estimates in Appendix Table A.4. The pass-through estimates are larger, but the implied estimate of the welfare relevant metric - the total change in wage bill resulting from the tax reform – is very similar across income concepts.

6.3 Pass-Through Results in Context

The preferred estimates from Table 6, imply a pass-through of business income taxation to employee earnings of 15-18%. These estimates are lower than those in some recent studies on the incidence of business taxation. Fuest, Peichl and Siegloch (2018) estimate that 43% of the municipal corporate taxation in Germany is born by workers and Arulampalam, Devereux and Maffini (2012) estimate a long-run incidence of 39% using cross-country variation in Europe. European countries generally have higher levels of collective bargaining than in the U.S. In the bargaining model presented in Section 3, workers with more bargaining power may bear a larger burden of the tax change. Differences in labor market institutions may contribute to lower pass-through in the U.S. context. Suárez Serrato and Zidar (2016) use a model of mobile capital and labor across states and estimate that employees bear 30-35% of the burden of state corporate taxes in the U.S.; in contrast, my estimates are within state.

The parameters estimated in each of these studies is somewhat different. These other studies estimate responses to changes in corporate tax rates at national or subnational levels, whereas I estimate responses to a differential tax rates faced by firms within industry and jurisdiction. The degree of capital and labor mobility and the ability to shift the burden onto consumers may vary across these contexts. Additionally, owners of pass-through businesses may respond differently to income tax changes than do owners of C-corporations. The heterogeneity analysis suggests that the ownership structure - whether the tax change affects active or passive owners - may mediate the response to business income taxation (Figure 7). Yagan (2015) finds essentially no response to a change in tax rates on C-corporation dividends. The variation across states with different unemployment rates (Figure 6) suggests that the incidence may depend on the macro labor market conditions in addition to underlying labor market institutions.

Different estimates of tax incidence may be more appropriate for analyzing different business income tax policies. Critically, this study focuses specifically on the firms for which business income taxation is embedded in the personal income tax system and estimates the associated effect on employees. Therefore, the parameter estimated here is the best suited for analyzing cross-bracket spillovers associated with a change in the top marginal personal income tax rate.

7 Implications for Welfare and Optimal Income Taxation

In the standard Mirrleesian optimal income tax analysis, it is assumed that the marginal tax rate faced by individuals at a given income level has no effect on the income or behavior of those at different income levels. In other words, it is assumed that the entire incidence of the personal income tax is borne by households facing the given tax rate. The evidence presented here suggests that this is not necessarily the case. I find a behavioral response to the business income taxation embedded in the personal income tax system leading to within-firm, cross-bracket spillovers. In this section I present a simple model of welfare analysis which highlights two fundamental implications of this result. First, in the presence of cross-bracket spillovers, the owners' ETI is not a sufficient statistic for welfare analysis. We must also know the extent of the spillover, or how the distribution of surplus changes in response to a tax change. Second, when the pre-tax surplus shifts from employees to owners, the taxable income response of top-bracket households will understate the welfare loss associated with a change in their tax rate.[25] The exact magnitude of the marginal welfare loss depends on the underlying labor market structure.

7.1 Marginal Welfare Analysis

For simplicity, I assume that there are only two types of agents in the economy, business owners that are at the top of the income distribution and face tax rate τ and employees who are lower in the income distribution and face tax rate t, where $\tau > t > 0$. To focus on sufficient statistics for welfare analysis, I fully abstract away from distributional considerations by assuming that owners and employees have the same social welfare weights and have linear utility functions of the form:

$$\text{Owners: } u^o(c, z(\pi, e)) \quad = \quad (1-\tau)(\pi + e) - \psi(\pi, e), \tag{13}$$

$$\text{Employees: } u^e(c, z(\omega, -e)) = (1-t)(\omega - e) - \phi(\omega, -e). \tag{14}$$

Agents receive positive utility from consumption, but negative utility from activities which generate pre-tax earnings z. For owners, pre-tax earnings is the sum of π, which represents the earnings function were they to receive none of the match surplus, or rents, from employing workers, and of e, their share of the surplus arising from the employment relationships. Similarly, ω represents employee earnings were they to receive all of the match surplus. For example, ω could represent employee earnings were their wage equal to their marginal product, π owner earnings were they to pay employees ω, and e the mark-down associated with earning less than their marginal product.[26] Owners and employees choose net-of-surplus earnings π and ω, respectively, and experience

[25] Though the mechanism is different, the underlying intuition behind these results is similar to that in a model where competitive wages respond endogenously to tax rates in general equilibrium, such as in Allen (1982). The taxes induce redistribution within the labor market, in addition to through the fiscal system, with welfare implications. The analysis also shares some of the same intuition as when product markets are not perfectly competitive, as in Kaplow (2019), where the optimal income tax schedule must be adjusted to account for tax induced changes in product price mark-ups.

[26] I present here the pre-tax earnings as an additive function of π or ω and e for clarity of presentation, but this is not necessary. In Appendix C I use general earnings functions, and the intuition is the same.

the associated utility costs, ψ and ϕ, which are increasing and convex in π and ω. Whether the agents choose the surplus share, e, and experience associated utility costs, or whether e is as an exogenous parameter in their optimization problems depends on the labor market model, and will have implications for the welfare analysis.

The government does not observe π or ω directly, but only the total taxable income of owners and workers, $\pi + e$ and $\omega - e$ respectively. I assume the government collects taxes and returns the money to everyone lump-sum or, analogously, that the social marginal value of public funds equals one. The welfare in the economy is represented by:

$$W = \underbrace{(1-\tau)(\pi+e)-\psi}_{\text{owner welfare}} + \underbrace{(1-t)(\omega-e)-\phi}_{\text{employee welfare}} + \underbrace{\tau(\pi+e)+t(\omega-e)}_{\text{government revenue}} \tag{15}$$

To assess the excess burden generated by a small change in the top marginal tax rate, I differentiate Eq. (15) with respect to τ. A small increase in the tax rate produces a mechanical effect and a behavioral response, and can also induce a pre-tax transfer of surplus, $de/d\tau$. The impact of these responses for owners, employees and government revenue are summarized below.

$$\frac{\partial W}{\partial \tau} = \underbrace{\tau\frac{d\pi}{d\tau}}_{\substack{\text{behavioral}\\ \text{response}}} + \underbrace{\tau\frac{de}{d\tau} - t\frac{de}{d\tau}}_{\substack{\text{rev. externality}\\ \text{from transfer}}} + \underbrace{(1-\tau)\frac{de}{d\tau} - \psi'\frac{de}{d\tau} - (1-t)\frac{de}{d\tau} - \phi'\frac{de}{d\tau}}_{\text{direct effect of transfer}} \tag{16}$$

The mechanical effect holds behavior constant. An increase in the tax rate leaves the owner with less after-tax income and generates an equal amount of revenue for the government, and so produces no net change in welfare. The tax change induces a behavioral response among owners such that they reduce pre-tax earnings in response to the higher marginal tax rate, $d\pi/d\tau < 0$.[27] The behavioral response produces no first-order effect on the owner's welfare because the owner chooses π optimally as an implicit function of the tax rate τ. This is the standard application of the envelope theorem to the owner's utility optimization problem from Eq. (13). The behavioral response does have a first-order effect on revenue because the owner does not internalize the fiscal externality associated with the response. The net welfare effect of the behavioral response is thus the revenue loss associated with the fiscal externality, $\tau(d\pi/d\tau) < 0$.[28] In the standard model with no spillovers, this revenue loss equals the deadweight burden from a tax increase.

Additionally, the tax change induces a transfer in pre-tax surplus away from employees and

[27] I refer to this as an "earnings" response for simplicity. More generally it reflects all taxable income responses net of the transfer of surplus, which can include avoidance/evasion responses.

[28] Note that I assume here that the employees display no behavioral response to the change in the owners' marginal tax rate, i.e. that $d\omega/d\tau = 0$. This implies that employees do not change labor supply behavior and that their marginal productivity does not change in response to the owners' tax rate; their taxable earnings only respond through the tax induced transfer of surplus. This will generally hold in the frameworks of the two models described in Section 3, where the change in surplus is small such that the offered earnings remains above their reservation wage for the firm. I make this assumption only to simplify the discussion. In Appendix C, I allow for $d\omega/d\tau \neq 0$; the intuition is very similar, though the formulas become slightly more complicated.

towards owners, $de/d\tau > 0$, as consistent with the empirical results. There is a fiscal externality associated with the transfer when the money is shifted across groups facing different tax rates. In this case, the fiscal externality increases revenues because the surplus is shifted from lower-bracket employees to top-bracket owners. The net welfare effect depends on whether the tax-induced transfer has a first-order effect on the welfare of the owners and employees, or whether the surplus, e, is a choice variable or an exogenous parameter in the agents' optimization problems, which will determine whether the envelope theorem applies.

The net change in welfare consists, first, of the total revenue externality associated with all tax-induced responses to the change in the top rate. This is a standard result of marginal welfare analysis, the unique feature being the need to account for the pre-tax transfer of surplus. The net welfare effect also depends on the direct effect on the agents associated with the tax-induced transfer of surplus. I will discuss the three relevant cases for the latter component in turn.

Case 1: Transfer determined by the market

First I consider the case where the surplus share is not part of the agents' choice set, but is taken as a parameter determined by the market, and is function of the tax system, $e(\tau)$. Agents choose $\pi(\tau, e)$ and $\omega(t, e)$ optimally as implicit functions of their tax rates and surplus shares, and $\partial\psi/\partial e = \partial\phi/\partial e = 0$ because the distribution of surplus shares implies no marginal utility cost beyond the effect on consumption. This would be the case for the class of models presented in Section 3.2.1 where agents make economic decisions and e is determined by the Nash bargain, which is governed by an exogenous bargaining parameter.

When e is not chosen optimally by the agents, the envelope condition does *not* apply and tax induced changes in e have a first-order effect on agents' welfare. In this case, the marginal welfare calculation given by Eq. (16) reduces to:

$$\frac{\partial W}{\partial \tau} = \tau \frac{d\pi}{d\tau}. \tag{17}$$

The tax induced change in surplus is a pure transfer between owners and workers, and between individuals and the government, so the net welfare effect of the transfer is zero. All that remains in the marginal welfare calculation is the revenue effect associated with the change in the owners' underlying earnings behavior. With no distributional concerns, Case 1 is an application of the result in Chetty (2009*a*) when transfers between agents have no net welfare or revenue effect.[29]

Equation (17) shows that the owners' ETI is not a sufficient statistic for welfare analysis in this context. The ETI reflects the response of total reported taxable income, $d(\pi + e)/d\tau$. Rewriting Eq. (17) in terms of taxable income gives,

$$\frac{\partial W}{\partial \tau} = \tau \left(\frac{d(\pi + e)}{d\tau} - \frac{de}{d\tau} \right).$$

[29] If distributional considerations are introduced, the marginal welfare analysis becomes more complex, and the direct effect of the transfer would appear directly in the marginal welfare calculation.

There are two primary implications. First, the sufficient statistics for welfare analysis are the total taxable income response and the transfer response. Second, since I find that $de/d\tau > 0$ and we know generally that $d(\pi + e)/d\tau < 0$, this implies that total taxable income response of the owners underestimates the marginal welfare cost. This is because the transfer from employees to owners mitigates the owners' total change in taxable income, thereby understating the underlying welfare relevant response to the rate change, $d\pi/d\tau$, which creates the deadweight loss.

