The Efficiency-Equity Tradeoff of the Corporate Income Tax: Evidence from the Tax Cuts and Jobs Act

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Abstract

This paper studies the effects of an historically large federal corporate income tax cut on U.S. firms and workers, leveraging quasi-experimental policy variation from the 2017 law known as the Tax Cuts and Jobs Act. To identify causal effects, we use employer-employee matched federal tax records and an event study design comparing similarly-sized firms in the same industry that faced divergent tax changes due to their pre-existing legal status. Reductions in marginal income tax rates cause increases in sales, profits, investment, and employment, with responses driven by firms in capital-intensive industries. Workers' earnings gains are concentrated in executive pay and in the top 10% of the within-firm income distribution, while workers in the bottom 90% of the distribution see no change in earnings. Interpreted through the lens of a stylized model, our estimates imply that a $1 marginal reduction in corporate tax revenue generates an additional $0.10 in output, with 78% of gains flowing to the top 10% of the income distribution.

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1 Introduction

We study the effects of corporate income tax cuts on firms and workers in the United States, where in 2017 Congress enacted the most sweeping and significant legislation on American federal business taxation in a generation. Commonly known as the Tax Cuts and Jobs Act (TCJA), the legislation introduced reforms to corporate marginal income tax rates, investment incentives, and taxation of foreign income, among several other provisions of the tax code. Collectively, the breadth of these provisions and the magnitude of the tax rate changes constitute the largest overhaul of American business taxation since the Tax Reform Act of 1986, providing a rare and sharp natural experiment to shed light on contemporary research and policy debates.

Even as governments around the globe have dramatically reduced corporate income tax rates over the past half-century — from an unweighted average country worldwide statutory tax rate of 40% in 1980 to just 23% in 2021 (Tax Foundation 2021) — policymakers and researchers today fiercely debate the costs and benefits of declining corporate tax burdens. Advocates for tax cuts argue that lower rates increase investment, growth, and workers' living standards, while opponents argue they do little to boost growth and primarily benefit the wealthy.

In this paper we bring new evidence to these debates. Our empirical analysis specifically studies the core provisions of TCJA affecting firms' statutory marginal income tax rates, using a rich employer-employee matched panel dataset constructed from large random samples of firm- and worker-level federal tax records. The data allow us to observe a holistic set of firm outcomes — such as sales, profits, shareholder payouts, and investment — and to merge them with worker-level data on employment and annual labor earnings.

Our main empirical strategy leverages an event study design to compare the outcomes of similarly-sized firms in the same industry that faced divergent changes in their tax treatment. In particular, TCJA cut the top marginal tax rate for a legal entity type of firms known as C-corporations from 35% to 21% (a 40% reduction). At the same time, TCJA cut the implied top marginal tax rate for a separate legal entity type of firms known as S-corporations from 39.6% to 37% (a 6% reduction), and also introduced a new tax deduction that, for many of these firms, further reduced the top marginal rate to 29.6% (for a cumulative 25% reduction).[1] C-corporations and S-corporations operate in the same industries, overlap in their firm size distributions, and faced broadly similar tax burdens prior to TCJA, inviting a natural comparison between the two.

We exploit the fact that the average C-corp received a significantly larger tax cut than the average S-corp to provide the first exhaustive evidence of these corporate tax changes on firms' sales, profits, shareholder payouts, investment, and employment, as well as on workers' annual

[1] The top marginal tax rate for S-Corporations is *implied* because, unlike for C-Corporations, it must be computed as a weighted average of the marginal tax rates faced by each firms' individual owners and cannot be directly inferred from firms' tax records. The newly introduced tax deduction for S-corporations is known as the Qualified Business Income (QBI) deduction. We discuss both points in greater detail in Sections 2 and 3. As we will describe, the main differences between the firm types are that C-corporations may have unlimited shareholders and pay taxes directly to the federal government, whereas S-corporations face greater shareholder restrictions and pay taxes indirectly to the government via the individual tax filings of their shareholders.

earnings. As in Yagan (2015), the identifying assumption of our research design is not random assignment of C or S status; rather, it is that outcomes for C- and S-corps would have trended similarly in the absence of the tax cuts. Event studies indicate that outcomes of comparable C- and S-corps were on similar trends prior to TCJA, and we further implement a series of robustness checks to validate that our causal estimates are driven by changes in top marginal tax rates rather than other features of the law, superficial tax shifting behaviors, or unrelated economic forces differentially affecting C- and S-corps at the same time as TCJA.

Our benchmark regression specifications, which compare trends in outcomes of C- versus S-corps controlling for firm and industry-size-year fixed effects, indicate that corporate income tax cuts cause economically and statistically significant increases in firms' sales, profits, payouts to shareholders, employment, and real investment in capital goods. Responses are concentrated in capital intensive industries, and are not larger for smaller or cash-constrained firms, suggesting that effects are driven by a reduction in the cost of capital rather than by liquidity effects.

Our benchmark estimate of the federal corporate elasticity of taxable income, a key parameter for measuring the magnitude of tax distortions, is 0.38 (s.e.=0.13). This elasticity is smaller than most comparable estimates generated from variation in state and local corporate taxes, but larger than most estimates on personal income taxes. Since businesses are less mobile at the federal level than at the state or local level, and since a large literature documents that personal labor supply elasticities are small, we interpret this evidence as consistent with the common economic intuition that tax distortions vary proportionally with factor mobility.

Moving to the worker-level evidence, we study impacts on firm wage quantiles and show that annual earnings do not change for workers in the bottom 90% of the within-firm distribution, but do increase for workers in the top 10%, and increase particularly sharply for firm managers and executives. Unlike other outcomes such as employment and investment, we find that executive earnings increase in both capital and non-capital intensive industries. Moreover, executive pay increases are only weakly correlated with changes in firm sales, profits, or sales growth relative to other firms in the same industry. Synthesizing this evidence, we estimate that approximately 10% of the executive pay bump is driven by improved firm performance, while the remaining 90% is plausibly attributable to rent-sharing or executive capture.

Descriptively, relative to the population of workers in our sample, the executives and workers in the top 10% who benefit from higher earnings are typically older, have longer employment tenures at the firm, and are more likely to be men. However, we find little evidence that earnings effects vary heterogeneously by gender, age, or tenure after controlling for workers' place in the within-firm earnings distribution.

To evaluate the effects of corporate tax cuts on tax revenue and output, we combine the reduced-form elasticities from the empirical analysis with a stylized model of firm owners and workers. Using the model, we estimate that a \$1 marginal reduction in corporate tax revenue generates an additional \$0.10 increase in output. Corporate tax revenues decline by \$0.87, with behavioral responses of firms and workers modestly blunting mechanical revenue losses, and

consistent with the notion that contemporary top corporate marginal income tax rates in the US are below the revenue-maximizing rate.

To assess distributional impacts, we estimate the short-run incidence of corporate tax cuts on several factor groups — firm owners, executives, and high- and low-paid workers — as the share of total output gains accruing to each factor. Combining our reduced form elasticities with moments from the tax data, we find that approximately 56% of gains flow to firm owners, 12% flow to executives, 32% flow to high-paid workers, and 0% flow to low-paid workers. We then go beyond factor incidence to estimate effects across the income distribution, accounting for the empirical fact that many workers are also firm owners (that is, they hold equity portfolios) and many firm owners also work. Using data on the distribution of capital ownership, we find that approximately 78% of the gains from tax cuts accrue to the top 10% of earners, and 22% of gains flow to the bottom 90%. Leveraging the empirically observable geographic distribution of workers and income, we further find that these benefits are disproportionately concentrated in the Northeastern and Western regions of the United States, particularly among workers in large and high-income cities.

This paper builds on a large body of research that studies the effects of corporate taxes on profits, investment, shareholder payouts, employment, wages, and executive compensation.[2] Early seminal studies use aggregate or firm-level panel data and estimate two-way fixed effect models to study policy variation across countries or industries (Hall and Jorgenson 1967; Cummins, Hassett, and Hubbard 1994; Cummins, Hassett, and Hubbard 1996; Goolsbee 1998; Hassett and Hubbard 2002). More recent contributions use detailed administrative microdata and modern econometric methods to exploit geographic policy variation (Link, Menkhoff, Peichl, and Schüle 2022; Duan and Moon 2022; Garrett, Ohrn, and Suárez Serrato 2020; Giroud and Rauh 2019; Fuest, Peichl, and Siegloch 2018; Suárez Serrato and Zidar 2016; Becker, Jacob, and Jacob 2013), industry-level variation in exposure to tax deductions or credits (Curtis, Garrett, Ohrn, Roberts, and Serrato 2021; Ohrn 2022; Dobridge, Landefeld, and Mortenson 2021; Ohrn 2018; Zwick and Mahon 2017; House and Shapiro 2008), and firm-level policy variation induced by plausibly arbitrary legal or circumstancial distinctions (e.g., Boissel and Matray 2022; Moon 2022; Carbonnier, Malgouyres, Py, and Urvoy 2022; Bachas and Soto 2021; Risch 2021; Alstadsæter, Jacob, and Michaely 2017; Patel, Seegert, and Smith 2017; Yagan 2015; Devereux, Liu, and Loretz 2014).

Despite major advances in recent research, there are natural reasons to question whether existing evidence is generalizable to understanding the effects of corporate tax cuts in the context of TCJA. Evidence from subnational governments, small developing countries, or small firms may

[2]Other outcomes studied in the literature include: establishment counts (e.g., Suárez Serrato and Zidar 2016; Giroud and Rauh 2019); consumer prices (Baker, Sun, and Yannelis 2020); innovation and the mobility of inventors (Akcigit, Grigsby, Nicholas, and Stantcheva 2021); international tax competition (Devereux, Lockwood, and Redoano 2008); the location and investment decisions of multinational firms (Becker, Fuest, and Riedel 2012; Devereux and Griffith 2003); tax avoidance and profit shifting (Garcia-Bernardo, Janskỳ, and Zucman 2022; Desai and Dharmapala 2009; Auerbach and Slemrod 1997; Slemrod 1995; Hines and Rice 1994); and macroeconomic performance (Cloyne, Martinez, Mumtaz, and Surico 2022; Zidar 2019; Romer and Romer 2010, Lee and Gordon 2005). These outcomes are beyond the scope of this paper.

have limited applicability to major reforms in a large advanced economy such as the United States (Auerbach 2018). This concern is especially salient with respect to the U.S. federal corporate income tax, where the tax base is broader, top tax rates are higher, revenues are orders of magnitude larger, and factors of production are considerably less mobile. Moreover, economic theory predicts that alternate tax instruments — such as dividend taxes, capital gains taxes, or narrowly targeted corporate tax deductions and credits — have very different effects than the corporate income tax (Auerbach 2002; Hassett and Hubbard 2002). In this light, it is not surprising that, due to differences in both normative and empirical worldviews, debates over the effects of TCJA remain hotly contested by researchers and policymakers (Barro and Furman 2018).

Empirical evidence on the effects of the federal corporate income tax has remained scarce for three reasons. First, federal tax reforms are rare historical events, leaving limited policy variation for researchers to study. Second, digitized administrative microdata was previously unavailable to researchers, constraining the scope and precision of empirical analyses. Third, even when countries do change their tax rates, it is difficult for researchers to establish credible counterfactuals for causal inference, particularly as the parallel trends assumption underlying cross-country difference-in-difference analyses are challenging to defend in disparate socioeconomic and institutional settings.

This paper overcomes these limitations to provide clear and transparent evidence on the effects of corporate tax cuts on firms and workers. In doing so, we make four main contributions to the literature.

First, we study a rare policy change that generated historically large within-country variation in federal corporate income tax rates, and moreover generated variation even across similarly-sized firms in the same industry. As a share of GDP, the TCJA tax cut is orders of magnitude larger than previous studies that focus, for example, on changes in state or local corporate taxes, which tend to have lower rates and a smaller tax base (e.g., Giroud and Rauh 2019; Fuest, Peichl, and Siegloch 2018; Suárez Serrato and Zidar 2016). The large magnitude of the tax cut is relevant on both theoretical grounds (according to the conventional view that tax distortions are proportional to the square of the tax rate, as in Harberger 1964) and on purely empirical grounds (since ex-ante it is unclear whether existing evidence can be extrapolated to the case of an outlier).

Second, we complement the large shock with detailed employer-employee matched tax records that allow us to observe an unusually holistic set of firm- and worker-level outcomes. We build on frontier research that uses employee-level data to provide a nuanced account of corporate tax incidence on different types of workers (Carbonnier, Malgouyres, Py, and Urvoy 2022; Risch 2021; Dobridge, Landefeld, and Mortenson 2021; Fuest, Peichl, and Siegloch 2018), and extend existing work by empirically estimating geospatial incidence and incidence on firm owners. In contrast to studies that do not directly observe profits (e.g., Suárez Serrato and Zidar 2016), the richness of our data allows us to estimate incidence using fewer assumptions than are typically required when data availability are more limited.

Third, we contribute to a growing literature that seeks to understand the effects of TCJA on

the U.S. economy. Researchers have studied impacts on macroeconomic performance (Gale and Haldeman 2021; Gale, Gelfond, Krupkin, Mazur, and Toder 2019; Kumar 2019; Barro and Furman 2018; Mertens 2018), international and intertemporal profit shifting (Garcia-Bernardo, Janskỳ, and Zucman 2022; Dowd, Giosa, and Willingham 2020; Clausing 2020), pass-through businesses (Goodman, Lim, Sacerdote, and Whitten 2021), executive compensation (De Simone, McClure, and Stomberg 2022), capital structures (Carrizosa, Gaertner, and Lynch 2020), and regional or local economic outcomes (Kennedy and Wheeler 2022; Altig, Auerbach, Higgins, Koehler, Kotlikoff, Terry, and Ye 2020). Our study differs from existing research in that we specifically study the effects of TCJA's marginal corporate income tax cuts on firm- and worker-level outcomes using rich admistrative microdata and a quasi-experimental research design leveraging cross-firm policy variation.

Finally, we contextualize our findings from this historical episode in broader debates about efficiency and equity in national tax and transfer systems (Carbonnier, Malgouyres, Py, and Urvoy 2022; Bachas and Soto 2021; Risch 2021; Hendren and Sprung-Keyser 2020; Fuest, Peichl, and Siegloch 2018; Suárez Serrato and Zidar 2016; Devereux, Liu, and Loretz 2014; Arulampalam, Devereux, and Maffini 2012; Gruber and Rauh 2007). With respect to efficiency, our model-based estimates of the marginal output gains from cutting the federal corporate income tax are approximately 1.5 to 2 times as large as the literature-implied marginal gains from cutting personal income or payroll taxes. With respect to equity, our results contrast with much existing research in that we find the incidence of the corporate falls heavily on capital and highly-paid workers. Assessing incidence across the income distribution, we estimate that corporate income tax cuts are similarly regressive relative to personal income tax cuts, but markedly less progressive than payroll tax cuts. We note that our results capture short-run responses and do not account for potential changes in government spending or after-tax redistribution, which are important considerations for policymakers but beyond the scope of this research.

The rest of the paper proceeds as follows. Section 2 summarizes key features of the Tax Cuts and Jobs Act, including its legislative history, institutional context, and major policy changes. Section 3 describes data sources and variable definitions. Section 4 details our empirical strategy and presents results. Section 5 presents a stylized model that we use to estimate the revenue impacts, excess burden, and incidence of TCJA's corporate tax cuts. Section 6 concludes with a discussion of the results.

2 Institutional Setting: The Tax Cuts and Jobs Act

2.1 Legislative History

In 2017 Congress took on the task of reforming federal business tax policy, with the stated aims of increasing capital investment, economic growth, and international competitiveness.[3] Following

[3]The policy reforms were first proposed in a blueprint document released by Republicans in the House of Representatives in June 2016, available here.

several months of political negotiations and policy proposals, in December 2017 Congress and the President enacted Public Law 115-97, more commonly known as the Tax Cuts and Jobs Act, or TCJA. The law included provisions affecting many aspects of the federal business tax code, including corporate income tax rates, investment incentives, and taxation of foreign income. Most policy changes were implemented beginning in tax year 2018, although some provisions, such as the investment incentives that we will later discuss, were applied to tax year 2017. Our aim below is not to exhaustively detail TCJA's numerous reforms — for reviews of significant provisions see Auerbach (2018) and Joint Committee on Taxation (2018) — but rather to illuminate the key institutional details and policy variation that we leverage in our empirical analysis.

2.2 C-Corporations vs. S-Corporations

At the heart of TCJA was an overhaul of the income tax schedules facing two legally distinctive types of businesses, known as C-Corporations and S-Corporations. Combined, C- and S-corps account for approximately 70% of total U.S. employment and 74% of total payrolls, with government, non-profits, and non-corporate private businesses comprising the remainder (Census Bureau 2019). Our analysis focuses exclusively on the corporate sector, as other entity types face different tax and regulatory regimes, and are beyond the scope of this paper. Below we describe salient legal differences between C- and S-corps.

C-Corporations

C-corps are required to pay income taxes directly to the federal government, may be private or public, and are subject to both corporate income taxes (paid on corporate profits) and dividend taxes (paid by shareholders on profits distributed as dividends). Prior to TCJA, C-corps faced a progressive tax schedule with eight income brackets and a top marginal rate of 35%. After TCJA, these brackets collapsed to a single uniform 21% tax rate. Appendix A.1 documents the evolution of top marginal income tax rates for C-corps in the United States since 1909, illustrating the historic nature of this large and rare tax cut, and Appendix A.2 details the collapse of the progressive corporate income brackets following TCJA. Appendix A.3 puts the U.S. corporate tax in a global perspective, and Appendix A.4 benchmarks the magnitude of the TCJA corporate tax cut against other recent studies in the literature.

S-Corporations

S-corps do not pay taxes directly to the federal government. Rather, the firms' profits are distributed to the individual owners of the firm, who pay taxes on profits as ordinary income and can deduct any losses. S-corps may have up to 100 shareholders, all of whom must be U.S. citizens and not businesses or institutional investors, and are not permitted to sell shares on publicly traded stock exchanges. Unlike C-corps, S-corps do not face corporate income taxes, nor are their distributed profits subject to the dividend tax.

Prior to 2018, owners of S-corps faced a top marginal income tax rate of 39.6%. TJCA then provided two distinct types of tax relief to owners of S-corps. First, it reduced the top personal income tax rate from 39.6% to 37%. Second, it introduced a 20% tax deduction on qualified business income that further reduced the effective marginal tax rate on S-Corp income for most high-income tax-payers from 37% to 29.6%. This tax deduction — known as the Qualified Business Income ("QBI") deduction, or as "Section 199A" after the applicable section of the internval revenue code — is claimable by most but not all owners of S-corps. Since the QBI limitations are complex and not crucial for our empirical analysis, we abstract from details here and provide more details in Appendix A.5.

Entity Type Choice and Switching

Firms must elect either C or S status upon incorporating. The decision to choose one corporate form over the other may reflect a variety of considerations, including access to capital (recall that S-corps may not be publicly traded) and tax planning (recall that C-corps must pay entity-level taxes and are subject to dividend taxes on distributed profits). After electing C or S status, switching entity types is costly, rare, and subject to regulatory restrictions. Thus, a firm's entity type prior to TCJA is strongly related to the tax rate change it faced after TCJA, and endogenous switching is not a concern for our analysis.

2.3 Policy Variation in Marginal Income Tax Rates

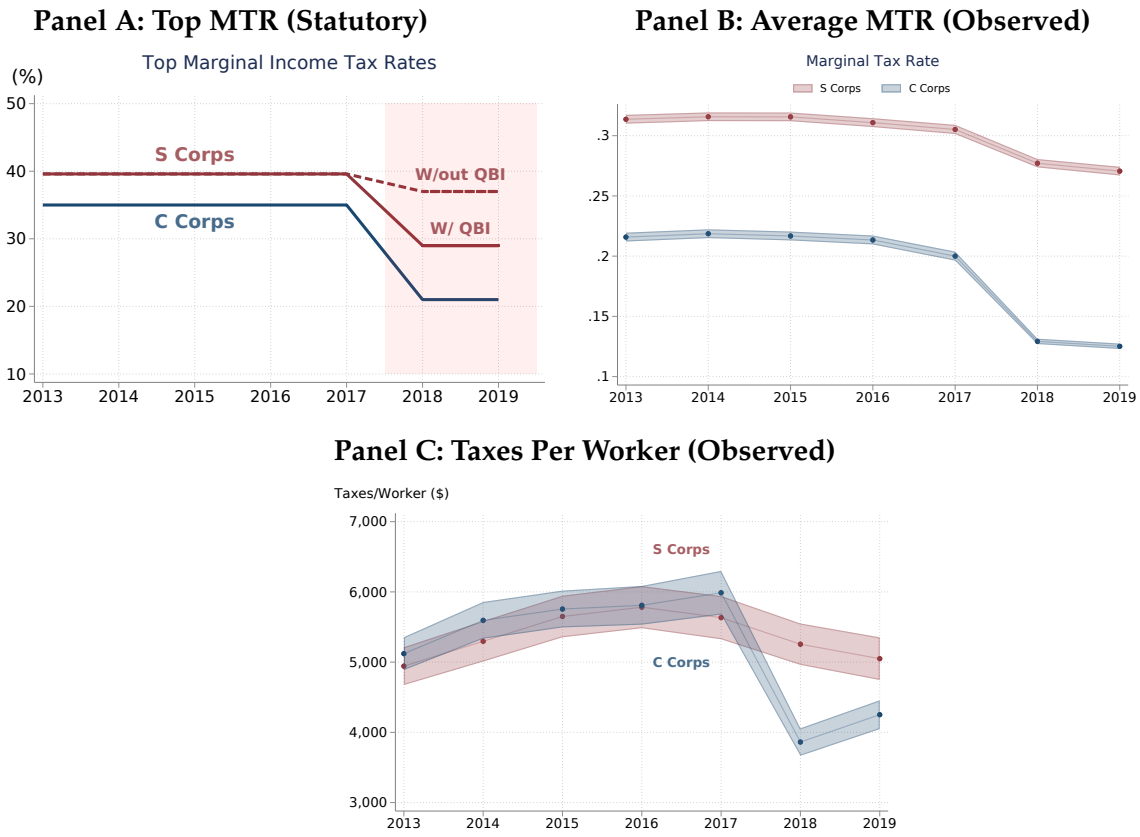
Figure 1 shows the evolution of top marginal income tax rates and tax burdens for C- and S-corps in the years before and after TCJA. Panel A shows the sharp reduction in top statutory marginal income tax rates for C-corps, as well as the change in implied top statutory marginal income tax rates for S-corps depending on whether or not they are eligble for the QBI deduction.

Panel B shows the change in observed marginal tax rates from our analysis sample of large firms with at least 100 employees. Entity-level tax rates and taxes paid are imputed for S-corps by linking to returns of S-corp owners, as we will describe in detail in the following section. Observed average marginal tax rates are lower than top statutory rates for several reasons. First, in any given year some firms will have non-positive taxable income (for example, if they earn zero or negative profits) and thus face a marginal tax rate of zero. Second, C-corps prior to TCJA faced a graduated tax rate schedule. Third, our measure of the marginal tax rate for S-corps is computed as a weighted-average of the tax rates faced by their owners, some of whom may not be in the top tax bracket.

Panel C underscores the economic significance of the tax cuts in dollar terms, documenting the observed average change in corporate taxes per worker for C- and S-corps. The panel shows that average taxes per worker declined from 2016 to 2019 by approximately $1,600 per worker (≈28%) for C-corps, and by approximately $800 per worker (≈13%) for S-corps.

Most importantly, all three panels show that, on average, C-corps received a significantly larger tax cut than S-corps due to TCJA, illustrating the key policy variation that we use in our empirical analysis to identify causal effects.

FIGURE 1: MARGINAL INCOME TAX RATES AND TAXES PER WORKER



Notes: Panel A shows top statutory marginal income tax rates for C and S Corporations before and after enactment of TCJA. Panel B shows the average MTRs observed in our data analysis sample of large firms with at least 100 employees; we discuss the data construction and variable definitions in Section 3. Panel C shows the change in taxes per worker paid by C- and S- corps observed in the data over the sample period.

3 Data

We use a panel of employer-employee matched annual federal tax records from tax years 2013 to 2019. We begin the sample period in 2013, allowing us to compare trends in the outcomes of C- and S-corps several years before TCJA, and end the sample in 2019, prior to the onset of the COVID-19 pandemic in 2020. Below we describe the data sources and sample construction, provide variable definitions, and present descriptive statistics. We provide additional details about the data cleaning procedures in Appendix B.

3.1 Corporate Tax Returns

We study firms in the corporate Statistics of Income (SOI) files produced by the U.S. Internal Revenue Service (IRS). The corporate SOI files include stratified random samples of corporate tax returns from both C-corps (from IRS Form 1120) and S -corps (from IRS Form 1120S). IRS produces and cleans these random samples to estimate aggregate statistics and to provide government agencies with essential data for development of legislation and policy analysis. The corporate tax returns allow us to observe firms' domestic sales, costs, profits, investment, and taxes paid, as well as their year of incorporation and industry. The IRS over-samples large firms with known probability weights, and the samples are designed as rolling panels so as to allow for longitudinal analyses.[4]

We impose the following two sample restrictions on the SOI panel, yielding an analysis sample of approximately 11,600 unique firms and 81,000 distinct firm-year observations.

First, we restrict the sample to large firms, defined as those with at least 100 employees and $1 million in sales in every year of our pre-treatment period from 2013 to 2016. There are two reasons for restricting the sample to large firms. Large firms account for the lion's share of corporate economic activity, comprising approximately 90% of corporate sales, 70% of corporate taxes, and 67% of corporate employment.[5] Moreover, many small C-corps faced tax increases (rather than tax cuts) after TCJA due to the flattening of corporate income tax brackets to a uniform 21% rate. Including smaller firms would thus require significantly complicating our empirical design, which simply compares outcomes of similar C- and S-corps over time. The large firm restriction both allows us to study the most economically significant firms and to employ a more transparent and credible research design.

Second, we balance the panel and drop firms that ever switch entity types from C to S or from S to C over the course of our sample period. Balancing the panel ensures that our results are not driven by the changing composition of firms in the SOI samples. Because entity-switching is rare, dropping switchers from our sample excludes only approximately 4% of firms, collectively comprising less than 0.5% of corporate sales or profits.

[4] For additional details on construction of the SOI samples, see documentation provided by the IRS here.

[5] Authors' calculations using IRS SOI data.

3.2 Individual Tax Returns

We complement the sample of corporate tax records with several sources of individual-level administrative records.

First, we merge the sample of corporate tax returns with the universe of worker-level filings of IRS Form W-2, which provides information on workers' annual wage earnings from each of their employers. Employers are required each year to share copies of form W-2 both with their workers and with the IRS, allowing us to observe the earnings of all workers even if they had no federal tax liability or did not file a personal income tax return.

Second, we collect information about the owners of S-corps in our sample from the universe of filings of IRS Form 1099-K1, which provides data on the income received by owners of S-corps from each of their pass-through businesses each year, including pass-through income from non-corporate partnerships. As we will describe below, we complement this information with data from IRS Forms 1040 to compute implied marginal income tax rates and federal taxes paid for S corporations.

Finally, we observe individuals' age and gender from the Master Database maintained by the Social Security Administration (SSA). We also observe their residential location using data from Kennedy and Wheeler (2022).

3.3 Variable Definitions and Measurement

Our empirical analysis uses information on firm-level tax rates, taxes paid, sales, profits, investment, employment, and shareholder payouts. We also use data on workers' employment and annual wage and salary earnings. We take care to measure these variables consistently over time, such that our outcomes are not affected, for example, by changes in the tax base or in reporting requirements on tax forms. We provide additional details on variable definitions, including specific forms and line item numbers, in Appendix B.

Marginal Tax Rates

Our primary explanatory variable of interest is the marginal income tax rate paid by firms. For C-corps, we observe taxable income and directly infer each firm's marginal income tax rate using the federal corporate income tax schedules reproduced in Appendix Table A.1. For S-corps, we observe each owner's taxable income from their personal tax returns, and directly infer their personal marginal income tax rate using the federal personal income tax schedules as reproduced in Appendix Table A.1. We then compute the implied corporate marginal tax rate for the firm as a weighted average of the marginal personal income tax rates faced by the firms' owners, where the weights are given by the share of ordinary business income distributed to each owner from that firm. For example, if an S-corp has two owners who receive an equal share of that firm's business income, facing marginal tax rates on their individual income of 25% and 35%, respectively, then we compute the implied corporate marginal tax rate as $(.5 * .25) + (.5 * .35) = 30\%$. Appendix

Figure B.1 shows the sample distribution of corporate MTRs for both S- and C-corps before and after TCJA.

Taxes Paid

For C-corps, we directly observe total tax payments to the federal government on Form 1120. For S-corps, which do not pay entity-level taxes, we must estimate tax payments using information from the individual-level tax records of the firms' owners. To do so, we first compute each owner's average tax rate from Form 1040 as total federal tax divided by taxable income. We also record each owner's total net ordinary business income from Form 1040 Schedule E, and estimate total business taxes paid on this income by multiplying it by the owner's average tax rate. We bottom code total business taxes at zero, ensuring in our calculations that owners do not pay tax on business losses. For each owner, we allocate her total business tax payments to each firm that she owns in proportion to the share of ordinary business income received from that business. Finally, we sum up the total tax payments of each firm's owners to record an estimate of total firm-level tax payments. We provide additional details about these computations in Appendix B.

Sales, Costs, and Profits

We measure firm sales as gross receipts. Pre-tax profits are defined as sales minus cost of goods sold, which includes both material and labor inputs. An advantage of this profit measure is that it is simple, transparent, consistent over time, and invariant to tax law and corporate form. As a robustness check, we also construct a harmonized measure of earnings before interest, taxes, depreciation, and amoritization (EBITDA), described in B. After-tax profits are equal to pre-tax profits minus taxes paid.

Dividends, Share Buybacks, and Total Payouts

Dividends are defined as total cash and property payments to shareholders. Share buybacks are defined as non-negative changes in treasury stock, and total payouts are measured as the sum of dividends and share buybacks.

Investment

Net investment is defined as the change in the dollar value of capital assets, where capital assets are equal to the book value of tangible investment minus capital asset retirements and accumulated book depreciation. We also report results on new investment, defined as the sum of capital expenditures reported on IRS Form 4562. These tax forms include information on firms' purchases of new capital assets such as machinery, computers, vehicles, office furniture, and structures. Firms report these investments according to the lifespan of the investment, which affects the horizon of capital tax deductions available to the firm. We decompose new investment into "short-life" equipment with depreciation schedules of less than or equal to 10 years (such as light machinery,

computers, and vehicles), "long-life" equipment with longer depreciation schedules (such as heavy machinery), and structures (such as new factories or office buildings).

Employment, Earnings, and Executive Compensation

We measure firm employment as the total number of unique individuals with a W-2 issued by the firm. Firms with complex ownership structures often use multiple employer identification numbers, and we use crosswalks to improve the linkage between W-2s and their ultimate parent companies (see Joint Committee on Taxation 2022). Workers' annual earnings are defined as Medicare wages from the W-2, which capture wage, tip, and salary income even if it is not taxable. Total firm payrolls are the sum of workers' annual earnings. Because employment, earnings, and payrolls are always strictly positive in our sample, we take logs of these outcomes in the empirical analyses.

