Executive Compensation, Firm Investment and Innovation*

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Abstract

We study whether tax rules that increase the cost of executive incentive pay affect corporate innovation. The 2017 Tax Cuts and Jobs Act (TCJA) eliminated the Section 162(m) deduction for qualified performance-based compensation, differentially exposing firms that relied more on such pay before the reform. Using pre-reform reliance as a continuous treatment in difference-in-differences and event-study designs, we find that more exposed firms reduce R&D, patent applications, and intangible capital, while capital expenditures do not respond significantly. These firms also reduce performance-based compensation and executive vega, consistent with weaker incentives for managerial risk-taking. The effects are larger among firms with weaker growth opportunities and lower financial resilience, and are robust to controls for other TCJA provisions and alternative exposure measures. The results show that compensation-tax policy can affect innovation through managerial incentive contracts.

Keywords: Executive Compensation, Tax Policy, Investment, Innovation, Incentives, Risk-Taking, U.S. Tax Cuts and Jobs Act

JEL Codes: D22, E22, G32, H25, J33, O31, O32, O38

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1 Introduction

Innovation is a central driver of long-run firm value, yet it is also long-horizon, uncertain, and prone to early failure, which makes it unusually sensitive to the incentives facing the executives who decide whether to pursue it. How firms structure executive pay therefore plays an important role in shaping their investment in research and innovation, and one influential but often overlooked force behind that pay structure is the tax code, which determines how different forms of compensation are treated. In the United States, Section 162(m) of the Internal Revenue Code had long permitted publicly traded firms to deduct unlimited "qualified performance-based compensation" for covered executives, creating powerful tax incentives to tie pay to stock options, equity awards, and performance-linked bonuses. The 2017 Tax Cuts and Jobs Act (TCJA) eliminated this exception, imposing a uniform $1 million nondeductible cap on all forms of executive compensation for covered executives, broadening the set of covered employees to include the Chief Financial Officer, and introducing a permanent "once-covered, always-covered" rule. These changes substantially raised the after-tax cost of performance-based pay, especially for firms that had relied most heavily on such instruments, without any corresponding change in their competitive or technological environment.

We use this reform to examine whether increasing the tax price of incentive pay changes firms' allocation toward long-horizon innovation. The empirical challenge is that compensation design is chosen jointly with investment opportunities, making cross-sectional relationships between incentive pay and innovation difficult to interpret. We address this concern by exploiting cross-firm variation in pre-reform reliance on performance-based compensation. Specifically, we measure exposure as the share of total compensation paid to eligible executives in 2017 that was performance based. We then compare the post-reform outcomes of firms with different levels of exposure using difference-in-differences and event-study specifications that include firm and four-digit-industry-by-year fixed effects. To separate the Section 162(m) channel from other components of the TCJA, we also account for firms' exposure to the corporate tax-rate reduction, the Section 163(j) interest-deductibility limitation, bonus depreciation, and the reform's international provisions.

We find that firms more exposed to the deductibility elimination reduced innovation inputs and outputs. A 10-percentage-point increase in exposure reduces R&D intensity by 1.3 percent and patent-application intensity by 3.4 percent. At the corresponding sample means, these estimates imply approximately $1 million less annual R&D spending and two fewer patent applications per firm-year. We find no statistically detectable response in capital expenditures, indicating that the decline is concentrated in innovation and intangible investment rather than extending uniformly to physical investment. We also find that the decline in innovation is not limited to flows: intangible capital stocks also contract, with knowledge capital falling by 1.3 percent ($3.9 million) and organizational capital by 1.1 percent ($7.5 million) per 10-percentage-point increase in exposure.

Our paper makes three contributions. First, we provide evidence of an internal-governance channel through which business taxation affects innovation. Unlike tax provisions that directly change the cost of R&D or physical capital, the Section 162(m) reform changes the cost of designing executive incentives and thereby alters firms' willingness to sustain risky, long-horizon projects. Second, we extend the literature on the taxation of executive compensation beyond pay outcomes. We trace firms' exposure to the repeal through reductions in performance-based compensation and executive vega to declines in R&D, patent applications, and intangible capital, while capital expenditures do not respond significantly. Third, we examine compensation and portfolio incentives across the eligible senior-executive group rather than focusing exclusively on the CEO, capturing adjustments distributed across the management team.

We conduct several additional analyses to assess whether the baseline findings reflect the Section 162(m) reform rather than concurrent changes introduced by the broader TCJA. We augment the baseline specification with controls for firms' exposure to the corporate rate reduction, the Section 163(j) interest-deductibility limitation, bonus depreciation under Section 168(k), foreign tax exposure, multinational status, and changes in the user cost of capital. We then replace the baseline treatment variable with an alternative measure based on the potential loss of deductibility relative to pre-reform pretax income. We also scale the reduced-form estimates by the first-stage response of performance-based compensation intensity, which expresses the

changes in innovation per unit of reform-induced change in incentive pay. The baseline findings remain stable across these analyses. Because the scaling exercise uses the same reform variation as the reduced-form estimates, we interpret it as evidence consistent with the compensation channel rather than as an independent source of identification.

We next analyze changes in compensation design and portfolio incentives to assess the managerial-incentive mechanism. A 10-percentage-point increase in pre-reform exposure reduces performance-based compensation intensity by 3.9–4.3 percentage points and lowers total performance-based compensation paid to eligible executives by 17.4 percent, equivalent to approximately $2.1 million at the pre-reform mean. The adjustment is concentrated in stock awards and non-equity incentive compensation, while option intensity does not change significantly. To capture the risk-taking incentives embedded in executive pay, we follow Coles et al. (2006) and analyze executive vega and delta.[1] We find that the vega of the median eligible executive falls by 4.8 percent, whereas delta does not change significantly. The contrast between declining vega and stable delta suggests that the reform weakened incentives for managerial risk-taking rather than broadly reducing pay–performance sensitivity.

We also examine whether the effects vary with firms' pre-reform growth opportunities and financial resilience. We find that the R&D and patenting declines are largest among firms with lower market-to-book ratios and become smaller as market-to-book increases. The R&D response is also attenuated among firms with higher Altman Z-scores and Tobin's Q, while the patenting response becomes smaller among firms with stronger profitability, cash flow, Altman Z-scores, and Tobin's Q. These results suggest that firms with more valuable investment pipelines face a higher opportunity cost of abandoning innovative projects and therefore preserve R&D more aggressively. On the other hand, firms with healthier balance sheets are better able to absorb the higher tax cost of incentive pay or redesign compensation without reducing long-horizon investment. Lower-growth and financially weaker firms consequently account for a disproportionate share of the decline in innovation following

[1] Vega is the change in executive wealth associated with a 0.01 increase in the volatility of the firm's stock returns, while delta is the change in executive wealth associated with a 1 percent increase in the firm's stock price.

the reform.

The findings remain stable across several robustness checks. Placebo event studies show flat and statistically insignificant pre-reform coefficients, while propensity-score reweighting produces estimates close to the baseline. Results are robust across alternative functional forms, including the ratio transformation, the inverse hyperbolic sine, and Poisson pseudo-maximum-likelihood (PPML). Relatedly, the direct-ratio specifications provide an important check because they normalize the outcomes by lagged assets without imposing the logarithmic transformation used in the baseline. They continue to show declines in R&D and patent-application intensity, together with no detectable change in capital-expenditure intensity. The results therefore do not depend on either the log transformation or the addition of one to retain zero-valued observations. The inverse-hyperbolic-sine specifications similarly accommodate zeros while limiting the influence of highly skewed outcomes, and the PPML estimates model the conditional mean directly in levels. Both approaches preserve the central distinction between declining innovation and the absence of a significant capital-expenditure response. The estimates also remain stable after adding state- and year-level linear trends and corporate governance controls such as board size and non-executive director ratio, while event studies using forward citations and breakthrough patents provide suggestive evidence of declining patent quality due to the reform.

Related Literature This paper relates to recent research on business taxation, executive compensation, and corporate innovation in the United States. A large public-economics literature examines how business tax provisions affect investment, capital allocation, and adjustment through marginal tax rates, bonus depreciation, the user cost of capital, and tax complexity (Auerbach, 1989; Cummins et al., 1994; Yagan, 2015; Zwick and Mahon, 2017; Chodorow-Reich et al., 2024). We study a different margin. Section 162(m) did not directly change the tax price of R&D or physical capital; it changed the tax price of performance-based executive compensation. Our findings therefore identify an internal-governance channel through which business taxation affects innovation by altering the cost of the contracts used to support risky, long-horizon investment.

Our paper is also related to research on the taxation of executive compensation. Prior work shows that tax policy affects the level, timing, and composition of executive pay (Frydman and Molloy, 2011; Gorry et al., 2017; Durrant et al., 2021; Galle et al., 2021; De Simone et al., 2022; Luna et al., 2023; Babenko et al., 2025). The closest studies examine the TCJA repeal of the Section 162(m) performance-pay exception and document changes in executive compensation. We extend this work by tracing firms' pre-reform exposure beyond pay outcomes. We show that more-exposed firms reduce performance-based compensation and executive vega, together with R&D, patent applications, and intangible capital, while capital expenditures do not respond significantly. We also construct compensation and portfolio-incentive measures across the eligible senior-executive group rather than focusing exclusively on the CEO, capturing adjustments distributed across the management team.

The paper further contributes to research on managerial characteristics and incentives, corporate investment, and innovation. Agency models emphasize how compensation contracts affect effort, risk-taking, and the allocation of managerial attention (Jensen and Meckling, 1976; Holmström, 1979; Jensen and Murphy, 1990; Holmstrom and Milgrom, 1991). Related evidence shows that individual executives matter for firm outcomes and that compensation reflects differences in managerial ability. Using CEO departures, Chang et al. (2010) show that prior firm performance, CEO pay, and market reactions to CEO departures predict executives' subsequent labor-market outcomes and firms' post-departure performance. Empirical studies further connect equity-based compensation and portfolio incentives to investment, risk-taking, disclosure, earnings management, and long-term corporate policies (Guay, 1999; Coles et al., 2006; Armstrong and Vashishtha, 2012; Cheng and Warfield, 2005; Bergstresser and Philippon, 2006; Edmans et al., 2017; Ladika and Sautner, 2020). Manso (2011) shows that motivating innovation requires contracts that tolerate early failure and reward long-term success rather than conventional pay-for-performance arrangements that penalize short-run failure. Ferreira et al. (2014) show that ownership structure affects managers' willingness to pursue innovative rather than conventional projects by changing the tolerance for early failure and the rewards to risk-taking. We add evidence from a federal tax reform that increased the cost of performance-based pay for some firms more than others. The accompanying declines in performance-based

compensation, executive vega, R&D, and patenting connect the tax treatment of managerial incentives to firms' allocation toward uncertain projects whose returns are delayed and difficult to contract on.

Layout The paper is organized as follows: Section 2 describes the institutional background, data, and variable construction. Section 3 outlines our empirical specification and discusses the key results. Section 4 discusses several robustness checks. Section 5 offers concluding remarks.

2 Institutional Background and Data

This section explains how the TCJA's repeal of the Section 162(m) performance-pay exception generates cross-firm variation in the tax price of incentive compensation. It then describes the construction of the firm-level dataset, including variable definitions, data sources, measurement, and sample distribution.

2.1 The Tax Cuts and Jobs Act (TCJA)

The Section 162(m) reform is useful for identification because it changed the after-tax price of one compensation instrument rather than all firms' tax incentives uniformly. Before the TCJA, covered public firms could generally deduct compensation above $1 million only when it qualified as performance-based pay. Firms that relied more heavily on stock awards, option grants, or non-equity incentive compensation for covered executives therefore received a larger tax benefit from the exception. Firms relying mostly on salary or other nonqualified pay received little benefit from it. The 2018 repeal removed this differential treatment and converted pre-reform reliance on performance pay into differential exposure to a higher tax price of incentive compensation.

The cross-firm variation comes from compensation structures set before the reform. A firm with high 2017 performance-based eligible intensity lost more of the deduction benefit when the exception disappeared; a firm with low intensity faced a smaller change. This is the source of treatment intensity in the empirical design. The reform

also expanded covered employees to include the Chief Financial Officer and introduced the "once-covered, always-covered" rule, increasing the set of executives for whom the cap could bind. These features matter because our exposure measure is defined over eligible executives rather than only the Chief Executive Officer.

Other TCJA provisions could affect investment directly, so they are not the focus of this subsection but enter the empirical design as controls. The corporate rate cut, the Section 163(j) limit on interest deductibility, bonus depreciation under Section 168(k), and international provisions may move the user cost of capital or the tax base. Our identifying variation is instead the loss of deductibility for performance-based compensation under Section 162(m), conditional on those other TCJA channels.

2.2 Data

Appendix A provides a fuller description of the data sources, sample coverage, and variable construction, together with detailed summary statistics for the estimation sample.

Compustat We use the annual version of the Compustat North America Fundamentals, which provides firm-level accounting data compiled from income statements, balance sheets, and cash flow statements for publicly traded U.S. firms. First, we apply standard Compustat filters to ensure that our firm-year observations are internally consistent and comparable across the sample. We restrict the dataset to industrial-format filings (*indfmt* = *INDL*), which capture operating firms rather than banks or insurance companies that follow different accounting rules. We retain only domestic population sources (*popsrc* = *D*) to avoid inconsistencies arising from foreign filings that may follow different reporting requirements. We use consolidated statements (*consol* = *C*) to reflect the full economic activity of the firm rather than individual subsidiaries. We also include only observations reported in the standard data format (*datafmt* = *STD*) to ensure uniform accounting conventions across firms and over time. Finally, we exclude firms in regulated or non-comparable sectors, namely utilities (*4-digit SIC code: 4900–4999*), financial and real estate industries (*4-digit SIC code: 6000–6999*), and public administration (*4-digit SIC code: 9000–9999*).

Innovation We use multiple measures to capture firm-level innovation. We obtain research and development (R&D) expenditures from Compustat, which measure firms' investment in innovative activity. We also use the DISCERN database[2] to construct a firm-year panel of innovation outputs, including the number of patent applications. Following Arora et al. (2021, 2024), we use DISCERN to consistently measure firm-level innovation outcomes over time. We focus on patent applications, which provide a timely measure of innovative output.

Executive Compensation We collect detailed data on executive compensation from the ExecuComp database, which provides annual compensation information for top executives at publicly traded U.S. firms. For each executive, ExecuComp reports salary, bonus, stock awards, option awards, non-equity incentive plan compensation, and other forms of pay, along with total compensation measures based on both realized and grant-date values. The database also includes executive identifiers, titles, and tenure information, which allow us to identify executives covered by Section 162(m) and to apply the appropriate eligibility criteria under the revised statute. Our analysis focuses on the compensation structure of eligible executives subject to the $1 million deductibility cap. We merge ExecuComp and Compustat at the firm-year level; the sample is restricted to firm-years with ExecuComp coverage to ensure executive compensation measures are directly observed.

Corporate Governance We augment our baseline sample with board-level governance information from BoardEx. Using these data, we construct two firm-year governance measures: board size, defined as the total number of directors, and the share of non-executive directors.

We further combine ExecuComp compensation data with CRSP stock-return data to construct standard measures of managerial incentives. Following Coles et al. (2006, 2013) and Chircop et al. (2025), we compute Vega and Delta using the methodology and data provided by Coles et al. (2006)[3]. These measures are constructed at the executive level and aggregated to the firm-year level by taking the median across eligible

[2]See https://discern-project.com/.
[3]The dataset is available at https://sites.temple.edu/lnaveen/data/.

executives. Vega measures the change in the median eligible executive's wealth associated with a 0.01 increase in the volatility of firm returns, while Delta captures the dollar change in wealth associated with a 1 percent change in the firm's stock price. Eligible Executive Portfolio Wealth reflects the total value of the median eligible executive's stock and option holdings.

Marginal Tax Rates We incorporate firm-level marginal tax rates (MTRs) from the simulated tax rate series developed by Graham (1996a) and Graham (1996b). Unlike statutory rates or backward-looking effective tax rates, these simulated MTRs more accurately capture the marginal tax incentives firms face when making compensation and investment decisions. We obtain the data from John Graham's publicly available database,[4] which provides annual firm-level simulated marginal tax rates for Compustat firms.