Case 2: Transfer determined by owner and employee optimization

Next, I consider the case where owners and employees optimize utility by jointly choosing (c, π, e) and (c, ω, e) respectively, and the amount of surplus received implies a utility cost such that $\partial\psi/\partial e \neq 0$ and $\partial\phi/\partial e \neq 0$. In this case, the direct effect of the transfer has no first-order welfare consequences for either the owners or the employees as the envelope condition applies to both. The resulting net change in welfare is the marginal revenue externality from all taxed induced behavioral responses - the behavioral response and the transfer of surplus,

$$\begin{aligned} \frac{\partial W}{\partial \tau} &= \tau \frac{d\pi}{d\tau} + (\tau - t)\frac{de}{d\tau}, \text{ or} \\ &= \tau \frac{d(\pi + e)}{d\tau} - t\frac{de}{d\tau}. \end{aligned} \tag{18}$$

This result is similar to an analysis of avoidance behavior in which an agent shifts income from one tax base to another, as discussed in Saez, Slemrod and Giertz (2012). The welfare calculation must account for income shifted to a different base and the tax rate of the alternate base. In this case the alternate base is not a different income source for the taxed individual but is the earned income of other taxpayers who face a different tax rate. The second formulation of Eq. (18) again highlights that the owners' taxable income response is not a sufficient statistic for welfare analysis and the taxable income response understates the marginal loss in welfare when $de/d\tau > 0$.

Case 3: Transfer determined by owner optimization

Finally, I consider the case where e is chosen directly by the owner, but not by the employees. Here, the tax induced transfer has no first-order effect on the welfare of the owners by the envelope condition, but there is a first-order effect on the welfare of the employees. This would be the case in the wage posting model presented in section 3.2.2 where owners choose the employees' offered wages (inclusive of the mark-down) to optimize profits given the labor market fundamentals, and employees take that as given and make labor supply decisions.[30]

This implies the net marginal welfare effect,

$$\frac{\partial W}{\partial \tau} = \tau \frac{d(\pi + e)}{d\tau} - \frac{de}{d\tau}. \tag{19}$$

[30]In the wage posting model the marginal employee will be indifferent between working at firm j at earnings $\omega - e$ and will change behavior in response $de/d\tau$. Thus, the marginal employee will experience no first-order welfare loss, but all of the inframarginal employees will experience a first-order welfare loss.

Again, the total reported taxable income response of the owners is not a sufficient statistic for the marginal welfare loss. The taxable income responses of owners *and* employees to the change in the owners' tax rate are sufficient statistics for welfare analysis, as in the other two cases. In contrast to Case 2, the total revenue externality understates marginal welfare loss. Instead, the employees' taxable earnings response must be weighted by one, instead of by the employees' tax rate, because the transfer has a first-order effect on employee welfare. Therefore, the marginal welfare loss in this case is larger than in the other two.

7.2 Discussion

The welfare analysis presented here ignores distributional considerations, but when evaluating optimal tax policy it becomes particularly important to account for the distributional consequences of cross-bracket spillovers. Solving for the optimal personal income tax structure for each potential labor market model is beyond the scope of this paper, but the main insights of the simple welfare analysis remain. Conceptually, when designing the optimal tax schedule the government can adjust the tax rates and/or transfers for the lower-bracket employees to help offset the welfare effect of the pre-tax transfer of surplus. In order to effectively adjust rates or transfers, the government would need a statistic beyond the ETI of those facing the top bracket, they must also know the magnitude of the spillovers, the location of the affected employees in the income distribution and the underlying mechanisms. The empirical analysis provides the sign and magnitude of the spillover and shows that the within-firm earnings response is a mediating channel. Accounting for such spillovers can improve the efficiency and equity of the tax system.

Section 3 shows how features of the labor market can mediate the transfer of surplus in response to a tax change. The welfare analysis implies that the underlying market structure also has implications for optimal income tax policy. In addition to taxes, the government designs policies which affect the interaction between workers and firms in the labor market, for example the minimum wage, health care policy, unemployment insurance, and regulations of monopoly and monopsony power. If the government has tools which eliminate or reduce the rents, e, or the transfer of rents, $de/d\tau$, this could also make income taxation more efficient. Therefore, it may be optimal to jointly consider tax and labor market policies.

Finally, I find that the business income taxation embedded in the personal income tax system is associated with within-firm cross-bracket spillovers. This raises questions about the design of a business income tax system, and whether it is optimal to tax business income separately or as part of the personal income tax. This issue is increasingly important as the majority of businesses in the U.S. are pass-through businesses and pass-through business income is earned disproportionately by those at the top of the income distribution, becoming a main contributor to income inequality (Smith et al. (2019)).

8 Conclusion

This paper investigates whether a recent change in the top marginal personal income tax rate faced by pass-through business owners affected the compensation of employees in the firms that they own. I use linked owner-firm-employee administrative data and the pass-through tax rules to isolate variation in exposure of S-corporation owners the tax change, and use panel difference-in-differences methods to compare the compensation patterns of employees in similar firms, but whose owners were differentially exposed to the tax change. The results show a behavioral response to the business income taxation embedded in the personal income tax system leading to within-firm, cross-bracket spillovers.

I find that S-corporation owners passed a share of the burden of their new tax liability onto their employees. Workers in firms more exposed to the tax change saw lower relative earnings growth following the rate hikes. The burden was mostly borne by stayers, employees that remained with their firm through the tax change. I find little evidence of an extensive margin employment response. This implies that the observed spillovers likely represented lower wages paid to the same employees and can be interpreted as pass-through of the tax liability. I estimate that 15-18 cents of each exogenous $1 increase in business tax liability was passed through to employee earnings over the medium-run. This is some of the first direct evidence of the incidence of changes in top marginal personal income tax rates to workers not directly subject to the rate changes.

Heterogeneity analysis shows that the burden was borne by employees in the lower half of their firm's income distribution and that the pass-through to employees was larger in states with slack labor markets. The results suggest that pass-through parameters estimated from changes in business income taxation may be a function of the type of business income being taxed, macro-economic conditions and the underlying labor market institutions, which may affect the ability of owners to directly pass tax burdens on to employees.

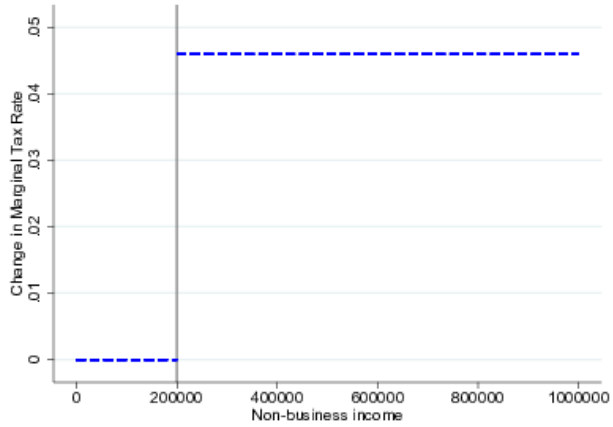
I conduct a simple welfare analysis and show that estimated cross-bracket spillovers imply that the ETI of those facing the top marginal tax rate is not a sufficient statistic for welfare analysis. We must also know how the pre-tax distribution of surplus changes in response to a tax change. The exact magnitude of the welfare loss and the resulting design of optimal tax schedule depend on the underlying labor market mechanisms which mediate the spillovers. This suggests that it may be optimal to jointly consider tax and labor market policy and that further research on interaction between these policies would be fruitful.

The passage of the Tax Cuts and Jobs Act of 2018 sparked debate over the appropriate taxation of pass-through businesses relative to C-corporations. As capital and labor income become increasingly intermingled, particularly at the top of the income distribution, it becomes increasingly important to analyze the optimal system for taxing this income.

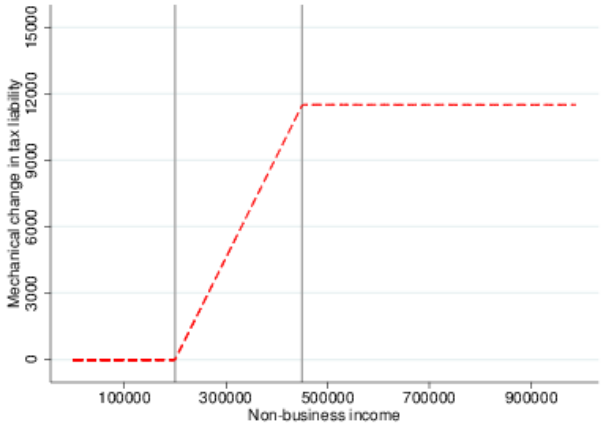
Figures and Tables

Figure 1: Identifying Variation

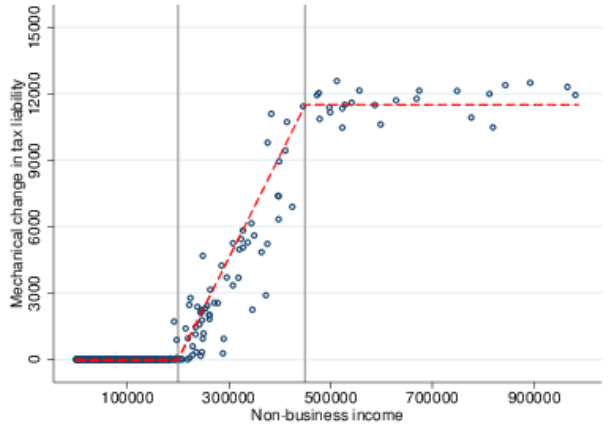
Panel A: Single Owner Firms w/ $250K Business Income



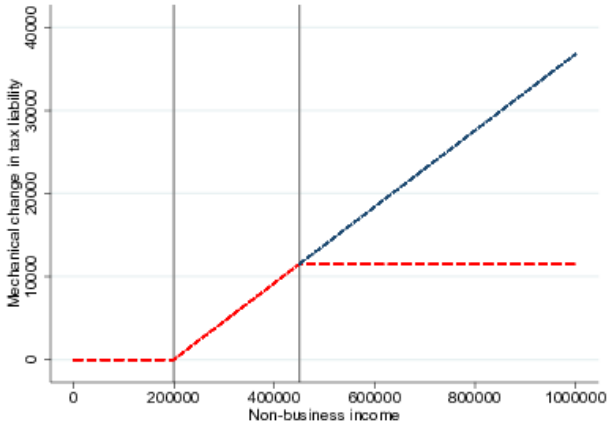
Panel B: Single Owner Firms w/ $250K Business Income