Firms report compensation of officers on Forms 1120 and 1120s, which we use to measure executive pay. Officer designations are determined by state tax law, and reported compensation captures several but not all components of executive pay, including: wage, salary, and bonus income; stock options and grants, when exercised; and non-qualified deferred compensation. However, this measure does not capture stock options or grants before they are exercised, and does not include qualified incentive-based compenstion plans.[6] The measure thus represents a lower bound on executive compensation.

We also construct an alternate proxy measure of executive compensation as the combined annual W-2 earnings of the top five highest paid workers at the firm. This measure captures compensation of high-ranking employees who may not qualify as officers for tax purposes.

Additional Firm Characteristics

We group firms into four time-invariant size bins with approximately comparable numbers of observations based on their average employment in the pre-period years prior to 2017, where the bins are: 100-199 employees; 200-499 employees; 500-999 employees; and 1000+ employees. We also classify firms into time-variant industries using the NAICS-3 codes they report on Forms 1120 and 1120s. In the resulting data we observe 86 distinct industries and 280 distinct industry-size bins.

Firm age is inferred from the firm's year of incorporation, reported on the 1120. Firms are classified as multinationals if their foreign sales share is greater than 1%, where foreign sales are defined as the sum of gross receipts from all Controlled Foreign Corporations (that is, foreign subsidiaries) reported on Form 5471. We measure capital intensivity at the industry level as capital

[6]Designation of officers is detemined by the laws of the state or country where the firm is incorporated. Qualifed deferred compensation plans include 401(k) and similar investment vehicles; these plans are subject to contribution limits and regulatory restrictions, and investments are generally risk-free to workers. Non-qualified deferred compensation plans are not subject to contribution limits and in principle are at risk if the firm declares bankruptcy, although such losses are empirically rare. Qualified incentive-based compensation plans have a maximum deferral of $100,000 per year and are taxed as long-term capital gains, and thus are not reported on the W-2.

assets divided by sales. Firms are classified as capital intensive if the mean of this ratio in the pre-period is greater than the sample median, and others are classified as non-capital intensive. Appendix B.3 shows that capital intensive firms are approximately equally distributed across the firm size bins, and are not exclusively manufacturing firms.

Data Processing

We scale several outcomes — taxes, sales, costs, and profits — by firm sales in 2016, our baseline year prior to the passage of TCJA. While it is common in economic research to estimate elasticities by transforming regression outcomes using natural logs, doing so in our case is problematic because taxes and profits are often zero or negative in a given year. Scaling firm variables by baseline sales permits a natural economic interpretation of the regression coefficients in our empirical analyses, allows us to study a range of outcomes such that they can be consistently and easily compared, and is standard in the literature. In accordance with economic theory and prior research, investment results are scaled by lagged capital, although for consistency across results we also report results scaled by baseline sales in the Appendix. We also follow the literature in winsorizing the top and bottom 0.1% of the scaled outcomes separately for C- and S-corps in each year. Winsorizing ensures that our results are not driven by outliers or by measurement error, and improves statistical precision. We also show that the empirical results are robust to alternate winsorizing thresholds.

3.4 Descriptive Statistics

Panels A and B of Figure 2 show the distributions of log firm sales and log firm employment in our sample, and illustrate broad overlap in the size distributions of C- and S-corps. The panels make clear that the firm size distributions are strongly right-skewed, and that this skewness is more pronounced for C-corps than S-corps. In robustness checks, we show that our empirical results are insensitive to the inclusion or exclusion of very large C-corps; since they are qualitatively irrelevant to the results, we include them in the main analysis sample.

Panel C of Figure 2 shows the NAICS-2 industry composition of the sample, and again reveals broad overlap of C- and S-corps. Most industries have comparable shares of C- and S-corps. Some sectors, such as management and professional services, have a relatively higher proportion of C- than S-corps, while the reverse is true for others, such as construction and retail trade. Because our event study analysis will use industry-size-year fixed effects to compare C- and S-corps in the same industry and employment size bin, the observed sectoral overlap in the sample is more than sufficient for our empirical design. In robustness checks, we show that results are insensitive to the exclusion of industries in which the firm share of C-corps or S-corps exceeds 80%.

Table 1 presents descriptive statistics for our analysis sample from 2016. The mean firm in the sample has annual sales of $1,046.9 million, earns pre-tax profits of $385.0 million, pays $18.1 million in federal taxes, and makes real investments of $49.6 million per year. Mean firm employment is 2,968 workers, and the average worker earns approximately $63,700 per year.

Consistent with Figure 2, columns 3-10 again underscore the right-skewness of firm size, especially of C-corps, such that mean outcomes are significantly higher than medians and outcomes for C-corps are higher and more variable than for S-corps.[7]

FIGURE 2: FIRM SIZE DISTRIBUTIONS AND INDUSTRY COMPOSITION

Notes: Panels A and B show the distribution of 2016 log firm sales and employment, respectively, for C- and S-corps in the analysis sample. Panel C shows the NAICS-2 industry composition of firms in the sample.

[7] All medians and other quantile statistics reported in this paper are fuzzed to protect taxpayer privacy; see Appendix B for details.

TABLE 1: SUMMARY STATISTICS

	All Firms		C Corporations				S Corporations			
	(1) Mean	(2) SD	(3) Mean	(4) SD	(5) p50	(6) p90	(7) Mean	(8) SD	(9) p50	(10) p90
Taxes										
Marginal Tax Rate	0.248	0.161	0.215	0.168	0.340	0.350	0.310	0.124	0.380	0.396
Federal Tax (mil)	18.1	164.7	26.1	202.7	0.6	24.7	2.9	13.1	0.6	6.8
Federal Tax Per Worker	6,050	11,503	6,382	12,480	1,229	17,567	5,415	9,326	1,669	15,187
Sales and Profits										
Sales (mil)	1,046.9	5,976.2	1,467.0	7,327.1	152.7	2,276.4	244.4	636.3	117.6	463.5
Costs (mil)	654.5	4,667.9	905.8	5,733.4	69.5	1,130.1	174.5	521.9	72.5	345.3
Pre-Tax Profit (mil)	385.0	1,902.1	549.9	2,325.6	55.2	937.6	69.9	216.8	31.9	134.0
After-Tax Profit (mil)	366.9	1,799.7	523.8	2,199.9	52.2	906.3	67.0	211.7	30.2	127.1
EBITDA (mil)	155.9	1,240.2	227.0	1,525.2	11.6	273.0	20.1	64.4	8.1	38.6
Shareholder Payouts										
Dividends (mil)	34.6	444.8	47.6	548.1	0.0	14.6	9.8	33.8	2.9	20.5
Share Buybacks (mil)	19.4	351.2	29.5	433.2	0.0	0.8	0.3	4.6	0.0	0.0
Total Payouts (mil)	56.5	708.4	80.8	873.0	0.0	24.9	10.1	34.1	3.0	20.9
Real Investment										
Net Investment (mil)	17.9	404.4	26.6	498.8	0.0	23.3	1.3	15.0	0.0	5.3
Net Investment / Lagged Capital	0.16	1.36	0.15	1.26	0.01	0.39	0.18	1.53	0.01	0.42
New Investment (mil)	66.7	1,650.6	98.2	2,036.5	3.2	73.0	6.5	36.5	1.2	12.4
Employment and Earnings										
Employment	2,968	21,533	4,041	26,241	510	5,986	918	5,262	340	1,454
Payroll (mil)	173	975	242	1,192	31	402	39	146	18	70
Mean Annual Earnings (thous)	63.7	59.2	68.2	62.8	56.5	111.3	55.1	50.3	49.0	80.9
Median Annual Earnings (thous)	46.2	25.4	49.6	28.0	42.9	84.8	39.7	17.7	37.6	60.2
Executive Pay										
Executives' Earnings (thous)	5,606	26,572	7,319	32,077	1,651	13,654	2,334	8,555	988	4,806
Mean Top 5 Earnings (thous)	1,187	3,329	1,496	3,950	458	3,203	596	1,388	341	1,059
Firm Characteristics										
Firm Age	35	23	33	24	28	64	40	21	37	67
Multinational	0.24		0.32				0.10			
Private	0.84		0.76				1.00			
Capital Intensive	0.50		0.55				0.41			
N Firms	11,647		7,645				4,002			

Notes: Table shows summary statistics from 2016 for firms in the analysis sample. Medians and centile statistics are fuzzed to protect taxpayer privacy. For data sources and variable definitions see Section 3.

4 Empirical Analysis

4.1 Empirical Strategy

We implement a transparent research design comparing trends in outcomes of C- and S-corps in the same industry-size bin before and after TCJA. Our event study specification is given by:

$$y_{ft} = \sum_{t \neq 2016} \beta_t C_f * \mathbf{1}(year = t) + \gamma_f + \alpha_{is(f),t} + \epsilon_{ft} \tag{1}$$

where y_{ft} is an outcome for firm f in year t; C_f is a binary variable equal to 1 if firm f is a C-corp or 0 if it is an S-corp; γ_f is a firm fixed effect; and $\alpha_{is(f),t}$ is an industry-size-year fixed effect, where the industry-size bins are constructed as described in Section 3.3. The coefficients of interest, β_t, capture the average differences in outcomes between C- and S-corps in the same industry-size bin in year t. We use 2016 as the reference year, allowing us to compare C- and S-corp trends for several years prior to TCJA and also to observe any potential anticipatory tax-shifting behaviors beginning in 2017. Standard errors are clustered by firm.

The key identifying assumption permitting a causal interpretation of the β_t coefficients is that the outcomes of C- and S-corps would have trended similarly in the absence of TCJA's changes to firms' marginal income tax rates. While this assumption is not directly empircally testable, there are several reasons that parallel trends is likely to hold in our setting. First, Congressional passage of TCJA was widely unexpected prior to the 2016 federal elections, and so firms had limited scope to anticipate the reform and to adjust their behavior endogenously to the policy changes. Second, our narrowly defined industry-size-year fixed effects imply that we make comparisons among C- and S-corps that that compete in similar product markets and are subject to the same industry-by-size specific supply and demand shocks. Third, Yagan (2015) finds that C- and S-corp trends in real outcomes were statistically indistinguishable for all years in his sample period from 1996-2008, implying that C- and S-corps have historically responded similarly to macroeconomic shocks and trends. Fourth, as we will show, our event studies show parallel trends in the outcomes of C- and S-corps in the years directly prior to the policy reform. Lastly, in Section 4.8, we carefully consider additional identification threats, and present a series of robustness checks to ensure that our causal estimates are not driven by non-MTR features of the law, anticipation effects, superficial tax-shifting behaviors, or unrelated economic shocks differentially affecting C- and S-corps at the same time as TCJA.

Our goal of assesssing the efficiency impacts and distributional effects of TCJA's corporate tax cuts will require that we obtain elasticities of profits, investment, and earnings with respect to the net-of-tax rate. To estimate these key elasticities, we pool outcomes in the post-period and use two-stage least squares. The reduced form, first-stage, and structural equations are given, respectively, by:

$$y_{ft} = \lambda C_f * Post_t + \gamma_f + \alpha_{is(f),t} + \epsilon_{ft} \tag{2}$$

$$\ln(1 - \Delta\tau_f) * Post_t = \delta C_f * Post + \gamma_f + \alpha_{is(f),t} + \epsilon_{ft} \tag{3}$$

$$y_{ft} = \varepsilon \ln(1 - \Delta\tau_f) * Post_t + \gamma_f + \alpha_{is(f),t} + \epsilon_{ft} \tag{4}$$

where $\Delta\tau_f$ is the 2016 to 2019 change in the marginal income tax rate for firm f, $Post_t$ is an indicator equal to 1 for years after 2018, and the fixed effects are the same as in equation 1. Intuitively, we instrument for firms' net-of-tax change using their pre-existing entity type status as a C-or S-corps. The identifying assumptions underlying this empirical strategy are well known: exogeneity, relevance, monotoncity, and exclusion. We do not claim strict exogeneity in our setting – that is, we do not claim there is random assignment of C or S status – but rather rely on the weaker claim of parallel trends in the outcome absent the changes in the tax rate (see Conley, Hansen, and Rossi 2012). We examine the relevance and monotoncity conditions below, and return to a discussion of the exclusion restriction when we evaluate mechanisms.

We begin the empirical analysis with a presentation of average responses, and then turn to heterogeneity tests and robustness checks. We conclude the empirical analysis with a discussion of mechanisms, where the focus is naturally related to the task of disentangling the impacts of TCJA's marginal tax rate cuts from other concurrent policy changes. First, however, our goal is more modest: to provide clear evidence on how TCJA differentially affected C- and S-corps.

4.2 Marginal Tax Rates and Taxes Paid

Figure 3 plots the β_t coefficients and 95% confidence intervals from estimating equation 1, using the firms' marginal tax rates and taxes paid as outcomes. We scale taxes paid (and other outcomes that we will report below) by the firm's baseline 2016 sales for the reasons discussed in Section 3.3. In the bottom of each left panel we also report the 2016 sample outcome mean to contextualize the economic scale and significance of the estimated coefficients.

Panel A of Figure 3 shows that the observed marginal tax rates of C- and S-corps trended similarly prior to TCJA, but diverged sharply thereafter. On average, the marginal tax rate of C-corps fell by approximately -5.2 percentage points (s.e.=0.2) compared to S-corps in the sample; relative to the 2016 outcome mean in levels of 0.25, this represents a -5.2/0.25 $\approx$ 20.8% decline in the marginal tax rate facing C-corps relative to S-corps. The panel also makes clear that firms' tax burdens began to decline in 2017, even though the bulk of TCJA's provisions did not take effect until 2018. This pattern provides suggestive evidence that firms engaged in intertemporal shifting behaviors to minimize tax liability, such as reporting costs in 2017 rather than 2018 so that those costs could be deducted at a higher tax rate. We discuss shifting behaviors in greater detail later in Section 4.8.

Panel B of Figure 3 shows an analogous version of Panel A, where the outcome is transformed as the log net-of-tax rate, (1-τ_f^{MTR}). We show this transformation because economic theory predicts

FIGURE 3: EVENT STUDIES: MARGINAL TAX RATES AND TAXES PAID

Notes: The unit of analysis is a firm-year. The panels plot the β_t coefficients estimated from equation 1. These coefficients capture average differences in outcomes between C- and S-corps over time after controlling for firm and industry-size-year fixed effects. Standard errors are clustered by firm and error bands show 95% confidence intervals. The outcome in Panel A is the firm's marginal tax rate, τ_f^{MTR}, and the outcome in Panel B is the log net-of-tax rate, $\ln(1-\tau_f^{MTR})$. The outcome in Panel C is tax per worker, reported in dollars, and the outcome in Panel D is tax scaled by the firms' baseline 2016 sales. Marginal tax rates for S-corps are defined as the weighted average of the shareholders' individual marginal tax rates, where the weights are given by the ownership shares. See Section 3 for details on the measurement of tax payments for S-corps. For data sources and variable definitions see Section 3.

that firms respond to the net-of-tax rate when optimizing profits. The figure shows that, on average, C-corps saw their net-of-tax rate increase by approximately 6.8% (s.e.=0.2) relative to S-corps following TCJA. Below, we use this result to scale other reduced form effects, allowing us to estimate elasticities of key outcomes with respect to changes in the log net-of-tax rate.

Panel C of Figure 3 shows that the differences in tax cuts also translated into differences in taxes paid, with C-corps paying approximately -1.0 percentage points (≈15.0%; s.e.=0.3) less in federal tax in 2019 relative to their baseline sales when compared to S-corps. Panel D illustrates that the magnitude of this effect is economically large: on average, C-corps paid approximately $2,200 (s.e.=$436) less in tax per worker than comparable S-corps following TCJA.

Columns 1 to 4 of Table 2 report the $C \times Post$ estimates produced from estimating equation 2. Similar to the event studies, these coefficients capture the average difference between C- and S-corps in the pre- and post-periods for each outcome after controlling for firm and industry-size-year fixed effects.

TABLE 2: MARGINAL TAX RATES AND TAXES PAID

	(1) τ_f^{MTR}	(2) $\ln(1-\tau_f^{MTR})$	(3) Tax Per Worker	(4) Tax/Sales_{2016}
C × Post	-0.052***	0.068***	-2203***	-0.010***
	(0.002)	(0.002)	(436)	(0.003)
2016 Outcome Mean	0.25	-0.31	6,045	0.06
Firm FE	Yes	Yes	Yes	Yes
Industry-Size-Year FE	Yes	Yes	Yes	Yes
R2	0.72	0.73	0.59	0.83
N	81,529	81,529	81,529	81,529
N Firms	11,647	11,647	11,647	11,647

Notes: The unit of analysis is a firm-year. The table shows the $C \times Post$ coefficients from equation 2. These coefficients estimate average differential changes in outcomes between C- and S-corps before and after TCJA, controlling for firm and industry-size-year fixed effects. The outcome in column 1 is the firm's marginal tax rate, τ_f^{MTR}, and the outcome in column 2 is the log net-of-tax rate, $\ln(1-\tau_f^{MTR})$. The outcome in column 3 is tax per worker, reported in nominal dollars, and the outcome in column 4 is tax scaled by the firms' baseline 2016 sales. Marginal tax rates for S-corps are defined as the weighted average of the shareholders' individual marginal tax rates, where the weights are given by the ownership shares. See Section 3 for details on the measurement of tax payments for S-corps. Standard errors are clustered by firm.

The results in Figure 3 and Table 2 provide evidence of a strong first stage, demonstrating an economically meaningful and statistically powerful differential effect of TCJA on the tax rates and tax payments of C-corps versus S- corps. These results also show that the relevance and monotoncity assumptions underlying equation 3 are satisfied in this setting.

4.3 Sales, Costs, Pre-Tax Profits, and EBITDA

Figure 4 plots the results from estimating equation 1 to assess trends in the sales, costs, and pre-tax profits, and EBITDA of C- and S-corps over time. The figure shows trends in these outcomes were statistically similar before TCJA, again lending support to the parallel trends assumption underlying the identification strategy. After TCJA, however, C-corps' sales increased markedly relative to S-corps, by approximately 3.6 percentage points (s.e.=1.5) by 2019. The effect is precisely estimated and economically significant: using values from Table 1, the coefficient implies that the average C-corp increased its sales by approximately $40 million relative to comparable S-corps.

C-corps also faced higher costs, as shown in Panel B, although the magnitude of the cost increase is smaller than for sales and, on average, is not statistically significant. Later we show that this average effect masks important heterogeneity, with both sales and costs increasing predominantly in capital intensive industries.

Given sharply increasing sales and only modestly increasing costs, Panel C shows that the average pre-tax profits of C-corps also increased relative to S-corps, by 2.6 percentage points (s.e.=0.9). Panel D shows an alternate measure of pre-tax profits, using the harmonized EBITDA measure, and again reveals a clear increase in the profits of C-corps relative to S-corps. These results provide initial evidence that firms expanded in response to tax cuts, consistent with the standard notion that taxes induce economic distortions and may generate deadweight loss.

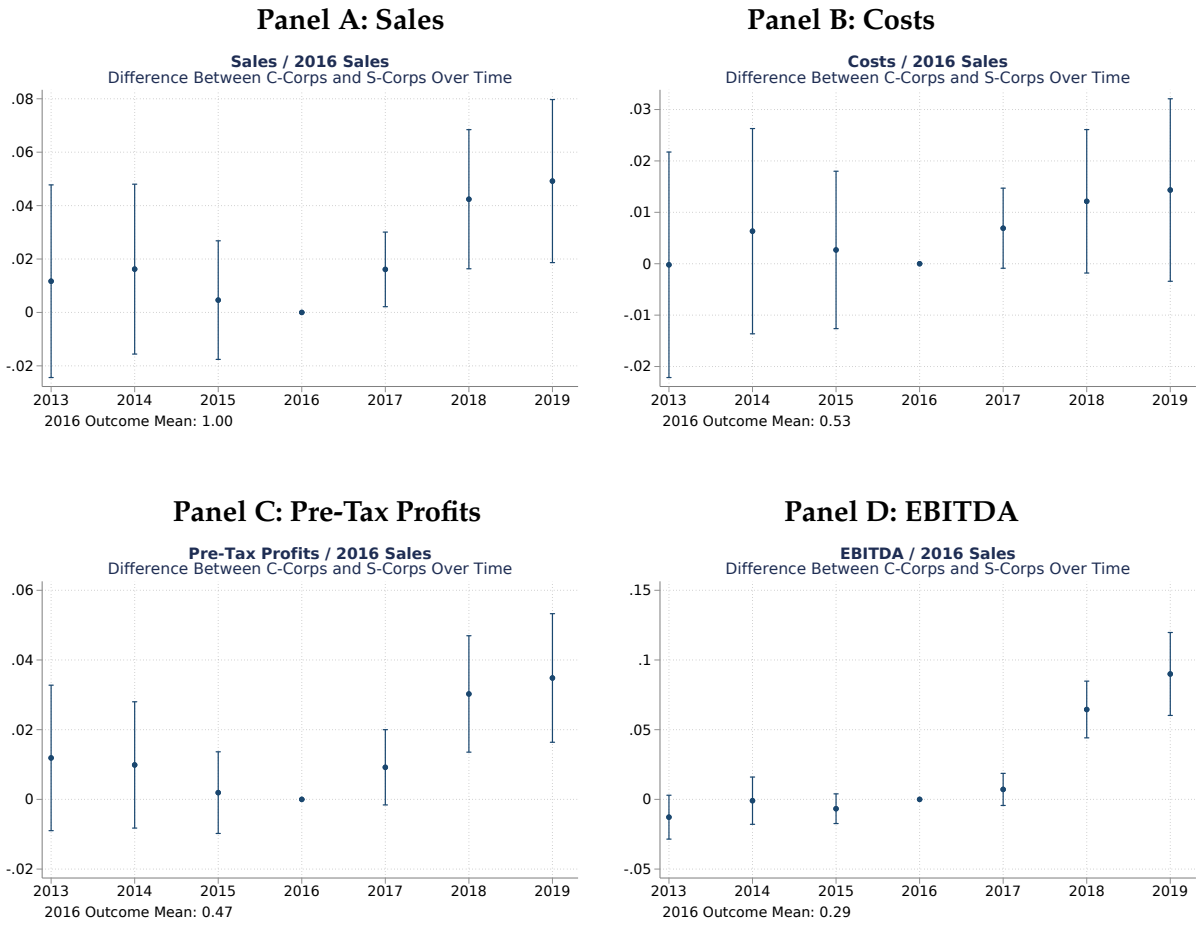
Columns 1 to 4 of Table 3 show the $C \times Post$ coefficients associated with the event studies in Figure 4. In column 5, we estimate the elasticity of pre-tax profits with respect to the net-of-tax rate using equation 4. Scaling the reduced form estimate in column 3 by the first-stage estimate from column 2 of Table 2 yields an elasticity of 0.38 (s.e.= 0.13).

This elasticity – known as the elasticity of the tax base, or alternately as the elasticity of taxable income (ETI) – is a key parameter in the analysis. As shown by Feldstein (1999) and reviewed by Saez, Slemrod, and Giertz (2012), under plausible assumptions it is a sufficient statistic that can be used to estimate the welfare impacts and efficiency costs of tax changes. In general, a larger taxable income elasticity implies greater deadweight loss, since it implies a larger distortion of economic activity resulting from the tax.

Our estimate of the federal corporate ETI, 0.38, is on the lower end of corporate elasticities identified from policy variation in small open economies. For example, Giroud and Rauh (2019) estimate an elasticity of establishment growth (a proxy for the tax base) of approximately 0.50 with respect to state corporate taxes in the United States; Suárez Serrato and Zidar (2016) estimate an elasticity of establishment growth of aproximately 0.9 for U.S. state corporate taxes over an analogous time horizon to ours; and Bachas and Soto (2021) estimate large taxable income elasticities of 3.0-5.0 for small firms in Costa Rica. On the other hand, our estimate of the corporate ETI is on the higher end of most existing estimates of the ETI for personal incomes, which Saez, Slemrod, and Giertz (2012) find in a literature review ranges from approximately 0.14 to 0.40, with a central estimate of 0.25.

Viewed in the context of other research, we view our corporate ETI estimate as consistent with

FIGURE 4: EVENT STUDY: FIRM SALES, COSTS, AND PRE-TAX PROFITS



Notes: Unit of analysis is firm-year. The panels plot the β_t coefficients estimated from equation 1. These coefficients capture average differences in outcomes between C- and S-corps over time after controlling for firm and industry-size-year fixed effects. Standard errors are clustered by firm, and error bands show 95% confidence intervals. Sales are gross receipts. Costs are equal to cost of goods sold, including both material and labor costs. Pre-tax profits are sales minus costs. EBITDA is a harmonized measure of earnings before interest, taxes, depreciation, and amoritization; see Section 3 and Appendix B for details.

the common economic intuition that tax distortions vary with factor mobility. Firms and workers are less mobile at the federal level than at the state and local level, mitigating distortions from the federal corporate tax relative to the state and local corporate tax. However, many forms of capital are internationally mobile relative to workers (Kotlikoff and Summers 1987), suggesting that federal taxes on labor income, the primary source of personal income tax revenue, may be less distorative than the federal corporate tax.

In Section 4.8 we perform extensive robustness checks on our ETI estimate, and in Section 6 we discuss its significance in the context of the broader national tax and transfer system.

TABLE 3: SALES, COSTS, AND PRE-TAX PROFITS

	(1) Sales	(2) Costs	(3) Pre-tax π	(4) EBITDA	(5) Pre-tax π
C $\times$ Post	0.036**	0.010	0.026***	0.080***	
	(0.015)	(0.009)	(0.009)	(0.011)	
$\Delta \ln(1-\tau_f)\times$ Post					0.379***
					(0.127)
2016 Outcome Mean	1.00	0.53	0.47	0.29	0.47
Firm FE	Yes	Yes	Yes	Yes	Yes
Industry-Size-Year FE	Yes	Yes	Yes	Yes	Yes
R2	0.40	0.65	0.62	0.84	n.a.
N	81,529	81,529	81,529	81,529	81,529
N Firms	11,647	11,647	11,647	11,647	11,647
First-Stage F					409.5

Notes: The unit of analysis is a firm-year. Columns 1-4 show the $C \times Post$ coefficients from equation 2. These coefficients estimate average differential changes in outcomes between C- and S-corps before and after TCJA, controlling for firm and industry-size-year fixed effects. All outcomes are scaled by 2016 baseline sales. Sales are gross receipts. Costs are equal to cost of goods sold, including both material and labor costs. Pre-tax profits are sales minus costs. EBITDA is a harmonized measure of earnings before interest, taxes, depreciation, and amoritization. Column 5 reports the elasticity of pre-tax profits with respect to the net-of-tax rate, computed by scaling the reduced form outcome in column 3 by the first stage coefficient from column 2 of Table 2. Standard errors are clustered by firm. For additional information on data sources and variable definitions see Section 3 and Appendix B.

4.4 After-Tax Profits and Shareholder Payouts

We use the same empirical strategy to evaluate trends in firms' after-tax profits and payouts to shareholders. Consistent with the increases in pre-tax profits and decline in tax liability, Panel A of Figure 5, and Column 1 of Table 4, shows that the after-tax profits of C-corps increased relative to S-corps following TCJA, by 3.6 percentage points (≈10.7%; s.e.=0.9). The magnitude of this effect is

economically and statistically signficiant, and underscores that tax cuts are highly lucrative to firm owners. The elasticity of after-tax profits with respect to the net-of-tax rate, estimated in column 4 of Table 4 using equation 4, is 0.52 (s.e.= 0.13). Later, we use this elasticity to assess the incidence of TCJA's tax cuts on firm owners.

We also find that firms returned some of these excess profits to their shareholders via dividends and share buybacks, the sum of which we refer to as total shareholders payouts. Because shareholder payouts are infrequent events (approximately half of the payout observations in our sample are zero), we study both the extensive and intensive margins. The outcome in Panel B of Figure 5 is equal to one if total payouts are greater than zero (that is, the extensive margin), and shows an increase of 4.0 percentage points (s.e.=0.8) in the payout probability of C-corps relative to S-corps following TCJA. In Panel C we show the intensive margin, where the outcome is log total payouts, and find that payouts of C-corps relative to S-corps increase by 21.9% (s.e.=5.0). Consistent with this increase in shareholder payouts, in Appendix C.1 we find that C-corps do not increase their issuance of equity or debt relative to S-corps after TCJA. The results are consistent because, if firms need external financing to fund operations, they generally do not simulatenously distribute cash to shareholders.[8]

Overall, the results from Figure 5 and Table 4 provide evidence that firm owners bear a substantial portion of the short-run economic incidence of the corporate income tax.

4.5 Labor Market Outcomes and Executive Pay

We again use equation 1 to examine the labor market outcomes of workers at C- and S-corps before and after TCJA. Figure 6 shows the results from estimating equation 1 to assess trends in log employment, total payroll, and annual earnings for selected groups of workers.

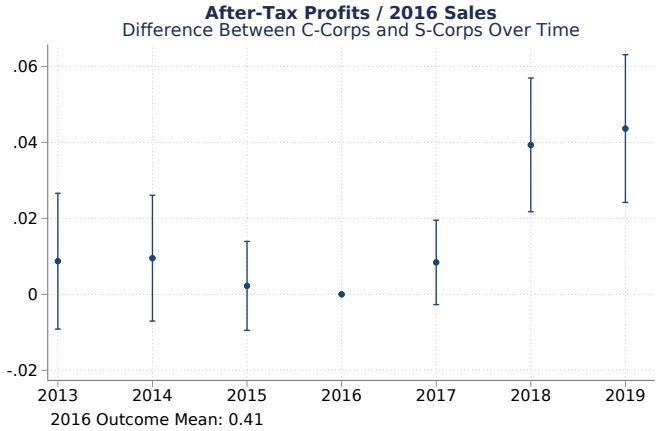
Figure 6 shows that the labor market outcomes of C- and S-corps followed similar trends prior to TCJA. After TCJA, employment in C-corps increased modestly relative to S-corps, by 0.4% (s.e.=0.8) on average, but the difference is not statistically distinguishable from zero. Total payrolls, shown in Panel B, also increased modestly in C-corps relative to S-corps, by 1.2% (s.e.=0.8), and again the difference is not statistically significant. However, later we show that these average effects mask important heterogeneity across firms.

Panels C and D move beyond total payrolls to shed light on the distributional impacts of TCJA on workers' earnings. Panel C shows that the earnings of the median worker at the firm evolved similarly for both C- and S-corps over the entire sample period, and implies that corporate tax

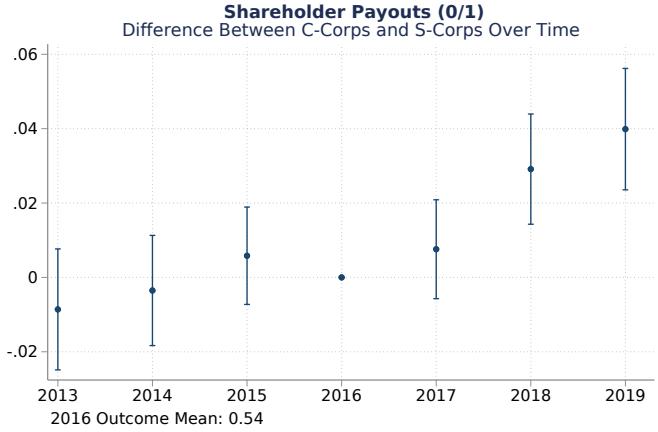
[8]In assessing the effects of TCJA on shareholder payouts, it is also relevant that enactment of the TCJA levied a one-time, mandatory tax on the previously untaxed foreign earnings of C-corporations through section 965 of the Internal Revenue Code. The American Jobs Creation Act in 2005 included a similar provision in which c-corporations could voluntarily repatriate foreign earnings at a reduced rate. Research on the 2005 repatriation holiday has suggested that the primary effect of this provision was to increase shareholder payouts (Dharmapala, Foley, and Forbes 2011) and potentially increased investment among some credit constrained firms (Faulkender and Petersen 2012). This one time repatriation tax is a potential confounder in our setting, but our results are robust to inclusion of controls for foreign earnings as well as the exclusion of large multinational firms, suggesting that is not the primary driver of our findings.