Several data limitations merit acknowledgment. First, Compustat covers only publicly listed U.S. corporations; private firms, which account for the majority of U.S. employment and economic activity, fall outside the scope of our analysis, and performance-based compensation practices among private-firm executives may differ substantially from the patterns we document. Second, board-level variables are sourced from BoardEx, whose coverage skews toward larger, more prominent firms and may further narrow the sample relative to the full Compustat universe.

2.3 Variable Measurement

Our primary measure of executive compensation is *comp1*, defined as the sum of salary, bonus, non-equity incentive plan compensation, the grant-date fair value of restricted stock and stock options, deferred compensation earnings, and other compensation.[5] To assess the robustness of our findings, we also examine alternative compensation metrics such as *comp2*, *alt1*, *alt2*, and *sec*. The variable *comp2* is based on `tdc2`, which includes the value realized from stock option exercises. *sec* reflects

[4]We thank John Graham for making the simulated marginal tax rate data publicly available. More details can be found at https://people.duke.edu/~jgraham/taxform.html.

[5]In our main analysis, we use the `tdc1` variable from ExecuComp, which values stock and option awards at their grant-date fair value.

total compensation as reported in SEC filings. *alt1* and *alt2* modify `sec` by replacing reported equity compensation with either the grant-date fair value (*alt1*) or the realized value from equity vesting and option exercises (*alt2*).

Key outcome variables such as R&D, capital expenditures, and patent applications are scaled by lagged total assets and log-transformed (adding one to retain zero observations). Results are robust to alternative measures: the direct ratio, the inverse hyperbolic sine transformation, and Poisson pseudo-maximum-likelihood estimation.

We define *performance-based compensation* as the sum of non-equity incentive plan compensation, restricted stock grants, and stock option awards. Consistent with the expanded definition of "covered employees" we focus our analysis on CEOs, CFOs, and the top three highest-paid executives. We consider *eligible executives* to be those among covered employees who received more than $1 million in total compensation (with strictly positive performance-based compensation). Using the sample of eligible executives, we construct a measure of *performance-based eligible intensity*, defined as the ratio of a firm's total performance-based compensation paid to eligible executives to the firm's total compensation paid to those executives. Given that the TCJA was enacted in fiscal year 2018, we specifically examine this intensity measure in 2017 to capture firms' compensation structures immediately prior to the reform.

2.4 Control Variables

Our baseline regressions include standard firm-level controls. We define *Leverage* as total debt divided by total assets and *CashFlow* as operating cash flow scaled by assets. *Sales* measures year-over-year revenue growth, and *Employees* is the logarithm of total employment. *LaborIntensity* is employment scaled by assets, while *AssetTurnover* is sales divided by assets. *Market-to-Book* is the ratio of market value to book assets, and *ROA* is return on assets as the ratio of income to book assets. *FirmAge* is the number of years since founding.[6]

We also include board-level controls for board size and the fraction of non-executive

[6]Founding years are obtained from Jay Ritter's IPO database when available. If unavailable, we use the first appearance in CRSP, and if still missing, the earliest appearance in Compustat. When multiple sources report founding years, we use the earliest.

directors. All specifications include firm fixed effects and industry-by-year fixed effects. Identification relies on within-firm variation over time. Table D.1 provides detailed definitions of variables and data sources.

2.5 Sample Construction

We construct a firm-year panel covering 2012–2022. The initial dataset includes 16,508 unique firms and 105,855 firm-year observations. After excluding firms in regulated or non-comparable sectors (financial institutions, utilities, public administration, and nonclassifiable firms), the sample contains 8,925 firms and 58,040 observations. We merge with ExecuComp to construct the performance-based compensation intensity exposure variable; because ExecuComp covers primarily S&P 1500 constituents and large-cap firms, this merge substantially narrows the sample to 1,915 firms and 16,483 firm-year observations with non-missing exposure values. We drop observations with negative values for key financial variables, including market value, R&D expenditures, capital expenditures, total assets, and sales. We then restrict the sample to firms observed in all years of the sample window, yielding 1,050 firms and 11,550 firm-year observations. This balanced-panel requirement ensures that identification comes from within-firm variation over time rather than from compositional shifts in the firm population: entry and exit events whether driven by IPOs, delistings, mergers, or bankruptcies can confound DiD estimates if such transitions are correlated with firms' pre-reform compensation structures or investment propensities. Finally, we remove singletons and observations with missing regression variables, resulting in a final estimation sample of 741 firms and 7,101 firm-year observations. Table D.2 summarizes the sample selection process.

All monetary variables are deflated to constant 1990 U.S. dollars using the Consumer Price Index. Continuous variables are winsorized at the 1st and 99th percentiles within each year.

Sample Period and Post-Treatment Window Our sample spans 2012–2022, with the TCJA taking effect in January 2018. The pre-reform window (2012–2017) provides six years of baseline variation, while the post-reform window (2018–2022) provides five years to trace firms' behavioral responses. We retain 2022 to observe medium-run

responses but do not extend the panel farther because the TCJA's separate amendment to Section 174 began requiring firms to capitalize and amortize research and experimental expenditures for tax years beginning after December 31, 2021. That rule affects R&D incentives independently of Section 162(m); extending the sample further into the post-2021 regime would make it harder to separate the compensation-tax channel from the direct tax treatment of R&D.

The post-reform window includes the COVID-19 years of 2020 and 2021. We do not exclude these years because our specifications absorb the COVID shock at multiple levels. Firm fixed effects remove the time-invariant component of each firm's exposure to pandemic-related disruption. Industry-by-year fixed effects absorb the full set of industry-specific shocks in each calendar year, including differential exposure to lockdowns, supply-chain disruptions, and sectoral demand shifts that disproportionately affected particular industries during the pandemic. As a further check, the event-study estimates show that the post-reform divergence between high- and low-exposure firms began prior to the COVID period (visible as early as 2019) and continued beyond it, indicating that our findings are not driven by the differential impact of the pandemic on high- and low-exposure firms.

3 Empirical Analysis

3.1 Empirical Specification

We outline the difference-in-differences and event-study specifications used to estimate the effects of the TCJA's reform of Section 162(m).

Difference-in-Differences We measure firms' ex ante exposure to the increase in the cost of performance-based compensation by their reliance on such incentives prior to the reform. Specifically, $\text{Exposure}_{i,2017}$ denotes the share of executive compensation classified as performance-based in 2017. Firms with greater reliance on performance-based pay were more exposed to the elimination of deductibility under Section 162(m).

We estimate:

$$\begin{aligned} Y_{it} = {} & \beta_0 \, \text{Post}_t + \delta_1 \, \text{Exposure}_{i,2017} + \delta_2 \, \text{MTR}_{i,2017} + \delta_3 \, \text{Interest Exposure}_{i,2017} \\ & + \beta_1 \left(\text{Post}_t \times \text{Exposure}_{i,2017} \right) + \beta_2 \left(\text{Post}_t \times \text{MTR}_{i,2017} \right) \\ & + \beta_3 \left(\text{Post}_t \times \text{Interest Exposure}_{i,2017} \right) + X'_{it-1}\gamma + \lambda_{j,t} + \alpha_i + \varepsilon_{it}, \end{aligned} \tag{1}$$

where Y_{it} denotes firm i's outcome in year t. Post_t equals one beginning in 2018. The coefficient β_1 captures the differential change in outcomes after the reform for firms with greater pre-reform Section 162(m) exposure.

To account for other provisions of the TCJA that may affect firm behavior, we include firms' exposure to the statutory corporate tax rate reduction ($\text{MTR}_{i,2017}$) and to the revised interest deductibility limits under Section 163(j), each measured in 2017 and interacted with Post_t. $\text{Interest Exposure}_{i,2017}$ equals one if interest expense exceeded 30 percent of EBITDA in 2017. The specification includes firm fixed effects α_i and industry-by-year fixed effects $\lambda_{j,t}$ to absorb time-invariant firm characteristics and shocks common to firms within a given industry-year, including contemporaneous policy changes that affect firms at the industry or aggregate level. The stand-alone terms Post_t, $\text{Exposure}_{i,2017}$, $\text{MTR}_{i,2017}$, and $\text{Interest Exposure}_{i,2017}$ are subsumed by the fixed effects and are therefore not separately estimated. The three 2017 exposure measures are time-invariant and are absorbed by the firm fixed effects α_i, whereas Post_t is common to all firms within each period and is absorbed by the industry-by-year fixed effects $\lambda_{j,t}$. Standard errors are clustered at the firm level.

Event Study To examine dynamic responses and assess pre-trends, we estimate an event-study specification that interacts event-time indicators with firms' pre-reform exposure:

$$\begin{aligned} Y_{it} = {} & \sum_{\tau \neq -1} \beta_\tau \left(\mathbb{1}\{t = \tau\} \times \text{Exposure}_{i,2017} \right) + \beta_2 \left(\text{Post}_t \times \text{MTR}_{i,2017} \right) \\ & + \beta_3 \left(\text{Post}_t \times \text{InterestExposure}_{i,2017} \right) + X'_{it-1}\gamma + \lambda_{j,t} + \alpha_i + \varepsilon_{it}, \end{aligned} \tag{2}$$

where event time is defined relative to the year prior to implementation, with $\tau = -1$ omitted as the reference period and $\tau = 0$ corresponding to 2018. The coefficients β_τ trace the differential evolution of outcomes for firms with higher pre-reform exposure

in the years before and after the TCJA.

The specification includes the same lagged controls, firm fixed effects, and industry-by-year fixed effects as in equation (1). Standard errors are clustered at the firm level. The pre-reform coefficients provide a direct test of the parallel trends assumption.

Identification Assumptions Identification relies on a parallel trends assumption: absent the TCJA reform, outcomes for firms with different levels of pre-reform exposure would have evolved similarly. Because $\text{Exposure}_{i,2017}$ is measured prior to implementation, it is predetermined with respect to post-reform adjustments in compensation structure and firm behavior. We assess the plausibility of parallel trends using the event-study specification by examining whether the pre-reform coefficients are statistically indistinguishable from zero. All specifications include firm fixed effects and industry-by-year fixed effects (at the 4-digit NAICS level), as well as standard lagged controls.

Exogeneity Test To assess whether pre-reform exposure is systematically related to observable firm characteristics, we regress firm-level eligible-executive performance-based compensation intensity in the pre-TCJA period on lagged firm-level controls and lagged board size and non-executive director ratio which can be associated with the treatment variable. We also absorb firm and industry-year fixed effects.

Table 1 reports the results across three specifications: the baseline intensity measure (Column 1), its *asinh* transformation (Column 2), and a PPML estimator (Column 3). Across all three specifications, virtually none of the lagged firm characteristics are statistically significant predictors of pre-reform exposure, with the exception of the market-to-book ratio, which enters with a small and marginally significant coefficient. Crucially, the joint significance tests fail to reject the null hypothesis that all control variables are jointly equal to zero: the F-statistics in Columns (1) and (2) are 1.48 ($p = 0.134$) and 1.46 ($p = 0.142$), respectively, and the Wald χ^2 statistic in Column (3) is 16.55 ($p = 0.122$). These results indicate that observable firm characteristics do not systematically predict treatment intensity in the pre-reform period, supporting the identifying assumption that pre-reform exposure is plausibly exogenous with respect to firm-level observables.

Table 1: Treatment Variable Exogeneity Test

	(1) Baseline	(2) *ASINH*	(3) *PPML*
L.FirmAge	0.012	0.009	0.051
	(0.063)	(0.056)	(0.096)
L.ROA	0.387	0.357	0.546
	(0.416)	(0.378)	(0.594)
L.Sales	0.012	0.009	0.010
	(0.023)	(0.021)	(0.035)
L.AssetTurnover	-0.010	-0.010	-0.010
	(0.022)	(0.020)	(0.035)
L.Market-to-Book	0.019***	0.017***	0.028***
	(0.007)	(0.006)	(0.011)
L.Leverage	-0.038	-0.033	-0.071
	(0.041)	(0.037)	(0.060)
L.CashFlow	-0.299	-0.267	-0.414
	(0.430)	(0.390)	(0.620)
L.Employees	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.001)
L.LaborIntensity	0.002	0.002	0.004
	(0.002)	(0.002)	(0.004)
L.Board Size	0.005	0.004	0.007
	(0.005)	(0.005)	(0.007)
L.Non-Executive Director Ratio	0.610	0.514	0.964
	(0.474)	(0.423)	(0.731)
Controls	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
R^2	0.798	0.796	-
F-statistic	1.48	1.46	-
Prob > F	0.134	0.142	-
Wald χ^2	-	-	16.55
Prob > χ^2	-	-	0.122
Observations	3,368	3,368	3,311

Note: This table reports an exogeneity test by regressing firm-level eligible-executive performance-based compensation intensity in the pre-TCJA period on pre-TCJA firm characteristics. Column (1) uses dependent variable as the pre-TCJA firm-level eligible executives performance based compensation intensity ; Column (2) uses the inverse hyperbolic sine (*asinh*) transformation of this variable; Column (3) uses the Poisson Pseudo-Maximum Likelihood (PPML) estimator using the same variable. Standard errors (in parentheses) are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

3.2 Difference-in-Differences Results

3.2.1 Baseline Exposure Measure

In this section, we present empirical results on the impact of the TCJA on firm-level investment and innovation outcomes, followed by an analysis of changes in firm-level compensation structures and median eligible executives' risk-taking. We also provide heterogeneity analysis.

Table 2: DiD Estimates: Innovation and Investment Outcomes

	(1)	(2)	(3)
Panel A: Dependent Variable - R&D			
Post × Exposure_{2017}	-0.103*	-0.126**	-0.131**
	(0.062)	(0.061)	(0.066)
Post × MTR_{2017}		-0.011	-0.016
		(0.118)	(0.122)
Post × $\text{Interest Rate Deductibility}_{2017}$			-0.076
			(0.060)
Controls	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
R^2	0.984	0.988	0.988
Observations	5,534	4,947	4,537
Panel B: Dependent Variable - Capex			
Post × Exposure_{2017}	-0.006	-0.029	-0.062
	(0.080)	(0.084)	(0.091)
Post × MTR_{2017}		0.188	0.196
		(0.135)	(0.141)
Post × $\text{Interest Rate Deductibility}_{2017}$			-0.155
			(0.096)
Controls	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
R^2	0.848	0.848	0.851
Observations	8,711	7,604	7,101
Panel C: Dependent Variable - Patent Applications			
Post × Exposure2017	-0.421***	-0.378**	-0.342**
	(0.151)	(0.155)	(0.162)
Post × MTR_{2017}		-0.174	-0.153
		(0.251)	(0.262)
Post × $\text{Interest Rate Deductibility}_{2017}$			-0.121
			(0.174)
Controls	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
R^2	0.903	0.905	0.906
Observations	4,341	4,010	3,702

Note: This table reports Difference-in-Differences (DiD) estimates of the effect of firm-level exposure (eligible-executive performance-based compensation intensity in 2017) on innovation and investment outcomes. *Post* equals one for $t \geq 2018$. Exposure_{2017} denotes eligible-executive performance-based compensation intensity in 2017, which proxies for pre-treatment exposure. Standard errors (in parentheses) are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 2 presents our main difference-in-differences estimates.[7] The results indicate a consistent and economically meaningful decline in R&D and patent applications among firms with greater exposure to the Section 162(m) reform. In particular, a 10 percentage point increase in exposure reduces R&D expenditures by 1.31 percent. Given mean R&D expenditures of $78.0 million, this corresponds to an average reduction of approximately $1.0 million in R&D spending for the average firm. By contrast, we do not find a statistically significant effect on capital expenditures. The estimates

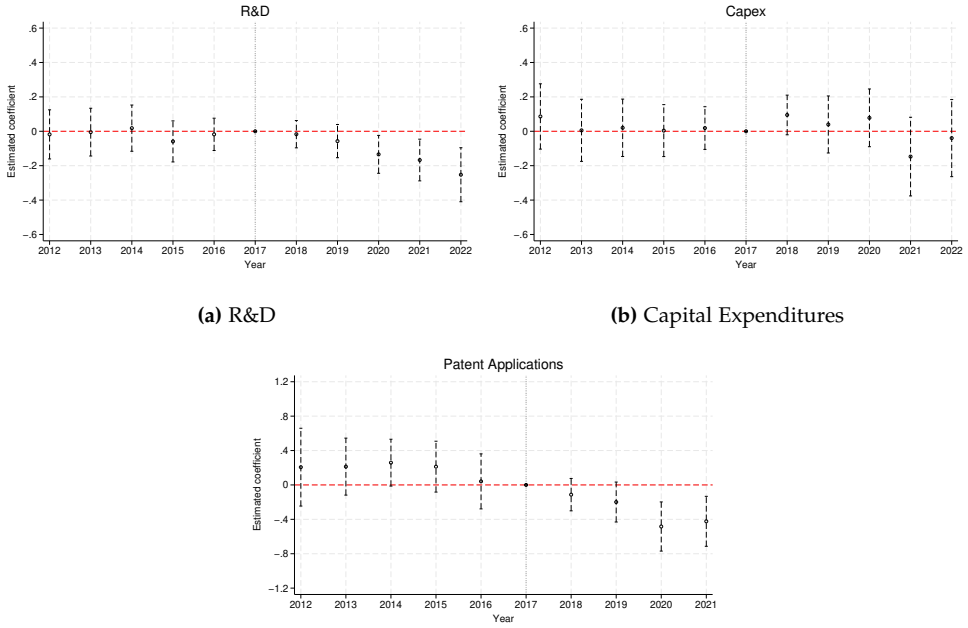
[7]Full regression results, including all control variables, are reported in Table D.10 in the Appendix.

for capital expenditures are small relative to their standard errors and are statistically indistinguishable from zero across specifications, indicating that the reform did not meaningfully change firms' physical investment.