Panel C: Single Owner Firms w/ $225-275K Business Income

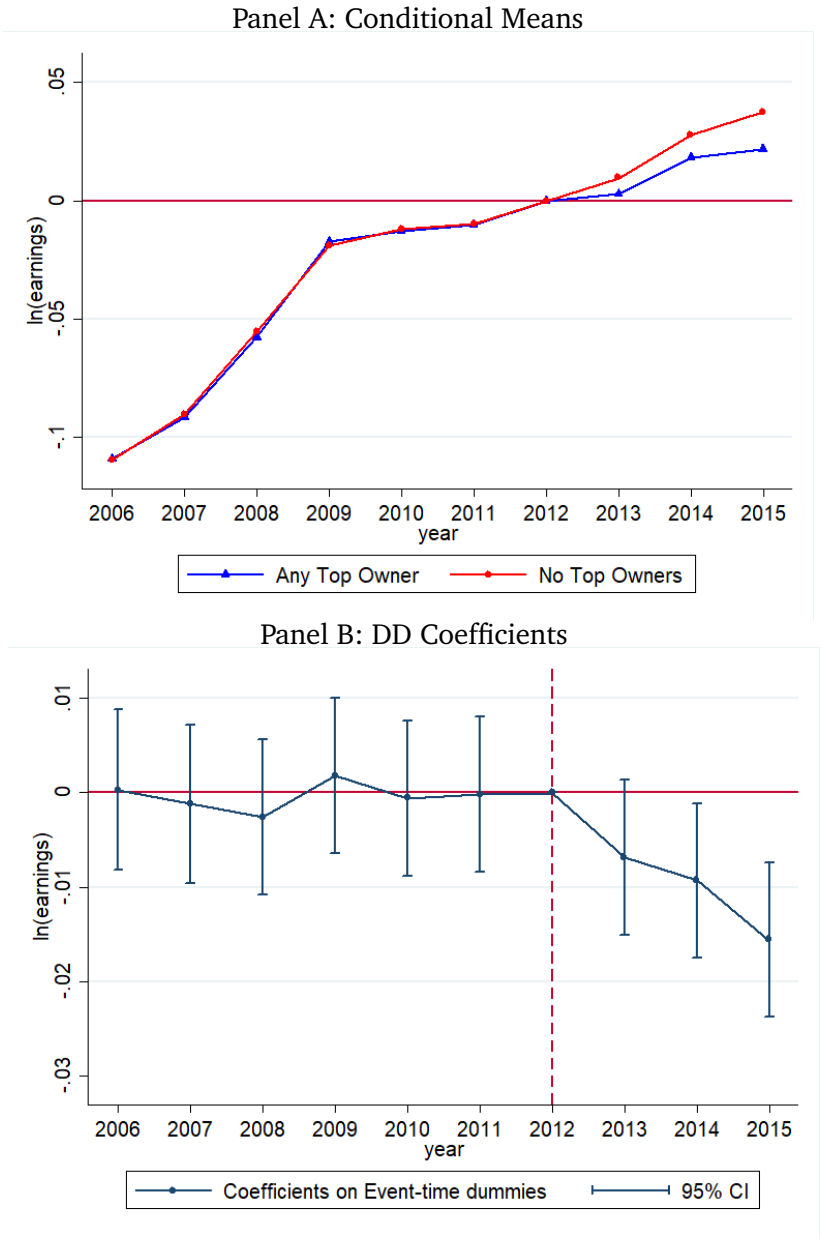


Panel D: Single Owner Firms w/ $250K Business Income



Notes: The figures show the mechanical change in tax rates and liability for a single owner firm with $250K in business income, as a function of the owner's non-business income. Panel A shows the change in marginal tax rate as a function of non-business income. The tax rate jumps by 4.6pp as non-business income exceeds $200K (which is where taxable income exceeds $450K and the owner enters the new top bracket). Panel B shows the mechanical change in tax liability on business income as a function of non-business income. Panel C plots the binned averages of the change in tax liability (using 10 firm bins) for firms with approximately $250K in business income, showing the variation in non-business income for similar firms in the sample. The red line in Panel D replicates that in Panel B, and the blue line shows the mechanical change in the owner's total tax liability.

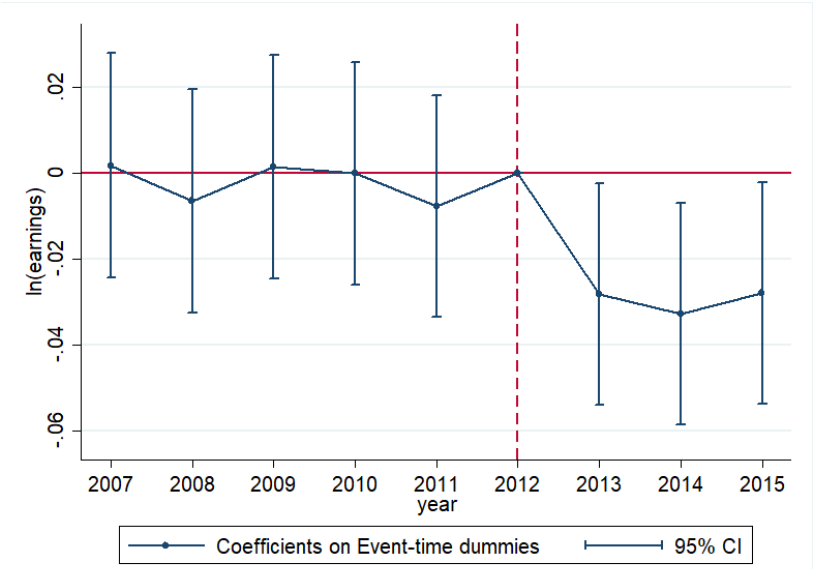
Figure 2: Average Earnings in Exposed and Unexposed Firms



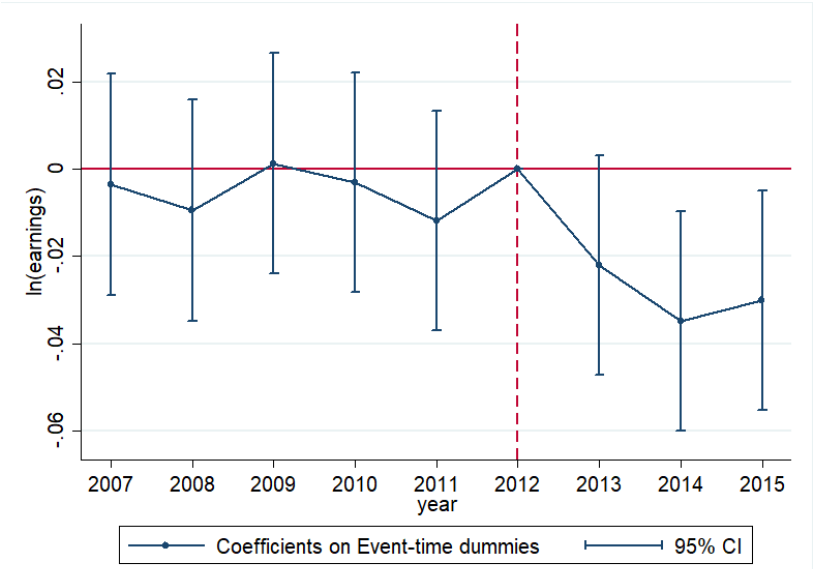
Notes: Figure 2 displays evolution of log average earnings for employees in "exposed" firms relative to control firms relative to the pre-reform year 2012, after absorbing pre-reform differences in firm characteristics, using specification (7). The $exposure_j$ treatment is defined as having at least one top-bracket owner in each year 2010-2012 and control is defined as having no top owners in the years 2010-2012. Panel A shows the conditional mean outcome of the treatment and control group relative to 2012. Panel B shows the coefficients and corresponding 95% confidence intervals from the DD specifications. Each specification includes firm fixed effects and controls for the pre-reform (2012) deciles in business income and value-added, categories for the number of employees and industry dummies (2-digit NAICS codes) all interacted with year dummies to allow for flexible time trends. The 95% confidence intervals are based on robust standard errors clustered at the firm level.

Figure 3: Earnings Responses for Firm Stayers

Panel A: All Stayers

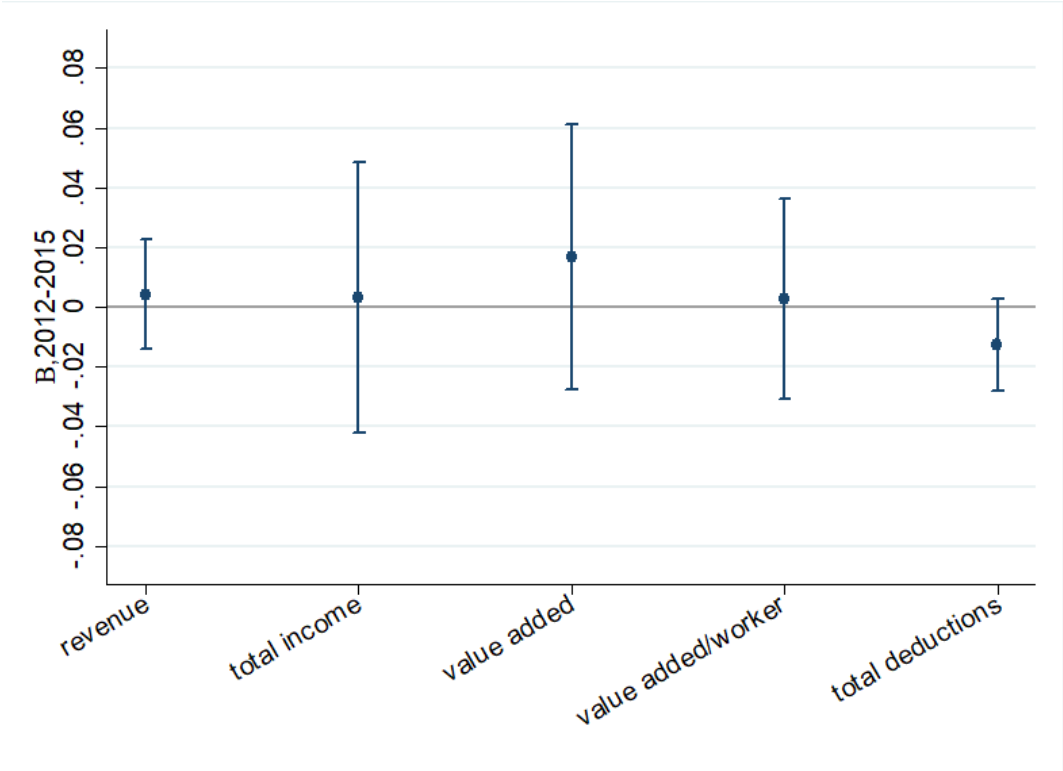


Panel B: Stayers, $\geq$3 yrs tenure in 2012



Notes: These figures show results from regression (7) for subsets of "stayers," incumbent employees at the time of the tax change that remain with the firm through 2015. Panel A shows results for all stayers. Panel B shows results for stayers with at least three years of tenure as of base year 2012. Each specification compares firms with at least one top owner in 2012 relative to firms with no top owners in 2012 and controls for baseline net income and value-added deciles and 2-digit NAICS codes interacted with year. Standard errors are clustered at the firm level.

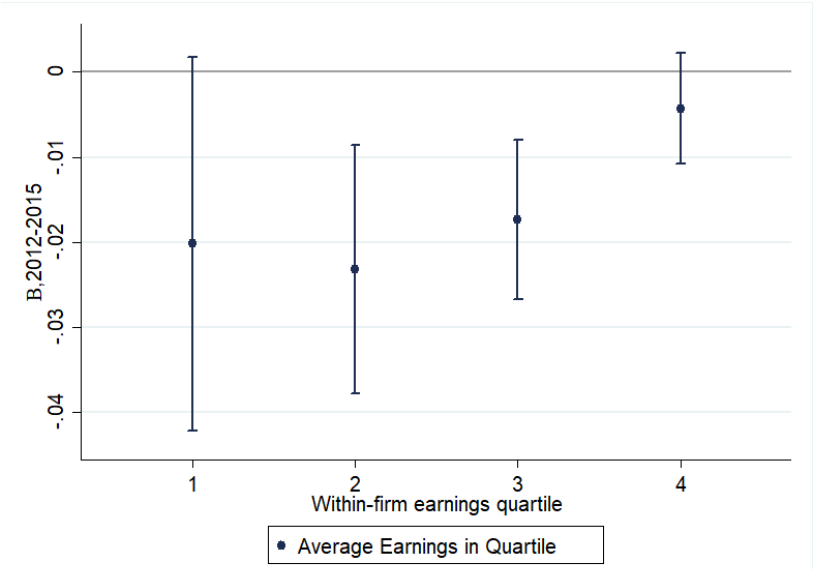
Figure 4: Firm Production and Productivity Responses



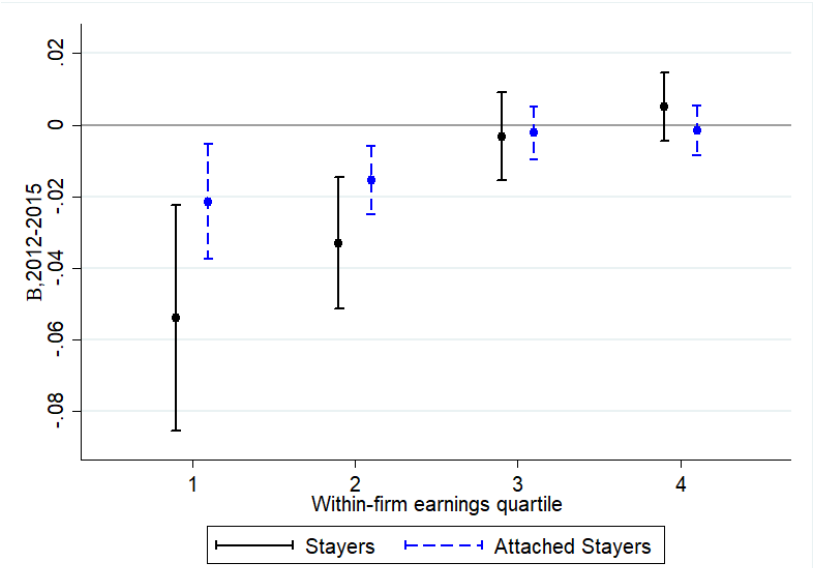
Notes: Figure 4 plots DD coefficients from Eq. (8) where the outcome variables are various elements from the firm's income tax return. Each estimate represents the differential change in the outcome variable between 2012 and 2015 for firms with at least one top-bracket owner relative to firms with no top-bracket owners. Each specification controls for baseline net income deciles and 2-digit NAICS codes interacted with year. Standard errors are clustered at the firm level.