FIGURE 5: EVENT STUDY: AFTER-TAX PROFITS AND SHAREHOLDER PAYOUTS

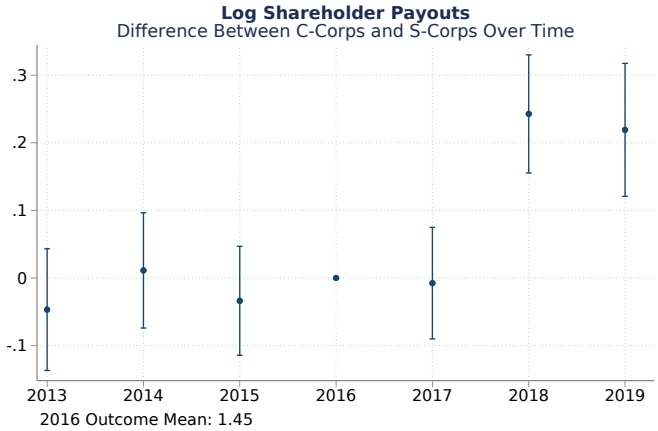
Panel A: After-Tax Profits



Panel B: Shareholder Payouts (Extensive Margin)



Panel C: Shareholder Payouts (Intensive Margin)



Notes: The unit of analysis is a firm-year. The panels plot the β_t coefficients estimated from equation 1. These coefficients capture average differences in outcomes between C- and S-corps over time after controlling for firm and industry-size-year fixed effects. Standard errors are clustered by firm and error bands show 95% confidence intervals. In Panel A, after-tax profits are defined as pre-tax profits minus tax, and are scaled by 2016 baseline sales. In Panel B, the outcome is an indicator equal to 1 if shareholder payouts are positive (i.e., the extensive margin), where payouts are defined as the sum of cash and property distributions to shareholders. In Panel C, the outcome is log shareholder payouts (i.e., the intensive margin). For additional information on data sources and variable definitions see Section 3 and Appendix B.

TABLE 4: AFTER-TAX PROFITS AND SHAREHOLDER PAYOUTS

	(1) Post-Tax π	(2) Payouts (0/1)	(3) Log Payouts	(4) Post-Tax π
C $\times$ Post	0.036^{***}	0.034^{***}	0.246^{***}	
	(0.009)	(0.006)	(0.034)	
$\Delta \ln(1-\tau_f)\times$ Post				0.521^{***}
				(0.129)
2016 Outcome Mean	0.41	0.54	1.45	0.41
Firm FE	Yes	Yes	Yes	Yes
Industry-Size-Year FE	Yes	Yes	Yes	Yes
R2	0.69	0.76	0.86	n.a.
N	81,529	81,529	81,529	81,529
N Firms	11,647	11,647	11,647	11,647
First-Stage F				409.5

Notes: The unit of analysis is firm-year. Columns 1-3 show the $C \times Post$ coefficients from equation 2. These coefficients estimate average differential changes in outcomes between C- and S-corps before and after TCJA, controlling for firm and industry-size-year fixed effects. After-tax profits are defined as pre-tax profits minus tax, and are scaled by 2016 baseline sales. In column 2, the outcome is an indicator equal to 1 if shareholder payouts are positive (i.e., the extensive margin), where payouts are defined as the sum of cash and property distributions to shareholders. In column 3 the outcome is log shareholder payouts (i.e., the intensive margin). Column 4 reports the elasticity of after-tax profits with respect to the net-of-tax rate, computed as in equation 4. Standard errors are clustered by firm. For additional information on data sources and variable definitions see Section 3 and Appendix B.

cuts did not have a statistically significant effect on earnings for the typical worker.[9] By contrast, Panels D shows that the earnings of higher-income C-corp workers increased sharply relative to their counterparts in S-corps.

To more comprehensively evaluate the effects of TCJA on the distribution of workers' earnings, we estimate quantile regression specifications of equation 1, where the outcome $y_{ft}(p)$ is log annual earnings of workers in firm f and year t at centile p. For example, $y_{ft}(p = 50)$ uses log median earnings as the outcome, as shown in Panel C of Figure 6, and $y_{ft}(p = 99)$ uses the 99th percentile of log worker earnings as the outcome, as in Panel D.

Figure 7 plots the β_{2019} coefficients from these quantile regressions along with their corresponding 95% confidence invervals. The figure shows that the relative earnings of workers in C- and S-corps below the 90th percentile are statistically identical following TCJA; we cannot reject that the coefficients are statistically distinguishable from zero.

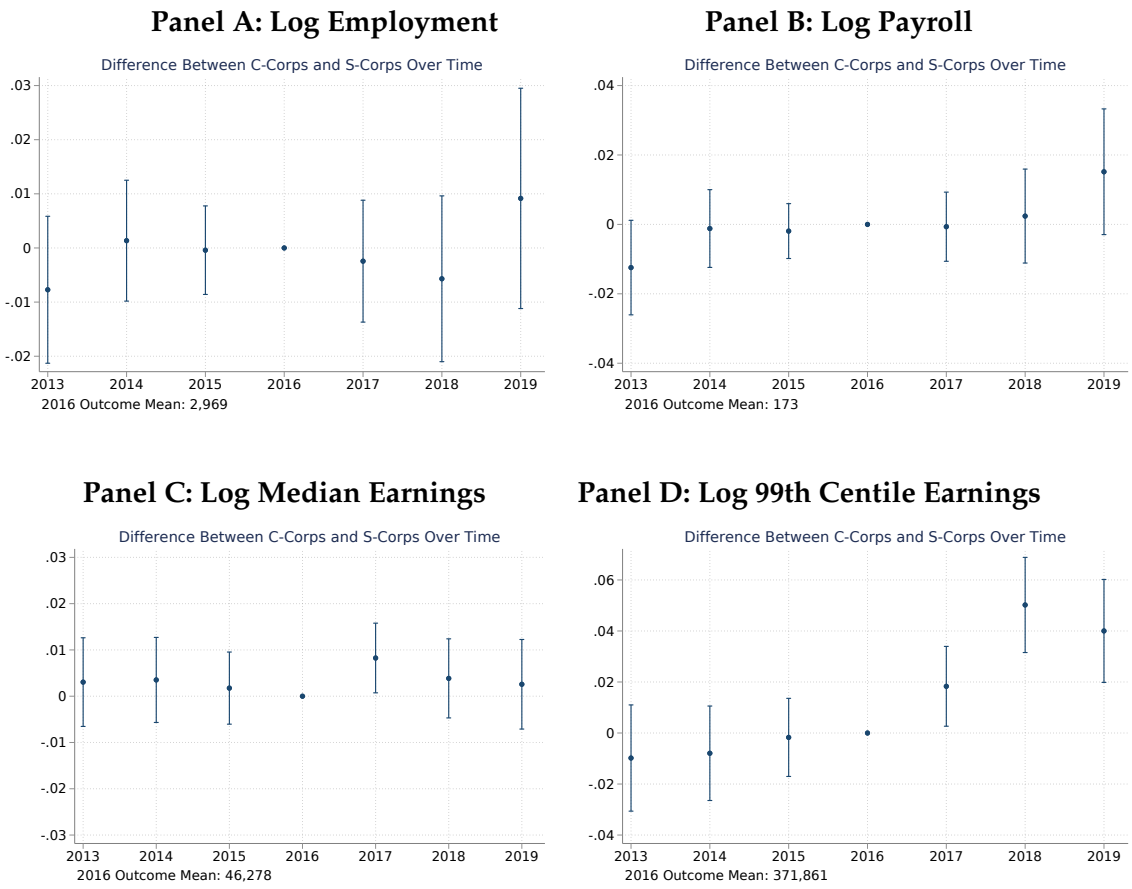
However, Figure 7 reveals a very different pattern for workers in the top 10% of the earnings distribution. Workers in C-corps at the 90th percentile of the within-firm distribution see their relative earnings increase by 1.0% (s.e.=0.3), and these impacts grow steadily larger and statistically sharper further up the distribution. At the 95th percentile, we estimate a relative earnings increase of 1.2% (s.e.=0.4) for C-corp workers, and this magnitude climbs to 4.5% (s.e.=0.8) at the 99th percentile.

We further assess the impacts of MTR cuts on executive pay. Figure 8 estimates equation 1 using as outcomes log officer compensation (observed on IRS Forms 1120 and 1120s) and a proxy variable constructed as the log mean earnings of the top five highest-paid workers at the firm (observed from IRS Form W2). In Panel A, we estimate that the relative earnings of executives increased by 4.6% (s.e.=1.2) at C-corps relative to S-corps, and in Panel B we estimate a quantitatively comparable effect for the earnings of the top 5 highest paid workers at the firm of 4.0% (s.e.=0.8). Because the tax data do not allow us to observe all components of executive compensation, such as awarded bu unvested stock grants, these estimates likely represent a lower bound on the effects of TCJA on executive pay. The fact that executive earnings increase in 2017, before TCJA fully took effect, is consistent with firms intertemporally shifting forward executive compensation, perhaps in the form of bonuses, so that these costs could be deducted at a higher tax rate prior to the corporate rate cut beginning in 2018.

Panel A of Table 5 reports the $C \times Post$ coefficients from equation 2, as well as the dependent variable means in the baseline year and implied elaticities with respect to the net-of-tax rate. For workers at the 95th percentile, we estimate an earnings elasticity of 0.18% (s.e.=0.05), and for executives we estimate a larger earnings elasticity of 0.64% (s.e.=0.17). The mean baseline earnings of these workers and executives are high: the average worker in the sample at the 95th percentile of the within-firm distribution earns $157,639 per year, the average worker in the top five earns

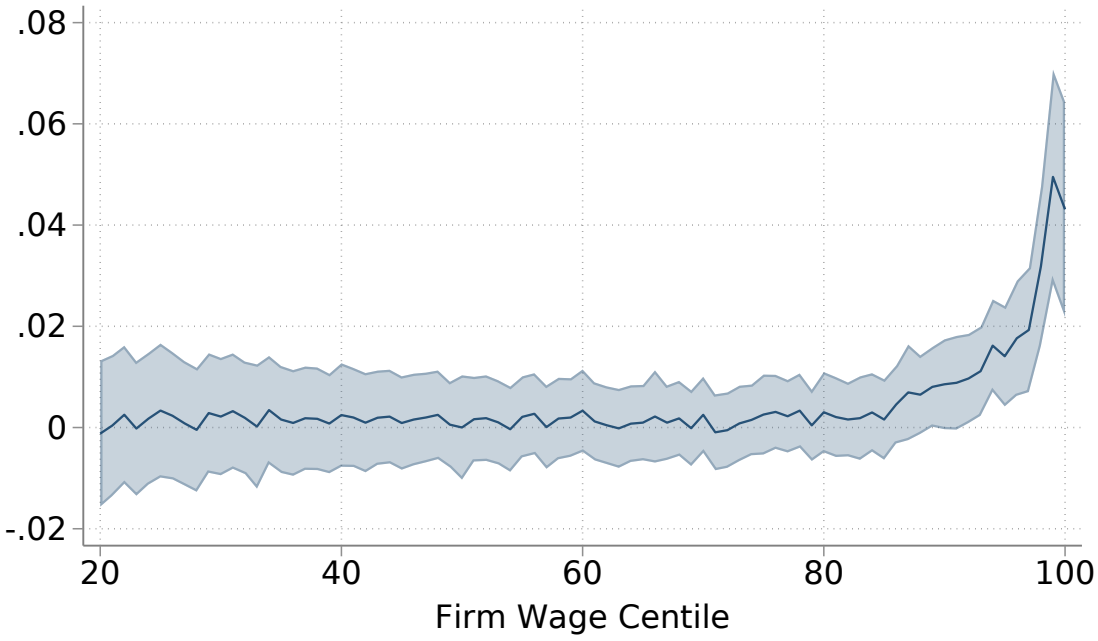
[9] Models of perfect labor competition predict that, in response to an increase in labor demand, wages should increase equally for workers of both C- and S-corps. It is possible that these general equilibrium effects are absorbed in our industry-size-year fixed effects. Our main results abstract from this potential response. we discuss theoretical and empirical strategies for considering potential general equilibrium effects of corporate tax cuts on outcomes such as earnings, profits, and investment in Appendix XXX.

FIGURE 6: EVENT STUDIES: LABOR MARKET OUTCOMES



Notes: Unit of analysis is firm-year. The panels plot the β_t coefficients estimated from equation 1. These coefficients capture average differences in outcomes between C- and S-corps over time after controlling for firm and industry-size-year fixed effects. Standard errors are clustered by firm and error bands show 95% confidence intervals. Employment, payrolls, and annual earnings are computed by matching worker-level W-2's with firm-level tax returns. For additional details on data sources and variable definitions see Section 3.

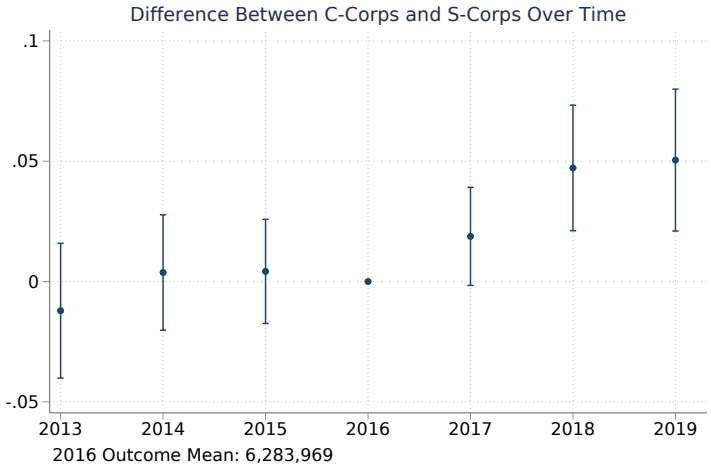
FIGURE 7: EARNINGS QUANTILE REGRESSIONS



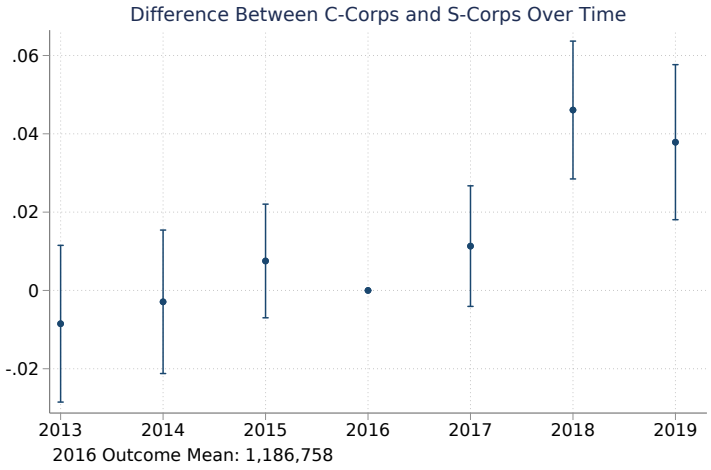
Notes: Unit of analysis is firm-year. Figure plots the β_{2019} coefficients from equation 1, where the outcomes are centiles of the distribution of workers' wages within the firm. For example, centile 50 measures the annual earnings of the median worker within the firm, and centile 90 captures the annual earnings of the worker at the 90th percentile of the within-firm earnings distribution. For additional details on data sources and variable definitions, see Section 3. Standard errors are clustered by firm and error bands show 95% confidence intervals.

FIGURE 8: EVENT STUDIES: EXECUTIVE PAY

Panel A: Log Officer Compensation



Panel B: Log Top 5 Earnings



Notes: Unit of analysis is firm-year. The panels plot the β_t coefficients estimated from equation 1. These coefficients capture average differences in outcomes between C- and S-corps over time after controlling for firm and industry-size-year fixed effects. Standard errors are clustered by firm and error bands show 95% confidence intervals. The right panels are constructed such that the distance between the C-corp and S-corp lines in each year is equal to the corresponding β_t coefficient in the left panel, and such that the observation-weighted average of the two lines is equal to the unweighted sample average of the outcome in each year. For data sources and variable definitions see Section 3.

$1,186,758 per year, and the average annual combined earnings of firm executives is $6,283,969. Applying the baseline sample levels, the average firm net-of-tax-rate change in the sample, and the estimated net-of-tax elasticity, the results imply that average combined executive earnings increased by approximately $270,000 per year. Similar computations yield that average earnings for workers at the 95th percentile increased by approximately $1,900 per year, and that earnings changes for workers below the 90th percentile are statistically indistinguishable from zero.

What drives the sharp increases in executive pay? The coinciding increases in the sales, pre-tax and after-tax profits, and investment of C-corps compared to S-corps suggest there is plausible scope for managerial decisionmaking and effort to drive increased firm productivity. Moreover, in some cases firm owners may incentivize managerial effort by explicitly compensating executives on the basis of firm performance metrics (e.g., Bebchuk and Fried 2003; Murphy 1999; Jensen and Murphy 1990). On the other hand, to the extent that executives have significant bargaining power vis-a-vis shareholders, they may be in a position to extract a portion of after-tax profits even in the absence of improvements in managerial productivity.

In Panel B of Table 5 we perform a series of empirical tests developed by Ohrn (2022) to evaluate the relevance of these competing mechanisms, which are not necessarily mutually exclusive. The outcome in all columns is log officer compensation as reported on Forms 1120 and 1120s. The first column shows the benchmark specification given by equation 2. In the remaining columns, we respectively add controls for three measures of firm performance: sales growth, profit growth, and sales growth relative to other firms in the same industry.[10] To the extent that executive pay is correlated with these performance metrics, we may expect the $C \times Post$ coefficient to shrink as we add the controls.

The results in columns 2-4 show that the $C \times Post$ coefficient on executive pay shrinks only modestly as we add controls for the firm performance metrics. The benchmark estimate of 4.6% declines to a minimum of 4.1% when we add controls for sales growth, and shrinks by a similar amount when controlling for profit growth or sales growth relative to other firms in the same industry. Taken at face value, a plausible estimate is that 1-(4.1/4.6)≈10% of the increase in executive pay is plausibly attributable to improved firm performance, while the remaining 90% may reflect rent-sharing mechanisms. The results are similar when we use our proxy measure of executive pay, reported in Appendix C.3.

These tests are not dispositive — the econometric problems with conditioning on post-treatment outcomes are well-known (e.g., Imbens 2020), and increasing managerial productivity may not be fully reflected in the firm performance metrics over our limited time horizon — but they are suggestive, and give an approximate sense of plausible orders of magnitude. The results are consistent with empirical evidence from Ohrn (2022), who finds that executive pay in publicly traded firms is highly responsive to narrowly targeted corporate tax breaks, and that pay increases are driven by rent-sharing rather than a higher marginal product of labor. The results are also consistent with Bertrand and Mullainathan (2001), who find that

[10] As in Ohrn (2022), another natural performance metric would be earnings per share; however, we do not observe this information for S-corporations or for private C-corporations.

TABLE 5: LABOR MARKET OUTCOMES

Panel A: Labor Market Outcomes

	(1) Emp	(2) Payroll	(3) p50	(4) p90	(5) p95	(6) p99	(7) Top5	(8) Executives
C × Post	0.004	0.012	-0.000	0.010***	0.012***	0.045***	0.040***	0.046***
	(0.008)	(0.008)	(0.004)	(0.003)	(0.004)	(0.008)	(0.008)	(0.012)
2016 Outcome Mean	2,969	173	46,278	113,848	157,639	371,861	1,186,758	6,283,969
ε^{NTR}	0.05	0.18	-0.00	0.14	0.18	0.64	0.59	0.64
s.e.	0.12	0.11	0.05	0.05	0.05	0.12	0.12	0.17
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Size-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R2	0.97	0.97	0.95	0.96	0.95	0.88	0.92	0.92
N	81,529	81,529	81,529	81,529	81,529	81,529	81,529	72,400
N Firms	11,647	11,647	11,647	11,647	11,647	11,647	11,647	10,680

Panel B: Executive Compensation

Outcome is log executive pay				
		Controls for:		
	Benchmark	Sales	Profits	Relative Sales
C × Post	0.046***	0.041***	0.041***	0.042***
	(0.012)	(0.012)	(0.012)	(0.012)
Firm FE	Yes	Yes	Yes	Yes
Industry-Size-Year FE	Yes	Yes	Yes	Yes
R2	0.92	0.92	0.92	0.92
N	72,400	72,400	72,400	72,198
NF	10,680	10,680	10,680	10,678

Panel C: Worker Characteristics

	Bottom 90%	Top 10%	Executives
Mean Wage (2016)	39,688	175,957	1,063,511
Female (Share)	0.45	0.30	0.12
Age (Years)	39.5	46.7	53.5
Firm Tenure (Years)	4.2	5.7	6.0
N Workers	32,386,875	3,924,113	72,117

Notes: Unit of analysis is firm-year. Panel A reports results the $C \times Post$ coefficients obtained from estimating equation 2, where the outcomes are log employment, log payroll, log annual earnings of workers at various centiles of the within-firm income distribution, log mean earnings of the top 5 highest paid workers at the firm, and log executive compensation. These coefficients estimate average differential changes in outcomes between C- and S-corps before and after TCJA, controlling for firm and industry-size-year fixed effects. Panel B estimates variations of equation 2 where the outcome is log executive compensation, and adds time-varying controls for several measures of firm performance. Standard errors in Panels A and B are clustered by firm. Panel C presents descriptive statistics for the individual characteristics of workers in the bottom 90% of the distribution, in the top 10%, and of the top five highest paid workers, where we use the latter as a proxy for executives.

executives are often rewarded for positive shocks to the firm even if those shocks are clearly beyond the manager's control.

To provide additional insight into the distributional impacts of corporate tax cuts on workers' earnings, Panel C of Table 5 presents descriptive statistics on the individual characteristics of workers in the bottom 90% of the firm wage distribution, in the top 10% of the firm wage distribution, and in the group of top five highest paid workers at the firm, which we use a proxy for identifying executives (we do not directly observe which individuals are executives from Form W-2). In our sample, 88% of executives are men, and on average these workers are 53 years old, have worked for their employer for 6 years, and earn over $1 million in annual labor income. By contrast, just 55% of workers in the bottom 90% of the distribution are men, and these workers on average are 39 years old, have worked for their employer for 4 years, and earn less than $40,000 in annual labor income.

Collectively, the findings from Table 5 imply that the short-run effects of corporate tax cuts are regressive, increasing earnings only for workers at the top of the within-firm distribution. The results also demonstrate that the distributional impacts of corporate tax cuts do not affect all demographic groups equally; rather, the beneficiares of the tax cuts are disproportionately likely to be men, to be older, and to have longer tenures at their current employer.

Our results are consistent with studies finding evidence of rent-sharing with high-income workers in response to tax or productivity shocks (Ohrn 2022; Carbonnier, Malgouyres, Py, and Urvoy 2022; Gale and Thorpe 2022; Dobridge, Landefeld, and Mortenson 2021; Kline, Petkova, Williams, and Zidar 2019), but are in tension with other studies finding that the incidence of business income taxes falls substantially on low-income and marginally attached workers (Risch 2021; Fuest, Peichl, and Siegloch 2018). Notably, the former studies finding gains for high-income workers focus on tax cuts, whereas the latter studies finding that costs borne by low-income workers focus on tax increases. A plausible reconciliation of the literature is that tax cuts and tax hikes may have asymmetric labor market effects (see also discussion in Fuest, Peichl, and Siegloch 2018); we view this hypothesis as a fruitful area for future research.

In Appendix C.4, we we study whether causal effects vary by demographic characteristics, and find no evidence of heterogeneous effects after controlling for workers' initial place in the income distribution. We explore additional aspects of heterogeneity in Section 4.7, and return to broader issues of assesssing the incidence of the corporate income tax in Section 5.

4.6 Investment

Figure 9 shows the results from estimating equation 1 to assess relative trends in real net investment of C- and S-corps. As with shareholder payouts, investment is a statistically volatile outcome, and so we investigate both the extensive and intensive margin responses. In Panel A, the outcome is an indicator equal to one if net investment is positive (that is, the extensive margin), where net investment is defined as the change in book value of depreciable capital assets less accumulated book depreciation. In any given year, net investment is negative for approximately

half the firms in our sample. The figure shows that C- and S-corps have similar trends in this outcome over the pre-period, but after TCJA positive net investment among C-corps increases by approximately 2.2 percentage points (s.e.=0.9) relative to S-corps.

On the intensive margin, Panel B of Figure 9 shows trends in the investment rate, defined as net investment scaled by the lagged capital stock. We find that C-corps increase net investment by 3.5% (s.e.=0.9) relative to S-corps after TCJA. For consistency with other previously reported outcomes, in Panel C we also show net investment scaled by baseline 2016 sales. The figure again shows that investment of C-corps increases relative to S-corps, by approximately 0.8 percentage points (s.e.=0.5). In Appendix C.4, we provide additional results on investment using alternate measures.

The elasticity of investment may have implications for economic growth (e.g., Romer and Romer 2010) and, in our setting, has direct implications for assessing the incidence of the corporate tax on capital suppliers (e.g., as in Goolsbee 1998). In column 4 of Table 6, we estimate an investment elasticity of 0.52 (s.e.=0.08), implying that a 1% increase in the net-of-tax rate causes an approximately 0.52% increase in investment. Later, we also estimate the elasticity of investment with respect to the cost of capital. Before doing so, however we must first investigate whether changes in investment are driven by changes in the cost of capital, as in a standard model, or by others channels such as liquidity effects. We thus turn now to a battery of heterogeneity and robustness tests, and then turn to an explicit discussion of mechanisms.

4.7 Firm Heterogeneity

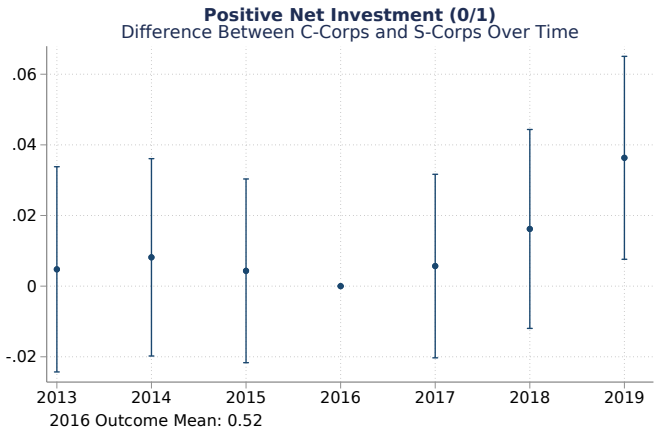
Figure 10 presents our benchmark difference-in-difference estimates (i.e., the $C \times Post$ coefficients and 95% confidence intervals from equation 2) across several dimensions of firm heterogeneity, focusing on the following outcomes: pre-tax profits, costs, employment, payroll, and net investment. We focus on these outcomes due to their natural relevance in assessing whether our estimates are driven by changes real economic activity or by tax and profit shifting behaviors by firms; we also present results on other outcomes in Appendix C.6.

Existing research has emphasized that the effects of tax changes may vary by firm size (where smaller firms may be better able to engage in tax shifting, as in Giroud and Rauh 2019); by liquidity (where low-cash firms may face borrowing constraints and thus respond more elastically to tax changes, as in Zwick and Mahon 2017 and Saez, Schoefer, and Seim 2019); by factor intensity (where capital-intensive firms may be most responsive to a shock, as in Acemoglu and Guerrieri 2008); by firm profitability (where highly profitable firms may be managed more effectively, as suggested by Bloom and Van Reenen 2007); by unionization rates (where highly unionized firms may reduce firms' profits and investment, as studied in Card, Devicienti, and Maida 2014); and by industry concentration (where highly concentrated firms may be better able to pass the costs of tax increases to their input suppliers, as in Fuest, Peichl, and Siegloch 2018 and Juarez 2022).

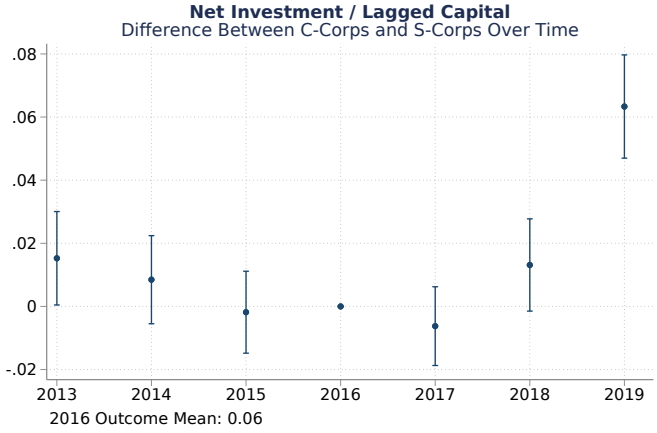
Here we focus on heterogeneity across the first three of these characteristics — firm size, liquidity, and capital intensity — and report additional heterogeneity tests in Appendix C.6. Firm

FIGURE 9: EVENT STUDIES: NET INVESTMENT

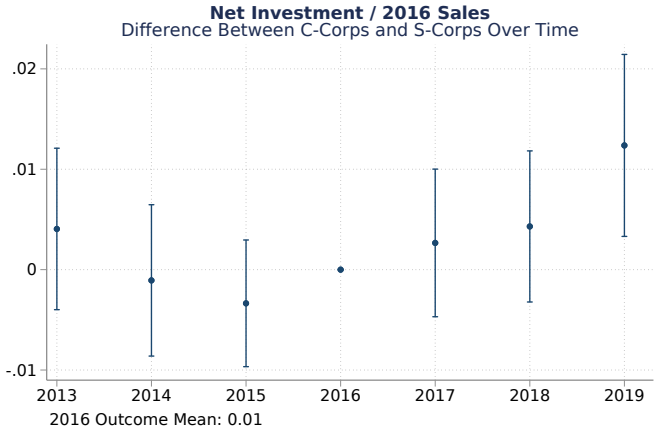
Panel A: Positive Net Investment (0/1)



Panel B: Net Investment / Lagged Capital



Panel C: Net Investment / 2016 Sales



Notes: Unit of analysis is firm-year. The figure plots the β_t coefficients estimated from equation 1. These coefficients capture average differences in outcomes between C- and S-corps over time after controlling for firm and industry-size-year fixed effects. Standard errors are clustered by firm and error bands show 95% confidence intervals. Net investment is defined as the change in book value of depreciable capital assets minus accumulated book depreciation. The outcome in Panel A is an indicator equal to 1 if net investment is positive. The outcomes in Panels B and C, are net investment scaled by lagged capital and by baseline 2016 sales, respectively. For data sources and variable definitions see Section 3.