With regard to the intensive margin, patent applications also decline among more exposed firms, indicating a reduction in innovative output. In column (3), a 10 percentage point increase in exposure reduces patent applications by approximately 3.4 percent. Given an average of 57 patent applications, this corresponds to approximately 2.0 fewer patent applications per firm-year among more exposed firms after the reform. Taken together, these results indicate that the repeal of the performance-based compensation exception caused a decline in firm-level innovation activity following the reform. Consistent with the framing we adopt throughout, the patenting decline is the most robust of our real-outcome results, the R&D decline is smaller though significant at the 5 percent level, and the precise capital-expenditure null serves as a discriminating result that points to a compensation and risk-taking channel rather than a general investment or tax-price channel. In Appendix B, we provide a detailed discussion on the economic interpretation of our DiD results with respect to continuous treatment effect.

Our results also show that the decline in innovation activity is not driven by firms' differential exposure to other major provisions of the 2017 tax reform. The coefficients on Post $\times$ MTR_{2017} and Post $\times$ Interest Rate $\text{Deductibility}_{2017}$ are statistically insignificant across the three panels. This implies that the reduction in R&D expenditures and patent applications operates through exposure to the repeal of the Section 162(m) performance-based compensation exception rather than through other contemporaneous tax channels.

Figure 1: Event Study Estimates: Firm Outcomes



(a) R&D

(b) Capital Expenditures

(c) Patent Applications

Note: This figure presents dynamic difference-in-differences estimates for the effect of firm-level exposure measure (eligible-executive performance-based compensation intensity in 2017) on firm-level outcomes. Control variables include a lag of Leverage, CashFlow, ROA, Sales, Employees, LaborIntensity, AssetTurnover, Market-to-Book, and FirmAge. The specification includes industry-by-year, and firm fixed effects. Standard errors are clustered at the firm level. Confidence intervals are shown at the 90% level.

Figure 1 presents the dynamic effects of the reform using the event-study specification. The estimates exhibit two key patterns. First, coefficients in the pre-reform period are close to zero and statistically insignificant, supporting the absence of differential pre-trends across firms with varying exposure. Second, after the reform, the coefficients for R&D expenditures and patent applications gradually become negative, indicating that more exposed firms experienced a delayed decline in innovation activity relative to less exposed firms. The timing of the effects suggests a delayed adjustment. R&D expenditures remain close to zero immediately after the reform but become increasingly negative from around 2020 onward. Patent applications follow a similar pattern, with the decline becoming more visible after roughly three years. This lag is consistent with the time required for changes in innovation investment to translate into patenting outcomes. By contrast, capital expenditures do not display a clear post-reform decline, consistent with the baseline estimates showing no significant effect on physical investment.

3.2.2 Alternative Exposure Measure: The Magnitude of Lost Deductibility

Our baseline exposure measure captures the intensity of a firm's reliance on performance-based pay based on the share of eligible-executive compensation classified as performance-based in 2017. While this measure cleanly proxies for which firms were most structurally dependent on the deductibility exception, it is silent on the dollar magnitude of the tax benefit at stake. Two firms with identical performance-pay intensities can face very different economic consequences from the reform if they differ in the absolute size of their incentive pay or in their underlying profitability. To complement the baseline and to ensure that our results are not an artifact of how exposure is scaled, we construct an alternative measure based directly on the tax dollars firms stood to lose when the performance-based exception was repealed.

Construction For each firm, we estimate the amount of eligible-executive performance-based compensation that would potentially lose deductibility under the TCJA. The resulting quantity approximates the incremental, non-deductible performance pay attributable to the reform, that is, the deduction firms would have retained absent the TCJA. We then scale this dollar amount by the firm's lagged (2016) fiscal-year pretax income. Scaling by pretax income expresses the lost deduction relative to the firm's tax base, capturing how economically meaningful the forgone deductibility is given the firm's profitability: a given dollar loss represents a larger erosion of tax benefits for a firm with a smaller taxable base. Using the lagged value of income, measured in the year prior to the reform, further mitigates simultaneity concerns, since post-reform income could itself respond to the policy change and to the investment adjustments we study. A higher value of this ratio therefore indicates that a firm lost a larger share of its prior tax advantage, and we interpret such firms as more exposed to the reform.

Results Table 3 reports the difference-in-differences estimates using this alternative exposure measure. The results are consistent with our baseline findings in sign and statistical significance. The coefficient on $Post \times Exposure_{2017}$ is negative and statistically significant for both R&D and patent applications, indicating that firms facing

a larger loss of deductibility relative to their tax base reduced both innovation inputs and innovation outputs following the reform. As in the baseline, the estimate for capital expenditures is small and statistically indistinguishable from zero, reaffirming that the reform did not meaningfully affect firms' physical investment. The smaller point estimates relative to the baseline simply reflect the different scaling of the regressor, a dollar-to-income ratio rather than a bounded compensation share, and are not directly comparable in magnitude.

Importantly, the additional TCJA channels remain statistically insignificant across all three outcomes: neither $Post \times MTR_{2017}$ nor $Post \times Interest\ Rate\ Deductibility_{2017}$ enters significantly, confirming that the estimated effect operates through the loss of performance-based deductibility rather than through other contemporaneous provisions of the reform. That two conceptually distinct measures of exposure, one based on the structure of compensation and the other on the magnitude of forgone tax benefits, yield the same qualitative conclusions strengthens the interpretation that the documented declines in R&D and patenting reflect a behavioral response to the weakening of performance-based incentives under Section 162(m).

Table 3: DiD Estimates: Alternative Exposure Measure

	R&D	Capex	Patent Applications
Post × Exposure_{2017}	-0.044*	0.006	-0.152***
	(0.025)	(0.030)	(0.058)
Post × MTR_{2017}	-0.063	0.125	-0.210
	(0.131)	(0.148)	(0.256)
Post × $\text{Interest Deductibility}_{2017}$	-0.080	-0.101	0.374
	(0.115)	(0.144)	(0.283)
Controls	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
R^2	0.988	0.858	0.915
Observations	3,802	5,893	2,964

Note: This table reports Difference-in-Differences (DiD) estimates of the effect of firm-level exposure measure (eligible-executive performance-based compensation intensity in 2017) on firm-level executive performance-based compensation measures by using an alternative exposure measure of performance-based loss deduction amounts in 2017 due to TCJA per lagged fiscal year pretax income. *Post* equals one for $t \geq 2018$. Exposure_{2017} denotes the performance-based loss deduction amounts in 2017 due to TCJA per lagged fiscal year pretax income. Standard errors (in parentheses) are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

3.3 Controlling Other TCJA Components

A natural concern is that our baseline exposure measure may proxy for firms' differential exposure to other provisions of the 2017 reform rather than for the elimination

of performance-based deductibility under Section 162(m). The TCJA was a broad package, and several of its provisions could plausibly affect investment and innovation through channels unrelated to executive incentive pay. We therefore augment the baseline specification with a richer set of TCJA-related controls. Before turning to the results, we briefly describe the additional provisions we account for.

Other Contemporaneous TCJA Provisions Beyond the Section 162(m) reform, the corporate rate reduction, and the interest deductibility limitation already included in the baseline, the TCJA introduced several additional provisions that may have independently shaped firms' investment and innovation incentives. First, the Act substantially expanded bonus depreciation under Section 168(k), allowing firms to immediately expense the full cost of qualifying capital investments placed in service after September 27, 2017, rather than depreciating them over their useful lives. This temporary provision, which was scheduled to phase down beginning in 2023, lowered the after-tax cost of physical capital, and its effect was concentrated among capital-intensive firms with sizable eligible investment. Second, the TCJA fundamentally restructured the taxation of multinational firms by shifting the United States from a worldwide system toward a quasi-territorial regime. The reform introduced a participation exemption for foreign dividends, a one-time transition tax on previously deferred foreign earnings, and new anti-base-erosion regimes, most notably the tax on Global Intangible Low-Taxed Income (GILTI), the deduction for Foreign-Derived Intangible Income (FDII), and the Base Erosion and Anti-abuse Tax (BEAT). Because these provisions specifically target the location and taxation of intangible income, they could plausibly affect R&D and patenting decisions through channels unrelated to executive compensation. We therefore control separately for firms' foreign tax exposure and for an indicator of multinational status to absorb differential exposure to the international components of the reform. Finally, we control for firms' exposure to changes in the user cost of capital, a summary measure of the after-tax cost of an additional unit of investment that combines the effects of the statutory rate reduction, accelerated expensing, and the interest deductibility limitation. Because these provisions moved the user cost in offsetting directions and to differing degrees across firms, including this channel ensures that our estimated Section 162(m) effect does

not simply reflect heterogeneous shifts in the overall tax-adjusted incentive to invest. Each control is measured in 2017 and interacted with $Post_t$, so that the specification isolates the effect operating through Section 162(m) from the other contemporaneous components of the reform.

Results Table 4 reports the results. The coefficient on $Post \times Exposure_{2017}$ remains negative, statistically significant, and similar in magnitude to our baseline estimates for both R&D and patent applications. A 10-percentage-point increase in exposure reduces R&D by 1.48 percent (approximately $1.2 million for the average firm) and patent applications by 3.66 percent (approximately 2.1 fewer filings per firm-year). As in the main specification, the estimate for capital expenditures is small and statistically indistinguishable from zero, reinforcing the conclusion that the reform did not meaningfully alter firms' physical investment.

Table 4: DiD Estimates: Controlling Other TCJA Components

	R&D	Capex	Patent Applications
Post × Exposure_{2017}	-0.148**	-0.087	-0.366**
	(0.073)	(0.098)	(0.178)
Post × MTR_{2017}	0.074	0.228	-0.125
	(0.183)	(0.230)	(0.406)
Post × $\text{Interest Rate Deductibility}_{2017}$	-0.096*	-0.107	-0.125
	(0.056)	(0.087)	(0.181)
Post × $\text{Foreign Tax Exposure}_{2017}$	2.394**	-1.208	3.250
	(0.952)	(1.815)	(3.245)
Post × $\text{Multinational}_{2017}$	-0.030	0.087*	0.016
	(0.039)	(0.051)	(0.110)
Post × User Cost_{2017}	-0.612	-0.160	-0.223
	(0.767)	(0.769)	(1.566)
Post × $\text{Bonus Depreciation}_{2017}$	-0.089	-0.442**	0.238
	(0.163)	(0.191)	(0.407)
Controls	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
R^2	0.988	0.853	0.908
Observations	4,594	6,995	3,774

Note: This table reports Difference-in-Differences (DiD) estimates of the effect of firm-level exposure measure (eligible-executive performance-based compensation intensity in 2017) on firm-level executive performance-based compensation measures by controlling other additional TCJA components. *Post* equals one for $t \geq 2018$. Exposure_{2017} denotes the eligible-executive performance-based compensation intensity in 2017, which proxies for the pre-treatment firm-level exposure measure. Standard errors (in parentheses) are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Crucially, the additional TCJA channels do not absorb the treatment effect. The coefficients on $Post \times MTR_{2017}$ and $Post \times User\ Cost_{2017}$ are statistically insignificant across all three outcomes, indicating that neither differential exposure to the statu-

tory rate reduction nor changes in the user cost of capital account for the documented declines in innovation. Exposure to the interest deductibility limitation enters with a small, marginally significant negative coefficient for R&D, while bonus depreciation exposure is associated with a reduction in capital expenditures, consistent with the temporary nature of that provision; neither, however, attenuates the estimated effect of Section 162(m) exposure on R&D or patenting. The remaining controls for foreign tax exposure and multinational status are largely uninformative for the innovation outcomes. Taken together, these results indicate that the reduction in R&D and patent applications operates specifically through firms' exposure to the repeal of the performance-based compensation exception, rather than through other contemporaneous tax channels introduced by the TCJA.

3.4 Scaling the Real Effects by the Compensation Response

The reduced-form difference-in-differences results establish that firms more exposed to the repeal of performance-based deductibility reduced investment and innovation. They also show, separately, that these firms scaled back the use of performance-based pay. A natural question is whether these two facts are causally linked: is it the reform-induced contraction in performance-based compensation that drives the decline in real outcomes, or could exposure proxy for some other adjustment occurring in parallel? To address this directly, we scale the reduced-form effect by the reform-induced change in compensation. Using the TCJA shock to isolate the component of actual performance-based compensation intensity that moves with the reform rather than with firms' investment decisions, we express the real effects per unit of reform-driven change in the compensation channel.

Specification We treat firms' *actual*, time-varying eligible-executive performance-based compensation intensity, $PerfCompInt_{it}$, as the channel of interest, and isolate its reform-driven component using the interaction of $Post_t$ and pre-reform exposure, $Post_t \times Exposure_{i,2017}$. The first stage is

$$\begin{aligned} PerfCompInt_{it} = {} & \pi_1 \left(Post_t \times Exposure_{i,2017} \right) + \pi_2 \left(Post_t \times MTR_{i,2017} \right) \\ & + \pi_3 \left(Post_t \times InterestExposure_{i,2017} \right) + X'_{it-1}\gamma + \lambda_{j,t} + \alpha_i + \nu_{it}, \end{aligned} \tag{3}$$

and the second stage is

$$Y_{it} = \delta \widehat{PerfCompInt}_{it} + \beta_2 \left(Post_t \times MTR_{i,2017}\right) + \beta_3 \left(Post_t \times InterestExposure_{i,2017}\right) + X'_{it-1}\gamma + \lambda_{j,t} + \alpha_i + \varepsilon_{it}. \tag{4}$$

where $\widehat{PerfCompInt}_{it}$ is the fitted value from the first stage and Y_{it} is the firm outcome. The other major TCJA channels enter both stages as additional controls, and all specifications retain the lagged controls, firm fixed effects, and industry-by-year fixed effects of the baseline. Standard errors are clustered at the firm level.

The first stage confirms that the reform strongly shifted actual performance-based compensation intensity, and pre-reform reliance on performance pay is predetermined. Under the same maintained assumption that underlies the reduced form, namely that the reform altered firms' real behavior by changing the incentive content of executive compensation rather than through some parallel channel, δ captures how the reform-induced change in performance-based compensation intensity maps into firm outcomes.