Figure 5: Earnings Response by Position in Within-Firm Earnings Distribution

Panel A: At least 1 top-bracket owner

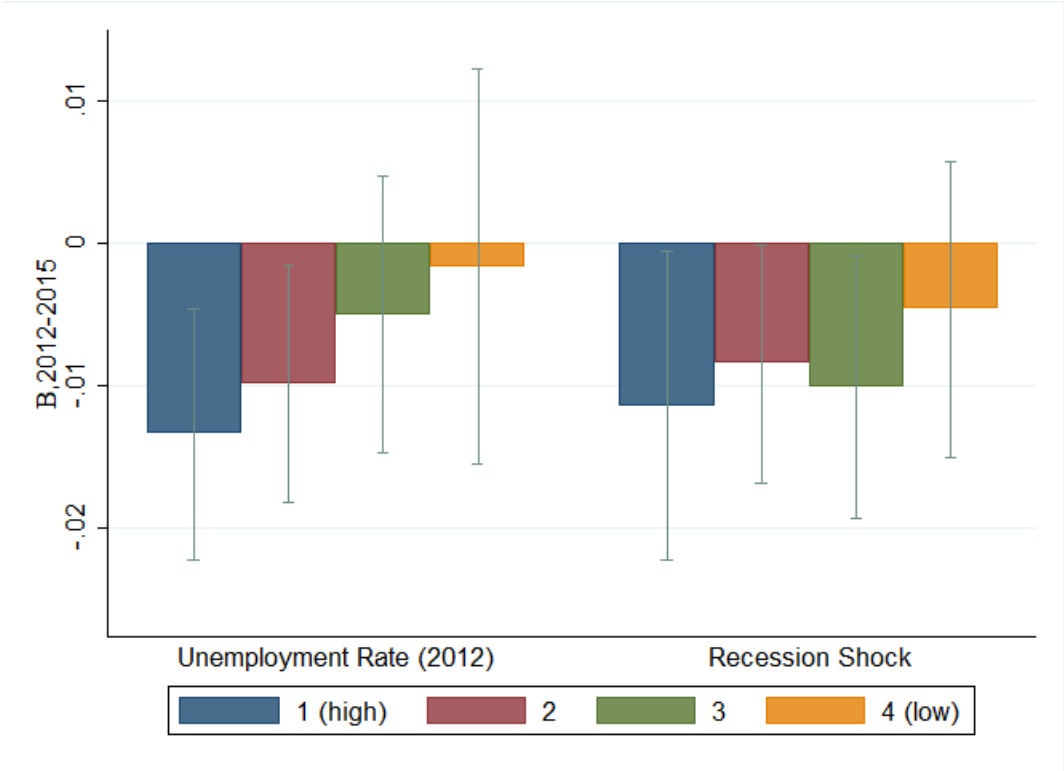


Panel B: At least 1 top-bracket owner



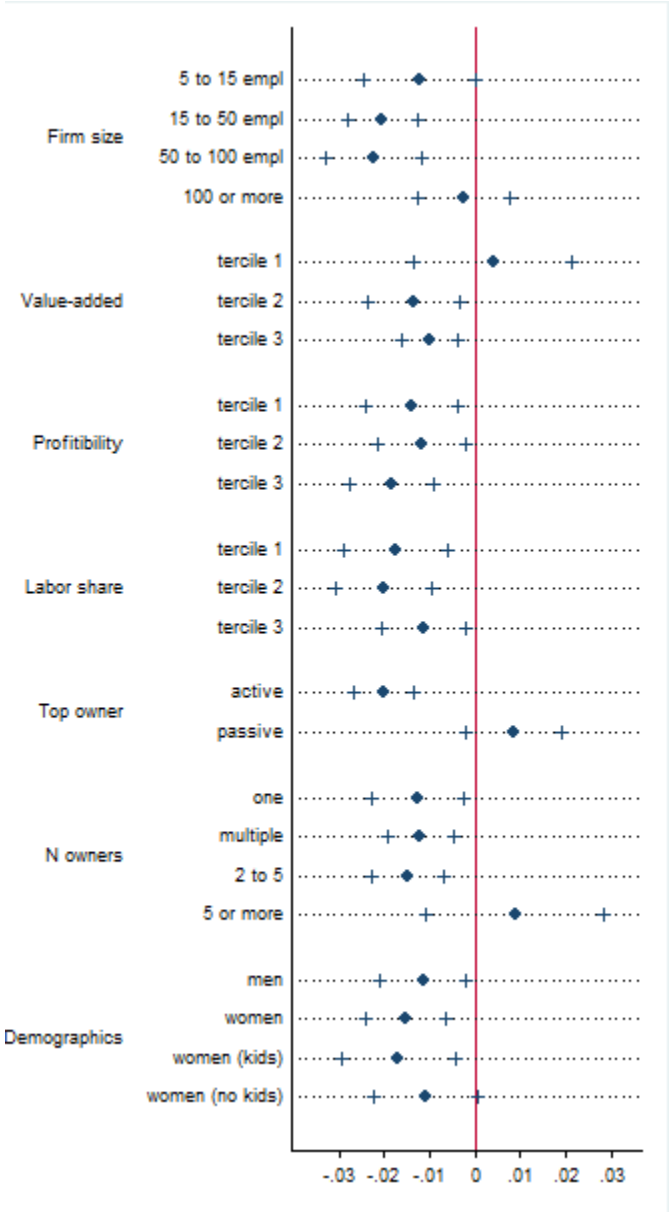
Notes: Figure 5 presents DD estimates from Eq. (8) where $exposure_j$ is an indicator for having a top-bracket owner in 2012. For Panel A I split the within-firm distribution of employee earnings into quartiles and take the average earnings in each quartile for each firm in each year. The estimates represent the change in log average earnings for those in each quartile. Panel B focuses on "stayers," incumbent employees at the time of the tax change that remain with the firm through 2015. I locate stayers according to their position in the 2012 within-firm earnings distribution, then estimate the response separately for the stayers according to their quartile in the pre-reform distribution. "Attached Stayers" defined as stayers with at least three years of tenure as of base year 2012. Each specification includes controls for baseline net income and value-added deciles and 2-digit NAICS codes interacted with year. Standard errors are clustered at the firm level.

Figure 6: Earnings Responses by Labor Market Conditions



Notes: Figure 6 plots DD estimates for differential changes in earnings of lower bracket workers in firms exposed to the tax change relative to those in firms not exposed to the tax change. The outcome variables for each coefficient in log change in earnings between 2012 and 2015. Each set of bars represents a state-level measure of labor market conditions. The first set shows estimates by quartile rank of the unemployment rate (UR) in 2012. Each bar represents DD estimates for firms in each of the four quartiles of the the distribution of the labor market measure. The second measure presents estimates by rank of the recession shock as developed in Yagan (2018). The first bar, "1 (high)", represents the estimate for states with the worst labor market conditions according to each measure, i.e. highest UR and largest recession shock. Each specification controls for baseline net income and value-added deciles and 2-digit NAICS codes and state interacted with year. Standard errors are clustered at the firm level.

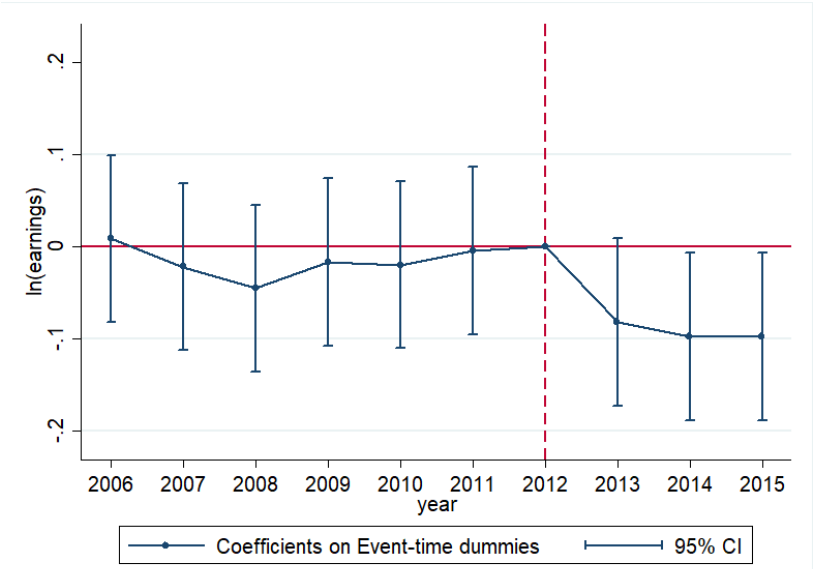
Figure 7: Heterogeneous Responses by Firm and Employee Characteristics



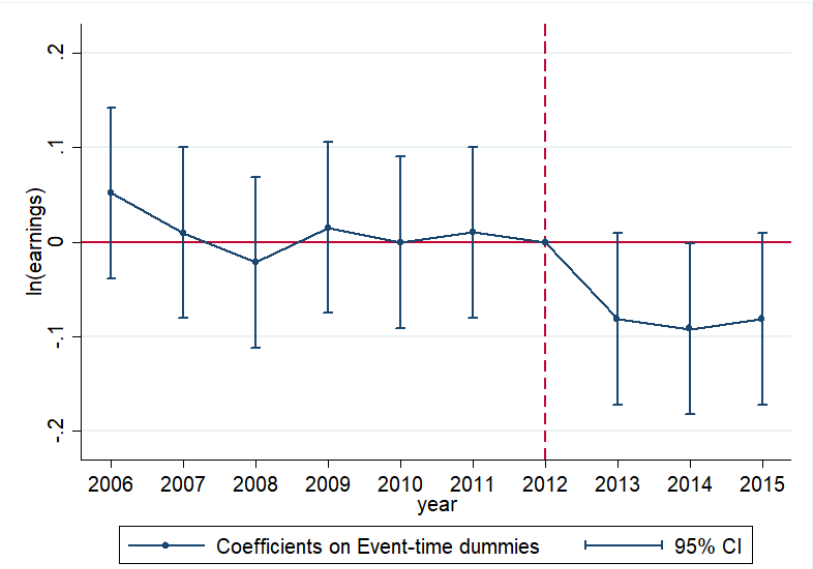
Notes: Figure 7 plots DD estimates from Eq. (8) comparing firms with at least one top-bracket owner to firms with no top-bracket owners; the outcome is the change in log average earnings between 2012 and 2015. Each point represents a coefficient from a separate regression where firms are distinguished by pre-reform characteristics. The first set of estimates divides firms by the number of employees; the second set by terciles of the value-added distribution; the third by profitability defined as (net profits/revenues); the fourth by labor share defined as (wage bill/revenues). Top owner "active" defines treatment as the firm having an active owner in the top-bracket and "passive" defines treatment as a firm where the only top-bracket owner is a passive owner. "N owners" divides firms by the number of owners. The outcomes in the "Demographics" estimates are the average earnings of the given group for each firm.