TABLE 6: NET INVESTMENT

	(1) $I_t > 0$	(2) I_t / K_{t-1}	(3) I_t/Sales$_{2016}$	(4) I_t / K_{t-1}
C $\times$ Post	0.022^{**}	0.035^{***}	0.008^{***}	
	(0.009)	(0.005)	(0.003)	
$\Delta \ln(1-\tau_f) \times$ Post				0.515^{***}
				(0.082)
2016 Outcome Mean	0.52	0.06	0.01	0.06
Firm FE	Yes	Yes	Yes	Yes
Industry-Size-Year FE	Yes	Yes	Yes	Yes
R2	0.29	0.22	0.26	n.a.
N	81,529	81,529	81,529	81,529
N Firms	11,647	11,647	11,647	11,647
First-Stage F				403.8

Notes: The unit of analysis is a firm-year. Columns 1-3 report the $C \times Post$ coefficients from equation 2. These coefficients estimate average differential changes in outcomes between C- and S-corps before and after TCJA, controlling for firm and industry-size-year fixed effects. Standard errors are clustered by firm. Net investment is defined as the change in book value of depreciable capital assets minus accumulated book depreciation. The outcome in column 1 is an indicator equal to 1 if net investment is positive. The outcomes in columns 2 and 3 are net investment scaled by lagged capital and by baseline 2016 sales, respectively. Column 4 reports the elasticity of net investment with respect to the net-of-tax rate, computed from equation 4.

size is defined using the the pre-TCJA employment bins used in our main analysis, although here we exclude very large firms (defined as those with greater than $1 billion in sales or greater 10,000 employees in 2016) to ensure that results in the largest firm size bin are not driven by C-corps with no comparably sized S-corps. We measure cash as the sum of the firm's liquid assets, and classify firms as high-cash if their average cash-to-assets ratio in the pre-period is greater than the median value for the sample. Capital intensity is defined as in Section 3.3.

When we test for heterogeneity across firm size we include only industry-year fixed effects in our regression specifications; for all other specifications we include industry-size-year fixed effects. To obtain the point estimates in Figure 10 we run the model separately for each subsample of firms.

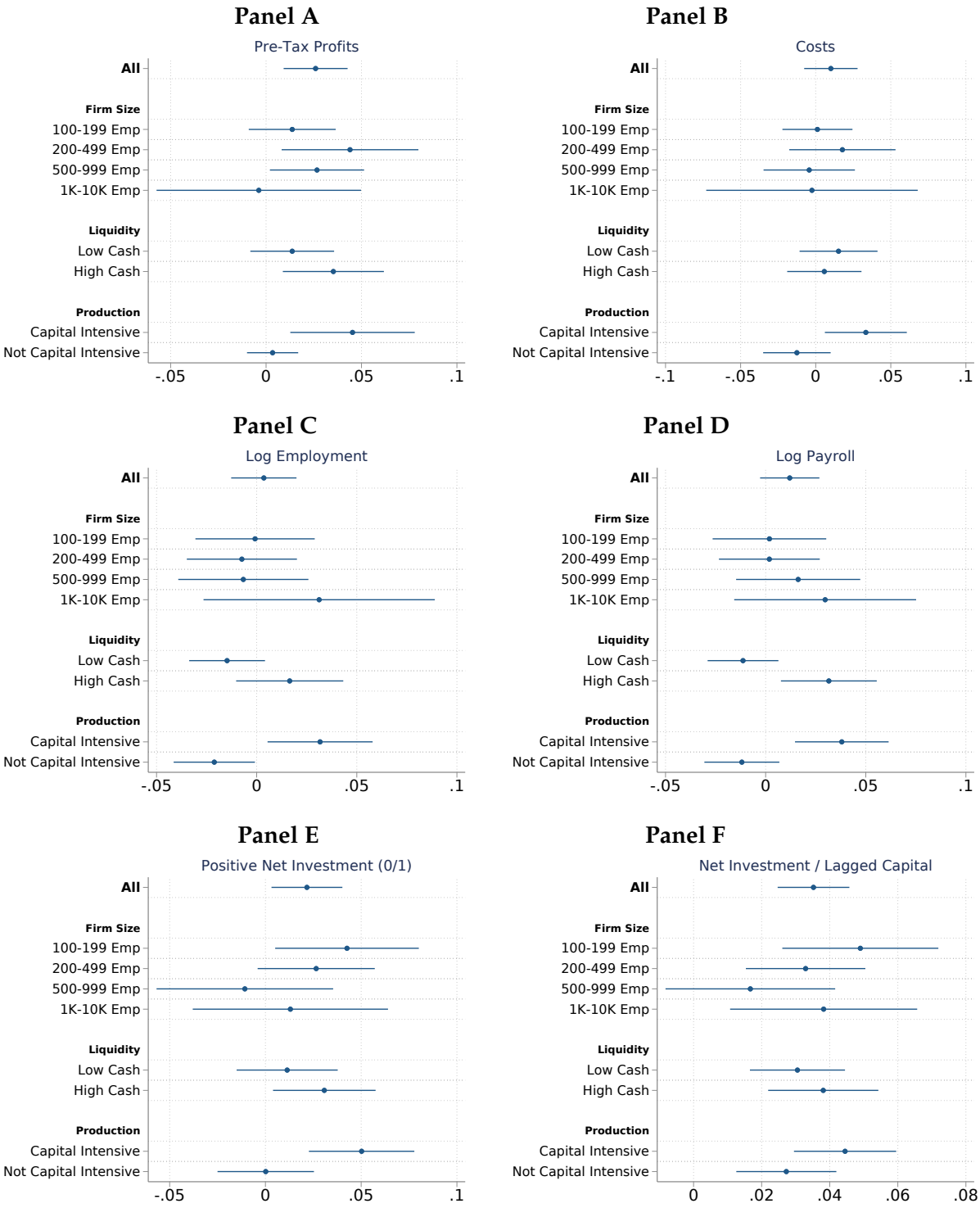
Looking across the outcomes in Figure 10, we find no clear pattern with respect to firm size. With respect to liquidity, we similarly do not find statistically significant differences between high- and low-cash firms; although, taking the point estimates at face value, the results suggest that high-cash firms are if anything weakly *more* responsive than low-cash firms in our sample. These results contrast with Zwick and Mahon (2017), who find that small and financially-constrained firms are most likely to increase investment and payrolls in response to bonus depreciation incentives. While we find that smaller firms have larger point estimates than larger firms, these differences are not statistically significant.

Several factors may explain why our findings differ from Zwick and Mahon (2017). First, Zwick and Mahon study countercyclical policies enacted during U.S. recessions, when financial constraints are most likely to be binding. By contrast, TCJA was enacted during a long macroeconomic expansion with low interest rates and favorable financial conditions. Second, Zwick and Mahon find that responses are largest for the smallest firms in their sample. By contrast, our sample includes only medium-to-large sized firms. Finally, Zwick and Mahon use an identification strategy that exploits cross-industry exposure to bonus depreciation incentives. By contrast, our identification strategy exploits within-industry variation in tax policy, and as such our industry-size-year fixed effects may absorb any time-varying policy impacts that affect both C- and S-corps similarly.

Although policy impacts do not appear to vary with firm size or liquidity, Figure 10 shows evidence that they do appear to vary with capital intensity. C-corps in capital intensive industries are much more likely than comparable S-corps to increase their pre-tax profits, costs, employment, and total payrolls in the years following TCJA, and the differences are both economically and statistically significant. The evidence also suggests that capital-intensive C-corps are somewhat more likely than comparable S-corps to increase investment, although the differences are not statistically significant. The fact that the investment responses for these firms are similar, even while the profit and cost elasticities are larger, suggests that the elasticity of output with respect to capital inputs is likely larger in capital intensive industries, as in Acemoglu and Guerrieri (2008).

In Appendix C.6 we show the full event studies separately for capital-intensive and non-capital-intensive firms, and present additional heterogeneity tests. In general, we do not find clear evidence that policy effects vary with firm profitability, unionization rates, or market

FIGURE 10: FIRM HETEROGENEITY



Notes: The unit of analysis is a firm-year. The table shows the $C \times Post$ coefficients from equation 2. These coefficients estimate average differential changes in outcomes between C- and S-corps before and after TCJA, controlling for firm and industry-size-year fixed effects. Standard errors are clustered by firm.

concentration.

4.8 Robustness

Having presented the main results, we turn now to assessing their robustness and to addressing potential threats to our identification strategy. The identifiying assumption underlying our elasticity estimation strategy is that the outcomes of C- and S-corps would have trended similarly in the absence of TCJA's marginal income tax rate cuts. While this assumption is not directly testable, the event studies above show that C- and S-corps followed broadly similar trends prior to TCJA, lending support to its plausibility. However, if the differential tax cuts affecting C- and S-corps following TCJA are correlated with simultaneous supply or demand shocks — for example, due to other provisions of the legislation or external events differentially affecting C- and S-corps — then our causal estimates would be biased. To address concerns about robustness and identification, we present specifications with alternate controls and samples, and explicitly consider how other provisions of TCJA, unrelated external events, anticipation effects, and tax-shifting behaviors may affect our analysis.

Alternate Specifications

Row 1 of Table 7 reports the key net-of-tax elasticities obtained from estimating equation 1 using our benchmark specification. We focus on the outcomes that will serve as key inputs in our analyses of welfare and incidence: pre- and after-tax profits; the earnings of executive and high- and low-paid workers; and net investment. In the remaining rows, we examine the sensitivity of these estimates to alternate modeling choices. Unless otherwise noted, all specifications include firm and industry-size-year fixed effects.

In row 2 we control for cohort-by-year fixed effects, where cohorts are defined using the firms' year of incorporation. This specification implies that the elasticities are identified from comparisons of C- and S-corps that are the same age.

In row 3 we controls for state-by-year fixed effects, where a firm's state is defined using the address reported on Form 1120 or 1120s. In practice, the operations of large or exporting firms may span many states. Therefore, this specification controls for location-specific trends to the extent that firm performance is influenced by time-varying shocks associated with the firm's reported tax address.

Although we do not observe any systematic evidence that C- and S-corps were on different trends prior to TCJA, in row 4 we nevertheless probe the sensitivity of the estimates to adding pre-trend controls. Specifically, we control for lagged outcomes in 2013, 2014, 2015, and 2016, and interact each of the lagged outcomes with year indicators.

In row 5 we show the results using a log transformation of the outcome. These specifications implicity exclude observations in which the outcome is zero or negative. For outcomes where the benchmark specificaiton was already logged, the results are the same as in row 1.

In column 6, we winsorize the outcomes at the 5th and 95th percentiles. These specifications provide information about the extent to which the estimates are driven by changes in outcomes at the tails of the outcome distribution.

In general, the elasticity estimates across all specifications and outcomes are stable and within the 95% confidence interval of the benchmark specification in row 1.

TABLE 7: ROBUSTNESS TO ALTERNATE SPECIFICATIONS

	(1) ε^B	(2) ε^π	(3) $\varepsilon^{w_{p50}}$	(4) $\varepsilon^{w_{p95}}$	(5) $\varepsilon^{w_{exec}}$	(6) ε^I
Specification	Pre-Tax π	After-Tax π	p50 w	p95 w	Exec w	I_t / K_{t-1}
1. Benchmark	0.379	0.521	-0.001	0.176	0.639	0.515
	(0.127)	(0.129)	(0.052)	(0.053)	(0.169)	(0.082)
2. Age Controls	0.247	0.397	-0.010	0.150	0.468	0.519
	(0.119)	(0.122)	(0.050)	(0.050)	(0.161)	(0.078)
3. Location Controls	0.361	0.502	-0.016	0.165	0.685	0.486
	(0.130)	(0.132)	(0.052)	(0.053)	(0.168)	(0.081)
4. Pre-Trend Controls	0.434	0.471	0.091	0.262	1.103	0.535
	(0.117)	(0.121)	(0.048)	(0.050)	(0.172)	(0.075)
5. Log Outcome	0.234	0.372	-0.001	0.176	0.639	0.790
	(0.136)	(0.137)	(0.052)	(0.053)	(0.169)	(0.452)
6. Winsorize 5-95	0.257	0.279	-0.009	0.148	0.761	0.302
	(0.051)	(0.050)	(0.041)	(0.043)	(0.150)	(0.066)

The table shows net-of-tax elasticities for key outcomes estimated from variations on equation 4. Unless otherwise indicated, all specifications include firm and industry-size-year fixed effects. The outcomes in columns 1 and 2 are scaled by baseline 2016 sales, the outcomes in columns 3-5 are logged, and the outcome in column 6 is scaled by lagged capital. Row 1 shows the benchmark specification. Row 2 controls for firm age by including cohort-by-year effects, where cohorts are defined as the firms' year of incorporation. Row 3 controls for state-by-year fixed effects, using the firm's reported address on its tax return. Row 4 controls for pre-trends, interacting the lagged pre-TJCA outcomes with year indicators. Row 5 shows a log transformation of the outcome rather than scaling by baseline sales; four columns 3-5, the results are the same as in row 1. Row 6 winsorizes the outcomes at the 5th and 95th percentiles. Standard errors clustered by firm.

Alternate Samples

Table 7 shows robustness results for the same key elasticities using alternate samples. Row 2 excludes firms with 2016 sales greater than $1 billion or 2016 employment greater than 10,000. This sample restriction effectively excludes C-corps that are larger than the largest S-corps. Row 3 excludes "mismatched" industries, defined as those in which C-corps account for greater than 80% or less than 20% of the firms in the sample. Row 4 excludes manufacturing firms, which may have been more affected, for example, by the US-China trade war that ocurred during our sample period

(Fajgelbaum, Goldberg, Kennedy, and Khandelwal 2020). In all the samples, the magnitudes are broadly similar to the benchmark specification.

Other Provisions of TCJA

Beyond reducing marginal corporate income tax rates, TCJA also introduced several new policies affecting various business tax deductions, the taxation of foreign business income, and capital investment incentives. To assess the extent to which our estimates may be driven by these policy changes rather than by the rate cuts, below we briefly summarize the major provisions of TCJA affecting corporations, and then present several additional robustness checks. For more details on these reforms, see Auerbach (2018) and Joint Committee on Taxation (2018).

- **Net Operating Loss (NOL) Deductions:** TCJA limited NOL deductions to 80% of a corporation's taxable income, eliminated NOL carrybacks, and allowed indefinite NOL carryforwards.
- **Domestic Production Activities Deduction (DPAD):** TCJA repealed DPAD, which provided a tax deduction to corporations that produce manufactured goods within the United States.
- **Alternative Minimum Tax (AMT):** TCJA repealed the corporate AMT, which imposed a minimum tax of 20% on corporations' relevant taxable income in excess of a $40,000 exemption threshold, excluding the firm's AMT foreign tax credit.
- **Interest Deductions**: TCJA limited the interest payment deductions to 30% of adjusted taxable income.
- **Bonus Depreciation:** TCJA temporarily allowed corporations to immediately deduct 100% of the cost of newly purchased eligible capital investments (known as "full expensing"), an increase from 50% prior to TCJA, but scheduled to phase out beginning in 2023.
- **Taxation of Foreign Income**: TCJA introduced several changes to taxation of corporations' income earned abroad. The most significant changes include: (a) a one-time tax on previously accumulated foreign income and an elimination of tax on repatriated income; (b) a minimum tax on foreign income above a threshold return on tangible assets (known as Global Intangible Low-Taxed Income, or GILTI); (c) a minimum tax on deductible related-party transactions to U.S. subsidiaries — known as the Base Erosion and Anti-Abuse Tax, or BEAT); and (d) a lower tax rate on income earned from foreign sales, known as Foreign Derived Intangible Income, or FDII).

Ex-ante, it may seem unlikely that these other provisions would drive our results, for two reasons. First, because TCJA's non-rate policy changes broadly applied to both C- and S-Corps, our difference-in-difference design implicitly controls for them to the extent that C- and S-corps were similarly affected. Second, the legislative budget scoring report by the Congressional Joint

Committee on Taxation (2017) projected that the rate cuts would do more than any other business tax provision of TCJA to reduce tax revenues, making those rate cuts natural suspects.

Neverthless, these considerations do not rule out that other provisions of TCJA may affect our estimates. For example, if C- and S-corps were differentially exposed to these policy changes — for example, perhaps because C-corps are more likely to earn foreign income than S-corps and thus more likely to be affected by the international provisions — then our net-of-tax elasticities may be biased. In the case of bonus depreciation, theory suggests that the effect of the tax rate may interact with the expensing rate; we discuss this possibility in greater detail in Section 4.9.

To assess the sensitivity of our estimates to alternate policy changes, in rows 5 to 9 of Table 8 we implement a series of additional robustness tests in which we exclude the firms most likely to be affected by each respective provision of TCJA. In row 5, we exclude industries where net operating losses are most common, defined as those where the share of firms reporting a loss in the pre-period is greater than the sample median. We similarly define and exclude industries where firms were most likely to claim the DPAD deduction (row 6) or exceed the interest limitation threshold (row 7). In row 8 we exclude industries where firms were most exposed to changes in bonus depreciation, defined as those where the ratio of bonus-eligible investment to sales is greater than the sample median in the pre-period, and in row 9 we exclude the multinational firms in our sample. Across the different samples, the results remain within the confidence interval of the benchmark estimates in row 1.

Anticipation Effects

If businesses expected the federal government to cut corporate taxes long before TCJA was formally enacted, they may have adjusted their behavior in anticipation of actual policy changes. In that case, a naive empirical strategy that compares outcomes of firms before and after TCJA risks underestimating the absolute magnitude of treatment effects, since a portion of the treatment effects would be captured in the pre-period data.

However, a careful consideration of the legislative history of TCJA suggests that anticipation effects are unlikely to bias our elasticity estimates. Pre-election polling and betting market spreads, as well as post-election stock market responses and media coverage, indicated that the November 2016 federal election outcome was difficult to predict and largely unexpected by the public.[11] Because members of the two major U.S. political parties generally have different preferences over business tax policy, the fact that the election was widely unexpected implies that firms and workers could not have significantly adjusted their behavior long in advance of TCJA. While it is possible that our empirical results may capture some anticipations effects during 2017 while policy negotiations were ongoing, in Appendix C.8 we report elasticity esimates based on changes in outcomes between 2016 and 2019 — where the former is long before the legislative details of TCJA were promulgated – and the results are similar. Moreover, because our difference-in-difference

[11] For pre-election polling, see a composite of surveys compiled by Real Clear Politics here. For betting spreads, see time series data from PredictIt here. For examples of media coverage, see here. For stock market responses, see here.

TABLE 8: ROBUSTNESS TO ALTERNATE SAMPLES

Sample	(1) ε^B Pre-Tax π	(2) ε^π After-Tax π	(3) $\varepsilon^{w_{p50}}$ p50 w	(4) $\varepsilon^{w_{p95}}$ p95 w	(5) $\varepsilon^{w_{exec}}$ Exec w	(6) ε^I I_t / K_{t-1}
1. All Firms	0.379	0.521	-0.001	0.177	0.645	0.516
	(0.127)	(0.129)	(0.052)	(0.053)	(0.169)	(0.082)
2. Exclude Large C-Corps	0.376	0.540	0.021	0.207	0.778	0.547
	(0.142)	(0.144)	(0.056)	(0.058)	(0.178)	(0.089)
3. Exclude Mismatch Industries	0.277	0.435	0.002	0.149	0.529	0.523
	(0.132)	(0.134)	(0.054)	(0.053)	(0.173)	(0.085)
4. Exclude Mfg Industries	0.344	0.545	0.093	0.245	0.814	0.618
	(0.149)	(0.152)	(0.069)	(0.068)	(0.222)	(0.109)
5. Exclude NOL Industries	0.213	0.390	-0.023	0.097	0.353	0.319
	(0.138)	(0.143)	(0.051)	(0.056)	(0.176)	(0.083)
6. Exclude DPAD Industries	0.244	0.495	0.123	0.170	0.640	0.608
	(0.168)	(0.173)	(0.076)	(0.074)	(0.238)	(0.119)
7. Exclude High-Debt Industries	0.789	1.120	0.077	0.474	0.918	0.813
	(0.243)	(0.252)	(0.090)	(0.106)	(0.309)	(0.166)
8. Exclude Bonus Industries	0.320	0.364	0.078	0.208	0.697	0.559
	(0.135)	(0.134)	(0.071)	(0.074)	(0.241)	(0.119)
9. Exclude Multinationals	0.221	0.406	0.012	0.217	0.773	0.575
	(0.116)	(0.118)	(0.056)	(0.059)	(0.187)	(0.093)
10. Exclude Small Firms	0.442	0.601	0.022	0.186	0.644	0.452
	(0.163)	(0.165)	(0.062)	(0.060)	(0.203)	(0.093)
11. Exclude Single-Owner S-Corps	0.378	0.478	0.008	0.162	0.640	0.477
	(0.122)	(0.124)	(0.050)	(0.052)	(0.162)	(0.079)

The table shows net-of-tax elasticities for key outcomes estimated from equation 4 using alternate samples. All specifications include firm and industry-size-year fixed effects. The outcomes in columns 1 and 2 are scaled by baseline 2016 sales, the outcomes in columns 3-5 are logged, and the outcome in column 6 is scaled by lagged capital. Row 1 shows the benchmark specification. Row 2 excludes firms with 2016 employment of greater than 10,000 or 2016 sales greater than $1 billion. Row 3 excludes industries where the firm share of C-corps is less than 20% or greater than 80%. Row 4 excludes manufacturing industries. Row 5 excludes industries where net operating losses are most common in the pre-period. Row 6 excludes industries most likely to claim the Domestic Production Activities Deduction in the pre-period. Row 7 excludes industries where firms are highly leveraged. Row 8 excludes industries most likely to claim bonus depreciation. Row 9 excludes multinational firms. Row 10 excludes firms with fewer than 199 employees, in our smallest firm-size bin. Row 11 excludes S-corps with only a single owner.

design compares relative changes in the trends of C- and S-corps, any anticipatory responses prior to 2017 affecting all firms are absorbed in our industry-size-year fixed effects.

Tax Shifting and Evasion

Tax-shifting behaviors are strategies employed by firms to minimize their tax burdens without significantly altering their broader economic behavior. Recent research emphasizes that taxable income elasticities must be interpreted with caution to the extent that firms engage in tax-shifting behaviors (e.g., Gorry, Hubbard, and Mathur 2021; Saez, Slemrod, and Giertz 2012). These behaviors may include intertemporal shifting (e.g., firms accelerate deductions or delay income in the years directly before and after a tax cut to minimize their tax burdens, for example as in Dowd, Giosa, and Willingham 2020) or shifting across tax bases (e.g., when owners of pass-through firms shift income between the corporate and individual sectors, for example as in Auerbach and Slemrod 1997 and Slemrod 1995).

Estimation strategies that do not account for shifting may yield misleading elasticities. In the case of intertemporal shifting, if revenue leakage in one year is offset by revenue gains in subsequent years (or vice versa), the choice of measurement years may materially impact the elasticity magnitudes. In the case of shifting across tax bases — in essence, a form of fiscal externality — elasticities that measure only a single tax base may exaggerate the decline in taxable income resulting from a tax incease (or vice versa for a tax cut).

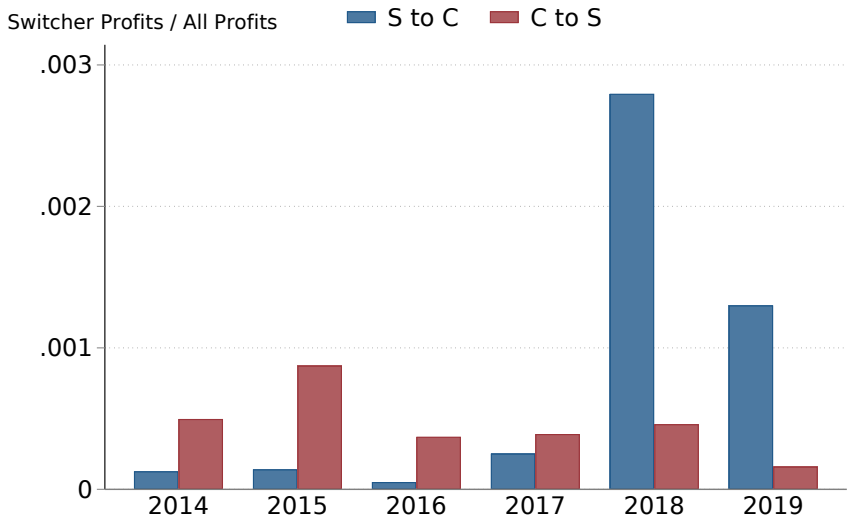
The elasticites that we report in Tables 3, 6, and 5 compare the relative changes in outcomes of C- and S-corps before and after TCJA. To assess the sensitivity of these estimates to shifting behaviors, in Appendix C.8 we show results where the elasticities are estimated from the differential change in C- and S-corps from 2016 to 2019. These specifications avoid capturing intertemporal tax-shifting behaviors in 2017 and 2018, the years where intertemporal shifting is likely to be most significant. The results are statistically similar to the benchmark results from equation 2.

In principle, shifting across tax bases is possible across several different margins. For example, firms may change their entity-type, switching from C to S status or vice versa. S-corps owners may choose to reclassify their wages as profits to maximize the value of the QBI deduction. The incentive to reclassify wages in this way is strongest for S-corps with just one owner: because wage costs are deductible, in firms with more than one owner, this form of shifting comes at the expense of the other owners, who are unlikely to approve of it. Multinational firms may have incentives to book their profits domestically rather than abroad in response to the new international tax provisions. Finally, to the extent that tax cuts reduce incentives for tax evasion (that is, illegal misreporting of income), this is most likely to be true among small firms, which are least likely to be audited.

To evaluate the extent of entity-type switching, Figure 11 shows the profit-weighted share of entity-type switchers in each year of our sample both before and after TCJA. The combined switching rate of both C and S corps prior to TCJA was less than 0.3%, and this share increased only

trivially after TCJA to less than 0.4%. Thus, although we document a clear increase in entity-type switching after TCJA, this form of tax shifting is negligible and does not bias our elasticities.

FIGURE 11: CORPORATE ENTITY-TYPE SWITCHING, 2013-2019



Notes: Figure shows the profit-weighted share of firms that switch their legal entity type from C-to-S or from S-to-C over our sample period. Entity switching is very rare, and increased only modestly after TCJA.

To further assess the sensitivity of our estimates to firms with potentially high shifting or evasion propensities, in Table 8 we run our benchmark specification from equation 4 on samples that: exclude multinational firms (row 6); exclude small firms (row 10); and exclude S-corps with only one owner (row 11). The point estimates are statistically indistinguishable from the benchmark specification and do not suggest that income shifting across tax bases is a significant concern in our setting. These findings are also consistent with contemporaneous research. With respect to S-corps, Goodman, Lim, Sacerdote, and Whitten (2021) study a large sample of de-identified tax returns of pass-through businesses and find that S-corps mostly did not engage in wage-to-profit shifting in response to the QBI deduction. With respect to multinationals, Garcia-Bernardo, Janskỳ, and Zucman (2022) find only small changes in the share of US multinational profits booked abroad following TCJA.

4.9 Mechanisms and the Cost of Capital

In Section 4.7 we provided evidence that our empirical results are unlikely to be driven by liquidity effects. In this section we argue that our findings are consistent with dynamic theories in which firms are responsive to both current and future changes in the cost of capital. To illuminate these mechanisms, we first begin with a static model of the corporate income tax. Suppose firms optimize after-tax profits π:

$$\pi = F(K, L)(1 - \tau) - wL(1 - \tau) - rK(1 - \theta\tau) \tag{5}$$

where τ is the corporate income tax rate, and $\theta \in [0, 1]$ is an expensing rate parameter capturing the share of production costs that are tax deductible. These costs may include fully deductible capital purchases (such as durable equipment eligible for bonus depreciation), partially deductible capital purchases (such as structures), and non-deductible costs (such as managerial effort, to the extent that it is not reflected in cost-deductible compensation). We assume that $F(K, L)$ varies across firms due to heterogeneous productivities, such that some firms are able to produce greater output than others with a fixed set of inputs. The first-order condition for profit maximization with respect to capital yields:

$$\underbrace{\frac{\partial F}{\partial K}}_{\text{MRPK}} = \underbrace{\frac{(1 - \theta\tau)}{1 - \tau} r}_{\text{cost of capital}} \equiv \phi \tag{6}$$

where the left side of the equation is the marginal revenue product of capital, and the right side expression is defined as the user cost of capital, ϕ. The expression shows that, in general, either decreasing the tax rate τ or increasing the expensing parameter θ lowers the cost of capital ϕ. However, if all production costs are tax deductible (corresponding to the "full expensing" case where $\theta = 1$), then the tax rate does not affect the cost of capital, and thus does not affect capital demand.

In our setting, TCJA permanently cut the corporate tax rate and, due to the bonus incentives discussed in Section 4.8, also temporarily increased the expensing rate (for some assets, up to 100%). In response to the lower cost of capital, standard models predict that firms will demand more capital (that is, invest more), demand more labor (to the extent that capital and labor are complements), and increase their scale (in part because a higher capital stock may make the firm more productive).

How should we make sense of the simultaneous changes in the tax rate and depreciation allowances in our setting? Which policy instrument is driving the results? In a two-period model where the changes in expensing are assumed to be permanent, such that $\theta_{pre} < 1$ and $\theta_{post} = 1$, equation 6 implies that the relative change in the cost of capital wedge for C- versus S-corps is given by the following expression:

$$\frac{\phi^C_{post}}{\phi^C_{pre}} - \frac{\phi^S_{post}}{\phi^S_{pre}} = \frac{(1 - \theta\tau^C_{pre})}{1 - \tau^C_{pre}} - \frac{(1 - \theta\tau^S_{pre})}{1 - \tau^S_{pre}} \tag{7}$$

In this expression, the change in the cost of capital wedge is only a function of the initial levels of the tax rates, τ^C_{pre} and τ^S_{pre}, and is not affected by the changes in tax rates or by the levels of the rates in the post-period. Because initial marginal income tax rates in our sample are higher for

S-corps than for C-corps — that is, $\tau^S_{pre} > \tau^C_{pre}$ — equation 7 implies that, at least for capital assets eligible for bonus depreciation, S-corps faced a larger reduction in the cost of capital than C-corps following TCJA. As a result, the model would predict that S-corps should increase investment, employment, and sales relative to C-corps — the exact opposite of our empirical findings.

That the qualitative predictions from this model differ from our empirical results suggests that the simple model does not fully capture economic reality. In practice, some capital expenditures, such as structures, do not qualify for bonus deprecitation. Moreover, existing studies show that a large fraction of firms do not claim bonus depreciation even when eligible to do so (Kitchen and Knittel 2016; see also Joint Committee on Taxation 2021), suggesting the corporate rate change may remain relevant for firm behavior.

A complementary plausible reconciliation of evidence and theory in our setting appeals to richer models that incorporate dynamics and adjustment costs, as in Auerbach and Hassett (1992). In these models, firms respond not only to current tax rates but also to the future path of policy. In the presence of high adjustment costs, firms will be highly sensitive to future policy, since investment will depend not only on the user cost of capital today but on the user cost of capital in the future. Because TCJA's provisions primarly favoring C-corps were made permanent (the large corporate rate cut), while the provisions favoring S-corps were made temporary (the QBI deduction), and the provisions benefitting both were also temporary (the increase in expensing), our empirical results are consistent with the view that firms considered the future path of tax policy in response to TCJA.

In Appendix C.9, we adpot the Auerbach and Hassett (1992) model and use cost-of-capital estimates from Foertsch (2018) to estimate structural elasticities with respect to (net of) effective marginal tax rates. The model can flexibly incorporate salient features of firm behavior and of the U.S. business tax provisions before and after TCJA, including: forward-looking expectations; adjustment costs in investment; different tax rates on the income of shareholders of C- versus S-corps, including individual-level taxes on divdends, capital gains, interest income, and distributions of nonqualified annuities; the expansion and phase-out of bonus depreciation, as well as incomplete take-up of bonus; and the sunsetting of the QBI deduction. Our net-of-tax elasticities using this method are very similar to our benchmark results reported in row 1 of Table 7.