Results Table 5 reports the estimates. Panel A presents the first stage. The reform-driven variation is a strong and statistically significant predictor of actual performance-based compensation intensity. $Post_t \times Exposure_{i,2017}$ enters with a negative coefficient of comparable magnitude across all three samples, confirming that more exposed firms sharply reduced their reliance on performance-based pay after the reform. The first-stage F-statistics range from roughly 12.6 to 21.7, exceeding conventional thresholds and alleviating concerns about a weak first stage.

Table 5: Two-Stage Estimates of the Performance-Based Compensation Channel

	(1) R&D	(2) Capex	(3) Patent Applications
Panel A: First Stage *Dependent Variable: Performance-Based Comp. Intensity*			
Post × Exposure_{2017}	-0.393***	-0.397***	-0.425***
	(0.104)	(0.085)	(0.119)
Post × MTR_{2017}	0.098	-0.084	-0.115
	(0.155)	(0.116)	(0.157)
Post × $\text{Interest Deductibility}_{2017}$	0.107	0.069	0.180
	(0.119)	(0.077)	(0.113)
First-stage F-stat.	14.419	21.757	12.625
R^2	0.892	0.887	0.899
Observations	4,537	7,101	3,702
Panel B: Second Stage *Dependent Variable: Firm Outcomes*	R&D	Capex	Patent Applications
Performance-Based Comp. Intensity	0.332**	0.157	0.806**
	(0.161)	(0.226)	(0.356)
Post × MTR_{2017}	-0.048	0.209	-0.060
	(0.113)	(0.142)	(0.272)
Post × $\text{Interest Deductibility}_{2017}$	-0.111*	-0.166*	-0.267
	(0.063)	(0.098)	(0.192)
R^2	0.111	0.114	-0.108
Observations	4,537	7,101	3,702
Controls	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes

Note: This table reports two-stage least squares estimates of the effect of eligible-executive performance-based compensation intensity on firm outcomes. The endogenous variable is actual eligible-executive performance-based compensation intensity. The excluded instrument is Post × Exposure_{2017}, where Exposure_{2017} is eligible-executive performance-based compensation intensity in 2017. Each column corresponds to a separate estimation sample, indicated in the column header. Panel A reports the first-stage estimates, in which the dependent variable is the actual performance-based compensation intensity. Panel B reports the second-stage estimates, in which the dependent variable is the corresponding firm outcome (log R&D, log Capex, or log patent applications, each normalized by lagged total assets). *Post* equals one for $t \geq 2018$. All specifications include lagged controls, firm fixed effects, and industry-by-year fixed effects. Standard errors (in parentheses) are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Panel B reports the second-stage estimates. The coefficient on performance-based compensation intensity is positive and statistically significant for both R&D and patent applications, and positive but insignificant for capital expenditures. Because the first stage is negative, these positive second-stage coefficients imply that the reform-induced decline in performance-based compensation intensity reduces R&D and patenting, while leaving physical investment unaffected. The second-stage coefficient for R&D implies that a one-unit reduction in performance-based compensation intensity (i.e., moving from fully performance-based to no performance-based pay) reduces R&D by 33.3 percent; at the mean R&D of $78.0 million, this corresponds to approximately $26.0 million, though the relevant variation in practice is much smaller

and concentrated around the mean shift induced by the reform. The pattern mirrors the reduced-form results but carries a sharper interpretation: it is the contraction in performance-contingent pay itself rather than exposure operating through some unrelated channel that accounts for the reductions in innovation. The other TCJA channels remain individually insignificant for the innovation outcomes, reinforcing that the effect is attributable to the performance-based compensation mechanism. Taken together, we do not read this two-stage estimate as an independent source of identification, since it re-uses the same reform-induced variation that identifies the reduced form, and the assumption that exposure affects real outcomes only through performance-based-pay intensity is a strong one. We interpret the estimates instead as evidence *consistent with* the incentive channel, in that the reform-induced contraction in performance-based pay moves together with the declines in innovation.

3.5 Compensation and Risk-Taking Mechanism

3.5.1 Compensation Structures

In this section, we examine how firms adjusted the structure and incentive properties of executive compensation in response to the elimination of performance-based deductibility, providing direct evidence on the mechanism through which the TCJA weakened managerial incentives.

Table 6 provides direct evidence that the elimination of deductibility led high-exposure firms to scale back performance-based compensation across the eligible-executive group. The estimates show a pronounced decline in total eligible performance pay, indicating that firms most affected by the reform reduced the overall volume of incentive-linked compensation provided to senior executives. A ten percentage point increase in performance-based pay intensity reduces total performance-based compensation by approximately 17.4 percent. Given mean total eligible performance pay of $12.24 million in the pre-TCJA sample, this corresponds to an average reduction of approximately $2.1 million in performance-based compensation. Stock-based performance bonus intensity also declines by 0.78 percentage points, while non-equity incentive intensity declines by 0.57 percentage points. In contrast, option-based performance bonus intensity does not exhibit a statistically

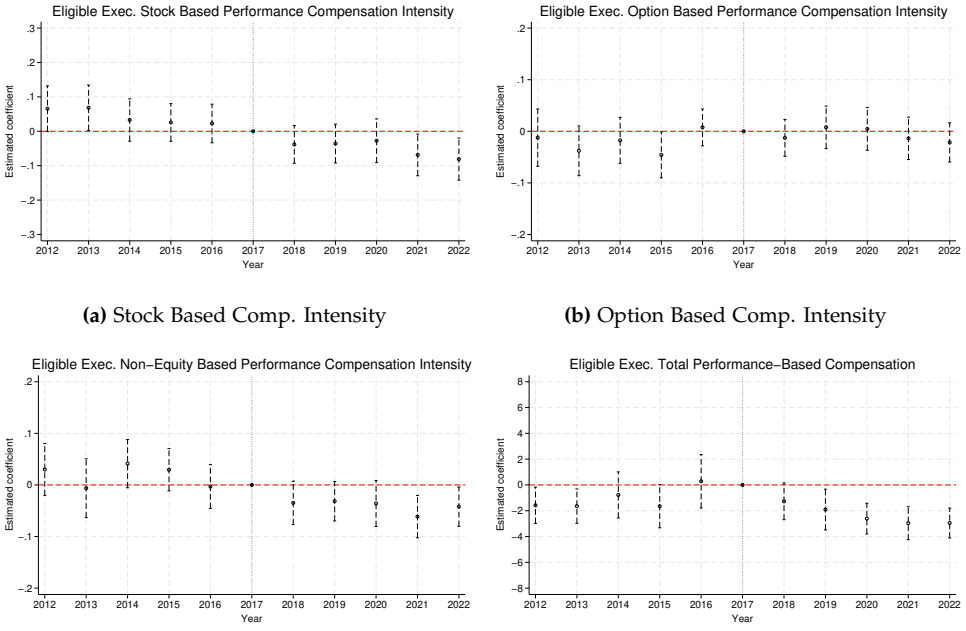
significant response. Overall, the results indicate a broad reduction in performance-contingent compensation for the senior team, not only a change in one executive's pay package.

Table 6: DiD Estimates: Eligible Executive Performance-Based Compensation

	(1) Total Perf. Comp.	(2) Stock-Based Int.	(3) Option-Based Int.	(4) Non-Equity Int.
Post × Exposure_{2017}	-1.739***	-0.078***	0.010	-0.057***
	(0.470)	(0.023)	(0.025)	(0.018)
Controls	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
R^2	0.775	0.933	0.914	0.887
Observations	6,385	6,573	6,545	6,492

Note: This table reports Difference-in-Differences (DiD) estimates of the effect of firm-level exposure measure (eligible-executive performance-based compensation intensity in 2017) on firm-level executive performance-based compensation measures. *Post* equals one for $t \geq 2018$. Exposure_{2017} denotes the eligible-executive performance-based compensation intensity in 2017, which proxies for the pre-treatment firm-level exposure measure. Standard errors (in parentheses) are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Figure 2: Event Study Estimates: Eligible Executive Performance-Based Compensation



(a) Stock Based Comp. Intensity

(b) Option Based Comp. Intensity

(c) Non-equity Based Comp. Intensity

(d) Performance Based Comp. Amounts

Note: This figure presents dynamic difference-in-differences estimates for the effect of firm-level exposure measure (eligible-executive performance-based compensation intensity in 2017) on firm-level executive performance-based compensation measures. Standard errors are clustered at the firm level. Confidence intervals are shown at the 90% level.

Figure 2 illustrates the dynamic adjustment of executive compensation around the reform. The pre-reform coefficients are generally close to zero and do not show

a systematic differential pre-trend. Following the reform, total performance-based compensation declines sharply and persistently among more exposed firms. Stock-based and non-equity incentive compensation display similar post-reform declines, indicating that firms reduced both equity-based and cash-based performance pay. In contrast, option-based compensation remains largely unchanged throughout the post-reform period. Overall, the evidence indicates that the reform is followed by a broad reduction in performance-contingent compensation among more exposed firms.

Table 7: DiD Estimates: Eligible CEO and CFO Compensation

	Total Comp.		Perf. Comp.		Salary Comp.	
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: CEO Compensation					
Post × Exposure_{2017}	0.008	-0.023	-0.065	-0.163	-0.029	-0.030
	(0.093)	(0.104)	(0.108)	(0.122)	(0.035)	(0.037)
Controls	No	Yes	No	Yes	No	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.797	0.832	0.783	0.819	0.826	0.864
Observations	8,491	6,128	8,491	6,128	8,491	6,128
	Panel B: CFO Compensation					
Post × Exposure_{2017}	0.054	0.090	0.099	0.046	-0.009	-0.016
	(0.086)	(0.090)	(0.088)	(0.110)	(0.027)	(0.025)
Controls	No	Yes	No	Yes	No	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.744	0.788	0.723	0.766	0.815	0.824
Observations	7,157	5,232	7,157	5,232	7,157	5,232

Note: This table reports Difference-in-Differences (DiD) estimates of the effect of firm-level exposure to the TCJA Section 162(m) reform on CEO (Panel A) and CFO compensation (Panel B) outcomes. *Post* equals one for $t \geq 2018$. Exposure_{2017} denotes the firm-level eligible performance-based compensation intensity in 2017. In addition to our baseline control variables, we also include executives' risk-taking proxies captures by Delta and Vega as control variables. Standard errors (in parentheses) are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The CEO and CFO specifications help clarify why the senior-team approach is important. Replicating the executive-level specification in De Simone et al. (2022), which focuses on CEO compensation and extends to CFO compensation, we obtain statistically insignificant estimates for both CEOs and CFOs (Table 7). Rather than treating these null results as uninformative, we interpret them as evidence that the compensation response is not concentrated in one named executive. This is consistent with the organizational nature of innovation: firms adjust incentives across the broader top-executive team, and those team-wide incentives are more relevant for long-horizon innovation decisions than CEO-only or CFO-only compensation.

3.5.2 Risk-Taking Incentives

After establishing that the reform reshaped executive compensation structures, we next examine whether it also affected the risk-taking incentives embedded in executive pay. In this section, delta and vega are firm-year outcomes measured for the median eligible executive, not predetermined moderators. Delta measures the sensitivity of executive wealth to changes in the firm's stock price, while vega captures the sensitivity of executive wealth to changes in stock-return volatility. Because Table 8 reports delta and vega but not total executive wealth, we interpret the evidence as changes in incentive sensitivities rather than changes in the level of executive wealth.

Table 8: DiD Estimates: Risk-Taking Incentives

	Delta		Vega	
	(1)	(2)	(3)	(4)
Post × Exposure_{2017}	-0.381**	-0.192	-0.741***	-0.487**
	(0.190)	(0.174)	(0.217)	(0.238)
Controls	No	Yes	No	Yes
Industry-Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
R^2	0.805	0.829	0.823	0.845
Observations	8,618	6,702	8,678	6,732

Note: This table reports Difference-in-Differences (DiD) estimates of the effect of firm-level exposure measure (eligible-executive performance-based compensation intensity in 2017) on firm-year risk-taking incentive outcomes, Delta and Vega, measured for the median eligible executive. *Post* equals one for $t \geq 2018$. Exposure_{2017} denotes the eligible-executive performance-based compensation intensity in 2017, which proxies for pre-treatment firm-level exposure measure. Standard errors (in parentheses) are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 8 examines whether firms with greater pre-reform exposure subsequently changed these incentive sensitivities. We find that higher exposure reduces vega, indicating a decline in volatility-based risk-taking incentives among more exposed firms. A ten percentage point increase in exposure reduces vega by 4.8 percent. Given mean vega of $31.1 thousand across the sample, this corresponds to a reduction of approximately $1.5 thousand per 0.01 change in stock return volatility for the median eligible executive, a meaningful reduction in the financial reward to pursuing high-variance, long-horizon projects. By contrast, the effect on delta is negative but statistically insignificant after including firm-level controls. This difference suggests that the reform primarily weakened compensation incentives tied to risk-taking rather than incentives tied to stock-price alignment. Firms may have preserved stock-price-based incentives through equity holdings or restricted

stock while reducing compensation structures that increased executives' exposure to return volatility.

3.6 Heterogeneity Analysis

To examine heterogeneity in the effect of TCJA exposure on firm investment and innovation, we interact the baseline DiD estimator with firm-level moderators measured in 2017, the year immediately preceding the tax reform. This design does not by itself establish separate causal channels. Instead, it shows which types of firms account for the average response and whether the cross-sectional patterns are consistent with mechanisms based on growth opportunities and financial resilience. The results are reported in Table 9.

For R&D expenditures, the positive and statistically significant interaction terms on Market-to-Book, Altman Z-Score[8], and Tobin's Q indicate that the negative association between TCJA exposure and R&D is smaller among firms with stronger growth opportunities and stronger balance sheets before the reform. These patterns are consistent with stronger-growth firms having a higher opportunity cost of allowing innovation projects to lapse, and with financially healthier firms having more internal capacity to absorb the higher tax cost of incentive pay. In contrast, no comparable heterogeneity appears for capital expenditures across most moderators, which is consistent with the baseline result that the reform primarily affected knowledge-intensive investment rather than physical capital. To illustrate the economic magnitude, in the Market-to-Book specification in Panel A, a 10-percentage-point increase in exposure is associated with a 3.68 percent decline in R&D for firms with low growth opportunities. Given mean R&D of $78.0 million, this corresponds to approximately $2.9 million less R&D per year for the lowest-growth-opportunity firms. A one-unit increase in Market-to-Book attenuates this decline by about 1.19 percentage points.

[8] Altman Z-Score is a composite index of financial resilience constructed from five accounting-based ratios and widely used as a predictor of financial distress which captures the overall soundness of a firm's balance sheet entering the shock period.