Figure 8: Pass-Through: Predicted Business Tax Liability on Employee Earnings

Panel A: Full Sample



Panel B: Firms with ≥ 1 top-bracket owner



Notes: Figure 8 plots event-time coefficients estimated from specification (7) and displays evolution of log average earnings for workers more "exposed" to the tax change relative to the pre-reform year 2012. In this specification, $exposure_j$ is defined as the predicted change in tax liability attributable to the tax reform based on reported business income in 2012. Panel A uses the full sample of firms, including the control firms with no top-bracket owners and experience no mechanical change in their business tax liability. Panel B includes only the subsample of firms with at least one top-bracket owner, isolating the continuous variation in the change in liability across firms with top-bracket owners. Each specification controls for baseline net income and value-added deciles and 2-digit NAICS codes and state interacted with year. Standard errors are clustered at the firm level.

Table 1: Summary Statistics - Firm Characteristics

Panel A: Summary Statistics

	All				With Top-bracket Owner(s)			
	Mean	p10	Median	p90	Mean	p10	Median	p90
Revenue	6,623,147	397,433	1,429,393	10,746,962	17,832,808	1,035,640	5,029,116	37,588,480
Profits	338,376	-29,044	64,637	641,872	1,148,187	-503	444,123	2,320,537
Value-Added	2,158,226	232,855	786,579	3,864,498	5,605,416	642,119	2,410,985	11,000,000
Value-Added/Worker	62,636	12,428	43,774	120,729	103,464	15,837	69,886	199,116
EBITD	219,572	-68,011	50,514	547,652	767,891	-152,822	354,722	1,996,631
Employees	50.12	7	17	86	108.32	10	35	192
Full-time Employees	34.59	6	13	62	69.78	6	25	137
# Owners	2.08	1	2	4	3.15	1	2	6
# Active Owners	1.52	1	1	3	1.82	1	1	3
# Passive Owners	0.57	0	0	2	1.33	0	0	3
# Top-bracket Owners	0.39	0	0	1	1.72	1	1	3
Top-bracket owner	0.23	0	0	1	1	1	1	1
Avg. Employee Earnings	24,125	6,900	21,145	44,096	33,191	10,197	30,115	57,847
Avg. Full-time Earnings	28,248	11,602	25,462	47,402	37,135	15,298	34,145	60,845
Wage Bill	930,561	77,545	284,806	1,775,865	2,348,966	187,062	860,856	4,925,834
Profits/Revenue	0.02	-0.03	0.04	0.19	-0.01	0.00	0.08	0.28
Wage Bill/Value-added	0.37	0.16	0.34	0.64	0.36	0.14	0.33	0.64
Wage Bill/Revenue	0.22	0.07	0.21	0.40	0.21	0.05	0.18	0.39

Panel B: Difference in Conditional Means - Firms with top-bracket owners v. firms with no top-bracket owners

	Avg. Earnings	Avg. Earnings full-time	Employees	Employees full-time	Value-added per worker	Value-added	Wage Bill	Wage Bill full-time
Difference in means	742.42***	906.42***	3.13	3.59	228.64	393,106.38***	58,982.89	59,176.82
	(281.96)	(267.87)	(3.24)	(2.28)	(756.67)	(166,890.52)	(77,858.44)	(77,350.25)
N	82,240	82,240	82,240	82,240	82,240	82,240	82,240	82,240

Notes: This table shows summary statistics for the firms in the sample by whether they were exposed to the tax reform, i.e. whether they have at least one top-bracket owner or have no top-bracket owners. Statistics and exposure status are defined for year 2012, the last year prior to the tax reform. Panel A shows means, medians the 10th and 90th percentiles for each variable for the full sample and for firms with at least one top-bracket owner. Statistics at percentiles of the income distribution represent the average of ten taxpayers around that percentile to avoid disclosure of any individual income tax information. "Full-time" employees are those receiving at least the equivalent of one quarter of full-time wages at the federal minimum wage, or about $2,827.50 in 2012. Panel B shows the conditional difference in means for various firm characteristics across firms with and without a top-bracket owner. The difference in means is conditional on net income and value-added per worker deciles, firm-size categories, 2-digit NAICS industry codes, and state. Robust standard errors are in parentheses.

Table 2: Estimates of Employee Wage Effects - First-Difference Specifications

	(1)	(2)	(3)	(4)	(5)	(6)
$\beta_{2006-2009}$	0.00002	-0.00036	0.00041	-0.00022	0.00019	0.00034
	(0.00229)	(0.00245)	(0.00250)	(0.00244)	(0.00247)	(0.00258)
$\beta_{2009-2012}$	-0.00313	-0.00333	-0.00311	-0.00297	-0.00300	-0.00324
	(0.00235)	(0.00254)	(0.00249)	(0.00255)	(0.00255)	(0.00263)
$\beta_{2012-2015}$	-0.01181***	-0.01251***	-0.01262***	-0.01191***	-0.01232***	-0.01077***
	(0.00216)	(0.00233)	(0.00241)	(0.00239)	(0.00253)	(0.00242)
Bus. Inc. Deciles	X	X	X	X	X	X
Value-added/worker		X	X	X	X	X
Firm size			X		X	X
Industry				X	X	X
State						X
Observations	244,035	244,035	244,035	244,035	244,035	244,035

Standard errors in parentheses
***p<0.01, **p<0.05, *p<0.1

Notes: Table 2 shows first-difference estimates for treatment effect of "exposure" to the tax reform on the average earnings of employees based on regression specification (8). The exposure measure is an indicator for having at least one top-bracket owner. The outcome in each column is change in log average earnings and each column includes different sets of firm-level base-year controls as labeled. Standard errors are clustered at the firm level.

Table 3: Robustness to Functions of Net Income Controls

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\beta_{2006-2009}$	-0.00163	-0.00086	0.00034	0.00060	-0.00077	0.00071	-0.00036	-0.00047
	(0.00305)	(0.00301)	(0.00304)	(0.00303)	(0.00306)	(0.00304)	(0.00302)	(0.00297)
$\beta_{2009-2012}$	-0.00258	-0.00226	-0.00250	-0.00316	-0.00293	-0.00280	-0.00220	-0.00307
	(0.00327)	(0.00317)	(0.00327)	(0.00318)	(0.00327)	(0.00319)	(0.00325)	(0.00313)
$\beta_{2012-2015}$	-0.01241***	-0.01065***	-0.01532***	-0.01262***	-0.01402***	-0.01202***	-0.01759***	-0.01480***
	(0.00307)	(0.00301)	(0.00304)	(0.00301)	(0.00305)	(0.00302)	(0.00300)	(0.00298)
Controls for net income	netinc deciles 2011, 2012	netinc deciles avg. 2011,2012	netinc splines 10 knots, linear 2012	netinc splines 10 knots, linear avg 2011,2012	netinc splines 20 knots, linear 2012	netinc splines 20 knots, linear avg 2011,2012	netinc splines 5 knots, cubic 2012	netinc splines 5 knots, cubic avg 2011,2012
Observations	244,035	244,035	244,035	244,035	244,035	244,035	244,035	244,035

Standard errors in parentheses

***p<0.01, **p<0.05, *p<0.1

Notes: Table 3 shows first-difference estimates for treatment effect of "exposure" to the tax reform on the average earnings of employees based on regression specification (8). The exposure measure is defined as having at least one top-bracket owner and the outcome in each column is change in log average earnings. Each column controls for a different function of baseline firm net business income. The first column uses both 2011 and 2012 deciles of net business income; column 2 uses deciles of the average net income over 2011 and 2012; column 3 linear splines of 2012 income with 10 knots; column 4 uses linear splines of the average of 2011 and 2012 income with 10 knots. Columns 5 and 6 repeat 3 and 4 but with 20 knots. Columns 7 and 8 use cubic splines with 5 knots. Each specification also controls for log value-added per worker, 2-digit NAICS and state. Standard errors are clustered at the firm level.

Table 4: Earnings Responses, Various $exposure$ Measures

Exposure Measure:	Any Top Owners	All Top Owners	Share of Owners in Top	Single Owner Firms
	(1)	(2)	(3)	(4)
$\beta_{2006-2009}$	0.00002	-0.00273	-0.00130	0.00523
	(0.00229)	(0.00301)	(0.00283)	(0.00401)
$\beta_{2009-2012}$	-0.00313	-0.00410	-0.00560*	-0.00165
	(0.00235)	(0.00332)	(0.00310)	(0.00434)
$\beta_{2012-2015}$	-0.01181***	-0.01437***	-0.01456***	-0.01286***
	(0.00216)	(0.00304)	(0.00285)	(0.00401)
Observations	244,035	222,980	244,035	115,176

Standard errors in parentheses

***p<0.01, **p<0.05, *p<0.1

Notes: Table 4 shows first-difference estimates for treatment effect of "exposure" to the tax reform on the average earnings of lower-bracket workers, based on regression specification (8). The outcome in each column is change in log average employee earnings. The table contains intent-to-treat (ITT) estimates of the treatment effect for various firm-level definitions of "exposure." The first column replicates the baseline specification defining treatment as having at least one top-bracket owner. In column 2 treatment is defined as having all owners in the top-bracket in the base year (t-1). In column 3 treatment is defined as a continuous variable representing the share of owners in the top-bracket in year t-1. The fourth column uses the subsample of firms with only one owner and defines treatment as the owner being in the top bracket in year t-1. Each specification controls for net income and value-added per worker deciles, firm-size categories, 2-digit NAICS industry codes, and state. Standard errors are clustered at the firm level.

Table 5: Decomposition of Employment and Earnings Response - Incumbents v. New Hires

	Employment			Earnings		
	Δfull-time employees	New hire share	Separation rate	Δtotal wage-bill	Δstayers earnings share	New hire earnings share
	(1)	(2)	(3)	(4)	(5)	(6)
$\beta_{2012-2015}$	0.00067	0.00238	-0.00170	-0.01243***	-0.01154*	-0.00059
	(0.00687)	(0.00653)	(0.00252)	(0.00473)	(0.00622)	(0.00840)
Controls	Full	Full	Full	Full	Full	Full
Observations	244,035	241,044	241,044	244,035	241,044	241,044

Standard errors in parentheses

***p<0.01, **p<0.05, *p<0.1

Notes: This table displays the decomposition of employment and earnings responses into the changes attributable to new hires and incumbent workers, including the earnings response of stayers, those who remain at the firm between the base year and year t. The decomposition follows from Eqs. (9) and (10). The outcome in column 1 is the change in log total full-time employment. The outcome in column 2 is the share new hires in year t relative to full-time employees in the base year, and the outcome for column 3 is the share of retained incumbents relative to baseline full-time employment. Column 4 shows the three year difference in log total wage bill for firms with a top bracket owner relative to firms with no top bracket owners for various base years. Column 5 shows the change in wage the earnings paid to stayers in the firm. The outcome in column 6 is the share of earnings of new hires in year t relative to the total wage bill in the base year. Each specification controls for net income and value-added per worker deciles, firm-size categories, 2-digit NAICS industry codes, and state. Standard errors are clustered at the firm level.