5 Revenue Impacts, Excess Burden, and Incidence

In this section we leverage the reduced form elasticities estimated in Section 4 to evaluate the short-run revenue impacts, excess burden, and incidence of TCJA's corporate tax cuts. We adopt a transparent framework in the style of Feldstein (1999), such that elasticities of key outcomes with respect to the net-of-tax rate are sufficient to estimate the aggregate welfare consequences of changes in tax policy. As discussed in Saez, Slemrod, and Giertz (2012), the empirical validity of this approach rests on two key assumptions: (a) neglible tax shifting, and (b) neglible income

effects. In Section 4.8 we presented several empirical tests suggesting that shifting behaviors are unlikely to drive our estimate of the corporate taxable income elasticity. Moreover, our heterogeneity tests in Section 4.7 showed that high- and low-liquidity firms responded similarly to corproate tax cuts, suggesting income effects are indeed neglible in our setting.

For clarity and to facilitate comparison with existing literature, when interpreting the results we focus only on the core provisions of TCJA relating to firms' marginal income tax rates, and abstract from issues relating to changes in personal income taxes, deficit financing, public goods provision, consumer prices, and dynamics.

Revenue Impacts

Starting from the firm problem in equation 5, let the corporate tax base B be defined as firm revenues less deductible costs:

$$B = F(K, L) - wL - \theta rK \tag{8}$$

Total corporate tax revenues T are the product of the tax base B and the corporate tax rate τ:

$$T = \tau B \tag{9}$$

In the absence of behavioral responses, mechanical changes in tax revenue from a change in the corporate net-of-tax rate $1 - \tau$ are given by holding the tax base constant:

$$dM = -Bd(1 - \tau) \tag{10}$$

The additional change in tax revenue generated by behavioral responses is given by:

$$dB = \frac{\varepsilon^B B\tau}{1 - \tau} d\tau \tag{11}$$

where $\varepsilon^B = \frac{\partial B/B}{\partial(1-\tau)/(1-\tau)}$ is the elasticity of taxable income with respect to the net-of-tax rate, equivalently called the elasticity of pre-tax profits or the elasticity of the corporate income tax base. Intuitively, the extent to which revenue losses from tax cuts are offset by an expanding tax base is directly proportional to the taxable income elasticity ε^B. The total change in tax revenue is given by:

$$dT \equiv dM + dB = dM \left[1 - \frac{\tau \varepsilon^B}{1 - \tau} \right] \tag{12}$$

where dT is the sum of the mechanical and behavioral reponses.[12]

Welfare and Excess Burden

Define aggregate welfare W as the sum of after-tax private income Y and public tax revenues T:

[12] For simplicity, here we abstract from the effects of corporate tax changes on personal income tax revenues.

$$W = Y + T \tag{13}$$

where taxes are defined as in equation 9, and Y is the sum of private income received by firm owners (π^K) and different groups of workers (π^{L_j}), indexed by j:

$$Y = \pi^K + \sum_j \pi^{L_j} \tag{14}$$

We use this defintion of welfare, which corresponds approximately to GDP or total output, because it is transparent, can be objectively measured in the data, and can be easily compared with existing estimates in the literature. In general, however, changes in output and welfare will not be equivalent if, for example, there is curvature in individuals' utility functions. Rather than welfare, an alternate interpreation of W is that it quantifies the market value of the output distortion from the corporate tax.

Guided by our empirical results, we classify three groups of workers: low-paid workers, high-paid workers, and executives. Low-paid workers are defined as those in the bottom 90% of the within-firm wage distribution, and high-paid workers as those in top 10%. Workers and executives optimize consumption $C^L = w^j L^j$, where w^j is the wage for workers of type j and L^j is labor supply. The indirect utility function for workers is given by $U^j(w^j) = w^j L^j$, and the change in utility from a change in wages is given by:

$$dU^j(w^j) = L^j dw^j = w^j L^j \varepsilon^{L_j} d(1-\tau) \tag{15}$$

where ε^{L_j} is the elasticity of earnings for workers of type j with respect to the net-of-tax rate. Because firm owners are assumed to optimize their demands for factor inputs, by application of the envelope theorem the change in firm owners' profits is given by:

$$d\pi^K = -d\tau B - \sum_j (1-\tau)(dw^j L^j) \tag{16}$$

The first term $-d\tau B$ implies that a reduction in the tax rate increases profits. The second term $\sum_j (1-\tau)(dw^j L^j)$ captures the effects of factor price adjustments: while higher wages improve welfare for workers, they reduce welfare for firm owners, whose production costs increase. In practice, these offsetting adjustments are implicitly embedded in the elasticity of after-tax profits to the net-of-tax rate, which we have estimated in the empirical analysis. We can thus compute the change in welfare for firm owners as:

$$d\pi^K = \pi^K \varepsilon^\pi d(1-\tau) \tag{17}$$

where ε^π is the elasticity of after-tax profits with respect to the net-of-tax rate, and π represents after-tax profits in the baseline year. The total change in welfare is given by:

$$dW = dY + dT \tag{18}$$

$$= d\pi^K + \sum_j dU^j + dT$$

We combine the elasticites estimated in Section 4 with moments from the tax data to compute the total change in welfare as expressed in equation 18. Finally, the marginal excess burden from the corporate tax cut is given by:

$$\frac{dW}{dT} = \frac{dT + d\pi^K + \sum_j dU^j}{dT} \tag{19}$$

which expresses the marginal welfare loss from raising an additional dollar of corporate tax revenue— or, in our setting, the marginal welfare gain from an additional dollar of foregone tax revenue.

Incidence

To assess distributional impacts of TCJA's corporate tax changes, we adapt the framework developed in Suárez Serrato and Zidar (2016) and Fuest, Peichl, and Siegloch (2018) to estimate the share of productive factors in the total corporate tax burden. Our analysis differs from these studies in two respects. First, the detailed microdata used in this study allows us to observe returns to firm owners, and thus allow us to empirically estimate how these returns are affected by changes in the corporate tax rate. Second, we are able to estimate the effects of corporate tax changes on the full distribution of workers' earnings. Using these two sets of estimates, we are able to evaluate the incidence of corporate taxes using weaker assumptions than are required when these outcomes are not empirically observable.

We are also able to extend our analysis to assess corporate tax incidence not only on factors of production — that is, on firm owners and workers, as is standard in the literature — but also to approximate incidence over the income distribution, taking account of the empirical fact that many low-income workers own capital and most capital owners also work. Doing so allows us to speak directly to research and policy debates about the progressivity of the corporate income tax. Because we observe workers' locations, we are also able to evaluate the geographic incidence of corporate income tax cuts. [13]

In evaluating incidence, we make the standard assumptions of a representative consumer and equal redistribution of tax revenues to all citizens. The former assumption rules out distributional

[13] In the incidence analysis of Fuest, Peichl, and Siegloch (2018) studying workers' wages, the effects of corporate tax changes on returns to firm owners are unobservable, and changes in rental rates are assumed to be negligible. This assumption is likely to be appropriate in their analysis of tax changes in German municipalities, which they characterize as small open economies. In the incidence analysis of Suárez Serrato and Zidar (2016), returns to firm owners are unobservable but inferred via structural estimation. These studies evaluate impacts of corporate tax changes on median and mean worker wages, respectively, but do not directly assess impacts over the earnings distribution.

impacts through changes in consumer prices, which are unobservable in our data. The latter assumption, while strong, allows us to avoid making even stronger alternative assumptions about the future path of fiscal policy. TCJA's corporate tax cuts were deficit financed, and the future trajectory of federal tax policy is always uncertain in a democracy.

Accounting for changes in factor prices, the change in welfare for firm owners is given by:

$$d\pi^K = -d\tau B - \sum_j (1-\tau)(dw^j L^j) \tag{20}$$

We can thus compute the change in welfare for firm owners as:

$$I^F = \frac{d\pi^K}{d\pi^K + \sum_j dU^j} \tag{21}$$

Similarly, the share of workers in the total tax burden, I^{L_j}, is given by replacing the numerator in equation 21 with dU^j.

We expand on the traditional analysis of factor incidence in two extensions. First, we evaluate incidence with respect to the population distribution of income. Estimating distributional incidence allows us to account for the empirical fact that many workers are also firm owners (because they may hold equity portfolios, as emphasized in Auerbach 2006) and that many firm owners also earn labor income (as documented in Smith, Yagan, Zidar, and Zwick 2019). We assume that everyone works, and ascribe firm and capital ownership to workers using data on the distribution of equity and wealth ownership from the Distributional Financial Accounts (DFA) produced by the Federal Reserve Board (2018). We assume that executives are in the top 1% of the distriubtion, that high-paid workers are in the 90-99th percentiles, and that low-paid workers comprise the bottom 90%. Letting ω^j represent the capital ownership share of workers of type j, we have:

$$I^{L_j} = \frac{dU^j + \omega^j d\pi^K}{d\pi^K + \sum_j dU^j} \tag{22}$$

which measures incidence across the income distribution for all workers, inclusive of both labor and capital income.

Second, we combine the distributional estimates from equation 22 with the observed locations of workers, inferred from zip codes reported on IRS Form W-2, to estimate the geographic incidence of corporate income tax cuts across Census regions and commuting zones. Letting $\rho^{j(r)}$ represent the share of workers of type j living in region r, and N^r represent the region's population, we compute:

$$\frac{dY^r}{N^r} = \frac{\sum_j \rho^{j(r)}(dU^j + \omega^j d\pi^K)}{N^r} \tag{23}$$

which provides an estimate of the effect of federal corporate tax changes on per capita income in region r. To the extent that firm ownership and employment are unequally spatially distributed across the country, the gains from corporate tax cuts are likely to be unequally geographically

distributed as well.

5.1 Quantification Moments and Parameters

Table 9 summarizes the key inputs that we use to quantify the welfare and incidence implications of TCJA's corporate income tax cuts. Panel A includes information on the empirically observed average tax rates and changes faced by C- and S-corps in our sample, and Panel B shows their aggregate 2016 levels of tax liabilities, after-tax profits, and payrolls for different groups of workers. Panel C reports the distribution of capital ownership as observed in the Distributional Financial Accounts data, and Panel D reviews the key net-of-tax elasticities we have estimated in the empirical analysis.

5.2 Revenue, Income, and Welfare Impacts

Panel A of Table 10 shows our estimates of the impacts of corporate income tax cuts on government tax revenues. To generate these estimates, we use the empirically estimated elasticities and key moments from our sample of tax returns. We show estimates of the mechanical effects on tax revenue (that is, holding the tax base constant), as well as estimates of the total effects (taking account of behavioral responses). We present the estimates as dollar values, percentage changes, and as a share of 2016 GDP.

Panel A of Table 9 shows that, on average, TCJA reduced the marginal tax rate by 10 percentage points for C-corps and by 4 percentage points for S-corps. In the absense of behavioral responses, Panel A of Table 10 shows that this would lead to a $101 billion (34%) reduction in corporate tax revenues, corresponding to approximately 0.47% of 2016 GDP. However, because firms respond to the tax cut by expanding their operations and increasing pre-tax profits, the total reduction in tax revenue is modestly attenuated, instead $88 billion (30%), or 0.41% of GDP.

Panel B of Table 10 shows our estimates of the change in private income from TCJA's corporate tax changes. We estimate that private income increases by $97 billion, or 0.46% of GDP. Approximately $54 billion of these gains accrue to firm owners and $43 billion accrue to workers.

Panel C shows our estimates our welfare and the marginal excess burden of the corporate tax. In our stylized framework, welfare increases linearly in private income and public revenues. Private income gains of $97 billion combined with revenue losses of $88 billion imply a net increase in total welfare of $9 billion, or 0.04% of 2016 GDP. Our estimate is of a similar order of magnitude to Barro and Furman 2018, who structurally simulate the effects of TCJA on GDP using a fully parameterized Ramsey model.

Panel C provides our estimate of the marginal excess burden of the corporate income tax, $\frac{dW}{dT}$. We find that a marginal dollar of foregone revenue from corporate income tax cuts generates an additional $0.10 in output. Viewed through the lens of the model, the results thus imply substantial efficiency gains from corporate tax cuts. However, as we show below, these aggregate gains mask significant distributional effects.

TABLE 9: QUANTIFICATION MOMENTS AND PARAMETERS

	All Corps	C-Corps	S-Corps
Panel A: MTRs (Sales-Weighted)			
Mean 2016 τ	0.25	0.24	0.31
Mean $\Delta\tau$	-0.09	-0.10	-0.04
Mean $\Delta\tau/\tau_{t-1}$	-0.33	-0.47	0.34
Mean $\ln(1-\tau)$	0.13	0.14	0.06
Panel B: Firm Aggregates (bil)			
Tax	299	255	44
Taxable Income	1,163	914	250
After-Tax Profit	882	658	224
Executive Payroll	151	105	47
Top 10 Payroll	767	673	94
Bottom 90 Payroll	1,403	1,211	192
Panel C: Distribution of Capital			
Top 1%	0.27		
91-99%	0.34		
Bottom 90%	0.39		
Panel D: Net-of-Tax Elasticities			
Pre-Tax Profit	0.38		
After-Tax Profit	0.52		
Executive Pay	0.65		
Top 10 Earnings	0.32		
Bottom 90 Earnings	0.00		

Table shows the inputs that we use to quantify the revenue, income, and welfare imapcts of TCJA's corporate tax cuts. Data in Panels A and B are directly observed in our sample of tax records, and data in Panel C are from the 2018 Federal Reserve Board Distributional Financial Accounts. The parameters in Panel E are estimated in the empirical analysis.

TABLE 10: REVENUE AND WELFARE ESTIMATES

	bil	%	% GDP
Panel A: Tax Revenues			
Mechanical, dM	-101.2	-33.8	-0.47
Total, dT	-88.4	-29.5	-0.41
Panel B: After-Tax Private Income			
Total Income, dY	97.3	3.0	0.46
Capital Income, $d\pi^K$	54.5	6.2	0.25
Labor Income, $d\pi^L$	42.9	1.8	0.20
Panel C: Welfare and Excess Burden			
Welfare, dW	8.9	0.04	0.04
Marginal Excess Burden, dW/dT		-10.1	

This table shows estimated revenue, income, and welfare impacts from TCJA's changes in marginal corporate income tax rates. Outcomes are scaled in billions of dollars in column 1. The denominators for percentage changes in tax revenues are: 2016 federal corporate tax revenues in Panel A; 2016 private income of corporate firm owners and employees in Panel B; and 2016 GDP in Panel C. Outcomes in column 3 are scaled as a percent of GDP. The marginal excess burden is defined as the ratio of the change in welfare to the change in tax revenues. See Section 5 for details.

5.3 Incidence

Panel A of Table 11 shows our estimates of changes in private income for firm owners, executives, and high- and low-paid workers. Combining our reduced form elasticities from Section 4 with the moments from the tax data, we find that approximately 56% of the gains from TCJA's corporate tax cuts flow to firm owners; 12% flow to executives; 32% flow to high-paid workers; and 0% of the gains flow to low-paid workers.

Panel B reports our estimates of incidence over the income distribution. When we allocate the gains of firm owners to workers using data from the Distributional Financial Accounts, we find that approximately 27% of the gains from corporate tax cuts accrue to the top 1% of the earnings distribution; 51% accrue to the 90-99th percentiles; and 22% accrue to the bottom 90%. These results highlight the importance of considering the joint impacts of changes on both capital and labor income when assessing the distributional effects of corporate tax changes.

Panel C of Table 11 reports our estimates of geographic incidence across Census regions, produced from equation 23.[14] Because firm owners and highly-paid workers are relatively highly concentrated in the Northeast and West Coast regions of the United States, we find that gains from the corporate tax cuts disproportionately accrue to those regions. For example, our estimate of the per capita income gain for residents of the Northeast ($33) is approximately 77% larger than for residents of the South ($19).

Panel A of Figure 12 maps the variation in our estimates of geographic incidence across commuting zones. Beyond the regional patterns highlighted in Table 11, the map highlights substantial within-region variation, with larger and higher-income commuting zones generally seeing larger gains from the corporate tax cuts. The patterns are most clearly illustrated in Panel B, which plots the estimated change in income against the 2016 average earnings of corporate-sector employees, and where the bubbles are proportional in size to each commuting zone's population. Relative to the median commuting zone gain of approximately $120 per capita, we estimate that gains are approximately 4 times larger in Houston or New York City; 6-7 times larger in Seattle; and roughly 10 times larger in the San Francisco Bay Area. The results imply that corporate income tax cuts not only increase income inequality across workers, but also contribute to growing inequality across regions and commuting zones (Gaubert, Kline, Vergara, and Yagan 2021).

5.4 The Efficiency-Equity Tradeoff of the Corporate Income Tax

Our estimate of corporate taxable income elasticity — a key parameter in the literature for measuring the distortion of a tax — implies substantial efficiency gains from cutting corporate taxes (or, equivalently, implies substantial losses from increasing the corporate tax rate). However, we also find that corporate tax cuts disproportionately benefit those with high incomes, with 78% of the gains flowing to just 10% of the population.

[14] We classify states into regions using the definitions from the U.S. Census, provided here, with the minor modifation of classifying Delaware, DC, and Maryland as belonging to the Northeast rather than to the South.

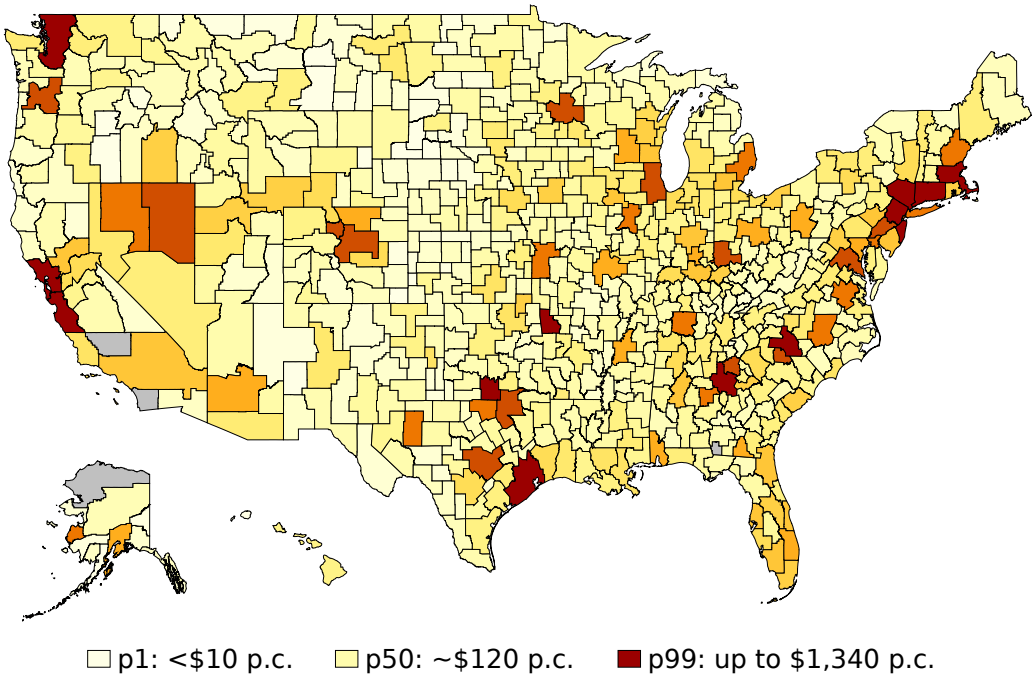
TABLE 11: INCIDENCE ESTIMATES

	$	% Change	% Incidence
Panel A: Factors ($ bil)			
Firm Owners	54.5	6.2	56
Executives	11.3	7.5	12
High-Paid Workers	31.6	4.1	32
Low-Paid Workers	0.0	0.0	0
Panel B: Distributional ($ bil)			
Top 1%	26.0	6.7	27
91-99th%	50.1	4.7	51
Bottom 90%	21.2	1.2	22
Panel C: Geographic ($ per capita)			
Northeast	423	0.7	33
Midwest	263	0.5	21
South	239	0.5	19
West	346	0.6	27

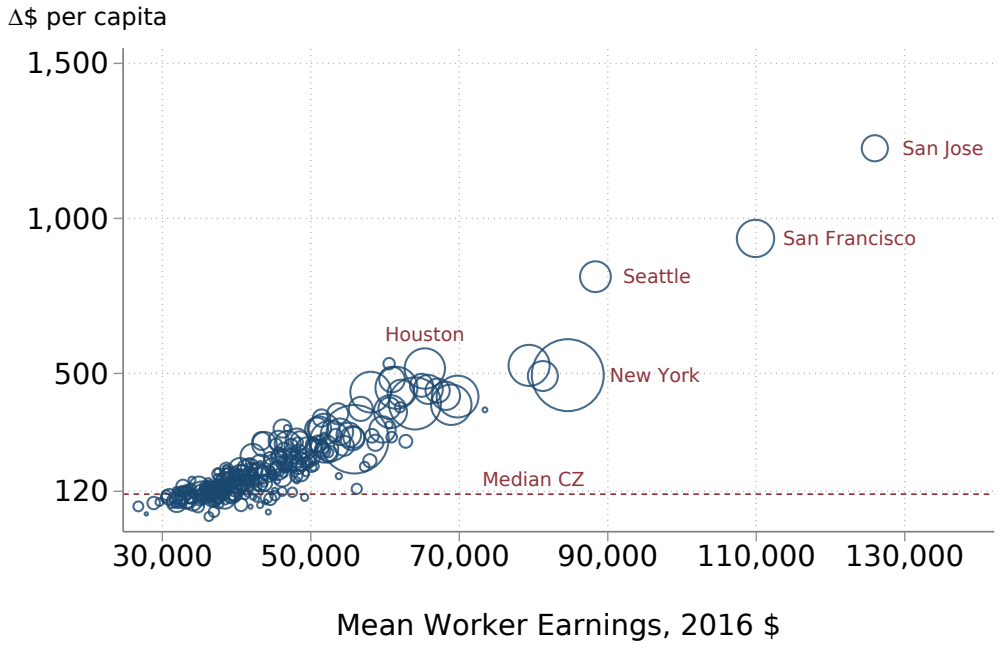
Table shows the estimated incidence of corporate tax cuts on firm owners, executives, and high- and low-paid workers. To compute distributional incidence, we allocate gains of firm owners to workers using data on capital ownership from the Federal Reserve Distributional Financial Accounts. The denominators for percent change shown in column 2 are: 2016 private income of corporate firm owners and employees in Panel A; private labor and corporate capital income in Panel B; and real mean personal income by Census region according to the 2016 Census American Community Survey in Panel C.

FIGURE 12: GEOGRAPHIC INCIDENCE

Panel A: Change in Per Capita Income across Commuting Zones



Panel B: Change in Per Capita Income vs. Initial Worker Earnings



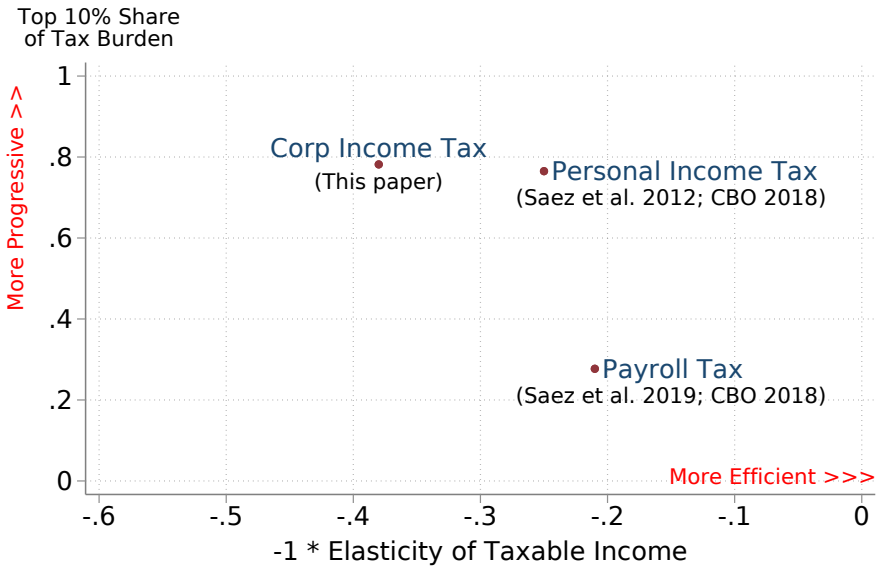
The unit of analysis is a commuting zone. Panel A illustrates geographic variation in our estimates of changes in per capita private income due to the corporate tax cuts, generated from equation 23. Income gains are proportional to color intensity in the map, with darker colors representing larger gains. Panel B plots the estimated change in income for each commuting zone against the 2016 average earnings of corporate-sector workers. The size of the bubbles is proportional to each commuting zone's 2016 population.

Given that the federal government must raise some level of revenue to finance its operations, how should we interpret our results on the corporate income tax in the context of the broader national tax and transfer system? In Figure 13, we benchmark our findings against estimates from the literature on personal income and payroll taxes — the two other largest sources of federal tax revenues in the United States. The X-axis shows $-\varepsilon^B$, where ε^B is the elasticity of the tax base to an increase in the net-of-tax rate for each policy instrument. A larger magnitude of ε^B implies a larger distortion from the tax. The Y-axis shows the share of tax burden borne by the top 10% of the income distribution, where higher shares imply that the tax is more progressive.

The estimates of ε^B for the personal income tax (0.25) and payroll tax (0.21) are from Saez, Slemrod, and Giertz (2012) and Saez, Schoefer, and Seim (2019), respectively. The former is based on a comprehensive literature review of the voluminous empirical evidence on personal income taxes, while the latter is, less satisfyingly, based on evidence of employment effects from a payroll tax reform in Sweden. However, it is, to our knowledge, the best available estimate for payroll taxes in the literature. We compute estimates for the share of personal and payroll tax burdens borne by the top 10% and top 1% of the income distribution using data from the Congressional Budget Office.

Viewed in the context of the literature, the results in Figure 13 suggest that the corporate income tax is approximately 1.5 times less efficient than the personal income tax. In Panel A, where our measure of equity is the share of the tax burden borne by the top 10%, the corporate income tax is similarly progressive to the personal income tax. In Appendix Figure C.12, we use a more extreme measure of equity, the share of the tax burden borne by the top 1%, and find that the corporate income tax is both less efficient and less progressive than the personal income tax. In either case, the corporate tax appears 3-4 times more progressive than the payroll tax, although it is twice as inefficient.

FIGURE 13: THE EFFICIENCY-EQUITY TRADEOFF IN CONTEXT



The figure contextualizes our results on the corporate income tax, compared here with the personal income and payroll taxes, the two other largest sources of federal tax revenue in the United States. The elasticity of taxable income, shown on the X-axis, is a key parameter for measuring tax distortions. The share of the tax burden borne by the top 10% of the income distribution, shown on the Y-axis, is a measure of progressivity.

6 Conclusion

This paper analyzes the short-run impacts of historically large federal corporate income tax cuts on large U.S. firms and their workers. Exploiting tax policy variation that allows us to compare trends in outcomes of similarly sized firms operating in the same industry, we find that tax cuts cause firms to increase their sales, profits, and investment. These responses are predominantly concentrated in capital-intensive industries. Labor earnings increase for workers in the top 10% of the within-firm earnings distribution, and rise particularly sharply for executives, but do not change for workers in the bottom 90%. We do not find evidence that firms' responses are driven by liquidity effects, and interpret the results as consistent with dynamic models in which firms are responsive to both current and future changes in the cost of capital.

We empirically estimate key elasticites of firm- and worker-level outcomes, and combine these elasticities with a stylized model to estimate the revenue impacts, welfare gains, and incidence of TCJA's corporate tax changes. We find that private incomes increase by $97 billion and tax revenues decline by $88 billion, implying a net aggregate output gain of $9 billion, equivalent to approximtely 0.04% of GDP. In the the model, reducing corporate tax revenues by $1 generates an additional $0.10 in output, implying substantial efficiency gains from corporate tax cuts.

We also find that the gains from corporate tax cuts disproportionately flow to those with high incomes. We estimate that approximately 56% of the gains accrue to firm owners, 12% accrue to

executives, 32% accrue to high-paid workers, and 0% flow to low-paid workers. When we adjust these calculations to allow for the empirical fact that many workers hold equity portfolios, we estimate that 78% of the gains flow to the top 10% of the earnings distribution, and 22% flow to the bottom 90%.

In a benchmarking excercise, we find that the efficiency gains from corporate tax cuts are 1.5 to 2 times as large as personal income or payroll tax cuts, even while the distributional effects are similarly regressive. Holding all else equal, the results imply that, on the margin, adjusting the composition of federal revenues toward a larger share of personal income taxes and a lower share of corporate income taxes may yield significant efficiency gains without sacrificing progressivity.

We conclude with important caveats. Our results do not capture a range of potentially important channels through which corporate tax cuts may affect welfare. For example, in the long-run, higher investment may increase productivity and broadly increase workers' wages. While we do not find clear effects of tax cuts on productivity in our data (see Appendix C.7), and estimate zero effect on low-income workers' earnings, it is possible that such gains may materialize over a longer time horizon. On the other hand, reductions in tax revenues may lead to a deterioration in the provision of public services (such as education, health, or infrastructure spending), or reduce redistributive transfers, with potentially adverse implications for equity and efficiency. We believe these are important topics for future research.

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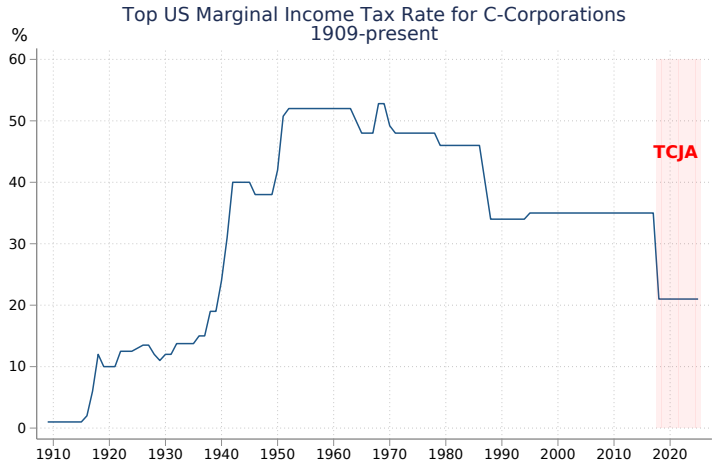
Appendix Figures and Tables

A Appendix to Section 2: Setting and Institutional Details

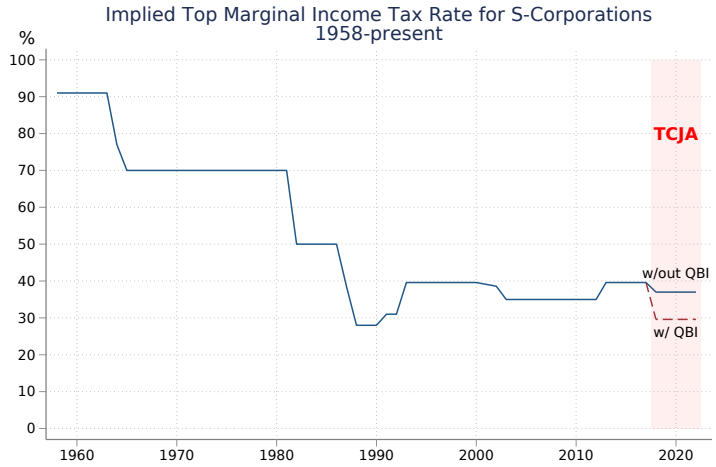
A.1 Historical Statutory Federal Top Marginal Income Tax Rates

FIGURE A.1: TOP MARGINAL INCOME TAX RATES IN HISTORICAL CONTEXT

Panel A: Top Marginal Tax Rate for C-Corporations



Panel B: Implied Top Marginal Tax Rate for S-Corporations



Notes: Data from the Tax Foundation. Panel A shows the evolution of the top statutory marginal corporate income tax rate facing C-Corporations throughout U.S. history. Panel B shows the implied top statutory marginal income tax rate facing S-corporations, which equal to the top rate facing individuals.