Table 9: DiD Estimates: Heterogeneity in Firm Investment and Innovation Outcomes

Panel A: Dependent Variable - Log R&D	(1)	(2)	(3)	(4)	(5)
Post × Exposure_{2017}	-0.368***	-0.147**	-0.251***	-0.205***	-0.288***
	(0.101)	(0.070)	(0.079)	(0.079)	(0.102)
Post × Exposure_{2017} × $\text{Market-to-Book}_{2017}$	0.119***				
	(0.037)				
Post × Exposure_{2017} × $\text{Profitability}_{2017}$		0.836			
		(0.631)			
Post × Exposure_{2017} × Cash Flow_{2017}			1.043		
			(0.661)		
Post × Exposure_{2017} × Altman Z_{2017}				0.008**	
				(0.003)	
Post × Exposure_{2017} × Tobin's Q_{2017}					0.043**
					(0.019)
R^2	0.988	0.988	0.988	0.988	0.988
Observations	4,415	4,519	4,597	4,510	4,537
Panel B: Dependent Variable - Log Capex					
Post × Exposure_{2017}	0.048	-0.113	-0.166	-0.165	-0.002
	(0.154)	(0.099)	(0.113)	(0.108)	(0.127)
Post × Exposure_{2017} × $\text{Market-to-Book}_{2017}$	-0.055				
	(0.074)				
Post × Exposure_{2017} × $\text{Profitability}_{2017}$		1.141			
		(1.008)			
Post × Exposure_{2017} × Cash Flow_{2017}			0.993		
			(0.897)		
Post × Exposure_{2017} × Altman Z_{2017}				0.008	
				(0.007)	
Post × Exposure_{2017} × Tobin's Q_{2017}					-0.011
					(0.021)
R^2	0.853	0.852	0.849	0.841	0.852
Observations	6,971	7,075	7,177	6,892	7,101
Panel C: Dependent Variable – Log Patent Applications					
Post × Exposure_{2017}	-0.656**	-0.401**	-0.640***	-0.534**	-0.605**
	(0.264)	(0.163)	(0.149)	(0.212)	(0.263)
Post × Exposure_{2017} × $\text{Market-to-Book}_{2017}$	0.184**				
	(0.089)				
Post × Exposure_{2017} × $\text{Profitability}_{2017}$		2.830**			
		(1.268)			
Post × Exposure_{2017} × Cash Flow_{2017}			3.414***		
			(1.266)		
Post × Exposure_{2017} × Altman Z_{2017}				0.019**	
				(0.009)	
Post × Exposure_{2017} × Tobin's Q_{2017}					0.080*
					(0.048)
R^2	0.905	0.906	0.905	0.906	0.906
Observations	3,607	3,688	3,766	3,684	3,702
Controls	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes

Note: Standard errors (in parentheses) are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Patent applications show a similar pattern. Firms with higher pre-shock profitability, cash flow, Altman Z-Score, and Tobin's Q exhibit smaller post-reform declines in patenting activity. This is consistent with financially weaker firms being less able to preserve incentive intensity or maintain long-horizon projects when the after-tax cost of incentive compensation rises. A 10-percentage-point increase in exposure is associated with a 6.56 percent decline in patent applications in the Market-to-Book specification, while a one-unit increase in Market-to-Book offsets this decline by about 1.84

percentage points. In absolute terms, the 6.56 percent decline corresponds to approximately 3.7 fewer patent applications per firm-year for the average low-growth firm, compared with about 0.9 fewer applications for a firm one unit higher in Market-to-Book.

Taken together, the heterogeneity results are consistent with growth opportunities and financial resilience shaping firms' ability to maintain innovation after the tax price of incentive compensation rises. Firms with stronger investment opportunities appear less likely to scale back R&D and patenting, plausibly because abandoning marginal innovation projects is more costly when the project pipeline is valuable. Firms with stronger internal finances also appear less responsive, plausibly because they can absorb the higher cost of incentive pay or redesign contracts without cutting back innovation. These patterns should be interpreted as disciplined cross-sectional evidence rather than as definitive proof of separate mechanisms.

4 Robustness Checks

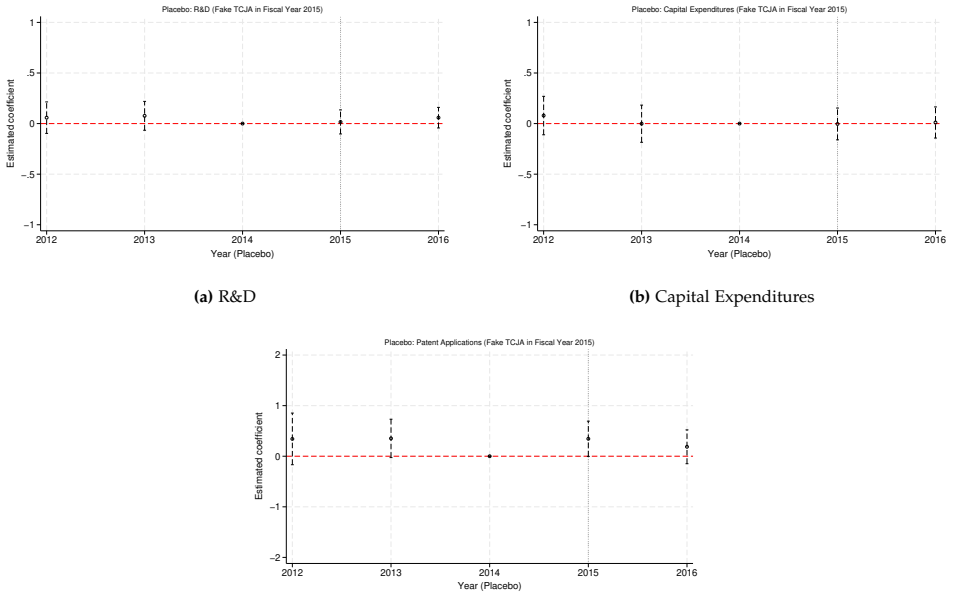
This section discusses the robustness checks focused on a pre-reform placebo exercise and specifications with additional linear trends. We then report two additional outcome analyses: Section 4.3 examines patent-quality outcomes, and Section 4.4 examines intangible-capital outcomes. These subsections show whether the main findings extend beyond patent counts to the quality and cumulative stock of innovative activity. Additional analyses, including propensity-score matching, alternative functional forms, governance controls, and the associated longer tables, are reported in Appendix C.

4.1 Placebo Test

We conduct a placebo test using fiscal year 2015 as the placebo treatment year and 2014 as the baseline. We use 2015 because it predates the TCJA and therefore provides a pre-treatment window for probing whether high- and low-exposure firms were already diverging before the actual reform. This falsification exercise tests a central threat to the interpretation: that the main results are driven by pre-existing differential trends rather than by the post-2017 policy change. As shown in Figure 3, the

estimated event-time coefficients are close to zero and statistically indistinguishable from one another across the placebo window. This pattern supports the parallel-trends assumption and reduces the concern that the post-TCJA effects are simply extrapolations of pre-reform divergence.

Figure 3: Placebo Test



(a) R&D

(b) Capital Expenditures

(c) Patent Applications

Note: Event-study estimates from a placebo test assigning treatment to 2015 (baseline: 2014). Coefficients correspond to interactions between event time and the 2017 exposure measure. The specification includes firm and industry-by-year fixed effects. Standard errors are clustered at the firm level. 95% confidence intervals are reported.

4.2 Controlling Linear Trends

We next augment the baseline specification by controlling for both state-level and year-level linear trends. A potential concern in difference-in-differences settings is that unobserved, gradually evolving forces, such as state-specific economic conditions or nationwide secular shifts in innovation activity, may differentially affect high- and low-exposure firms even in the absence of the TCJA reform. Incorporating linear trends at the state and year levels probes whether the baseline estimates are sensitive to these slow-moving dynamics.

Table 10 presents the corresponding DiD estimates. The coefficients on $Post \times Exposure_{2017}$ remain negative, statistically significant, and similar in magnitude to our baseline results for R&D and patent applications. The estimates therefore support

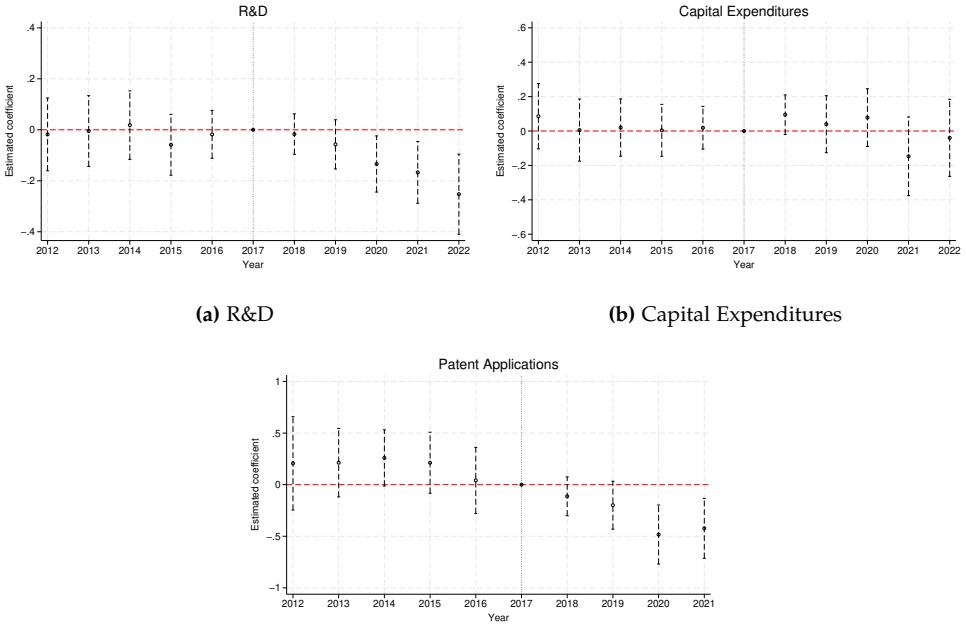
the baseline interpretation, while appropriately stopping short of treating the trend controls as definitive proof of identification.

Table 10: DiD Estimates: Controlling Linear Trends

	(1) R&D	(2) Capex	(3) Patent Applications
Post × Exposure_{2017}	-0.131**	-0.062	-0.342**
	(0.066)	(0.091)	(0.162)
Controls	Yes	Yes	Yes
Time Trends	Yes	Yes	Yes
Industry Time Trends	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
R^2	0.988	0.851	0.906
Observations	4,537	7,101	3,702

Note: This table reports Difference-in-Differences (DiD) estimates of the effect of firm-level exposure measure (eligible-executive performance-based compensation intensity in 2017) on firm outcomes, controlling for year-level and state-level linear trends. *Post* equals one for $t \geq 2018$. Exposure_{2017} denotes the eligible-executive performance-based compensation intensity in 2017. Standard errors (in parentheses) are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Figure 4: Event Study Estimates: Controlling Linear Trends



(a) R&D

(b) Capital Expenditures

(c) Patent Applications

Note: This figure presents dynamic treatment effects for the effect of firm-level exposure measure (eligible-executive performance-based compensation intensity in 2017) on firm-level outcomes controlling the year-level, and state-level linear trends. The specification includes industry-by-year, and firm fixed effects. Standard errors are clustered at the firm level. Confidence intervals are shown at the 90% level.

Figure 4 provides the event-study version of this specification. The pre-reform coefficients are flat and generally statistically indistinguishable from zero after accounting

for heterogeneous linear dynamics. Following the TCJA, the dynamic paths exhibit the same divergence observed in the baseline: high-exposure firms show sustained declines in R&D, and patent applications decline with the expected lag. The timing and persistence of these effects closely mirror the baseline event studies.

Overall, controlling for state-level and year-level linear trends yields results that remain consistent with the core findings. The deductibility elimination is still associated with reductions in firms' long-term investment and innovation, providing additional support for the baseline interpretation.

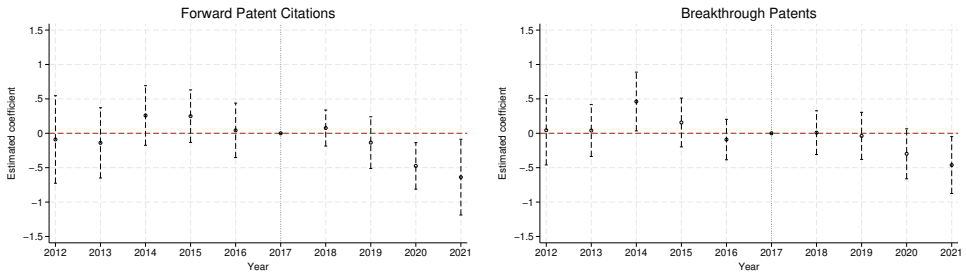
4.3 Patent Quality Outcomes

As auxiliary evidence on innovation quality, we examine whether the TCJA-induced reduction in performance-based compensation is followed not only by fewer patent applications, but also by weaker measures of the technological significance of patents produced. To capture patent quality, we follow Kogan et al. (2017) and Kelly et al. (2021) and use a measure of breakthrough patents based on backward citation similarity. We also analyze forward patent citations as an alternative proxy for patent quality.

Figure 5 reports event-study estimates using the logarithm of forward patent citations and breakthrough patents as dependent variables. The post-reform paths move downward toward the end of the sample, especially around 2020–2021, which is directionally consistent with the baseline decline in patent applications and with the long development horizon of innovation. Because this subsection relies on event-study figures rather than a compact coefficient table with p-values, we interpret the patent-quality evidence as suggestive rather than as a standalone statistical claim of significant average declines.

Taken together, the patent-quality figures are best read as complementary evidence: they suggest that the decline in patenting quantity may be accompanied by later weakness in measures of technological importance, but the main statistical weight of the paper remains on R&D, patent applications, compensation changes, and intangible capital.

Figure 5: Event Study Estimates: Patent Quality Outcomes



(a) Forward Patent Citations **(b)** Breakthrough Patents

Note: This figure presents dynamic treatment effects for the effect of firm-level exposure measure (eligible-executive performance-based compensation intensity in 2017) on alternative measures of patent quality, including forward patent citations and breakthrough patents. The specification includes industry-by-year, and firm fixed effects. Standard errors are clustered at the firm level. Confidence intervals are shown at the 90% level.

4.4 Intangible Capital Outcomes

We next examine intangible capital outcomes using stock measures from Peters and Taylor (2017), who develop a methodology to construct firm-level capital stocks for both knowledge capital and organizational capital. Knowledge capital is derived by capitalizing historical R&D expenditures using a perpetual inventory method, accounting for depreciation and firm-specific adjustment rates. Organizational capital is constructed analogously by capitalizing a portion of selling, general, and administrative (SG&A) expenses, under the assumption that these costs represent internal investments in firm structure, human resources, and routines that enhance productivity over time.

Beyond the flow-based measures of investment and innovation activity examined in the baseline, intangible capital stocks capture the cumulative consequences of sustained changes in investment behavior. This makes them especially relevant for a setting in which the reform may affect long-horizon projects through managerial incentives. If the higher tax cost of performance-based compensation leads firms to weaken incentive intensity, the effects may accumulate gradually in knowledge capital and organizational capital rather than appearing only in annual R&D or patent flows.

Table 11: DiD Estimates: Intangible Capital

	(1) Knowledge Capital	(2) Organizational Capital
Post × Exposure_{2017}	-0.125*	-0.116*
	(0.071)	(0.065)
Post × MTR_{2017}	-0.102	0.060
	(0.143)	(0.122)
Post × Interest Rate $\text{Deductibility}_{2017}$	0.085	-0.050
	(0.116)	(0.073)
Controls	Yes	Yes
Propensity Score Matching	Yes	Yes
Time Trends	Yes	Yes
Industry Time Trends	Yes	Yes
Industry-Year FE	Yes	Yes
Firm FE	Yes	Yes
R^2	0.991	0.971
Observations	6,916	6,958

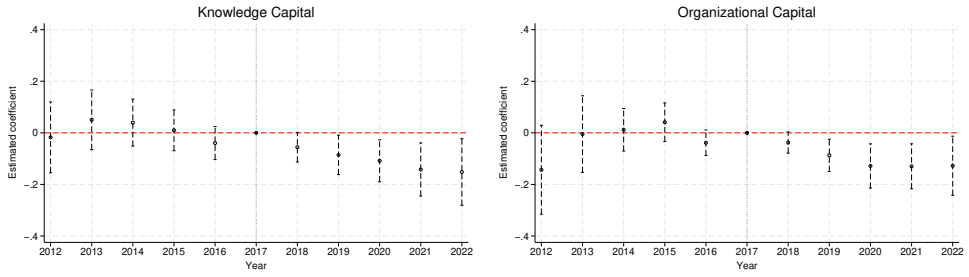
Note: This table reports Difference-in-Differences (DiD) estimates of the effect of firm-level exposure measure (eligible-executive performance-based compensation intensity in 2017) on alternative performance-based firm-level outcomes, including knowledge capital and organizational capital. *Post* equals one for $t \geq 2018$. Exposure_{2017} denotes the eligible-executive performance-based compensation intensity in 2017. Standard errors (in parentheses) are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 11 reports the DiD estimates. The coefficient on $Post \times Exposure_{2017}$ is negative and statistically significant at the 10% level for both knowledge capital and organizational capital, with magnitudes of -0.125 and -0.116, respectively. A 10-percentage-point increase in exposure reduces knowledge capital by 1.25 percent, corresponding to a reduction of approximately $3.9 million given mean knowledge capital of $314.3 million. The analogous reduction in organizational capital is 1.16 percent, or approximately $7.6 million given mean organizational capital of $656.6 million. These dollar magnitudes are economically substantial and reflect the cumulative, compounding nature of intangible capital stocks: sustained reductions in annual knowledge capital and organizational capital translate into persistent shortfalls in the stock of productive knowledge and organizational capabilities. These results indicate that firms more exposed to the performance-based compensation deduction cap accumulated meaningfully less intangible capital in the post-reform period, consistent with and complementary to the flow-based evidence presented in the baseline. The alternative TCJA channels remain statistically insignificant throughout, confirming that the estimated effect is specific to the performance-based compensation channel.