Table 6: Pass-Through of Business Tax Liability on Employee Earnings

	All Employees			Stayers		
	(1)	(2)	(3)	(4)	(5)	(6)
$\beta_{2012-2015}$	-0.09037***	-0.10059***	-0.09827***	-0.13226***	-0.1256***	-0.1235***
	(0.0258)	(0.0299)	(0.0229)	(0.0293)	(0.0322)	(0.0352)
Pass-Through ($)	-0.1690***	-0.1880***	-0.1837***	-0.1588***	-0.1508***	-0.1483***
	(0.0482)	(0.0559)	(0.0435)	(0.0352)	(0.0387)	(0.0408)
Mean ΔLiability	42,080	42,080	42,080	42,080	42,080	42,080
Implied Δ Wage Bill	7,111	7,911	7,856	6,682	6,346	6,030
Bus. Inc. deciles	X	X	X	X	X	X
Value-added deciles		X	X		X	X
Industry			X			X
State			X			X
Observations	81,780	81,780	81,780	81,780	81,780	81,780

Standard errors in parentheses
***p<0.01, **p<0.05, *p<0.1

Notes: This table displays estimates of the first-difference estimate of intent-to-treat (ITT) effect of log change in business income tax liability on average earnings. Business income is defined as the firm's reported net business income plus owner wage and salary income. In columns (1)-(3) the outcome is the average earnings of all full-time employees. In columns (4)-(6) the outcome is the average earnings of firm "stayers," incumbent employees at the time of the tax change that remain with the firm through 2015. The first row shows the elasticity estimated using Eq. (8). The second row contains estimates of the dollar-for-dollar pass-through attributable to the change in liability, which are estimated as $\beta_{2012-2015} \times (W/L)$, where W/L is the ratio of the wage bill to tax liability calculated at the sample mean. Each regression is weighted by firm size and standard errors are clustered at the firm level. Standard errors for the pass-through estimate are calculated using the delta method.

Table 7: Pass-Through of Non-Business Income Tax Liability

	K1 + Wage & Salary Income		K1 Income only	
	All	Top-bracket only	All	Top-bracket only
	(1)	(2)	(4)	(5)
Business Income, $\beta_{2012-2015}$	-0.14023***	-0.11879***	-0.12293***	-0.10996***
	(0.02577)	(0.03132)	(0.02364)	(0.03384)
Non-business Income, $\theta_{2012-2015}$	0.02934	0.02288	0.00651	-0.00898
	(0.02167)	(0.02828)	(0.02123)	(0.02913)
Controls	Full	Full	Full	Full
Observations	81,780	18,883	81,780	18,883

Standard errors in parentheses

***p<0.01, **p<0.05, *p<0.1

Notes: This table displays results from Eq. (12). The first row shows the coefficient on the mechanical change in log tax liability on business income between 2012 and 2015 and the second row shows the coefficient on the mechanical change in log tax liability on non-business income. The first two columns define business income as total owner K1 plus wage and salary income; the second set of columns defines business income as total owner K1 income. Columns 1 and 3 use the full sample of firms and columns 2 and 4 use the subsample of firms with at least one top-bracket owner. Each specification controls for net income and value-added per worker deciles, firm-size categories, 2-digit NAICS industry codes, and state. Standard errors are clustered at the firm level.

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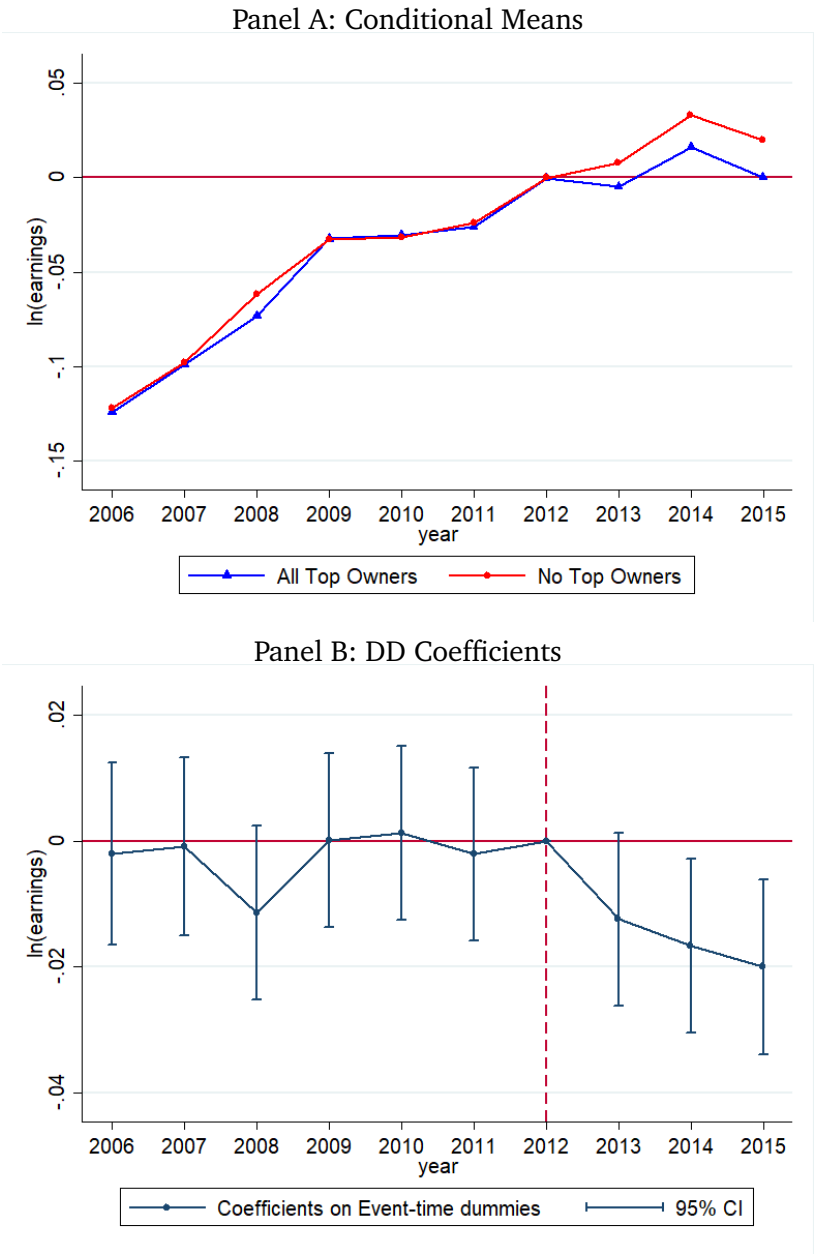
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A Appendix: Figures and Tables

A.1 Appendix Figures

Figure A.1: Average Earnings in Exposed v. Unexposed Firms - Single Owner Firms



Notes: Figure A.1 displays evolution of log average earnings for workers in "exposed" firms relative to control firms relative to the pre-reform year 2012 using specification (7). All firms in this sample are single owner firms. Exposed firms are those with a top-bracket owner in each year 2010-2012. Panel A shows the conditional means after absorbing baseline firm controls. Panel B shows the coefficients and 95% confidence intervals from the DD specification. The 95% confidence intervals are based on robust standard errors clustered at the firm level.

A.2 Appendix Tables

Table A.1: Firm Attrition Rates After 2012 by Top-Bracket Owner or Not

	Any top-bracket owner		All top-bracket owners	
Year	Yes	No	Yes	No
2005-2012	1	1	1	1
2013	0.9463	0.9377	0.9444	0.9390
2014	0.9084	0.9089	0.9030	0.9099
2015	0.8765	0.8708	0.8697	0.8727

Notes: Table A.1 shows the attrition rates of firms which fit the sample criteria from 2005-2012 by whether they have top-bracket owners in 2012 or not. The sample criteria are having at least 5 employees and some business activity in each year. Each row shows the share of firms that fit the sample criteria that remain in the sample in that year. The first column presents shares for firms with at least one top-bracket owner in 2012; column 2 for firms with no top-bracket owners in 2012; column 3 for firms with all owners in the top bracket in 2012; column 4 for firms with not all top-bracket owners. For example, the second row of the first column shows that 94.63% of firms with at least one top-bracket owner in 2012 that fit the sample criteria in each year from 2005-2012 also fit these criteria in 2013. The next row shows that 90.84% of firms fitting the criteria from 2005-2012 also fit the criteria in 2014.

Table A.2: Summary Statistics - Industry

NAICS	All	Top-bracket owner	
(2 digit)	N	N	Share
11: Agriculture, Forestry, Fishing and Hunting	1,569	295	19%
21: Mining, Quarrying, and Oil and Gas Extraction	308	131	43%
22: Utilities	78	18	23%
23: Construction	11,227	1,742	16%
31-33: Manufacturing	7,567	2,515	33%
42: Wholesale Trade	4,521	1,670	37%
44-45: Retail Trade	12,490	2,579	21%
48-49: Transportation and Warehousing	2,014	438	22%
51: Information	794	209	31%
52: Finance and Insurance	1,920	641	33%
53: Real Estate and Rental and Leasing	1,896	636	34%
54: Professional, Scientific, and Technical Services	8,897	2,162	24%
55: Management of Companies and Enterprises	85	51	60%
56: Administrative and Support and Waste Management	3,109	563	18%
61: Educational Services	590	104	18%
62: Health Care and Social Assistance	10,288	2,771	27%
71: Arts, Entertainment, and Recreation	1,320	262	20%
72: Accommodation and Food Services	8,930	1,520	17%
81: Other Services (except Public Administration)	6,170	564	9%

Notes: Table A.2 shows summary statistics for firms in the sample by their reported 2-digit NAICS industry in 2012. The first column shows the number of firms in the sample in each industry. The second column shows the number of firms with at least one top-bracket owner in 2012 in each industry. The third column shows the share of firms in a given industry that have a top-bracket owner in 2012.

Table A.3: Summary Statistics - State

	All	Top-bracket owner			All	Top-bracket owner	
State	N	N	Share	State	N	N	Share
AK	244	63	26%	NC	2,533	448	18%
AL	1,169	292	25%	ND	328	95	29%
AR	712	115	16%	NE	724	143	20%
AZ	1,135	216	19%	NH	366	76	21%
CA	7,864	1,954	25%	NJ	2,902	732	25%
CO	1,706	293	17%	NM	432	95	22%
CT	878	238	27%	NV	496	115	23%
DC	122	37	30%	NY	5,959	1,498	25%
DE	279	70	25%	OH	3,218	747	23%
FL	5,199	1,139	22%	OK	920	221	24%
GA	2,290	461	20%	OR	1,391	225	16%
HI	229	47	21%	PA	4,459	966	22%
IA	1,075	236	22%	RI	539	121	22%
ID	614	80	13%	SC	1,118	219	20%
IL	3,975	985	25%	SD	424	88	21%
IN	2,431	484	20%	TN	829	230	28%
KS	808	179	22%	TX	3,962	1,173	30%
KY	1,190	217	18%	UT	833	122	15%
LA	1,092	318	29%	VA	2,223	497	22%
MA	2,528	568	22%	VT	368	58	16%
MD	1,610	299	25%	WA	2,008	383	19%
ME	665	95	15%	WI	2,066	445	22%
MI	2,695	609	23%	WV	335	76	23%
MN	2,297	468	20%	WI	2,066	445	22%
MO	1,682	375	22%	WV	335	76	23%
MS	585	133	23%	WY	279	62	22%
MT	469	55	12%	WY	279	62	22%

Notes: Table A.3 shows summary statistics for firms in the sample by their state as reported on Form 1120S in 2012. The first column shows the number of firms in the sample in each state. The second column shows the number of firms with at least one top-bracket owner in 2012 in each state. The third column shows the share of firms in a given state that have a top-bracket owner in 2012.