A.2 Marginal Income Tax Rates and Brackets Before and After TCJA

TABLE A.1: MARGINAL INCOME TAX BRACKETS BEFORE AND AFTER TCJA

Panel A: Tax Brackets for C-Corporations

Income Bracket	Upper Income Threshold ($)	Pre-TCJA MTR	Post-TCJA MTR	Firm Share	Emp Share	Sales Share
0	0	0	0	0.916	0.659	0.477
1	50,000	0.15	0.21	0.061	0.026	0.012
2	75,000	0.25	0.21	0.006	0.006	0.004
3	100,000	0.34	0.21	0.003	0.004	0.002
4	335,000	0.39	0.21	0.007	0.013	0.010
5	10,000,000	0.34	0.21	0.005	0.043	0.047
6	15,000,000	0.35	0.21	0.000	0.008	0.009
7	18,000,000	0.38	0.21	0.000	0.003	0.005
8	>18,000,000	0.35	0.21	0.001	0.240	0.433

Panel B: Implied Tax Brackets for S-Corporations (Married Joint Filers)

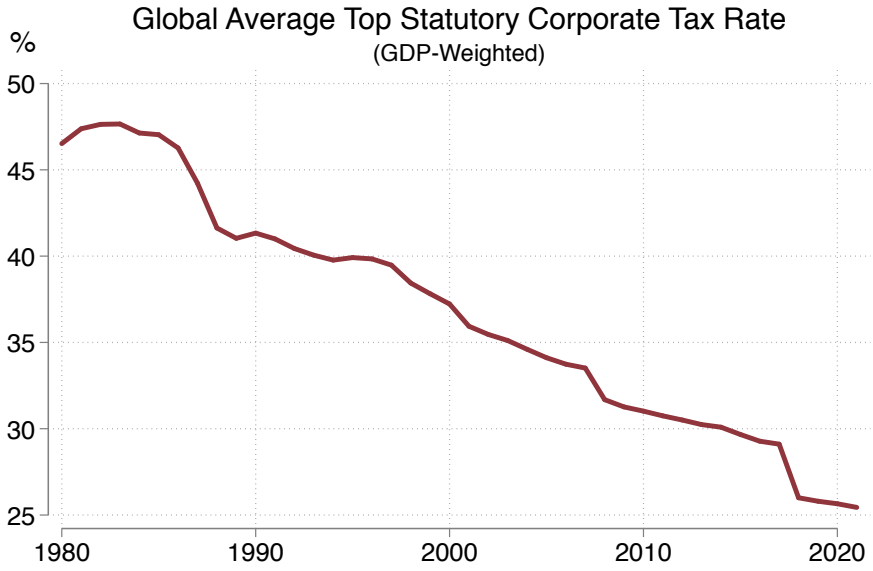
Income Bracket	Upper Income Threshold 2017 ($)	2017 MTR	Upper Income Threshold 2019 ($)	2019 MTR
1	18,650	.1	19,400	.1
2	75,900	.15	78,950	.12
3	153,100	.25	168,400	.22
4	233,350	.28	321,450	.24
5	416,700	.33	408,200	.32
6	470,700	.35	612,350	.35
7	>470,700	.396	>612,350	.37

Notes: Panel A reports the statutory marginal income tax brackets facing C-corps before and after TCJA. The firm, employment, and sales shares are calculated in tax year 2016 using SOI data. Panel B illustrates an example of the implied statutory marginal income tax brackets facing S-corp owners. This schedule varies depending on the taxpayer's filing status. For illustrative purpsoes, the schedule shown here is for married joint filers, although in practice we use the corresponding tax schedules for different filer types.

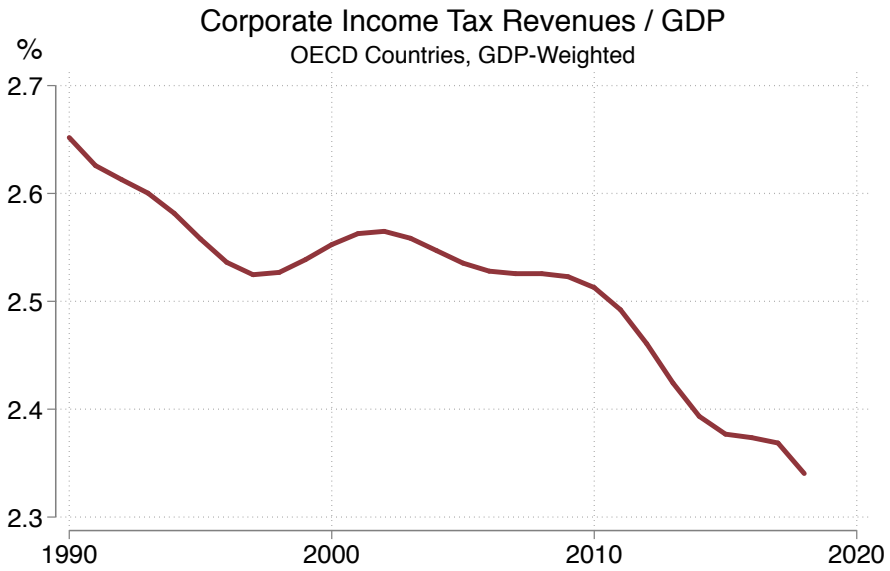
A.3 A Global Perspective on Corporate Income Taxes

FIGURE A.2: CORPORATE TAXES IN GLOBAL PERSPECTIVE

Panel A: Average Global Corporate Tax Rates

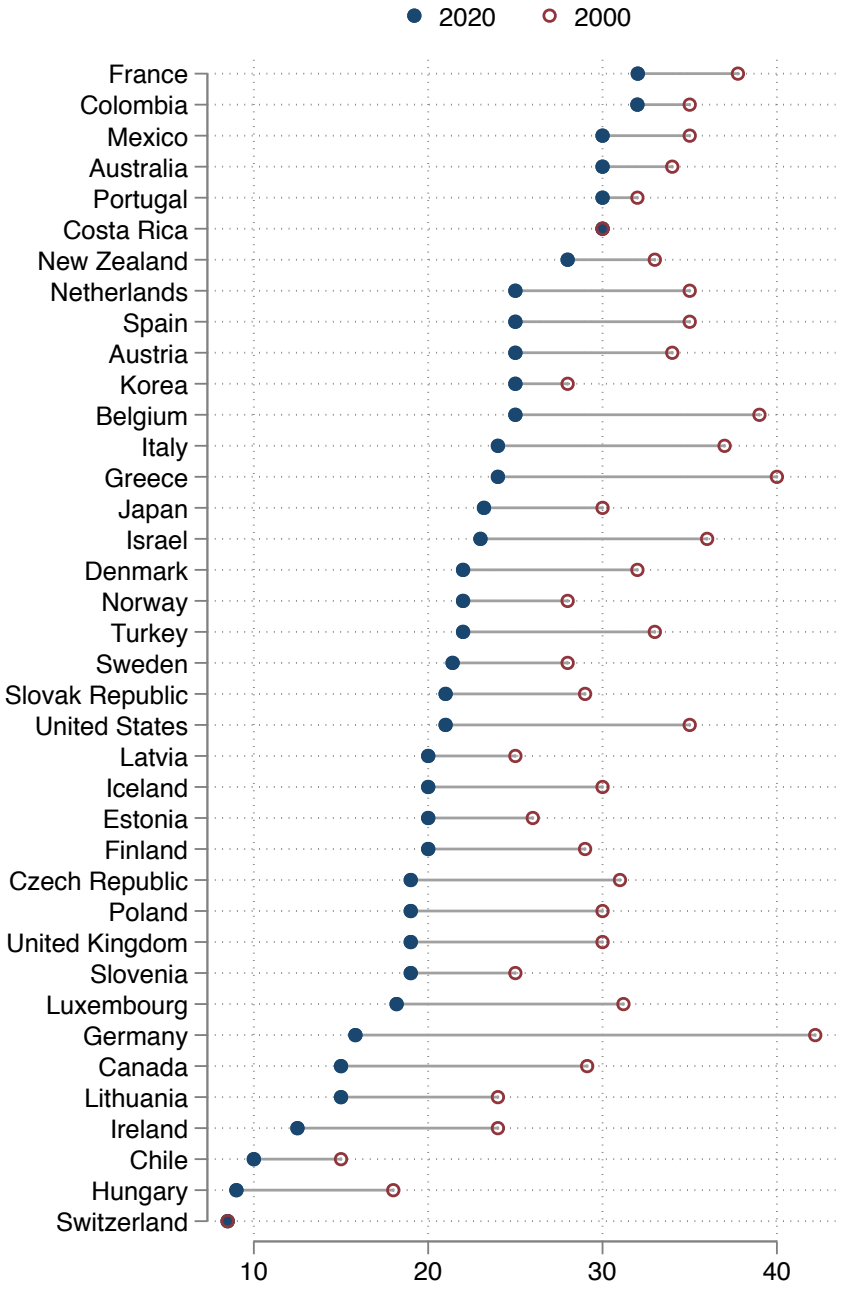


Panel B: Average Corporate Income Taxes in OECD Countries as a Share of GDP



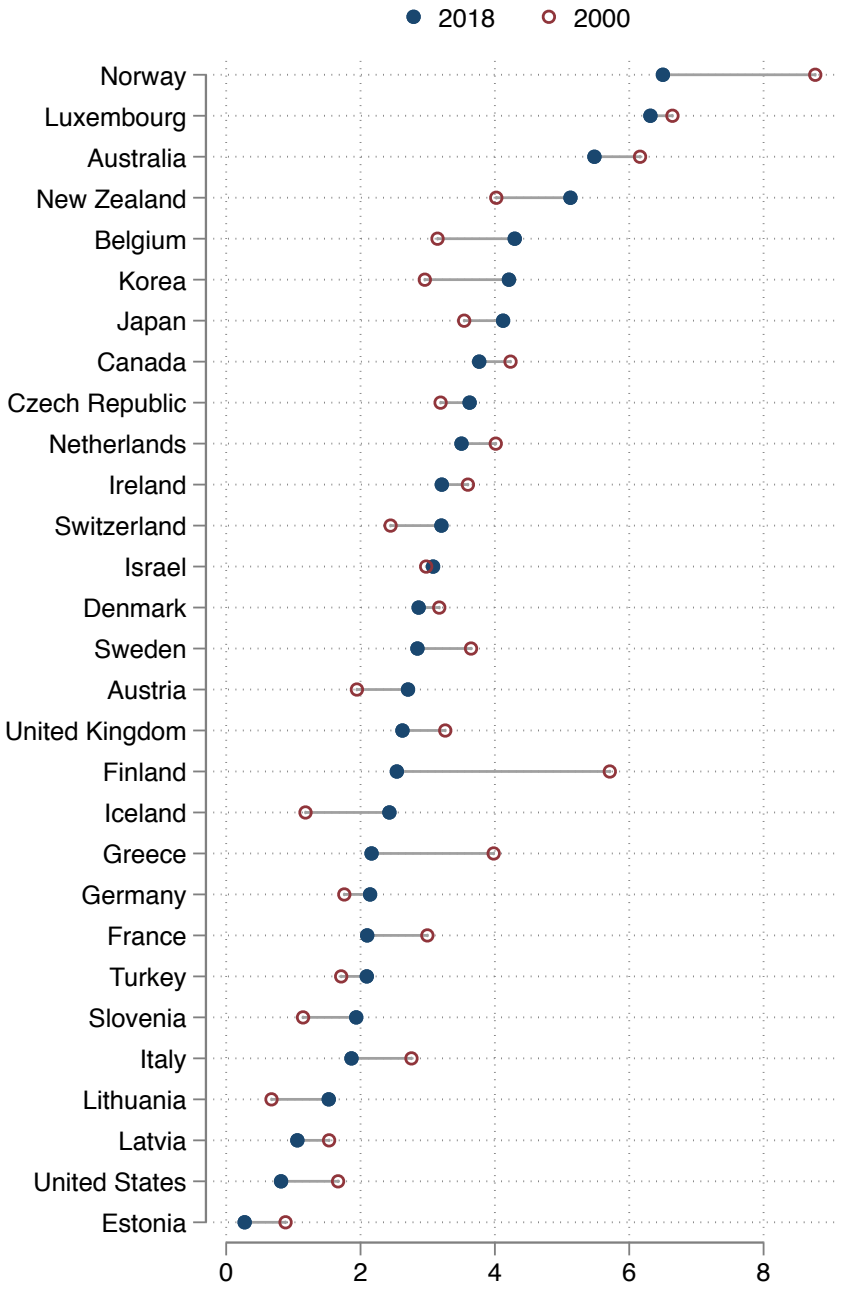
Notes: Panel A shows the GDP-weighted global average top statutory corporate income tax rate since 1980, using data from the Tax Foundation. Panel B shows the lowess-smoothed GDP-weighted ratio of corporate income tax revenues to GDP since 1990 for OECD countries, using data from the OECD tax database (data is not available for this series before 1990).

FIGURE A.3: TOP STATUTORY CORPORATE TAX RATES IN OECD COUNTRIES, 2000-2020



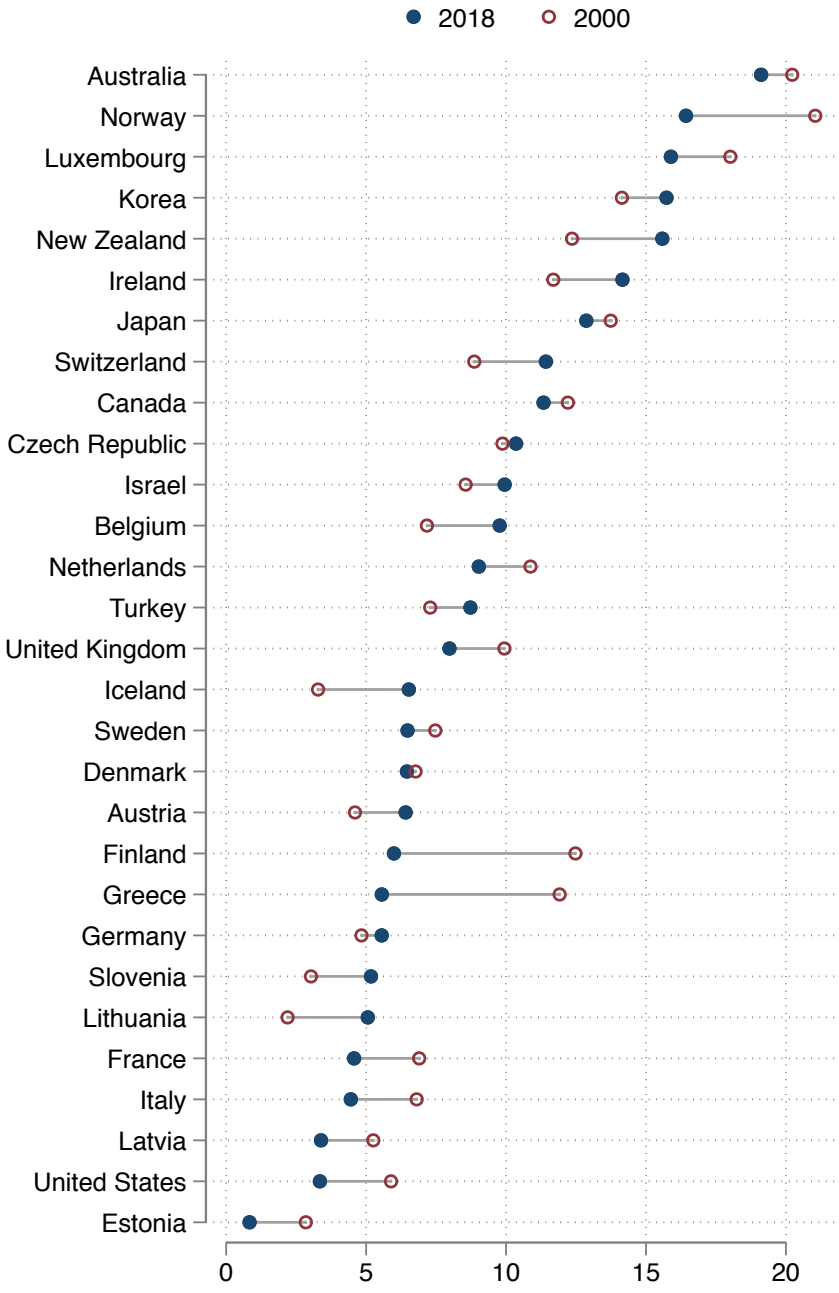
Notes: Figure shows the top statutory corporate income tax rate in OECD countries in 2000 and 2020. Data are from the OECD Tax Database.

FIGURE A.4: CORPORATE TAX REVENUES AS A SHARE OF GDP IN OECD COUNTRIES, 2000-2018



Notes: Figure shows corporate tax revenues as a share of GDP for OECD countries in 2000 and 2018 (the most recently available year). Data are from the OECD Tax Database.

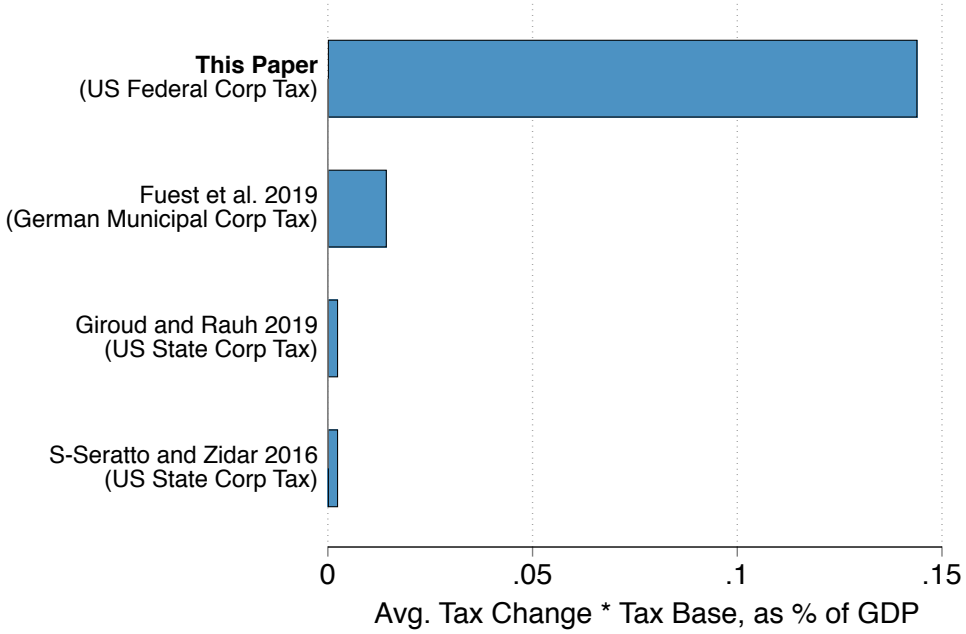
FIGURE A.5: CORPORATE TAX REVENUES AS A SHARE OF TOTAL TAXATION IN OECD COUNTRIES, 2000-2018



Notes: Figure shows corporate tax revenues as a share of total taxation for OECD countries in 2000 and 2018 (the most recently available year). Data are from the OECD Tax Database.

A.4 TCJA Tax Cut in the Context of Recent Literature

FIGURE A.6: TCJA TAX CHANGE VS. OTHER RECENT STUDIES



Notes: This figure shows the average tax change studied in several recent papers, multiplied by the tax base and scaled by GDP. The average tax change in Fuest et al. (2018) is 0.9 percentage points, and the LBT tax base is approximately 1.6% of GDP (see OECD/UCLG 2019). The average tax change in Suárez Serrato and Zidar (2016) and Giroud and Rauh (2019) is 1.0 percentage point, and the state corporate tax base is approximately 0.25% of GDP (Census 2019). The average tax change in this study is 9.0 percentage points, and the 2016 federal corporate tax base is approximately 1.6% of GDP (OMB 2022).

A.5 The QBI Deduction

Here we broadly summarize the Qualified Business Income (QBI) deduction enacted in TCJA. For comprehensive details, see documentation from the IRS here.

Commonly referred to as "Section 199A" after the corresponding section of the tax code, the QBI deduction is potentially available to S-corporations, as well as other pass-through businesses not included in our analysis sample, and is not relevant for C-corporations. The deduction amount is equal to the minimum of:

1. 20% of taxable income, where taxable income is calcuated prior to assessing the QBI deduction, minus net capital gains; or,
2. The sum of of both:
   (a) 20% of the aggregate qualified real estate and investment trust (REIT) dividends and publicly traded partnership (PTP) income; and
   (b) Deductible amounts from qualified trades or businesses.

Moreover, the deduction amount is subject to an adjusted gross income limitation after which the deduction amount phases out. The limitation amounts for tax year 2019 where $321,000 for married taxpayers, and $161,000 for single taxpayers. If a taxpayer exceeds these limitations, then two additional tests apply:

- Qualified business income must not be from a service specialized trade or business, otherwise the deduction amount is phased out; and
- The deduction amount is limited to 50% of the firm's allocated W-2 wages.

A Descriptive Analysis of QBI Take-Up

By the very nature of pass-through businesses, the QBI deduction is claimed by individual taxpayers rather than by firms. Below we analyze QBI take-up at the firm-level by taking the weighted average of shareholder take-up, where the weights are given by each Using this definition of take-up, approximately 67% of S-corps in our sample claim the QBI deduction.

To shed light on the factors correlated with QBI take-up, we regress our shareholder-weighted measure of QBI take-up on four firm-level variables: (i) the weighted average of a shareholder-level indicator equal to one if the shareholder exceeds the income limitation, where

the weights are given by the shareholder's equity share in the firm; (ii) an indicator equal to one if the firm operates in an SSTB industry; (iii) an indicator equal to one if the firm earned negative net income; and (iv) log sales of the firm.

The results are shown in Table A.2. The first column shows results from a cross-section of firms in 2018; the second column shows a cross-section from 2019; and the third column shows years 2018 and 2019 pooled, and includes a year fixed effect. All the coefficients are precisely estimated and statistically distinct from zero. Unsurprisingly, the income limitation measure, ω_f^{TI}, is strongly negatively predictive of QBI take-up, and firms in SSTB industries are also less likely to claim the deduction. Take-up is lower among firms with owners, and among larger firms.

TABLE A.2: PREDICTORS OF TAKE-UP OF THE QBI DEDUCTION FOR S-CORPS

	(1) 2018	(2) 2019	(3) Pooled
ω_f^{TI}	-0.801***	-0.834***	-0.817***
	(0.012)	(0.011)	(0.009)
SSTB (0/1)	-0.110***	-0.068***	-0.090***
	(0.025)	(0.021)	(0.020)
Profits <=0 (0/1)	-0.311***	-0.174***	-0.241***
	(0.077)	(0.059)	(0.050)
Log Sales	-0.014***	-0.008**	-0.011***
	(0.004)	(0.003)	(0.003)
Outcome Mean	0.66	0.67	0.67
Year FE	No	No	Yes
R2	0.59	0.67	0.63
N Firms	3,623	3,407	7,030

Notes: See above for details.

A.6 Entity-Type Switching

TABLE A.3: ENTITY-TYPE SWITCHING

	(1) S to C	(2) C to S
Log Lagged Sales × Post	0.000	0.004
	(0.000)	(0.002)
Firm Age × Post	-0.000	-0.000
	(0.000)	(0.001)
Multinational (0/1) × Post	0.026***	-0.023**
	(0.008)	(0.010)
SSTB Industry × Post	-0.001	0.016
	(0.002)	(0.026)
R2	0.00	0.02
N Firms	47,860	94,159

Notes: Table shows predictors of entity-type switching after TCJA.

B Appendix to Section 3: Data Sources and Variable Definitions

B.1 Variable Definitions

Taxes Paid

Taxes paid are defined for C-corporations as Form 1120: Schedule L, line 31. For S corps, taxes paid are measured using the following methodology:

1. Match S-corp owners to their 1040s
2. Use 1040s to compute each owner's average tax rate (ATR) and total taxes paid on pass-through income
   (a) Calculate ATR for a tax unit: ATR = Taxes Paid / Taxable Income
   (b) Record net ordinary business income: NET_OBI = Line 32 from 1040 (from schedule E)
   (c) Compute taxes paid on business income: BIZ_TAX_PAID = min(max{ATR*(NET_OBI),0},total tax paid on 1040)
   (d) Save table unique by TIN-year
3. Compute total non-negative pass-through income from 1120s and 1065s by owner
   (a) Append all K1s and from 1120s and 1065s with positive OBI (drop K1s with OBI<$0)
   (b) Sum up OBI by TIN-year; call the sum OBI_SUM
   (c) Save table unique by TIN-year
4. Merge table 2 and 3 by TIN-year
5. Compute the OBI share of each pass-through business in the owner's portfolio
   (a) Append all K1s from 1120s with positive OBI
   (b) Match m:1 by TIN with table 4; new table is unique by TIN-K1-year
   (c) Compute share of each K1 in total OBI, call it W = OBI / OBI_SUM
   (d) Allocate tax_paid in proportion to the shares: S_TAX = W*BIZ_TAX_PAID
   (e) Sum up s_tax by firm-year, final table is unique by EIN-year

Sales, Costs, and Profits

Sales are defined for C- and S-corporations as Form 1120: line 1c and Form 1120-S: line 1c, respectively.

Costs of goods sold are defined for C- and S- corporations as Form 1120: line 2 and Form 1120-S: line 2, respectively.

Pre-tax gross profits are defined as sales minus costs of goods sold.

After-tax gross profits are defined as gross profits minus taxes paid.

Earnings before interest, taxes, depreciation, and amoritization (EBITDA) is defined as net income plus net interest expense plus depreciation. Net income is defined for C-corporations as Form 1120: line 28. For S-corporations, net income is defined as Form 1120-S: line 21 combined with Form 1120-S Schedule K: lines 2 – 14. Depreciation is defined for C- and S-corporations as Form 1120: line 20 and Form 1120-S: line 14, respectively. Net interest expense is defined for C-corporations as the maximum of zero and Form 1120: line 18 minus line 5. For S-corporations, net interest expense is defined as Form 1120-S: line 12 plus Form 1120-S Schedule K: line 12b minus line 4.

Shareholder Payouts

Dividends are defined for C-corporations as Form 1120: Schedule M-2, line 5a plus line 5c. For S-corporations, dividends are defined as Form 1120-S: Schedule K, line 17c.

Share buybacks are defined as the non-negative annual dollar change in the treasury stock; treasury stock is defined for C- corporations as Form 1120: Schedule L, line 27(d) and for S-corporations as Form 1120-S: Schedule L, line 26(d).

Total payouts are defined as dividends plus share buybacks.

Investment

Capital assets is defined for C- and S- corporations as buildings and other depreciable assets less accumulated depreciation, as measured on Form 1120: Schedule L, line 10b(d) and Form 1120-S: Schedule L, line 10b(d), respectively.

Net investment is defined as the annual dollar change in capital assets.

Short-life new investment is defined for C- and S-corporations as the sum of Form 4562: lines 19a(c) to 19c(c).

Long-life new investment is defined for C- and S-corporations as the sum of Form 4562 lines 19d(c) to 19i(c) plus the sum of lines 20a(c) to 20c(c) plus the sum of line 14, line 15, and line 16.

Total new investment is defined as short-life new investment plus long-life new investment.

Employment and Earnings

Employment for C- and S-corporations is defined as the total number of unique individuals with a W-2 issued by the firm.

Worker earnings are measured for C- and S-corporation employees from Form W-2, box 5 (Medicare Wages).

Payroll is defined as the sum of workers' annual earnings.

Executive compensation is defined for C-corporations as Form 1120: line 12 and for S-corporations as Form 1120-S: line 7.

Top-5 compensation is defined for C- and S-corporations as the combined annual W-2 earnings of the top five highest paid workers at the firm.

Other Firm Characteristics

Age is defined as tax year minus year of incorporation, where year of incorporation for C-corporations and S-corporations is defined as Form 1120: box C and Form 1120-S: box E, respectively.

Multinational firms are defined as those whose foreign sales share is greater than 1%, where foreign sales are defined as the sum of gross receipts from all Controlled Foreign Corporations (that is, foreign subsidiaries) reported for each foreign subsidiary on Form 5471 Schedule C: line 1c.

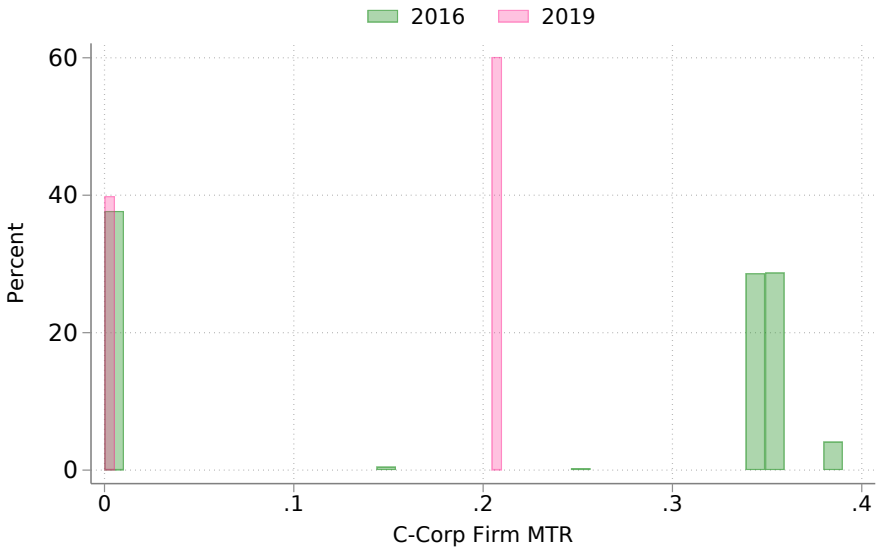
Capital intensity is defined at the industry level as total capital assets divided by total sales. C- and S-corporations are classified as capital intensive if the mean of this ratio in the pre-period (2013 to 2016) is greater than the sample median.

Industry is defined for C-corporations as the first three digits of Form 1120: Schedule K, line 2a and for S-corporations as the first three digits of Form 1120-S: Schedule B, line 2a.