The event study estimates presented in Figure 6 corroborate these findings and support the parallel trends assumption. Pre-reform coefficients for both outcomes are close to zero and statistically insignificant, indicating no differential trends between more and less exposed firms prior to 2018. Following the reform, both series exhibit

a sustained negative divergence, with post-period coefficients remaining below zero throughout the post-treatment window, a pattern consistent with the gradual accumulation of an intangible capital shortfall driven by the reduction in performance-based managerial incentives.

Figure 6: Event Study Estimates: Intangible Capital



(a) Knowledge Capital **(b)** Organizational Capital

Note: This figure presents dynamic treatment effects for the effect of firm-level exposure measure (eligible-executive performance-based compensation intensity in 2017) on intangible capital outcomes, including knowledge capital and organizational capital. The specification includes propensity score matching, time trends, industry-time trends, industry-by-year, and firm fixed effects. Standard errors are clustered at the firm level. Confidence intervals are shown at the 90% level.

5 Conclusion

This paper studies whether tax rules that raise the cost of executive incentive pay affect corporate innovation. Exploiting the TCJA repeal of the Section 162(m) deduction for qualified performance-based compensation, we compare firms with different pre-reform reliance on performance-based pay before and after the reform. The results show that more exposed firms reduce R&D spending, patent applications, knowledge capital, and organizational capital, while capital expenditures respond much less. The magnitudes are economically meaningful: a 10-percentage-point increase in pre-reform performance-pay intensity is associated with about $1.0 million less annual R&D, roughly two fewer patent applications per firm-year, $3.9 million less knowledge capital, and $7.5 million less organizational capital. The timing of the effects, together with robustness checks for other TCJA provisions and alternative exposure measures, supports the interpretation that the response is tied to the compensation-tax shock rather than to a broad post-2017 change in corporate investment.

The evidence is consistent with a managerial-incentive mechanism. High-exposure

firms reduce stock-based and non-equity incentive compensation, and executive vega declines, indicating weaker rewards for pursuing volatile, long-horizon projects. This pattern matters because innovation projects often have delayed payoffs, uncertain outcomes, and performance signals that are difficult to contract on directly. When the tax price of incentive pay rises, firms appear to adjust the contracts that help managers bear this risk, and the real effects show up most clearly in innovation and intangible capital. Heterogeneity patterns further suggest that firms with stronger growth opportunities or healthier balance sheets are better able to preserve innovation after the tax price of incentive compensation rises, while financially weaker or lower-growth firms appear more exposed to the adjustment.

For policy and management, the results point to a trade-off. Tax limits on executive-pay deductibility may address concerns about compensation levels, but they can also change the incentive systems that support innovation. For boards and managers, the implication is not that all firms should preserve the same compensation mix, but that firms relying on long-horizon intangible investment should anticipate how tax-policy changes alter incentive intensity. The analysis is limited to publicly traded firms exposed to this specific U.S. reform, and the patent-quality evidence should be read as suggestive, but the findings show that compensation-tax policy can matter for real investment decisions inside the firm.

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Appendices

A Data Description and Summary Statistics

Table D.3 summarizes the distribution of firm-year observations across calendar years and Fama–French 12 industries. Panel A shows that annual representation is remarkably stable: each year between 2012 and 2022 accounts for between 7.3 and 9.7 percent of the sample, with no single year dominating the panel. This temporal balance reflects the balanced-panel design and ensures that identification is not driven by compositional shifts across time. Panel B reveals that the sample is weighted toward innovation-intensive sectors. High Tech firms (computers, software, and electronic equipment) constitute the largest group at 19.5 percent of observations, followed by Manufacturing (17.9 percent) and the residual Other category (16.2 percent). Wholesale and Retail account for 12.0 percent, Healthcare (medical devices, pharmaceuticals, and biotech) for 10.1 percent, Consumer Non-Durables for 7.7 percent, and Chemicals for 6.1 percent. More capital-intensive or narrowly defined sectors such as Consumer Durables (4.2 percent), Oil, Gas, and Coal (4.1 percent), and Telephone and Television (2.1 percent) represent smaller shares. This composition is advantageous for the analysis, as performance-based executive compensation, R&D investment, and patenting activity are especially salient in the dominant sectors.

Table D.4 reports summary statistics for the final estimation sample. The mean (median) firm holds total assets of $4,569 million ($1,514 million), emphasizing substantial size heterogeneity. Innovation inputs and outputs display wide dispersion: mean R&D expenditures are $78.0 million and mean patent applications total 57.5 per firm-year, but both variables are heavily right-skewed, with medians of $12.5 million and 12 applications, respectively. Capital expenditures average $174.2 million (median $44.5 million). Intangible capital stocks also vary considerably: mean knowledge capital is $314.3 million and mean organizational capital is $656.6 million. Financial characteristics such as leverage (mean 0.56), cash flow-to-assets (mean 0.09), and market-to-book (mean 1.91) exhibit meaningful cross-sectional variation. Managerial incentive measures are similarly dispersed: mean delta is $99.7 thousand and mean vega is $31.1 thousand, while board size averages 9.4 directors.

Table D.5 presents summary statistics for the pre-TCJA subsample (2012–2017), permitting direct comparison of firm characteristics before the reform takes effect. Pre-TCJA mean R&D spending of $72.6 million and mean patent applications of 55.9 are modestly below the full-sample means ($78.0 million and 57.5, respectively), consistent with aggregate growth in innovative activity over the sample window rather than a reform-driven trend confounding the pre-period baseline. Mean total assets of $4.0 billion pre-TCJA (vs. $4.6 billion in the full sample) and a slightly lower market-to-book ratio (1.82 vs. 1.91) reflect the secular growth in firm size and valuations over the period.

Tables D.6 and D.7 document executive compensation composition in the full and pre-TCJA samples, respectively. Mean total eligible performance pay rose from $12.2 million in the pre-TCJA period to $14.3 million across the full sample. Notably, option-based compensation intensity declined from 13.8 percent pre-reform to 11.8 percent in the full sample, while stock-based compensation intensity increased from 34.3 percent to 38.5 percent, which is a compositional shift consistent with the Section 3 finding that the TCJA lower option-based and non-equity incentive pay while firms partially substituted toward stock-based compensation. Mean CEO performance compensation also rose from $5.9 million pre-TCJA to $7.1 million in the full sample, reflecting both the post-reform period and broader market trends in executive pay.

Table D.8 reports pairwise correlations among the main variables. R&D and patent applications are strongly positively correlated (0.603), reflecting the close link between innovation inputs and outputs. R&D is very highly correlated with knowledge capital (0.946), confirming that the intangible stock measure faithfully tracks cumulative research investment. Consistent with standard corporate finance evidence, leverage is negatively correlated with R&D (-0.351) and patent applications (-0.222), while market-to-book is positively associated with both (0.294 and 0.201, respectively), consistent with growth firms investing more in innovation. Managerial incentive measures comove: log delta and log vega exhibit a correlation of 0.656, and both are positively associated with R&D and innovation outcomes, consistent with prior evidence that equity-incentivized executives favor long-horizon investment. No pair of regressors exhibits a correlation approaching unity, indicating that multicollinearity does not pose a concern for the empirical specifications.

Table D.9 presents correlations across alternative constructions of performance-based compensation intensity. All five measures are strongly positively correlated. The correlation between the baseline measure (`comp1`) and its closest alternative (`alt1`) is 0.992, and even the weakest pairwise correlation between the SEC-disclosure-based measure (`sec`) and the broader alternative (`alt2`) remains 0.596. These high correlations confirm that the treatment variable is not sensitive to the specific definition of total compensation used in the denominator, lending robustness to the baseline exposure construction.

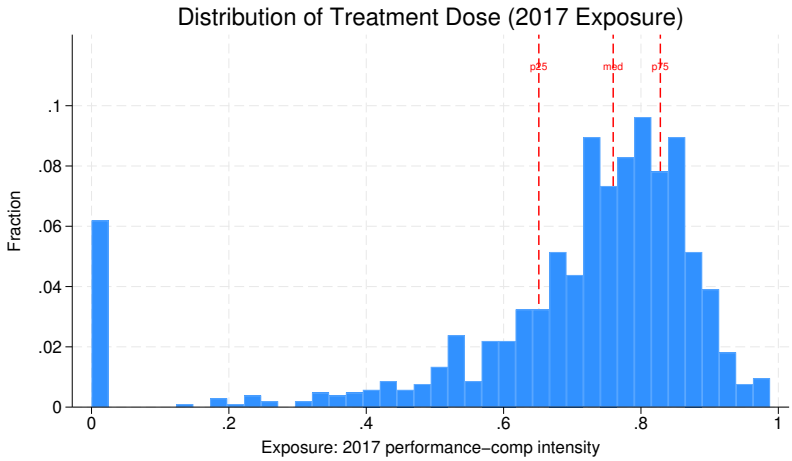
Figure E.1 displays the distributions of the logged firm-level outcome variables (R&D, capital expenditures, patent applications, knowledge capital, and organizational capital), each normalized by lagged total assets. All distributions exhibit the substantial right-skewness characteristic of firm-level investment and innovation data, motivating the log transformation applied throughout the empirical analysis. The wide support of each histogram confirms ample within-sample variation to identify the estimated treatment effects.

B Interpreting the Continuous Treatment

Our baseline design uses a continuous treatment as firms' 2017 reliance on performance-based compensation rather than a binary treated/control contrast. A continuous dose complicates the interpretation of the two-way fixed-effects coefficient: under treatment-effect heterogeneity it need not recover a convex, positively weighted average of dose-specific effects, and a causal dose–response reading requires common trends to hold across the entire exposure distribution rather than merely between a treated and an untreated group (Callaway et al., 2024). We emphasize at the outset that treatment timing in our setting is common, i.e. every firm is exposed to the repeal of §162(m) simultaneously in 2018, so the pathologies of staggered adoption, in which already-treated units serve as controls, do not arise here. The remaining issue is the continuous dose itself, which we address by (i) documenting where the identifying variation lies, (ii) corroborating the baseline with a discretized contrast, and (iii) estimating a binned dose-response function.

Distribution of the Treatment Dose Figure B.1 summarize the cross-sectional distribution of 2017 exposure. The dose is bounded in $[0, 1]$ and is concentrated at high values such that the median firm relies on performance-based pay for 0.76 of eligible compensation, the interquartile range is narrow ([0.65, 0.83]), and only 5.9% of firms have zero exposure. Two implications follow. First, the identifying variation is concentrated among firms that were already substantially exposed; there is little mass at low exposure and no large, clean group of untreated firms, so we interpret our estimates as the effect of high exposure to the reform rather than as a finely graded response along the full dose range. Second, because the interquartile spread is only 0.18, economically meaningful cross-firm differences correspond to modest movements in the dose which is a fact we take into account when quantifying magnitudes below.

Figure B.1: Distribution of the Treatment Dose



Note: Distribution of the treatment dose (2017 performance-compensation intensity), one observation per firm. Red dashed lines mark the 25th, 50th, and 75th percentiles.

Discretized Contrast Our first robustness check dispenses with the linear-in-dose functional form altogether. We replace the continuous treatment with a binary indicator equal to one for firms in the top quartile of 2017 exposure and zero for firms in the bottom quartile, dropping the middle half of the distribution, and re-estimate the baseline difference-in-differences. The results are in Table B.1. This is a deliberately demanding test in a sense that it discards half of the sample and much of the identifying variation, and it compares only the extremes of a distribution that is already compressed at high values. Even so, the post-reform decline in patenting among

high-exposure firms survives, as does the decline in R&D. The capital expenditure estimate, by contrast, is economically negligible and statistically indistinguishable from zero. Two points are worth emphasizing. First, the discretized estimates line up in sign and rough proportionality with the continuous coefficients, so the baseline is not an artifact of imposing a linear dose-response. Second, the sharp contrast between the significant innovation-input responses and the precise capital expenditures null is exactly what an incentive-based mechanism predicts.

Table B.1: Discretized DiD: High- vs. Low-Exposure Firms (Top vs. Bottom Quartile)

	Log R&D (1)	Log Capex (2)	Log Patent Applications (3)
Post × High exposure	−0.079*	−0.014	−0.189*
	(0.045)	(0.061)	(0.097)
Contrast	Top vs. Bottom Q	Top vs. Bottom Q	Top vs. Bottom Q
Observations	1,837	3,031	1,453
R^2	0.987	0.866	0.905

Note: High = top-quartile 2017 exposure; Low = bottom quartile (middle quartiles dropped). All columns include the full set of controls, firm fixed effects, and industry-by-year fixed effects; standard errors (in parentheses) are clustered by firm. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Dose-response Function We next estimate a binned dose-response function, the diagnostic recommended for continuous-treatment designs (Callaway et al., 2024). We sort firms into exposure quartiles and interact each quartile with the post-reform indicator, taking the lowest-exposure quartile (Q1, mean exposure 0.40) as the reference; Table B.2 reports the estimates. The pattern is informative in three respects. First, for patent applications the post-reform decline is negative and statistically significant in every treated quartile relative to Q1. The effect is therefore a broad-based feature of the exposed population, not an artifact of a small tail of extreme firms. Second, R&D behaves the same way qualitatively: the response is negative and significant in all three treated quartiles, though the magnitudes are smaller and the gradient is not strictly monotone. We read the absence of a clean monotone ranking as a consequence of the compressed dose range rather than as evidence against a dose-response because even Q1 firms carry a mean exposure of 0.40 and the top three quartiles span only 0.71 to 0.87, the quartiles are not sharply separated in treatment intensity, and small differences in average effects across them are difficult to order precisely. Indeed, because the reference group is itself substantially exposed, the quartile con-

trasts understate the gap between fully exposed and unexposed firms. Third, capital expenditures show no systematic gradient and are insignificant throughout.

Table B.2: Dose–Response by Exposure Quartile

	Log R&D	Log Capex	Log Patent Applications
Post × Q2	-0.065^{*}	-0.022	-0.304^{***}
	(0.039)	(0.053)	(0.109)
Post × Q3	-0.109^{**}	-0.025	-0.166^{*}
	(0.043)	(0.054)	(0.093)
Post × Q4	-0.075^{*}	-0.057	-0.246^{**}
	(0.044)	(0.056)	(0.098)
Observations	4,537	7,101	3,702

Note: Post interacted with exposure-quartile dummies; Q1 (lowest dose, mean exposure 0.40) is the reference, normalized to 0. Mean exposure by quartile: Q1 0.40, Q2 0.71, Q3 0.79, Q4 0.87. All columns include the full set of controls, firm fixed effects, and industry-by-year fixed effects; standard errors (in parentheses) are clustered by firm. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Economic Magnitude Table B.3 translates the baseline coefficients into economic terms. Because our outcomes are logs of investment-to-lagged-assets ratios, the estimates describe proportional changes in investment intensity rather than dollar changes, and we quantify them accordingly. Moving a firm from the 25th to the 75th percentile of the dose-an increase of 0.18 in exposure, which spans the bulk of the firms that actually differ in treatment-is associated with a 6.1% reduction in patenting intensity and a 2.3% reduction in R&D intensity; per ten-percentage-point increase in exposure, the corresponding effects are 3.4% and 1.3%. The capital expenditures effects are an order of magnitude smaller and economically trivial (-0.6% per ten percentage points). Two caveats discipline the interpretation. On the one hand, the per-firm magnitudes are modest, and we do not claim the reform reshaped aggregate innovation; on the other, the firms that populate the upper part of the exposure distribution are disproportionately the R&D- and patent-intensive firms for which these proportional declines translate into substantively meaningful reductions in innovative activity. The economic content of the result is therefore a targeted contraction of innovation among heavily performance-pay-reliant firms, rather than a broad or mechanical response.