Table A.4: Pass-Through of Business Tax Liability on Employee Earnings - K1 Income only

	All Employees	Stayers
	(1)	(2)
$\beta_{2012-2015}$	-0.1006***	-0.1685***
	(0.0212)	(0.0352)
Pass-Through ($)	-0.2813***	-0.2750***
	(0.0592)	(0.0574)
Mean ΔLiability ($)	31,139	31,139
Implied ΔWage Bill ($)	8,759	8,563
Controls	Full	Full
Observations	81,780	81,780

Standard errors in parentheses

***p<0.01, **p<0.05, *p<0.1

Notes: This table displays first-difference estimates of intent-to-treat effect of log change in business income tax liability on average earnings. Business income is defined as the firm's reported net business income. In column (1) the outcome is the average earnings of all full-time employees; in column (2) the outcome is the average earnings of firm "stayers," employees incumbent with the firm at the time of the tax change that remain with the firm through 2015. The first row shows the elasticity estimated using Eq. (8). The second row contains estimates of the dollar-for-dollar pass-through attributable to the change in liability, which are estimated as $\beta_{2012-2015} \times (W/L)$, where W/L is the ratio of the wage bill to tax liability calculated at the sample mean. Each regression is weighted by firm size and standard errors are clustered at the firm level. Standard errors for the pass-through estimate are calculated using the delta method.

B Appendix: Labor Market Models

Set-Up: Firm Owners' Problem

I begin by presenting a general version of the firm problem that includes taxation of business income using a simple model where firms have a general firm-specific production function which may include a firm-specific product price. The firm maximizes firm-specific after-tax profits π_j,

$$\pi_j = Q_j(L(s), K) - \sum_s w_j(s)L(s) - \alpha\rho K - \mathbf{T}(Q_j(L(s), K) - \sum_s w_j(s)L(s) - (1-\alpha)\rho K)), \tag{B.1}$$

where $Q_j(\cdot)$ is the firm j specific production function with the arguments $L(s)$ representing the labor inputs for each skill level s and K representing capital. The firm-specific wage paid to employees of skill level s is $w_j(s)$, ρ is the opportunity cost of capital invested by the owner(s), and α is a parameter governing how capital income returns are subject to the business tax rate. If capital returns are fully deductible from the tax base, $\alpha = 0$, but if they are less than fully deductible (e.g. capital is funded by equity of the business owners) and the outside option capital investment of the owners does not face the same tax rate as the business income (e.g. dividend or capital gain returns), then $\alpha < 1$. Net profits are taxed according to a general non-linear income tax function $\mathbf{T}(\cdot)$, which I treat as a graduated progressive income tax as is the case with the U.S. personal income tax.

Wage Bargaining

Workers have one discrete unit of labor they can supply to firm j; workers of a given skill-level decide whether to supply labor or not and receive earnings w_j. Earnings are set according to the Nash bargain

$$w_j^* = \underset{w}{argmax}\left[\theta ln(w_j - b) + (1-\theta)lnP_j\right],$$

where P_j is the share of firm profits π_j in Eq. (1) attributable the hiring or retention of the employee. Formally, $P_j = q_j - w_j - \alpha\rho k - T(q_j - w_j - (1-\alpha)\rho k)$ where q_j is the marginal revenue product of hiring employee j, and k is the capital investment necessary to equip employee j, or the average capital per worker of worker j's skill type $K(s)/L(s)$, and $T(\cdot)$ is the average tax liability associated with the profits generated by workers of that skill type. The exogenous bargaining parameter is θ, representing the bargaining power of the worker, and b is the worker's reservation wage. Differentiating with respect to earnings we have:

$$\frac{\partial}{\partial w_j} = \frac{\theta}{w_j - b} - \frac{(1-\theta)(1-\tau)}{(q_j - w_j - (1-\alpha)\rho k)(1-t) - \alpha\rho k},$$

where t is the average tax rate and τ is the marginal tax rate, or $\mathbf{T}'(\cdot)$. Setting this equal to 0 and rearranging gives the equilibrium wage:

$$w* = \frac{(1-\theta)(1-\tau)b + \theta((1-t)(q_j - (1-\alpha)\rho k) - \alpha\rho k)}{(1-\theta)(1-\tau) + \theta(1-t)}. \tag{B.2}$$

The numerator is a weighted combination of the reservation wage, b, and the after-tax product of the employee's labor $(1-t)(q_j-(1-\alpha)\rho k)-\alpha\rho k$, weighted by the relative bargaining power of the firm and workers. The denominator is a bargaining power weighted function of the net marginal and average tax rates. Eq. (B.2) shows that, in general, the equilibrium wage is a function of both the average and marginal tax rates.

In the general case with a non-linear tax rate and where $0 < \theta < 1$, the size and direction of the earnings response to an increase in the top marginal tax rate will depend on the parameters of the model. Taking the derivative of $w*$ given in Eq. (B.2) with respect to the marginal tax rate gives:

$$\begin{aligned}
\frac{\partial w*}{\partial \tau} &= \frac{-\left((1-\theta)b + \theta q_j \frac{\partial t}{\partial \tau}\right)\left((1-\theta)(1-\tau) + \theta(1-t)\right)}{\left((1-\theta)(1-\tau) + \theta(1-t)\right)^2} + \\
&\qquad \frac{\left(1-\theta+\theta\frac{\partial t}{\partial \tau}\right)\left((1-\theta)(1-\tau)b + \theta((1-t)(q_j-(1-\alpha)\rho k) - \alpha\rho k)\right)}{\left((1-\theta)(1-\tau) + \theta(1-t)\right)^2} \\
&= \frac{-((1-\theta)b + \theta q_j \frac{\partial t}{\partial \tau}) + (1-\theta+\theta\frac{\partial t}{\partial \tau})w*}{(1-\theta)(1-\tau) + \theta(1-t)} \\
&= \frac{(1-\theta)(w*-b) - \theta(q_j - w*)\frac{\partial t}{\partial \tau}}{(1-\theta)(1-\tau) + \theta(1-t)}
\end{aligned}$$

where moving from the first formulation to the second is done by substituting the equilibrium wage,$w*(\theta, b, t, \tau, \alpha, \rho k)$, given in Eq. (B.2).

Wage Posting

Starting from the assumptions on the wage posting model described in the main text, define the elasticity of labor supply with respect to wage be η such that $L = w^\eta$. Let the production function be general, but with the property that capital and labor are complements. Then we can define capital as a function of the choice of labor, $K(L) = K(w^\eta)$. Substituting this into the firm owner's problem given by Eq. (B.1) and taking the first order condition with respect to the wage and setting to zero, we find

$$\begin{aligned}
\frac{\partial \pi_j}{\partial w} &= (1-\tau)\left[Q_L \eta w^{\eta-1} + Q_K \frac{\partial K}{\partial L}\eta w^{\eta-1} - (\eta+1)w^\eta\right] - \rho\frac{\partial K}{\partial L}\eta w^{\eta-1} = 0 \iff \\
&= (1-\tau)\left[\underbrace{Q_L + Q_K\frac{\partial K}{\partial L}}_{q_j} - \frac{\eta+1}{\eta}w\right] - \rho\frac{\partial K}{\partial L},
\end{aligned}$$

where τ is the marginal tax rate defined as $\mathbf{T}'(\cdot)$. Letting q_j represent the net marginal revenue product associated with the employment of the given worker, we have

$$w* = \frac{\eta}{1+\eta}\left[q_j - \frac{\rho k}{(1-\tau)}\right]$$

where k represents the capital required when employing the additional unit of labor that comes from the wage increase.

The elasticity of labor supply, η, is an endogenous reduced form parameter which is a function of the wage w^* as well as the elasticity of labor supply to the firm which reflects the heterogeneity in preferences over firm-specific workplace characteristics. Adapting the notation from Manning (2011), let β be the elasticity of labor supply to firm j and the labor supply curve of workers of quality s to firm j be

$$L_j(s) = L(s)(w_j(s) - b_j(s))^{\beta}$$

where $w_j(s)$ is the wage offered to workers of quality s, $b_j(s)$ is the lowest reservation wage of the workers of quality s required to work for firm j, and $L(s)$ be the density of available workers of quality s. Labor is supplied to firm j as a function of the net wage premium $w_j(s) - b_j(s)$ with elasticity β. From this firm-specific labor supply curve, we can calculate the elasticity of labor supply with respect to the offered wage, $\eta = dln(L_j)/dln(w_j)$, is

$$\eta = \beta \frac{w_j}{w_j - b_j}.$$

Now, plugging the formula for the labor supply elasticity η into the equilibrium wage equation, we get

$$w^* = (1-\theta)b + \theta\left[q_j - \frac{\rho k}{(1-\tau)}\right],$$

where $\theta = \frac{\beta}{1+\beta}$.

Taking the derivative of the equilibrium wage with respect to the tax rate, we get

$$\frac{\partial w*}{\partial \tau} = -\theta \frac{\rho k}{(1-\tau)^2}$$

The derivative is negative, therefore the equilibrium wage is decreasing in the business tax rate. Also, we see that the derivative is increasing in θ and equals zero if $\theta = 0$. The parameter θ depends on the labor supply elasticity to the firm with respect to the wage surplus $(w_j - b_j)$. If market is perfectly competitive, the labor supply elasticity is perfectly elastic, the employees earn no surplus and the tax rate has no effect on earnings. If the firm faces an upward sloping supply curve, or if the elasticity is finite, then the firm's tax rate will affect employee earnings.

C Appendix: Marginal Welfare Analysis

I assume that there are only two types of agents in the economy, business owners that are at the top of the income distribution and face tax rate τ and employees who are lower in the income distribution and face tax rate t, where $\tau > t$. Firm owners' and employees' utility functions are represented by the following:

$$\text{Owners: } u^o(c, z(\pi, e)) = (1-\tau)z_o(\pi, e) - \psi(\pi, e), \tag{C.3}$$

$$\text{Employees: } u^e(c, z(\omega, -e)) = (1-t)z_e(\omega, -e) - \phi(\omega, -e). \tag{C.4}$$

Agents receive positive utility from consumption, but negative utility from activities which pre-tax earnings z such that $u_c > 0$ and $u_z < 0$. Earnings z is increasing in its arguments. Owners and employees choose π and ω, respectively, and experience utility costs, ψ and ϕ, which are increasing and convex in net-of-surplus earnings π and ω. Optimization with respect to these arguments implies

$$\text{Owners: } (1-\tau)\frac{\partial z_o}{\partial \pi} = \frac{\partial \psi}{\partial \pi} \tag{C.5}$$

$$\text{Employees: } (1-t)\frac{\partial z_e}{\partial \omega} = \frac{\partial \phi}{\partial \omega} \tag{C.6}$$

Whether the agents choose the surplus share, e, and experience an associated utility cost, or whether it is as an exogenous parameter in their optimization problems depends on the labor market model. When e is directly chosen by agents, the shape of the earnings and cost functions will depend on the underlying labor market model as well. Generally, I assume only that z is increasing in its second argument and the cost functions are decreasing in their second arguments.