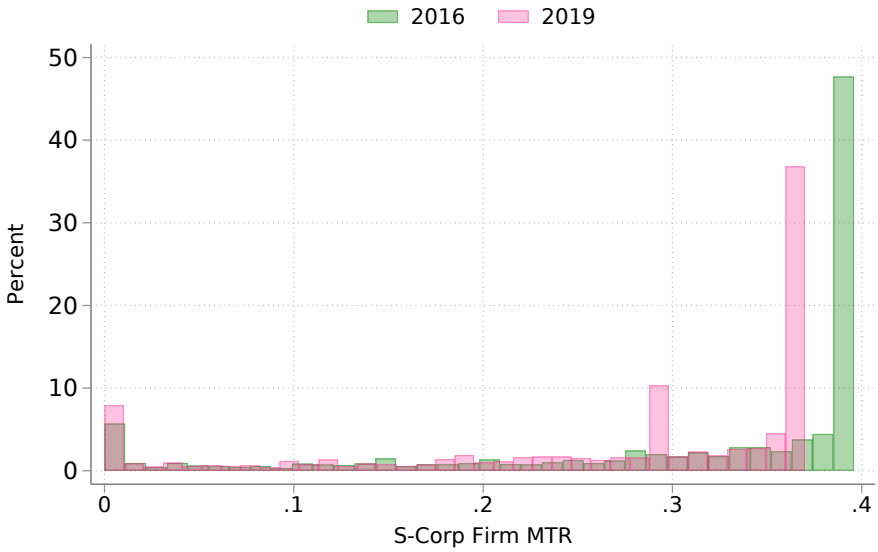
B.2 Sample Distribution of Firms' Statutory Marginal Income Tax Rates Before and After TCJA

FIGURE B.1: SAMPLE DISTRIBUTION OF C-CORP STATUTORY MTR'S

Panel A: Marginal Tax Rates for C-Corporations



Panel B: Implied Marginal Tax Rates for S-Corporations

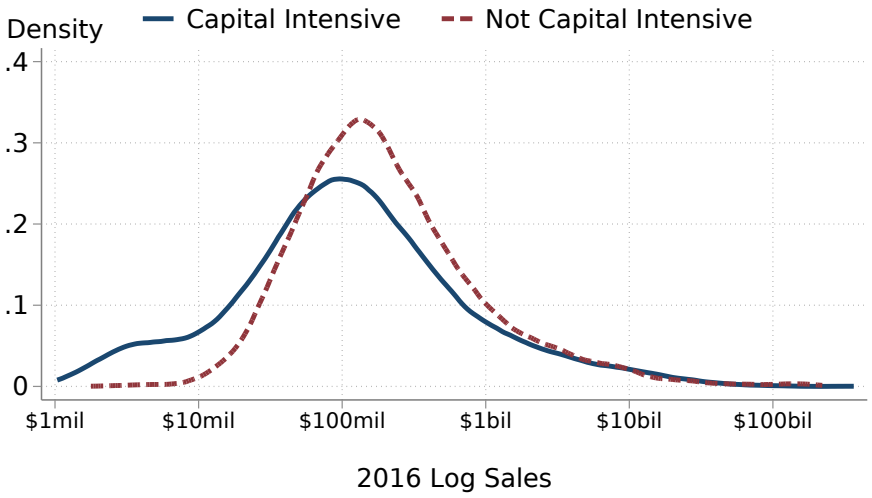


Notes: Table shows the sample distribution of statutory marginal income tax rates for C- and S-corps before and after TCJA.

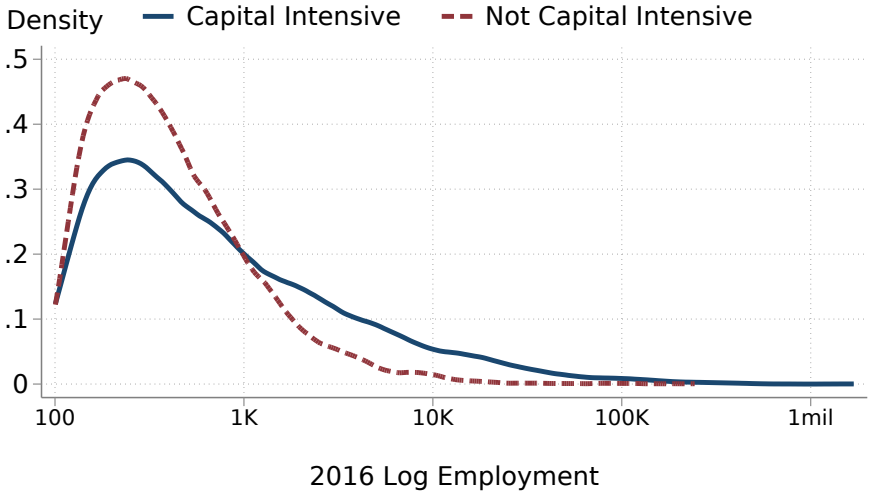
B.3 Size Distribution of Capital-Intensive Industries

FIGURE B.2: SIZE DISTRIBUTIONS OF FIRMS, BY CAPITAL INTENSITY

Panel A: 2016 Sales



Panel B: 2016 Employment



Notes: Panels A and B show the distribution of 2016 log firm sales and employment, respectively, for capital-intensive and non-capital-intensive firms.

C Appendix to Section 4: Empirical Results

C.1 Equity and Debt Issuance

TABLE C.1: EQUITY AND DEBT ISSUANCE

	Equity		Debt	
	(1) New Issuance (0/1)	(2) Log Issuance	(3) New Issuance (0/1)	(4) Log Debt
C × Post	-0.003	0.027	0.005	-0.002
	(0.006)	(0.115)	(0.008)	(0.011)
2016 Outcome Mean	0.30	1.38	0.61	4.13
Firm FE	Yes	Yes	Yes	Yes
Industry-Size-Year FE	Yes	Yes	Yes	Yes
R2	81501	22633	81501	81299
N	11,647	4,950	11,647	11,639

Notes: Table shows result from estimating equation 2 to assess if TCJA caused increases in equity or debt issuance of C-corps relative to S-corps. Columns 1 and 3 show the extensive margins, and columns 2 and 4 show the intensive margins. We find no signficiant difference.

C.2 Market-Level Analysis

Our firm-level empirical analysis leverages the fact that C- and S-corps on average received differently-sized tax cuts to identify causal effects. However, in the firm-level difference-in-differences design, it is possible that market-level adjustments affecting both C- and S-corps are absorbed by time fixed effects. In this case, firm-level "micro" elasticities may diverge from market-level "macro" elasticities. The firm-level elasticity captures the effect of treating a single firm within a market relative to other firms, holding all else equal. The market-level elasticity captures the effect of treating some non-trivial (sales- or employment- weighted) share of firms in a market, relative to other markets where different shares of firms are treated.

In theory, market-level elasticities could be either larger or smaller than firm-level elasticities. Consider the effects of corporate tax cuts on investment and profits. At the firm level, we estimate that C-corps increased their investment and pre-tax profits relative to S-corps following TCJA. However, if the supply of capital is constrained, it is possible that investors may divert investment away from S-corps and toward C-corps in response to the tax cut. Deploying a higher stock of productive capital, C-corps may then increase their pre-tax profits at the expense of competitor S-corps. In this case, the market-level investment and profit elasticities would be smaller than the corresponding firm-level elasticities, because increases in investment and profits for C-corps are offset by declines for S-corps.[1]

In the case of workers' wages, if corporate tax cuts lead firms to increase labor demand, and if workers are substitutable across firms as in a model of perfectly competitive labor markets, then the wages of both C- and S-corp workers would be predicted to increase by an equal amount. In this case, the market-level earnings elasticity would be positive, even as the firm-level earnings elasticity is zero.

Estimating the market-level effects of corporate tax cuts is empirically challenging, for several reasons. First, variation in corporate tax cuts at the market level is generally smaller than at the micro level: sharp policy variation in tax changes *within* industries often nevertheless yields attenuated policy variation in tax changes *across* industries. The attenuated policy variation, as well as the more limited number of industries (relative to the number of firms in a firm-level regression), reduces statistical precision. Second, the parallel trend assumption necessary to estimate a market-level elasticity is more challenging to defend at the market level than at the firm level. For example, while it may be plausible to suppose that firms within the same industry are subject to common supply and demand shocks, it may be less plausible to suppose that different industries provide suitable counterfactuals for causal inference. Third, general equilibrium effects

[1] This discussion is closely related to the literature in international economics on trade creation and diversion; e.g., see Balassa (1967); Krueger (1999); and Magee (2008), among others.

often unfold over longer time horizons, but our study only studies short-run responses. These challeneges naturally limit researchers' capacity to precisely estimate market-level elasticities.

Nevertheless, we consider two types of evidence that may be informative about market-level adjustments: time series evidence and market-level event studies. We first consider the time-series evidence. Figure C.1 reports mean outcomes in levels for C- and S-corps in our sample, without any fixed effects or controls. Guided by the economic intution described above, we focus on four key outcomes: mean and median worker earnings; pre-tax profits, and investment. Panels A and B do not suggest evidence of trend breaks consistent with the predictions of a perfect competition labor market; that is, the plots do not show that earnings increased faster for workers of both C- and S-corps following TCJA, relative to the pre-TCJA trend. Moreover, Panels C and D do not suggest evidence of a reallocation of profits or investment from S- to C-firms; that is, profits and investment of S-firms do not decline (relative to trend) at the same time that profits and investment increase for C-corps. This evidence does not rule out that such general equilibrium effects were present, but it does suggest that, if so, they were likely to be economically small.

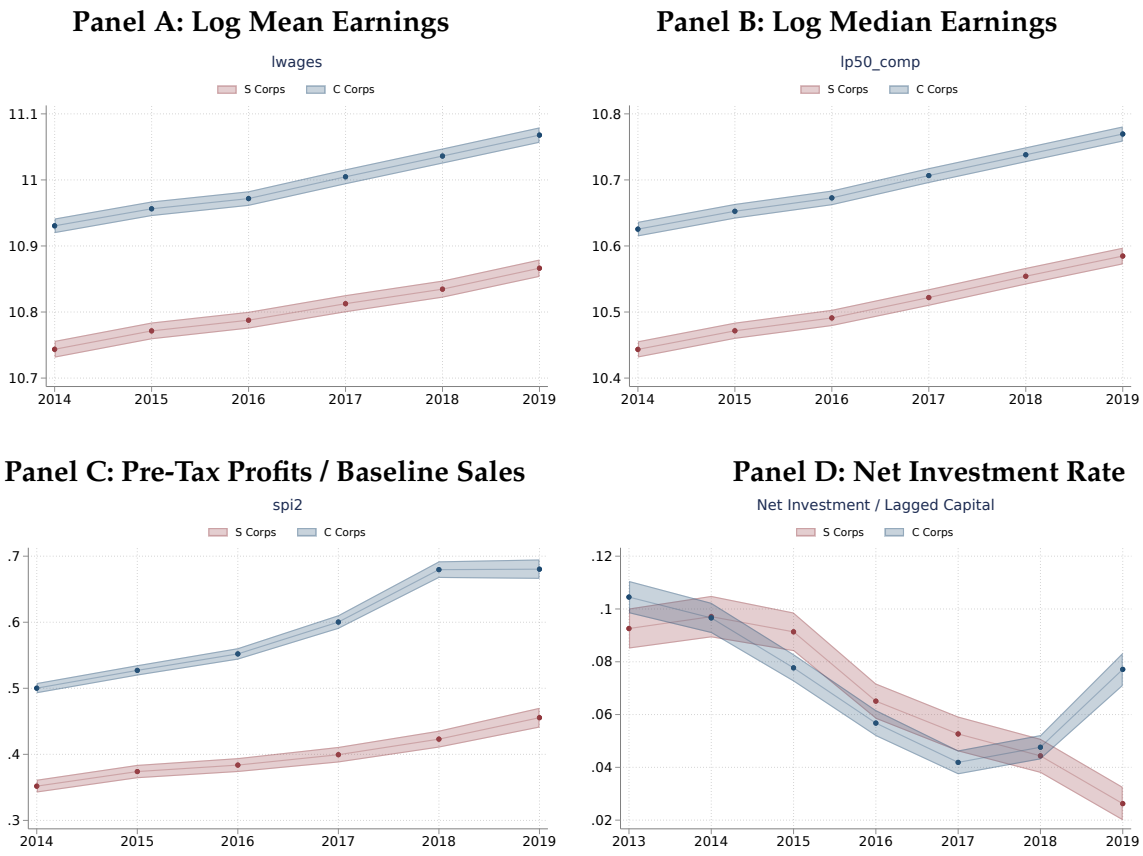
To look further for GE effects, we implement market-level event studies. To do so, we construct market-level MTR shocks, defined as the sales-weighted average 2016 to 2019 MTR change of firms within the same NAICS3 industry, commuting zone, or corporate entity type (C or S). We then estimate the following event-study specification at the industry level:

$$\ln y_{mt} = \sum_{t \neq 2016} \eta_t \ln(Z_m) * \mathbf{1}(year = t) + \gamma_m + \alpha_t + \epsilon_{it} \tag{24}$$

where y_{mt} indexes outcomes in market m in year t; Z_m is the sales-weighted market-level share of C-corps in a market; γ_m is a market fixed effect; and α_t is a year fixed effect. The coefficients η_t capture the average market-level elasticity of the outcomes with respect to the industry-level net-of-tax MTR change introduced by TCJA in year t. The fixed effects γ_m and α_t control, respectively, for time-invariant market characteristics and market-invariant macroeconomic trends correlated with the outcome. The reference year is 2016, and standard errors are clustered by industry. This specification corresponds to the reduced form of a shift-share design instrumenting the (sales-weighted) net-of-tax change with the (sales-weighted) share of C-corps in a market.

The results and the implied net-of-tax elasticities, ε^{NTR}, are reported in Table C.2. (The absence of standard errors in the entity type-level analysis reflects that the data are aggregated with only a single observation for C- and S-corps per year.) Although the implied taxable income elasticities are imprecisely estimated, the magnitudes are within the confidence interval of the firm-level elasticities, again implying that any market-level adjustments are likely to be relatively economically small in our setting.

FIGURE C.1: SIMPLE TIME SERIES EVIDENCE FOR C- AND S-CORPS



Notes: Figure plots mean outcomes for C- and S-corps over the sample period, without fixed effects or controls.

TABLE C.2: MARKET-LEVEL ELASTICITIES

Panel A: Industry-Level Elasticities

	(1) Ln $(1-\tau)$	(2) Pre-Tax π	(3) I_t/K_{t-1}	(4) LnW_{p50}	(5) LnW_{p99}
$Z_i \times 2019$	0.031	0.006	0.031	-0.095	-0.046
	(0.060)	(0.126)	(0.133)	(0.153)	(0.179)
ϵ^{NTR}		0.593	2.771	-2.147	-1.828
s.e.		3.053	4.432	4.951	5.705
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
R2	0.82	0.86	0.26	0.98	0.96
N	602	602	602	602	602

Panel B: Commuting Zone-Level Elasticities

	(1) Ln $(1-\tau)$	(2) Ln Wage	(3) p50	(4) p99
$Z_{cz} \times$ 2019	0.058^{***}	0.018	0.090	-0.039
	(0.017)	(0.047)	(0.062)	(0.100)
ϵ^{NTR}		0.303	1.537	-0.675
s.e.		0.804	1.071	1.766
CZ FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
R2	0.90	0.95	0.91	0.93
N	4,963	4,963	4,963	4,963

Panel C: Entity Type-Level Elasticities

	(1) Ln $(1-\tau)$	(2) Pre-Tax π	(3) I_t/K_{t-1}	(4) LnW_{p50}	(5) LnW_{p99}
$Z_e \times 2019$	0.077	0.032	0.045	0.010	0.083
	(.)	(.)	(.)	(.)	(.)
ϵ^{NTR}		0.412	0.584	0.123	1.073
N	14	14	14	14	14

Notes: Unit of analysis is a market-year. Standard errors are missing for entity-level regressions because data are aggregateed to the level of one observation per entity type per year. See above for details.

C.3 Top 5 Earnings

TABLE C.3: TOP 5 EARNINGS

Outcome is top 5 earnings				
		Controls for:		
	Benchmark	Sales	Profits	Relative Sales
C × Post	0.040***	0.038***	0.038***	0.038***
	(0.008)	(0.008)	(0.008)	(0.008)
Firm FE	Yes	Yes	Yes	Yes
Industry-Size-Year FE	Yes	Yes	Yes	Yes
R2	1	1	1	1
N	81501	81501	81501	81259
N Firms	11,643	11,643	11,643	11,643

Notes: Unit of analysis is firm-year. Table reports results from estimating variations of equation 2, where the outcome is log compensation of the top 5 highest paid workers at the firm. Column 1 shows the benchmark specification, and columns 2-4 adds time-varying controls for several measures of firm performance. Standard errors are clustered by firm.

C.4 Worker Heterogeneity

In Figure C.2 we explore whether the earnings effects of corporate statutory income tax cuts vary across worker characteristics. Specifically, we test whether the annual earnings responses estimated from equation 1 differ for men and women; for workers above and below the age of 40; and for workers with above and below 5 years of work history with their employer in 2019. In light of our previous evidence that earnings impacts vary across the within-firm earnings distribution, we also condition on workers' initial place in that distribution in 2016. For example, in Panel A where the x-axis is 60, we estimate equation 1 separately for men and women who were initially at the 60th percentile of the within-firm earnings distribution, and plot the resulting β_{2019} coefficients and associated 95% confidence intervals on the y-axis.[2] As can be seen from the widely overlapping confidence intervals in Figure C.2, we do not find compelling evidence that treatment effects vary by gender, age, or employment tenure.

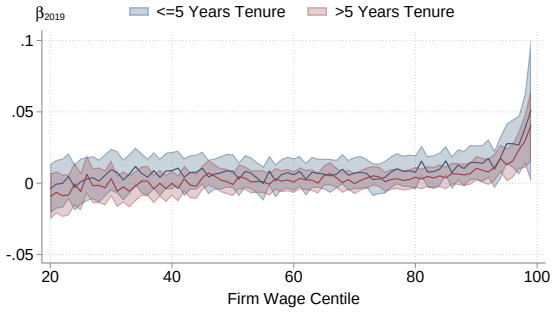
[2]Conditioning on workers' initial place in the within-firm distribution requires that our sample is comprised of "stayers", that is, employees who worked at the same firm in 2016 and 2019.

FIGURE C.2: WORKER HETEROGENEITY

Panel A: Gender

Panel B: Age

Panel C: Tenure



C.5 Additional Investment Results

TABLE C.4: INVESTMENT SCALED BY 2016 BASELINE SALES

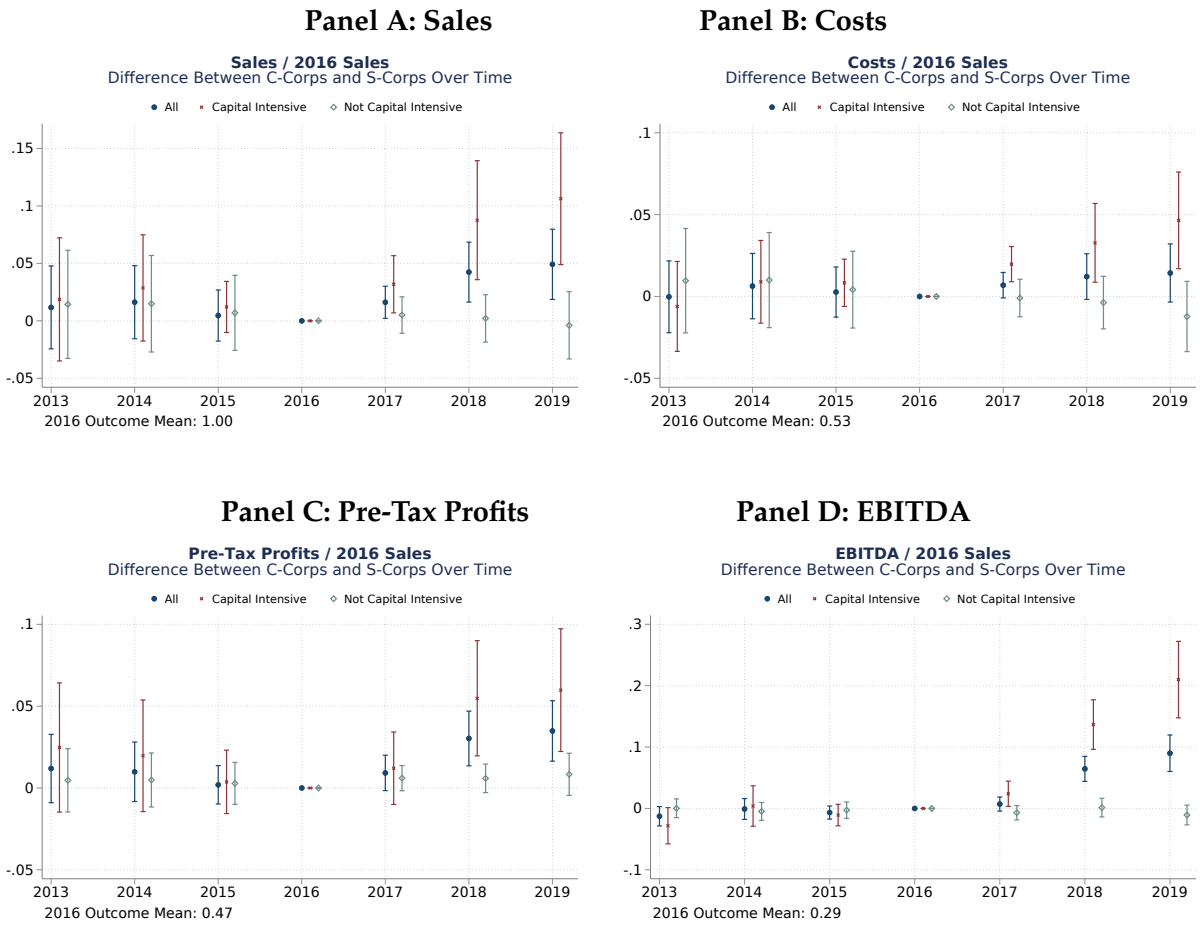
	(1) $NetI_t/K_{t-1}$	(2) $NewI_t/K_{t-1}$	(3) Short-Life	(4) Long-Life	(5) Structures
C × Post	0.008***	0.004	0.003**	-0.000	0.001
	(0.003)	(0.002)	(0.001)	(0.000)	(0.001)
2016 Outcome Mean	0.01	0.06	0.04	0.01	0.01
Firm FE	Yes	Yes	Yes	Yes	Yes
Industry-Size-Year FE	Yes	Yes	Yes	Yes	Yes
R2	0.26	0.60	0.63	0.50	0.38
N	81,529	81,529	81,529	81,529	81,529
N Firms	11,647	11,647	11,647	11,647	11,647

Notes: Table shows results for new investment scaled by baseline sales. See Section 3 for variable definitions.

C.6 Firm Heterogeneity

Event Studies for Capital Intensive vs. Non-Capital Intensive Industries

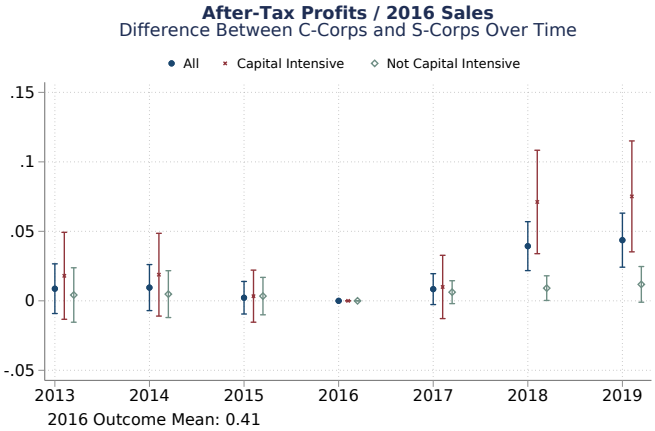
FIGURE C.3: SALES, COSTS, AND PRE-TAX PROFITS, BY CAPITAL INTENSITY



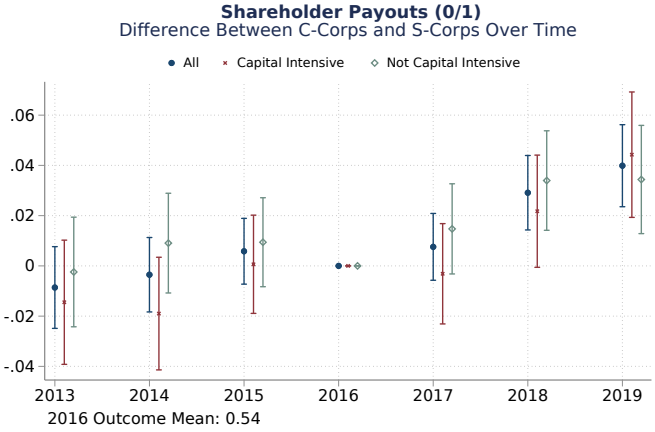
Notes: Unit of analysis is firm-year. The panels plot the β_t coefficients from equation 1, estimated for all firms and separately for capital-intensive and non-capital intensive industries. These coefficients capture average differences in outcomes between C- and S-corps over time after controlling for firm and industry-size-year fixed effects. Standard errors are clustered by firm, and error bands show 95% confidence intervals. Sales are gross receipts. Costs are equal to cost of goods sold, including both material and labor costs. Pre-tax profits are sales minus costs. EBITDA is a harmonized measure of earnings before interest, taxes, depreciation, and amoritization; see Section 3 and Appendix B for details.

FIGURE C.4: AFTER-TAX PROFITS AND SHAREHOLDER PAYOUTS, BY CAPITAL INTENSITY

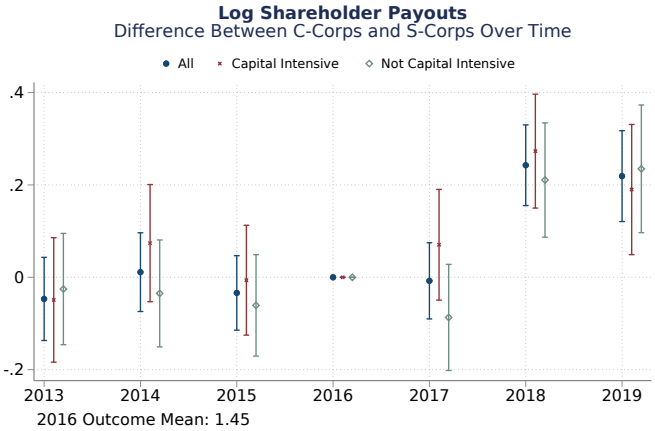
Panel A: After-Tax Profits



Panel B: Shareholder Payouts (Extensive Margin)

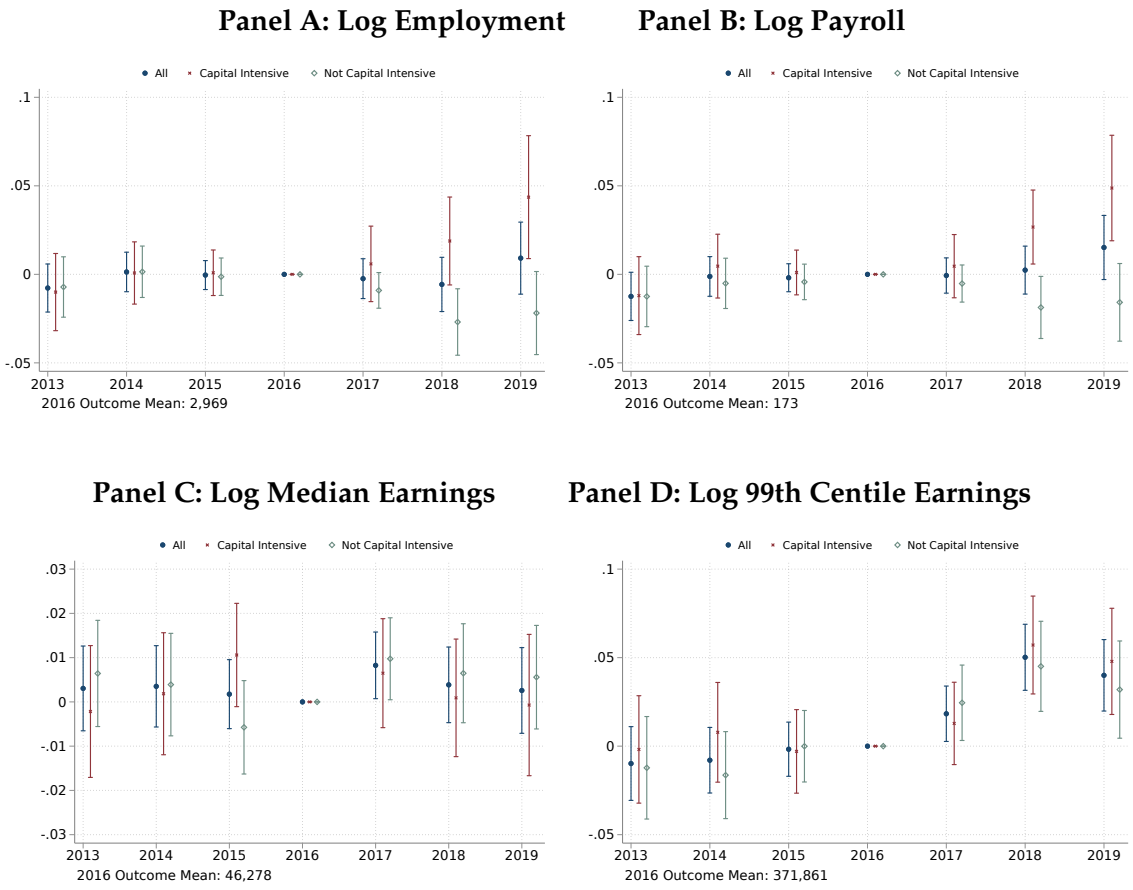


Panel C: Shareholder Payouts (Intensive Margin)



Notes: Unit of analysis is firm-year. The panels plot the β_t coefficients from equation 1, estimated for all firms and separately for capital-intensive and non-capital intensive industries. These coefficients capture average differences in outcomes between C- and S-corps over time after controlling for firm and industry-size-year fixed effects. Standard errors are clustered by firm and error bands show 95% confidence intervals. In Panel A, after-tax profits are defined as pre-tax profits minus tax, and are scaled by 2016 baseline sales. In Panel B, the outcome is an indicator equal to 1 if shareholder payouts are positive (i.e., the extensive margin), where payouts are defined as the sum of cash and property distributions to shareholders. In Panel C, the outcome is log shareholder payouts (i.e., the intensive margin). For additional information on data sources and variable definitions see Section 3 and Appendix B.

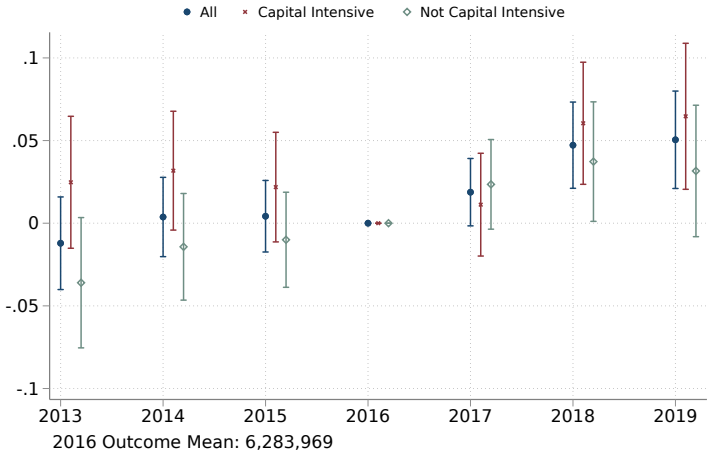
FIGURE C.5: LABOR MARKET OUTCOMES, BY CAPITAL INTENSITY



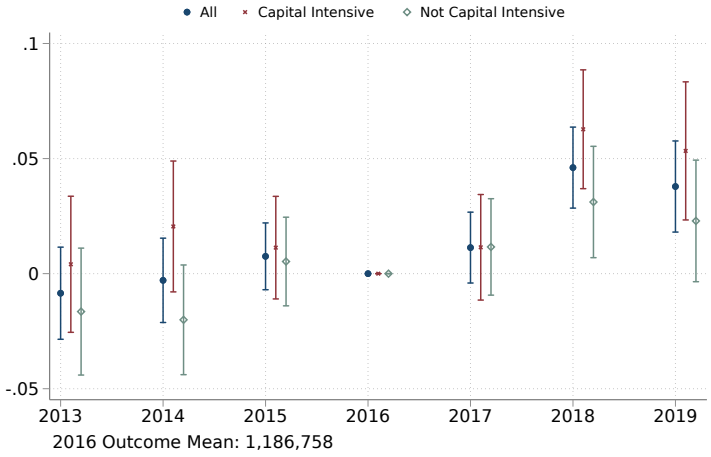
Notes: Unit of analysis is firm-year. The panels plot the β_t coefficients from equation 1, estimated for all firms and separately for capital-intensive and non-capital intensive industries. These coefficients capture average differences in outcomes between C- and S-corps over time after controlling for firm and industry-size-year fixed effects. Standard errors are clustered by firm and error bands show 95% confidence intervals. The right panels are constructed such that the distance between the C-corp and S-corp lines in each year is equal to the corresponding β_t coefficient in the left panel, and such that the observation-weighted average of the two lines is equal to the unweighted sample average of the outcome in each year. For data sources and variable definitions see Section 3.