Table B.3: Economic Magnitude of the Treatment Dose

Dependent Variable	Coef. (per unit)	Effect: p25→p75	Effect: +10pp
Log R&D	−0.131	−0.023	−0.013
Log Capex	−0.062	−0.011	−0.006
Log Patent Applications	−0.342	−0.061	−0.034

Note: Column 1 is the baseline Post×Exposure coefficient (full specification). Column 2 scales it by the p25-p75 exposure gap (0.177); column 3 by a +0.10 change in exposure. Outcomes are log investment-to-lagged-assets ratios, so entries approximate proportional changes in investment intensity.

Taken together, the four pieces of evidence in this subsection point in the same direction as the baseline. The distribution locates the identifying variation and motivates a "high-exposure" reading; the discretized contrast shows that the innovation-input declines survive a functional-form-free comparison of the extremes; the binned dose-response shows that they are present across the exposed population rather than in a narrow tail; and the magnitudes, while modest per firm, are concentrated among the innovation-intensive firms that matter most for the mechanism.

C Additional Robustness Analysis

C.1 Propensity Score Matching

A key concern in difference-in-differences settings is whether treated and control firms are sufficiently comparable along observable characteristics prior to the reform. To address this, we implement a propensity score matching (PSM) procedure that pairs high-exposure firms with observationally similar low-exposure firms based on pre-reform covariates.

We reweight the sample using propensity scores so that treated and control firms are comparable along observable pre-TCJA characteristics. Let Treated_i be an indicator equal to one if firm i belongs to the positive performance-based compensation group, and zero otherwise. We first estimate each firm's propensity to be in the treated group using pre-reform characteristics and a logit specification:

$$\Pr(\text{Treated}_i = 1 \mid X_{i,t-1}) = \Lambda\big(\theta_0 + X'_{i,t-1}\theta\big), \tag{5}$$

where $\Lambda(\cdot)$ is the logistic cumulative distribution function and $X_{i,t-1}$ is a vector of lagged firm characteristics (measured prior to the TCJA). In line with our baseline

controls, $X_{i,t-1}$ includes *Leverage*, *CashFlow*, *DividendPayout*, *Size*, *Sales*, *Employees*, *LaborIntensity*, *AssetTurnover*, *Market-to-Book*, *Tangibility*, the *Capex-to-Assets Ratio*, and *FirmAge*. The propensity score for firm i is denoted by $\hat{p}_i$.

In our sample, approximately 94.1% of firms have positive performance-based compensation exposure in 2017 and are classified as treated, while the remaining 5.9% have zero exposure and form the comparison group. Because the comparison group is relatively small, we restrict the analysis to firms within the region of common support. We estimate propensity scores using pre-TCJA firm characteristics and discard observations whose estimated propensity scores fall outside the overlapping support of the treated and comparison groups.[9]

Given the estimated propensity scores, we construct inverse-probability weights that reweight the sample toward a pseudo-population in which the distribution of $X_{i,t-1}$ is balanced across treated and control firms. Specifically, the weight w_i for firm i is

$$w_i = \begin{cases} \dfrac{1}{\hat{p}_i} & \text{if Treated}_i = 1, \\ \dfrac{1}{1-\hat{p}_i} & \text{if Treated}_i = 0. \end{cases} \tag{6}$$

These weights are then applied at the firm-year level in the outcome regressions.

To avoid excessive influence of a small number of firms with extreme weights, we trim the right tail of the weight distribution. Concretely, we compute the firm-level sum of weights over the sample window, obtain the 99th percentile of this distribution, and cap any higher values at this percentile. This trimming step mitigates the impact of outliers while retaining the majority of treated and control firms within common support.

Table C.1 reports the DiD estimates using the matched sample. The results closely mirror our baseline findings in both sign and magnitude. In particular, a 10-percentage-point increase in exposure reduces R&D expenditures by approximately 1.5% implying a reduction is approximately $1.2 million in R&D spending for the average firm. On the innovation-output side, the coefficient of -0.321 implies that a 10-percentage-point increase in exposure reduces patent applications by approxi-

[9]Operationally, we implement this procedure using `pscore` with common support and blocking on the estimated propensity score.

mately 3.2%. Given an average of 57 patent applications, this corresponds to about 1.8 fewer patent applications per firm-year among more exposed firms after the TCJA. The strength and consistency of the R&D and patent results reduce concerns that the baseline estimates are driven by differential pre-reform firm characteristics or covariate imbalance; instead, they are consistent with behavioral responses to the weakening of performance-based incentives.

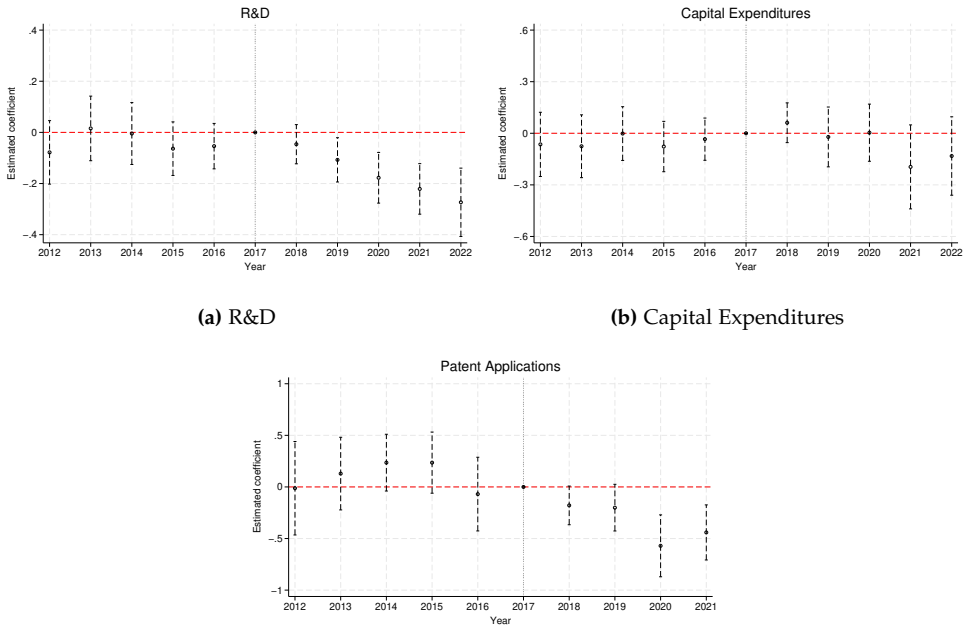
Table C.1: DiD Estimates: Propensity Score Matching

	(1) R&D	(2) Capex	(3) Patent Applications
Post × Exposure_{2017}	-0.151**	-0.070	-0.321**
	(0.059)	(0.087)	(0.149)
Controls	Yes	Yes	Yes
Propensity Score Matching	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
R^2	0.988	0.857	0.901
Observations	4,414	6,967	3,623

Note: This table reports Difference-in-Differences (DiD) estimates of the effect of firm-level exposure measure (eligible-executive performance-based compensation intensity in 2017) on firm outcomes using propensity score matching reweighting. *Post* equals one for $t \geq 2018$. Exposure_{2017} denotes the pre-treatment exposure measure. Standard errors (in parentheses) are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Figure C.1 presents the event-study version of the PSM specification, which provides an additional probe of the identifying assumptions. The pre-reform coefficients remain flat and statistically indistinguishable from zero, indicating that matched high- and low-exposure firms follow parallel trends prior to the TCJA. This is especially important given the structure of the reform and the potential for differential compensation trajectories before 2018. After the deductibility elimination takes effect, the dynamic coefficients show sustained and growing declines across R&D and patent applications. The timing of these responses mirrors the adjustments observed in the full sample, although the drop in innovation outcomes is even more pronounced once matching removes noise from observable heterogeneity. The event-study results therefore provide additional evidence of a post-reform break in investment behavior consistent with the proposed incentive mechanism.

Figure C.1: Event Study Estimates: Propensity Score Matching



(a) R&D

(b) Capital Expenditures

(c) Patent Applications

Note: This figure presents dynamic treatment effects for the effect of firm-level exposure measure (eligible-executive performance-based compensation intensity in 2017) on firm-level outcomes using the propensity score matching. The specification includes industry-by- year, and firm fixed effects. Standard errors are clustered at the firm level. Confidence intervals are shown at the 90% level.

C.2 Alternative Specifications for Outcomes

As a robustness check, we re-estimate our baseline specifications using two alternative functional form approaches that accommodate zero-valued observations: the inverse hyperbolic sine (*asinh*) transformation and the Poisson pseudo-maximum likelihood (PPML) estimator. The *asinh* transformation approximates the natural logarithm for large values while remaining defined at zero, thereby avoiding sample selection concerns that arise from log-transforming skewed distributions. PPML models the conditional mean of the outcome in levels and is similarly robust to excess zeros and heteroskedasticity, properties particularly relevant for patent data, where zero counts are prevalent by construction.

Table C.2 reports the results. The findings are broadly consistent with our baseline estimates across both estimators. In Panel A, the coefficient on the main exposure variable remains negative and statistically significant across all three *asinh* specifica-

tions, and is directionally consistent under PPML, indicating that firms with greater pre-reform exposure experienced a meaningful decline in R&D following the 2017 tax reform. Panel B shows no statistically significant effect on Capex under either estimator, consistent with our main results. Panel C reveals negative and statistically significant coefficients on patent applications across all six specifications. The stronger statistical significance under PPML relative to the baseline log specification is expected, as the prevalence of zero patent counts renders PPML particularly well-suited for this outcome. The additional control variables capturing other major components of TCJA remain insignificant throughout, suggesting that the main treatment effect is not explained by these alternative channels of the tax reform. Overall, these results indicate that the findings are not sensitive to the choice of functional form or the treatment of zero-valued observations.

Table C.2: DiD Estimates: Alternative Functional Form Specifications

	RATIO			*ASINH*			*PPML*		
Panel A: Dependent Variable - R&D	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Post × Exposure_{2017}	-0.007*	-0.009**	-0.007*	-0.007*	-0.009**	-0.007*	-0.095	-0.115*	-0.060
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.064)	(0.062)	(0.064)
Post × MTR_{2017}		0.005	0.004		0.004	0.004		0.134	0.121
		(0.005)	(0.005)		(0.005)	(0.005)		(0.173)	(0.172)
Post × Interest Rate $\text{Deductibility}_{2017}$			-0.002			-0.002			-0.029
			(0.003)			(0.003)			(0.075)
R^2	0.885	0.890	0.898	0.887	0.893	0.899	-	-	-
Observations	5,534	4,947	4,537	5,534	4,947	4,537	4,586	4,049	3,690
Panel B: Dependent Variable - Capex									
Post × Exposure_{2017}	0.003	0.002	-0.001	0.003	0.002	-0.001	0.015	-0.024	-0.074
	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)	(0.005)	(0.080)	(0.085)	(0.096)
Post × MTR_{2017}		0.005	0.006		0.005	0.006		0.093	0.095
		(0.007)	(0.007)		(0.007)	(0.007)		(0.136)	(0.146)
Post × Interest Rate $\text{Deductibility}_{2017}$			-0.016**			-0.016**			-0.335***
			(0.007)			(0.007)			(0.111)
R^2	0.773	0.783	0.790	0.784	0.787	0.794	-	-	-
Observations	8,711	7,604	7,101	8,711	7,604	7,101	8,711	7,604	7,101
Panel C: Dependent Variable - Patent Applications									
Post × Exposure_{2017}	-0.020**	-0.026**	-0.023**	-0.019**	-0.024***	-0.021**	-0.471**	-0.680***	-0.318*
	(0.010)	(0.010)	(0.010)	(0.009)	(0.009)	(0.009)	(0.217)	(0.239)	(0.190)
Post × MTR_{2017}		-0.005	0.002		-0.006	-0.000		-0.342	-0.225
		(0.012)	(0.012)		(0.011)	(0.011)		(0.250)	(0.271)
Post × Interest Rate $\text{Deductibility}_{2017}$			0.001			-0.000			-0.106
			(0.008)			(0.007)			(0.286)
R^2	0.702	0.709	0.679	0.736	0.745	0.718	-	-	-
Observations	4,341	4,010	3,702	4,341	4,010	3,702	4,020	3,697	3,387
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: This table reports Difference-in-Differences (DiD) estimates using alternative functional form specifications. Columns (1)-(3) use dependent variables as normalized by lagged total assets; Columns (4)-(6) use the inverse hyperbolic sine (*asinh*) transformation; Columns (7)-(9) use the Poisson Pseudo-Maximum Likelihood (PPML) estimator. *Post* equals one for $t \geq 2018$. Exposure_2017 denotes eligible-executive performance-based compensation intensity in 2017. All specifications include firm fixed effects, industry-year fixed effects, and firm-level controls. Standard errors (in parentheses) are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

C.3 Additional Corporate Governance Controls

A natural concern is that the estimated effects of the deductibility elimination may be confounded by time-varying differences in firms' internal governance structures. Board oversight, independence, and monitoring capacity potentially shape investment decisions and could interact with executive compensation policies. If governance characteristics evolve around the time of the TCJA or correlate with exposure to Section 162(m), they may bias our estimates. To address this possibility, we re-estimate our baseline specifications while controlling for two key governance variables widely used in the corporate finance literature: board size and the ratio of non-executive directors. These controls capture differences in monitoring intensity and managerial discretion that could otherwise confound the treatment effect.

Table C.3 reports the difference-in-differences estimates including governance variables. The coefficients on $Post \times Exposure_{2017}$ remain negative, statistically significant, and similar in magnitude to our baseline findings for R&D and patent applications. Interpreted for a 10-percentage-point increase in exposure, these estimates imply declines of about 1.4% in R&D, and 3.8% in patent applications. This corresponds to about approximately $1.1 million in R&D spending for the average firm, and 2.2 fewer patent applications per firm-year among more exposed firms after the TCJA.

The governance variables themselves do not appear to drive these results. Board size enters with small and statistically insignificant coefficients across outcomes, while the non-executive director ratio also does not overturn the main treatment effects. Importantly, including these governance controls does not attenuate the estimated effects on R&D and patent applications, reducing the concern that differences in corporate governance are driving the decline in innovation.

Table C.3: DiD Estimates: Corporate Governance Controls

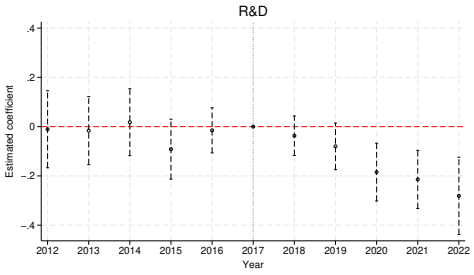
	(1) R&D	(2) Capex	(3) Patent Applications
Post × Exposure_{2017}	-0.138**	-0.047	-0.377**
	(0.069)	(0.096)	(0.180)
L.Board Size	0.012	0.000	-0.037
	(0.009)	(0.013)	(0.025)
L.Non-Executive Director Ratio	0.694	0.295	-1.511
	(0.760)	(1.088)	(2.317)
Controls	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
R^2	0.988	0.851	0.910
Observations	4,213	6,610	3,439

Note: This table reports Difference-in-Differences (DiD) estimates of the effect of firm-level exposure measure (eligible-executive performance-based compensation intensity in 2017) on firm-level outcomes, including corporate governance controls such as board size and non-executive director ratio. *Post* equals one for $t \geq 2018$. Exposure_{2017} denotes the eligible-executive performance-based compensation intensity in 2017. Standard errors (in parentheses) are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

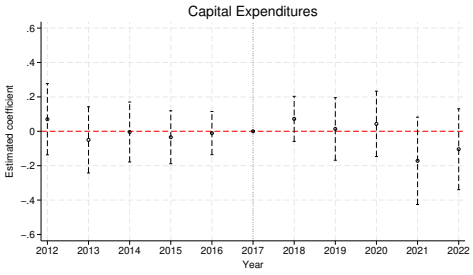
Figure C.2 presents event-study estimates after controlling for governance characteristics. The pre-treatment coefficients remain flat and close to zero across all outcomes, which supports the parallel-trends interpretation after adding these controls. Following the reform, high-exposure firms exhibit the same sharp declines in R&D and patent applications as in the baseline specification. The timing, magnitude, and persistence of these dynamic patterns are essentially unchanged, suggesting that governance characteristics do not explain the observed break in investment and innovation behavior after 2018.