The government does not observe π or ω directly, but only the total taxable income of owners and workers, z. I assume the government collects taxes and returns the money to everyone lump-sum, or analogously, that the social marginal value of public funds equals one. The welfare in the economy can be represented by:

$$W = \underbrace{(1-\tau)z_o(\pi, e) - \psi}_{\text{owner welfare}} + \underbrace{(1-t)z_e(\omega, -e) - \phi}_{\text{employee welfare}} + \underbrace{\tau z_o(\pi, e) + t z_e(\omega, -e)}_{\text{government revenue}} \tag{C.7}$$

To assess the excess burden generated by a small change in the top marginal tax rate, I differentiate Eq. (C.7) with respect to the top marginal tax rate, τ. A small increase in the tax rate produces a mechanical effect and a behavioral response, and also induces a pre-tax transfer of surplus, $de/d\tau$. The impact of these responses for owners employees and government revenue are

summarized below.

$$\frac{\partial W}{\partial \tau} = \underbrace{\tau \frac{\partial z_o}{\partial \pi}\frac{d\pi}{d\tau} - t\frac{\partial z_e}{\partial \pi}\frac{\partial \omega}{\partial e}\frac{de}{d\tau}}_{\text{behavioral response}} + \underbrace{\tau \frac{\partial z_o}{\partial e}\frac{de}{d\tau} - t\frac{\partial z_e}{\partial e}\frac{de}{d\tau}}_{\text{rev. externality from transfer}} + \underbrace{(1-\tau)\frac{\partial z_o}{\partial e}\frac{de}{d\tau} - \frac{\partial \psi}{\partial e}\frac{de}{d\tau} - (1-t)\frac{\partial z_e}{\partial e}\frac{de}{d\tau} - \frac{\partial \phi}{\partial e}\frac{de}{d\tau}}_{\text{direct effect of transfer}} \tag{C.8}$$

The mechanical effect holds behavior constant. An increase in the tax rate leaves the owner with less after-tax income and generates an equal amount of revenue for the government, and so produces no net change in welfare. The owners' and employees' choice of net-of-surplus earnings, π and ω respectively, may respond to the rate change, but this behavioral response produces no first-order effect on the agents' welfare because the earnings behavior was chosen optimally given τ. This is the standard application of the envelope theorem as implied by Eqs. (C.5) and (C.6). The behavioral response does have a first-order effect on revenue because the owner does not internalize the fiscal externality associated with the response.

The tax change induces a transfer in pre-tax surplus away from employees and towards owners, $de/d\tau > 0$. There is a fiscal externality associated with the transfer as long as the money is shifted across groups facing different tax rates. The net effect depends on whether the surplus, e, is a choice variable or an exogenous parameter in the agents' optimization problems, which will determine whether the envelope theorem applies to the welfare effects of the transfer.

The three cases follow. In each case, in this general setting like in the main text, i) the owners' taxable income response will not be a sufficient statistic for welfare analysis, and ii) when the taxable earnings response of the employees with respect to a top rate increase is negative, the owners' taxable income response will understate the total welfare effect.

Case 1: Transfer determined by the market

Agents do not choose e, instead e is determined by the market and becomes a parameter in their optimization problems. Owners and employees solve:

$$\text{Owners: } \max_{c,\pi} u(c, z(\pi; e)) = (1-\tau)z(\pi; e) - \psi(\pi)$$

$$\text{Employees: } \max_{c,w} u(c, z(\omega; -e)) = (1-t)z(\omega; -e) - \phi(\omega)$$

which imply optimal choices $\pi(\tau, e)$ and $w(t, e)$ which are implicit function of the tax rates and the surplus share. The resulting net marginal welfare effect of a small increase in the top marginal tax rate is

$$\frac{\partial W}{\partial \tau} = \tau \frac{\partial z}{\partial \pi}\frac{d\pi}{d\tau} - t\frac{\partial z_e}{\partial \omega}\frac{\partial \omega}{\partial e}\frac{de}{d\tau} + \frac{\partial z_o}{\partial e}\frac{de}{d\tau} - \frac{\partial z_e}{\partial e}\frac{de}{d\tau}$$

If the marginal change in earnings with respect to a small change in surplus is the same for owners and employees ($\partial z_o/\partial e = \partial z_e/\partial e$), as in the main text, then the transfer has no net welfare effect. This is the case when the transfer is zero-sum between owners and employees and utility is linear in earnings. The net welfare effect is then,

$$\begin{aligned}\frac{\partial W}{\partial \tau} &= \tau \frac{\partial z_o}{\partial \pi}\frac{d\pi}{d\tau} + t\frac{\partial z_e}{\partial \omega}\frac{\partial \omega}{\partial e}\frac{d(-e)}{d\tau} \\ &= \tau \underbrace{\left(\frac{\partial z_o}{\partial \pi}\frac{d\pi}{d\tau} + \frac{\partial z_o}{\partial e}\frac{de}{d\tau}\right)}_{\substack{\text{owners taxable} \\ \text{income response}}} + t \underbrace{\left(\frac{\partial z_e}{\partial \omega}\frac{\partial \omega}{\partial e}\frac{d(-e)}{d\tau} - \frac{\partial z_e}{\partial e}\frac{de}{d\tau}\right)}_{\substack{\text{employees taxable} \\ \text{income response}}} - (\tau - t)\frac{\partial z}{\partial e}\frac{de}{d\tau}\end{aligned} \tag{C.9}$$

where the third term in the second formulation comes from the zero-sum assumption. The first formulation in Eq. (C.9) shows that the welfare change is independent of the transfer and comes from fiscal externality from the change in economic decisions of the agents. Eq. (C.9) shows the primary results from the main text hold in the more general setting, i) the taxable income response of the owners is not a sufficient statistic for the marginal welfare loss, and ii) when the net earnings response of employees is negative, the taxable income response of the owners understates the total marginal welfare loss. In the more general setting the taxable income responses of the owners and employees to the top rate change are not sufficient statistics for welfare analysis; one also needs to be able to separately identify the transfer response from the total taxable income responses. But, the net revenue effect associated with the total taxable income responses understates the total marginal welfare loss by a constant - the transfer response weighted by the difference between owner and employee tax rates. When the taxable income response of employees is negative, the total revenue response from owners and employees will be a lower bound for the magnitude of the welfare loss, and will better approximate the welfare loss than the owner response alone.[31]

Case 2: Transfer determined by owner and employee optimization

When agents choose e as part of their optimization problem, owners and employees solve:

$$\max_{c,\pi,e} u(c, z(\pi, e)) = (1-\tau)z(\pi, e) - \psi(\pi, e)$$

$$\max_{c,w,-e} u(c, z(w, e)) = (1-t)z(w, -e) - \phi(w, -e)$$

Owners jointly choose (c, π, e) and employees jointly choose (c, w, e), and the choice of e affects consumption, but also has a utility cost. The agents' optimization problems with respect to e imply

$$\text{Owners: } (1-\tau)\frac{\partial z_o}{\partial e} = \frac{\partial \psi}{\partial e}$$

[31] This result is the same as in the main text. The main text presents a special case where the employees' taxable income response is a sufficient statistic.

$$\text{Employees: } (1-t)\frac{\partial z_e}{\partial e} = \frac{\partial \phi}{\partial e}$$

When the agents choose e optimally, at the margin a tax induced change in e, $de/d\tau$, has no first-order on agents' welfare. The envelope theorem applies to the direct effect of transfer and only the revenue externality remains, as seen in Eq (C.8). The resulting marginal welfare loss is given by:

$$\frac{\partial W}{\partial \tau} = \tau \underbrace{\left(\frac{\partial z_o}{\partial \pi}\frac{d\pi}{d\tau} + \frac{\partial z_o}{\partial e}\frac{de}{d\tau}\right)}_{\substack{\text{owners taxable} \\ \text{income response}}} + t \underbrace{\left(\frac{\partial z_e}{\partial \omega}\frac{\partial \omega}{\partial e}\frac{de}{d\tau} - \frac{\partial z_e}{\partial e}\frac{de}{d\tau}\right)}_{\substack{\text{employees taxable} \\ \text{income response}}} \tag{C.10}$$

The result is almost identical to that in the main text. The marginal welfare loss is equal to the total marginal revenue effect from all taxed induced behavioral responses from all sources. The main implications are also the same, i) the taxable income response of the owners is not a sufficient statistic, ii) the taxable income response of the owners will understate the total marginal welfare loss, and iii) in this case, the taxable income responses of the owners *and* employees are sufficient statistics for the marginal welfare loss.

Case 3: Transfer determined by owner optimization only

In the intermediate case where e is chosen directly by the owner, but not by the employees, the optimization problems of the agents are:

$$\max_{c,\pi,e} u(c, z(\pi, e)) = (1-\tau)z(\pi, e) - \psi(\pi, e)$$

$$\max_{c,w} u(c, z(w; -e)) = (1-t)z(w; -e) - \phi(w)$$

In this case the tax induced transfer will have no first-order effect on the welfare of the owners by the envelope condition, but there will be a first-order effect on the welfare of the employees. The marginal welfare effect is given by:

$$\frac{\partial W}{\partial \tau} = \tau \underbrace{\left(\frac{\partial z_o}{\partial \pi}\frac{d\pi}{d\tau} + \frac{\partial z_o}{\partial e}\frac{de}{d\tau}\right)}_{\substack{\text{owners taxable} \\ \text{income response}}} + t\frac{\partial z_e}{\partial \omega}\frac{\partial \omega}{\partial e}\frac{de}{d\tau} - \frac{\partial z_e}{\partial e}\frac{de}{d\tau} \tag{C.11}$$

$$= \tau \underbrace{\left(\frac{\partial z_o}{\partial \pi}\frac{d\pi}{d\tau} + \frac{\partial z_o}{\partial e}\frac{de}{d\tau}\right)}_{\substack{\text{owners taxable} \\ \text{income response}}} + t \underbrace{\left(\frac{\partial z_e}{\partial \omega}\frac{\partial \omega}{\partial e}\frac{d(-e)}{d\tau} - \frac{\partial z_e}{\partial e}\frac{de}{d\tau}\right)}_{\substack{\text{employees taxable} \\ \text{income response}}} - (1-t)\frac{\partial z_e}{\partial e}\frac{de}{d\tau}, \text{ or}$$

$$= \tau \underbrace{\left(\frac{\partial z_o}{\partial \pi}\frac{\partial \pi}{\partial \tau} + \frac{\partial z_o}{\partial e}\frac{de}{d\tau}\right)}_{\substack{\text{owners taxable} \\ \text{income response}}} + \underbrace{\left(\frac{\partial z_e}{\partial \omega}\frac{\partial \omega}{\partial e}\frac{d(-e)}{d\tau} - \frac{\partial z_e}{\partial e}\frac{de}{d\tau}\right)}_{\substack{\text{employees taxable} \\ \text{income response}}} - (1-t)\frac{\partial z_e}{\partial \omega}\frac{\partial \omega}{\partial e}\frac{de}{d\tau}$$

The main intuition remains: i) the taxable income response of the owners is not a sufficient statistics, and ii) using the owners' taxable income response alone understates marginal welfare loss when the taxable income response of employees is negative. As in Case1, the taxable earnings responses of the owners and employees are not sufficient statistics for welfare analysis in the general case, one also needs to be able to differentiate the transfer response from the total taxable income responses. Also, the total marginal revenue effect from all taxed induced behavioral responses of owners and employees is a lower bound on the magnitude of the total marginal welfare loss, as seen in the second formulation of Eq. (C.11). Using owners' and employees' taxable income responses provides a better approximation of the total welfare loss. The appropriate weighting for the latter statistic to best approximate the welfare effect depends on whether a larger share of the employees' earnings response is from the transfer or from changes in real economic behavior in response to the transfer, as seen by comparing the second and third formulation is Eq. (C.11).