FIGURE C.6: EXECUTIVE PAY, BY CAPITAL INTENSITY

Panel A: Log Officer Compensation



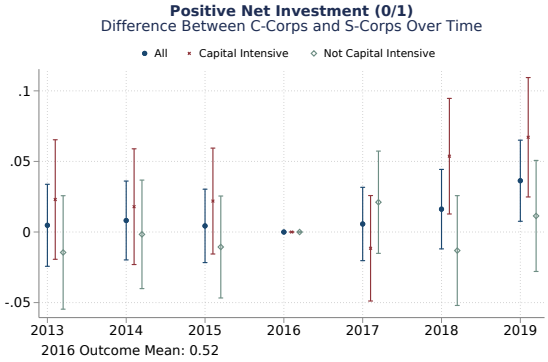
Panel B: Log Top 5 Earnings



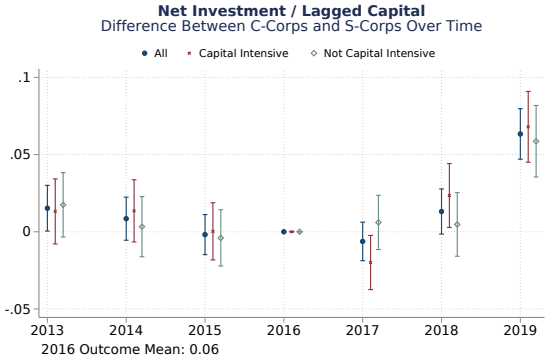
Notes: Unit of analysis is firm-year. The panels plot the β_t coefficients from equation 1, estimated for all firms and separately for capital-intensive and non-capital intensive industries. These coefficients capture average differences in outcomes between C- and S-corps over time after controlling for firm and industry-size-year fixed effects. Standard errors are clustered by firm and error bands show 95% confidence intervals. For data sources and variable definitions see Section 3.

FIGURE C.7: INVESTMENT, BY CAPITAL INTENSITY

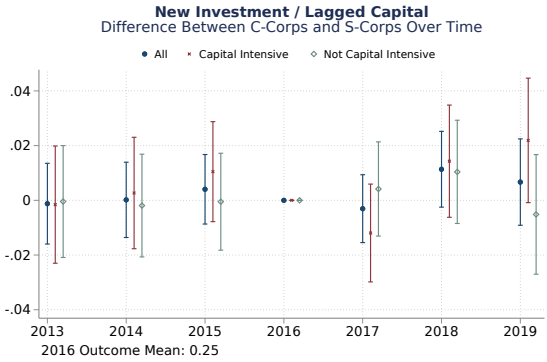
Panel A: Positive Net Investment (0/1)



Panel B: Net Investment / Lagged Capital



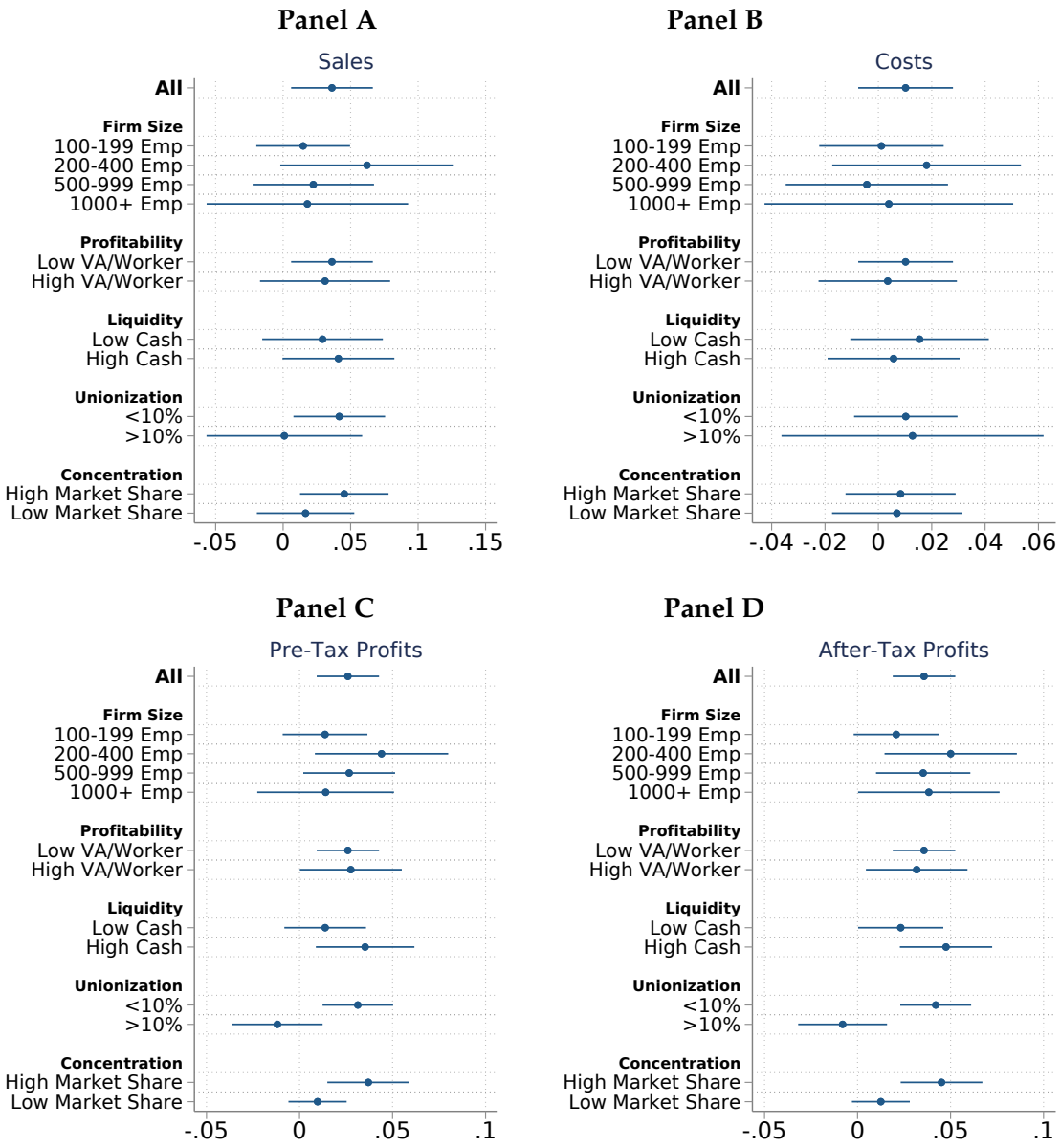
Panel C: New Investment / Lagged Capital



Notes: Unit of analysis is firm-year. The figure plots the β_t coefficients estimated from equation 1. These coefficients capture average differences in outcomes between C- and S-corps over time after controlling for firm and industry-size-year fixed effects. Standard errors are clustered by firm and error bands show 95% confidence intervals. Net investment is defined as the change in book value of depreciable capital assets minus accumulated book depreciation. New investment is measured as new capital expenditures; see Section 3 for details. The outcome in Panel A is an indicator equal to 1 if net investment is positive. The outcomes in Panels B and C, net and new investment, respectively, are scaled by lagged capital. For data sources and variable definitions see Section 3.

More Firm Heterogeneity

FIGURE C.8: FIRM HETEROGENEITY 1



Notes: The unit of analysis is a firm-year. The table shows the $C \times Post$ coefficients from equation 2. These coefficients estimate average differential changes in outcomes between C- and S-corps before and after TCJA controlling for firm and industry-size-year fixed effects (unless otherwise specified). Firm-size regressions include only industry-year fixed effects, and unionization regressions include only size-year fixed effects. Standard errors are clustered by firm. Firms are classified as high-cash if their mean ratio of liquid assets to assets in the pre-period is greater than the sample median. Firms are classified as highly profitable if their mean ratio of value-added per worker in the pre-period is greater than the sample median. Firms are classified as highly-concentrated if their market share in industry sales in the pre-period is greater than the sample median. Unionization rates are measured at the industry-level from the 2016 Current Population Survey.

FIGURE C.9: FIRM HETEROGENEITY 2

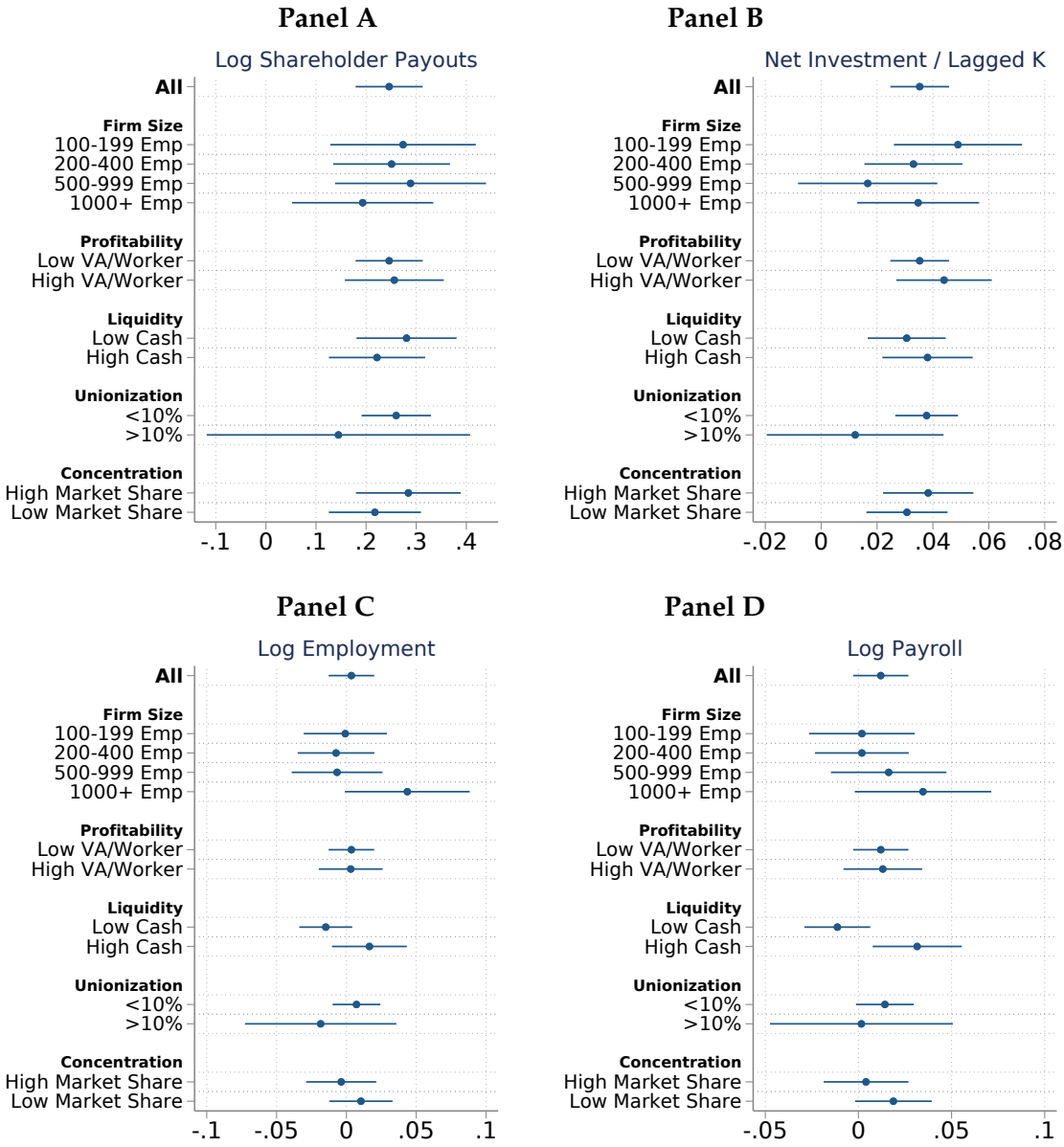
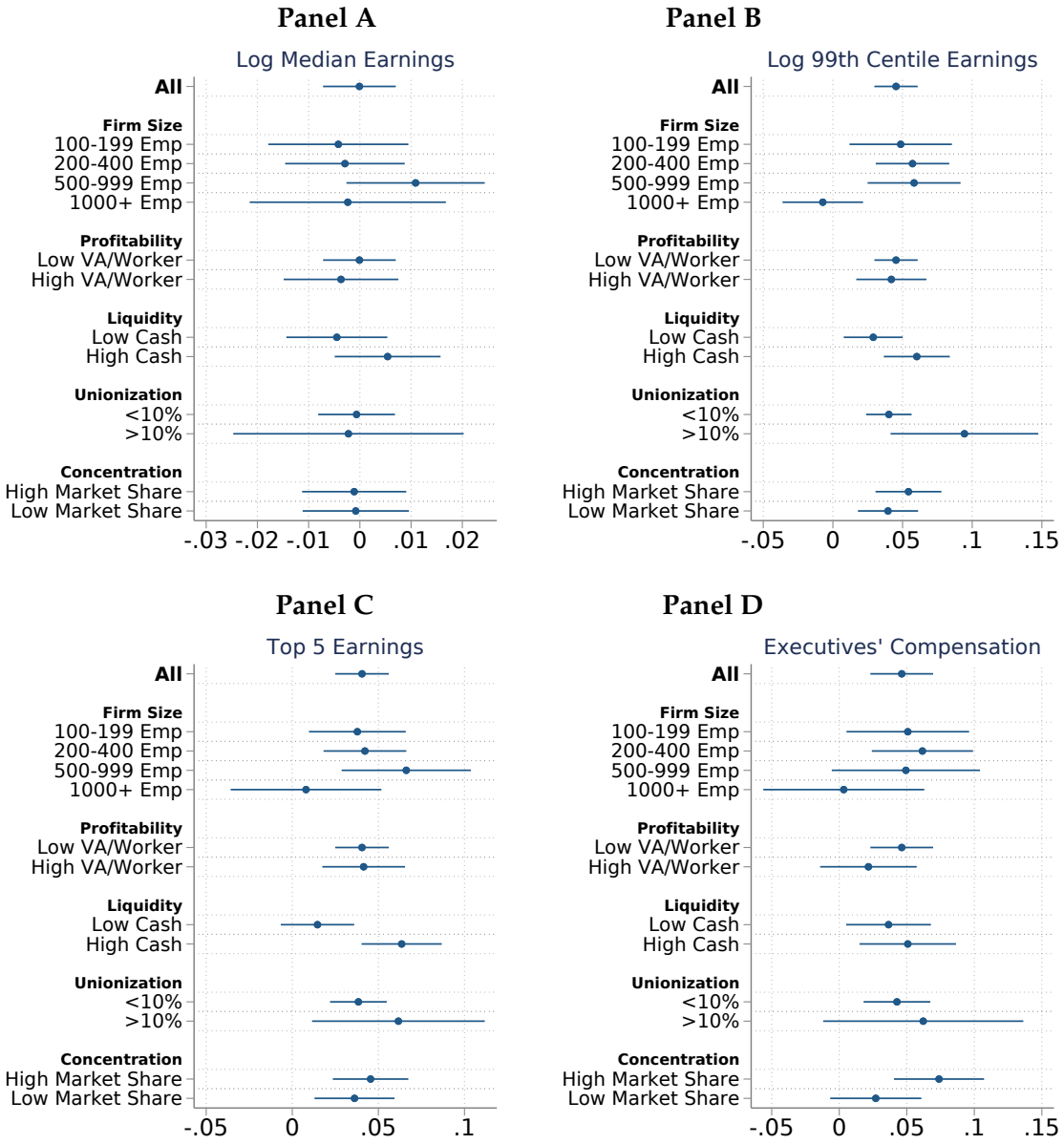


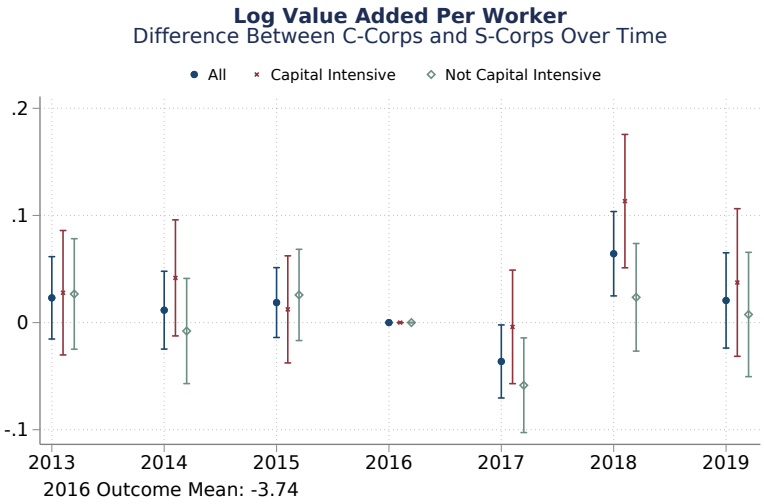
FIGURE C.10: FIRM HETEROGENEITY 3



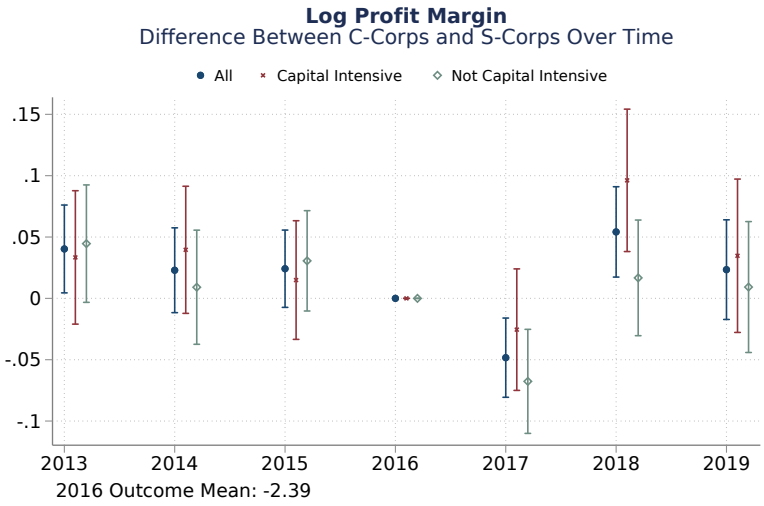
C.7 Productivity

FIGURE C.11: PRODUCTIVITY

Panel A: Log Valued Added Per Worker



Panel B: Log Profit Margin



Notes: Unit of analysis is firm-year. The panels plot the β_t coefficients from equation 1, estimated for all firms and separately for capital-intensive and non-capital intensive industries. These coefficients capture average differences in outcomes between C- and S-corps over time after controlling for firm and industry-size-year fixed effects. Standard errors are clustered by firm, and error bands show 95% confidence intervals. Value added is defined as EBITDA per worker. Profit margin is defined as the ratio of EBITDA to sales. Standard errors are clustered by firm and error bands show 95% confidence intervals.

C.8 2016-2019 Elasticities

TABLE C.5: ELASTICITIES ESTIMATED FROM TAX YEARS 2016-2019

	(1) Pre-tax π	(2) Post-tax π	(3) I_t/K_{t-1}	(4) w_{p50}	(5) w_{p95}	(6) Executives
$\ln(1-\tau_f)\times$ 2019	0.509^{***}	0.638^{***}	0.927^{***}	0.037	0.221^{***}	0.710^{***}
	(0.141)	(0.150)	(0.131)	(0.071)	(0.071)	(0.214)
2016 Outcome Mean	0.47	0.41	0.06	46,280	157,652	6,290,490
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Size-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	81,515	81,515	81,515	81,515	81,515	72,385
N Firms	11,645	11,645	11,645	11,645	11,645	10,678

Notes: Table shows elasticities estimated using changes in outcomes between C- and S-corps from 2016-2019. These estimates are unaffected by potential intertemporal shifting in tax years 2017 and 2018, and are similar to our benchmark estimates.

C.9 The Cost of Capital and Elasticities WRT Effective Marginal Tax Rates

We use a model of the corporate income tax based on theoretical work by Auerbach and Hassett (1992) and using data from Foertsch (2018). The Auerbach-Hassett model can flexibly incorporate salient features of firm behavior and of the U.S. business tax provisions before and after TCJA, including: forward-looking expectations; adjustment costs in investment; different tax rates on the income of shareholders of C- versus S-corps, including individual-level taxes on divdends, capital gains, interest income, and distributions of nonqualified annuities; the expansion and phase-out of bonus depreciation, as well as incomplete take-up of bonus; and the sunsetting of the QBI deduction. In the model, firms optimize the present discounted value of after-tax profits:

$$\max \mathbb{E}\left\{ \sum_{s=t}^{\infty}(1+\rho)^{-(s-t)}\left[\frac{F_s(K_s,L_s))(1-\tau_s)}{(1-r)} - w_s L_s(1-\tau_s) - C_s(I_s)I_s(1-\Gamma_s)\right] + A_t \right\} \tag{25}$$

where $\mathbb{E}$ is the expectations operator; ρ is the shareholders' discount rate; $F(K,L)$ is the firm's production function, which uses capital and labor as inputs; τ is the corporate income tax rate, which varies for C- and S-corps; r is the risk-free rate of return; w is the market wage, which may be generalized to include several types of workers and corresponding wage rates; I is new investment net of depreciation; $C(I)$ is a quadratic convex investment cost function capturing adjustment costs; Γ is the present discounted value of savings due to investment tax credits k and depreciation allowances:

$$\Gamma_s = k_s + A_s$$

and where A is the present discounted value of tax benefit from investment depreciation allowances D per dollar of investment:

$$A_s = \sum_{z=s}^{\infty}(1+r)^{-s(z-s)}\tau_s D_{z-s}$$

We assume that $F(K,L)$ varies across firms due to heterogeneous productivities, such that some firms are able to produce greater output than others given a fixed set of inputs. The first-order condition for profit maximization with respect to capital yields:

$$\underbrace{\frac{\partial F_s}{\partial K_s}}_{\text{MRPK}} = \underbrace{\left(\frac{(1-\Gamma_s)}{1-\tau_s}\right)\left(\frac{r+\delta+(\Gamma_{s+1}-\Gamma_s)}{1-\Gamma_s}\right)}_{\text{user cost of capital}} \equiv \phi_s \tag{26}$$

Auerbach-Hassett show that, in the presence of adjustment costs, optimization implies that firms' investment is a function of a weighted average of current and future user costs, given by:

$$\phi_t = \sum_{s \geq t} w_{s-t} \phi_s \tag{27}$$

where ϕ_s is the user cost of capital in period s, and w_{s-t} represents weights that sum to one and reflect adjustment costs. If adjustment costs are low, the weights assigned to future periods are low, and current investment is less sensitive to future user costs. Conversely, if adjustment costs are high, then the weights assigned to future periods are high, and investment is highly responsive to future user costs.

Foertsch (2018) parameterizes equation 26 separately for C-corporations and pass-through businesses (including S-Corps) for 54 NAICS industry codes.[3] The data are from the Bureau of Economic Analysis (BEA) and cover 76 distinct depreciable assets (covering both equipment and structures), land, inventories, and intangibles (such as research and development, advertisting, and artistic works). Foertsch then computes user costs at the entity type-level weighting by asset type and by industry, and computes effective marginal tax rates as follows:

$$EMTR_t = \frac{\phi_t - S}{\phi_t} \tag{28}$$

where S is a weighted average of the after-tax return on corporate equity and corporate debt. Effective marginal tax rates (EMTR's) measure the difference between the pre-tax and after-tax return on an investment, divided by the pre-tax return. In theory, a higher EMTR implies a larger distortion on firms' investment decisions. Foertsh (2018) reports EMTR's separately for C-corps and pass-through firms for each year in the ten-year period from 2018-2027, as well as EMTR's in a counterfactual scenario where TCJA was not enacted. Cohen, Hansen, and Hassett (2002) formulate the weights in Equation 27 using the parameter Ω:

$$w_0 = 1 - \Omega \tag{29}$$

$$w_{s-t} = w_{s-t-1} * \Omega, \forall s > t$$

[3]Here we broadly summarize the methodology in Foertsch (2018), and refer readers to that article for exhaustive details.

such that $\sum_{s \geq t} w_{s-t} = 1$. The expression implies that, if $\Omega = 0.5$, the weights in each succesive year are half as large as the prior year, and the successive year's user costs are half as important.

To estimate elasticities with respect to effective marginal tax rates, we use the actual and counterfactual (that is, pre-TCJA) EMTR's reported by Foertsch and, as in the baseline case of Cohen, Hansen, and Hassett (2002), apply an adjustment cost parameter of $\Omega = 0.5$. We also perform sensitivity analyses using Ω values of 0.3 (low adjustment costs) and 0.7 (high adjustment costs). Finally, we compute the TCJA shock to EMTR's separately for C- and S-corps as the difference in the resulting actual and counterfactual EMTR's, and estimate corresponding net-of-tax elasticities using equation 4.

The first row of Table C.6 reports our benchmark net-of-tax elasticities using the marginal income tax rates reported in the main text. Rows 2-4 report elasticities with respect to the (net-of) effective marginal tax rates, computed as described above, and varying the adjustment cost parameter. In the baseline adjustment cost case, $\Omega = 0.5$, the resulting elasticities are nearly identical to the benchmark elasticities reported in the main text (and in row 1). In the case with low adjustment costs, $\Omega = 0.3$, the elasticities are modestly higher. The modestly higher elasticities reflect that the tax wedge between C- and S-firms in the years immediately following TCJA was smaller relative to the latter end of the ten-year window, when the bonus expensing provisions are scheduled to phase out and several individual provisions (including the QBI) are scheduled to sunset. In this case, the reduced form coefficients (from equation 2) will be scaled by a smaller first-stage coefficient (from equation 3), generating a larger elasticity. The reverse hold for the high adjustment cost case where $\Omega = 0.7$, generating modestly smaller elasticities. In all cases, the estimated elasticities with respect to effective marginal tax rates remain within the confidence intervals of the benchmark estimates. Table C.7 reports corresponding cost of capital elasticities.

TABLE C.6: NET-OF-TAX ELASTICITIES

Specification	(1) ε^B Pre-Tax π	(2) ε^π After-Tax π	(3) $\varepsilon^{w_{p50}}$ p50 Earnings	(4) $\varepsilon^{w_{p50}}$ p95 Earnings	(5) $\varepsilon^{w_{exec}}$ Executive Earnings	(6) ε^I Net Investment
Benchmark	0.379	0.521	-0.001	0.177	0.646	0.516
	(0.127)	(0.129)	(0.052)	(0.053)	(0.169)	(0.082)
$\Omega = 0.5$	0.362	0.498	-0.001	0.171	0.645	0.491
	(0.119)	(0.119)	(0.050)	(0.050)	(0.165)	(0.075)
$\Omega = 0.3$	0.451	0.621	-0.002	0.213	0.804	0.612
	(0.148)	(0.149)	(0.063)	(0.063)	(0.206)	(0.093)
$\Omega = 0.7$	0.287	0.395	-0.001	0.135	0.512	0.389
	(0.094)	(0.095)	(0.040)	(0.040)	(0.131)	(0.059)
N	11,647	11,647	11,647	11,647	11,647	11,647

Notes: Row 1 reports benchmark net-of-tax elasticities using the marginal income tax rates reported in the main text. Rows 2-4 report elasticities with respect to the (net-of) effective marginal tax rates, computed as described above, and varying the adjustment cost parameter. See above for details.

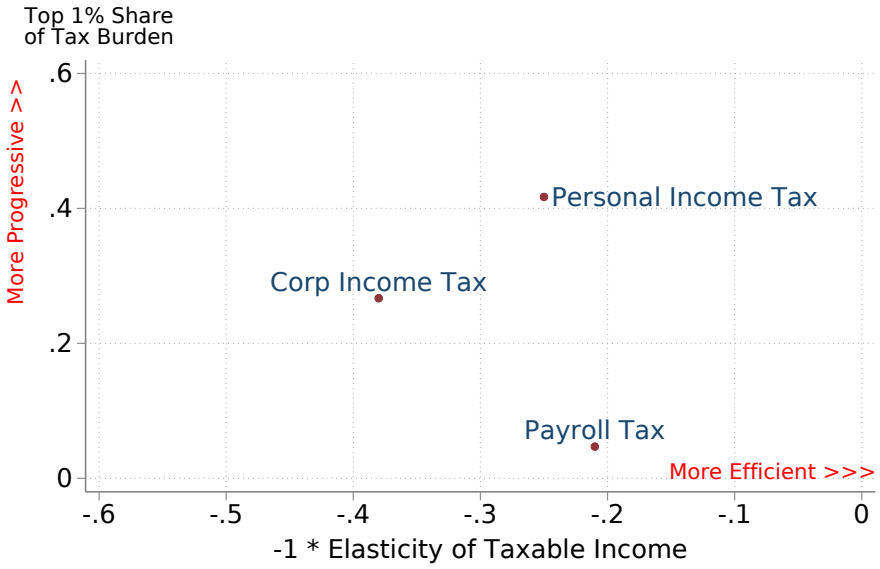
TABLE C.7: COST OF CAPITAL ELASTICITIES

	(1) Pre-tax π	(2) Post-tax π	(3) I_t/K_{t-1}	(4) w_{p50}	(5) w_{p95}	(6) w_{exec}
$\Delta\phi_f \times$ Post	-0.669***	-0.920***	-0.910***	0.002	-0.312***	-1.128***
	(0.224)	(0.228)	(0.145)	(0.092)	(0.094)	(0.298)
2016 Outcome Mean	0.47	0.41	0.06	46,278	157,639	6,283,969
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Size-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R2	81,529	81,529	81,529	81,529	81,529	72,400
N	11,647	11,647	11,647	11,647	11,647	10,680

Notes: Table reports cost-of-capital elasticities. See above for details

C.10 The Efficiency-Equity Tradeoff

FIGURE C.12: THE EFFICIENCY-EQUITY TRADEOFF IN CONTEXT



Notes: The figure contextualized our results on the corporate income tax against the personal income and payroll taxes, the two other largest sources of federal tax revenue in the United States. The elasticity of taxable income, shown on the X-axes, is a key parameter in the literature for measuring tax distortions. The share of tax burden borne by the top of the income distribution is a measure of progressivity.