Controlling for key corporate governance attributes leaves our results intact. Neither board structure nor director independence explains the differential decline in investment and innovation among high-exposure firms. These checks support the interpretation that the weakening of performance-based incentives under the TCJA, rather than changes in internal governance or monitoring capacity, is related to the reduced long-horizon investment behavior we document.

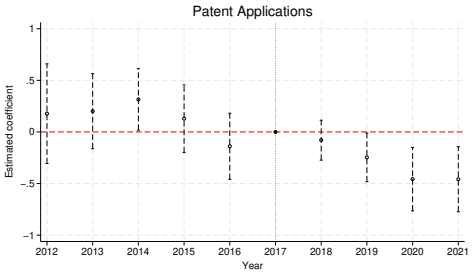
Figure C.2: Event Study Estimates: Corporate Governance Controls



(a) R&D



(b) Capital Expenditures



(c) Patent Applications

Note: This figure presents dynamic treatment effects for the effect of firm-level exposure measure (eligible-executive performance-based compensation intensity in 2017) on firm-level outcomes including the additional corporate governance variables such as board size, and non-executive director ratio. The specification includes industry-by-year, and firm fixed effects. Standard errors are clustered at the firm level. Confidence intervals are shown at the 90% level.

D Additional Tables

Table D.1: Variable Definitions

Variable	Definition	Database
Outcome Variables		
Log (R&D / L. Total Assets)	Natural logarithm of one plus R&D expenditures ($ million) per lagged total assets ($ million); $ln((xrd{+}1)/(L.at))$	Compustat
Log (Capex / L. Total Assets)	Natural logarithm of one plus capital expenditures ($ million) per lagged total assets ($ million); $ln((capx{+}1)/(L.at))$	Compustat
Log (Patent Applications / L. Total Assets)	Natural logarithm of one plus patent application count per lagged total assets ($ million); $ln((patent\ applications{+}1)/(L.at))$	DISCERN, Compustat
Treatment Variable		
Exposure_{2017}	Eligible-executive performance-based compensation intensity in 2017, defined as the ratio of total performance-based compensation of TCJA-eligible executives to total compensation of all executives	ExecuComp
Other TCJA Channels		
MTR_{2017}	Firm-level marginal tax rate in 2017, proxying for exposure to the corporate tax rate reduction under TCJA	Graham (1996a)
$\text{Interest Rate Deductibility}_{2017}$	Indicator equal to one if the ratio of interest expense to EBITDA exceeds 0.3 in 2017, proxying for exposure to the interest deductibility limitation under TCJA	Compustat
Control and Other Variables		
Leverage	Book value of total debt ($ million) divided by total assets ($ million); lt/at	Compustat
CashFlow	Sum of net income and depreciation ($ million) divided by total assets ($ million); $(ib+dp)/at$	Compustat
DividendPayout	Cash dividends to common shareholders ($ million) divided by lagged total assets ($ million); dvc/at_{t-1}	Compustat
Size	Natural logarithm of market capitalization ($ million); $\ln(mkvalt+1)$	Compustat
Sales Growth	Annual growth in firm sales; $(sale_t - sale_{t-1})/sale_{t-1}$	Compustat
Employees	Number of employees (thousands)	Compustat
LaborIntensity	Number of employees (thousands) divided by total assets (normalized to $ thousand); $emp/(at/1000)$	Compustat
AssetTurnover	Sales ($ million) divided by lagged total assets ($ million); $sale/at_{t-1}$	Compustat
Market-to-Book	Market value of assets divided by book value of assets; $(cshpri \times prcc_f + pstkl + dlc + dltt - txdb)/at$	Compustat
Tangibility	Net property, plant, and equipment ($ million) divided by total assets ($ million); $ppent/at$	Compustat
ROA	Income before extraordinary items ($ million) divided by total assets ($ million); ib/at	Compustat
FirmAge	Natural logarithm of the difference between current year and firm's founding year; $\ln(year - founding\ year+1)$	Jay R. Ritter's IPO Data, Compustat
Vega	Dollar change in the median eligible executive's equity portfolio value for a 0.01 change in stock return volatility	BoardEx, Compustat, CRSP, Coles et al. (2006)
Delta	Dollar change in the median eligible executive's equity portfolio value for a 1% change in stock price	BoardEx, Compustat, CRSP, Coles et al. (2006)
Board Size	Total number of directors on the board	BoardEx
Non-Executive Director Ratio	Ratio of non-executive directors to total board size	BoardEx
Knowledge Capital	Firm-level knowledge capital stock ($ million) constructed via perpetual inventory method applied to R&D expenditures	Peters and Taylor (2017)
Organizational Capital	Firm-level organizational capital stock ($ million) constructed via perpetual inventory method applied to SG&A expenditures	Peters and Taylor (2017)

Note: This table provides definitions, construction details, and data sources for all variables used in the analysis. All monetary variables are deflated to 1990 dollars using the seasonally adjusted CPI. Continuous variables are winsorized at the 1st and 99th percentiles by year. Log variables denote the natural logarithm of variables normalized by lagged total assets.

Table D.2: Sample Selection: Firm-Year Panel

Step	Dropped Firms	Dropped Observations	Remaining Firms	Remaining Observations
Initial Compustat Sample (2012–2022)			16,508	105,855
Exclude: SIC 6000–6999	6,760	42,991	9,748	62,864
Exclude: SIC 4900–4999	402	3,412	9,346	59,452
Exclude: SIC $\geq$ 9000	421	1,412	8,925	58,040
After merging ExecuComp and dropping missing exposure variable	7,010	41,557	1,915	16,483
After dropping negative values and duplicate firm-year observations	0	5	1,915	16,478
After restricting to balanced-panel firms	865	4,928	1,050	11,550
After dropping singletons and missing values in regressions	309	4,449	741	7,101
Final sample			741	7,101

Note: This table reports sample selection for the 2012–2022 firm-year panel. We begin with 16,508 unique firms (105,855 firm-year observations) from Compustat. Industry exclusions follow standard practice: financials (SIC 6000–6999), utilities (SIC 4900–4999), and public administration and non-classifiable industries (SIC $\geq$ 9000). The exposure variable is constructed from ExecuComp; observations with missing values for the performance-based compensation intensity measure are dropped. The final regression sample excludes singleton observations and firm-year observations with missing values for regression variables, leaving 741 unique firms and 7,101 firm-year observations.

Table D.3: Sample Composition by Year and Industry

Panel A: Sample Composition by Year		
Year	Number of Observations	Percentage of Observations
2012	519	7.3
2013	620	8.7
2014	628	8.8
2015	627	8.8
2016	641	9.0
2017	674	9.5
2018	690	9.7
2019	679	9.6
2020	678	9.5
2021	678	9.5
2022	667	9.4
Total	7,101	100.0
Panel B: Sample Composition by Industry		
Industry	Number of Observations	Percentage of Observations
Consumer Non-Durables	549	7.7
Consumer Durables	298	4.2
Manufacturing	1,273	17.9
Oil, Gas, and Coal	292	4.1
Chemicals	434	6.1
High Tech	1,388	19.5
Telephone and Television	146	2.1
Wholesale and Retail	854	12.0
Healthcare	716	10.1
Other	1,151	16.2
Total	7,101	100.0

Note: This table summarizes the sample distribution by year (Panel A) and by Fama-French 12-industry classification (Panel B).

Table D.4: Summary Statistics: Firm Outcomes and Controls - Final Sample

Variable	Mean	S.D.	p25	Median	p75	N
Total Assets	4561.886	8449.491	546.937	1508.162	4473.977	7,096
Log Total Assets	7.378	1.473	6.306	7.319	8.406	7,096
R&D	77.985	269.642	2.315	12.559	41.788	4,773
R&D / L. Total Assets	0.024	0.035	0.002	0.010	0.032	4,773
Log (R&D / L. Total Assets)	-4.664	1.726	-5.511	-4.434	-3.370	4,773
Capex	173.957	410.351	14.182	44.413	146.900	7,101
Capex / L. Total Assets	0.044	0.048	0.017	0.030	0.053	7,101
Log (Capex / L. Total Assets)	-3.441	0.863	-3.964	-3.436	-2.895	7,101
Patent Applications	57.547	142.393	2.000	12.000	44.000	3,922
Patent Applications / L. Total Assets	0.024	0.058	0.002	0.009	0.025	3,922
Log (Patent Applications / L. Total Assets)	-4.678	1.557	-5.640	-4.510	-3.598	3,922
FirmAge	3.731	0.538	3.401	3.807	4.111	7,099
ROA	0.052	0.100	0.023	0.055	0.091	7,101
Sales Growth	0.055	0.188	-0.029	0.034	0.112	7,052
Asset Turnover	1.041	0.627	0.602	0.875	1.322	7,081
Market-to-Book	1.913	1.451	1.005	1.473	2.293	6,985
Leverage	0.559	0.217	0.415	0.550	0.690	7,065
Cashflow / Assets	0.092	0.079	0.059	0.092	0.129	7,072
Employees	19.150	33.279	2.637	7.400	19.527	7,087
Labour Intensity	7.400	8.822	2.497	4.655	8.734	7,080
Profitability	0.053	0.082	0.023	0.056	0.091	7,063
Altman Z-Score	7.169	8.521	3.366	5.059	7.967	6,900
Tobin's q	3.824	3.125	1.984	2.897	4.492	7,101
Delta	99.569	146.330	20.709	49.290	116.571	6,752
Log (Delta/ L. Total Assets)	-3.451	1.425	-4.418	-3.459	-2.545	6,752
Vega	31.096	53.665	0.000	9.253	37.624	6,780
Log (Vega/ L. Total Assets)	-5.188	1.960	-6.510	-4.955	-3.746	6,780
Board Size	9.443	1.983	8.000	9.000	11.000	6,685
Non-Executive Director Ratio	0.084	0.021	0.070	0.080	0.094	6,684
Knowledge Capital	313.735	1011.008	0.000	23.106	177.800	7,042
Log (Knowledge Capital/ L. Total Assets)	-4.425	2.862	-7.015	-3.679	-1.967	7,042
Organizational Capital	655.779	1179.842	93.871	237.944	667.745	7,082
Log (Organizational Capital/ L. Total Assets)	-1.869	1.366	-2.337	-1.681	-1.103	7,082

Note: This table reports descriptive statistics for variables used in the empirical analysis. Mean, standard deviation (SD), and selected percentiles (P25, P50, P75) are shown along with the number of firm-year observations. Log variables denote the natural logarithm of variables normalized by lagged total assets.

Table D.5: Summary Statistics: Firm Outcomes and Controls - Pre-TCJA Sample

Variable	Mean	S.D.	p25	Median	p75	N
Total Assets	3990.971	7693.502	462.146	1304.197	3865.617	3,708
Log Total Assets	7.222	1.481	6.138	7.174	8.260	3,708
R&D	72.591	258.416	2.013	11.833	38.083	2,493
R&D / L. Total Assets	0.026	0.039	0.003	0.011	0.035	2,493
Log (R&D / L. Total Assets)	-4.550	1.702	-5.363	-4.355	-3.276	2,493
Capex	174.783	432.494	13.341	42.257	136.556	3,709
Capex / L. Total Assets	0.050	0.052	0.020	0.034	0.059	3,709
Log (Capex / L. Total Assets)	-3.318	0.862	-3.834	-3.323	-2.786	3,709
Patent Applications	55.932	140.817	2.000	11.000	41.000	2,269
Patent Applications / L. Total Assets	0.027	0.070	0.002	0.010	0.027	2,269
Log (Patent Applications / L. Total Assets)	-4.576	1.560	-5.542	-4.419	-3.523	2,269
FirmAge	3.658	0.572	3.332	3.761	4.043	3,707
ROA	0.051	0.106	0.026	0.056	0.089	3,709
Sales Growth	0.053	0.174	-0.024	0.034	0.106	3,682
Asset Turnover	1.119	0.662	0.652	0.956	1.405	3,699
Market-to-Book	1.822	1.153	1.031	1.480	2.224	3,640
Leverage	0.540	0.217	0.401	0.532	0.664	3,694
Cashflow / Assets	0.092	0.079	0.062	0.093	0.129	3,694
Employees	18.014	31.729	2.428	6.714	18.000	3,704
Labour Intensity	8.017	9.782	2.685	4.960	9.184	3,700
Profitability	0.053	0.080	0.026	0.056	0.089	3,690
Altman Z-Score	7.007	7.515	3.497	5.265	8.034	3,604
Tobin's q	3.525	2.397	2.034	2.837	4.180	3,709
Delta	92.513	118.912	22.821	50.250	113.453	3,553
Log (Delta/ L. Total Assets)	-3.266	1.384	-4.178	-3.263	-2.382	3,553
Vega	30.327	46.642	0.089	12.320	38.209	3,573
Log (Vega/ L. Total Assets)	-4.839	1.870	-5.991	-4.540	-3.533	3,573
Board Size	9.311	2.026	8.000	9.000	11.000	3,478
Non-Executive Director Ratio	0.084	0.022	0.070	0.080	0.094	3,481
Knowledge Capital	261.817	852.851	0.000	18.366	144.188	3,674
Log (Knowledge Capital/ L. Total Assets)	-4.361	2.803	-6.858	-3.690	-1.968	3,674
Organizational Capital	599.084	1113.560	79.190	215.557	587.338	3,699
Log (Organizational Capital/ L. Total Assets)	-1.832	1.393	-2.288	-1.620	-1.046	3,699

Note: This table reports descriptive statistics for variables used in the empirical analysis for the years before TCJA. Mean, standard deviation (SD), and selected percentiles (P25, P50, P75) are shown along with the number of firm-year observations. Log variables denote the natural logarithm of variables normalized by lagged total assets.

Table D.6: Summary Statistics: Executive Compensation Variables - Final Sample

Variable	Mean	S.D.	p25	Median	p75	N
CEO Perf. Comp.	7.092	9.484	2.734	5.292	9.113	6,570
Log CEO Perf. Comp.	1.817	0.715	1.318	1.839	2.314	6,570
CEO Total Comp.	8.427	9.871	3.745	6.470	10.616	6,570
Log CEO Total Comp.	2.017	0.639	1.557	2.011	2.452	6,570
CEO Salary	0.953	0.512	0.719	0.923	1.109	6,570
Log CEO Salary	0.650	0.185	0.542	0.654	0.746	6,570
CFO Perf. Comp.	2.399	2.563	1.088	1.762	2.858	5,748
Log CFO Perf. Comp.	1.086	0.482	0.736	1.016	1.350	5,748
CFO Total Comp.	3.137	2.764	1.650	2.435	3.673	5,748
Log CFO Total Comp.	1.306	0.435	0.975	1.234	1.542	5,748
CFO Salary	0.554	0.243	0.425	0.518	0.644	5,748
Log CFO Salary	0.432	0.123	0.354	0.418	0.497	5,748
Total Eligible Perf. Pay	14.266	12.656	5.596	11.075	19.073	6,481
Log (Total Elig. Perf. Pay / L. Total Assets)	-5.204	1.424	-5.813	-5.157	-4.488	6,467
Stock-Based Comp. Intensity	0.385	0.235	0.222	0.406	0.558	7,056
Option-Based Comp. Intensity	0.118	0.161	0.000	0.000	0.199	7,035
Non-Equity Comp. Intensity	0.181	0.141	0.070	0.170	0.261	7,017

Note: This table reports descriptive statistics for executive compensation variables. Mean, standard deviation (SD), and selected percentiles (P25, P50, P75) are shown along with the number of firm-year observations.

Table D.7: Summary Statistics: Executive Compensation Variables - Pre-TCJA Sample

Variable	Mean	S.D.	p25	Median	p75	N
CEO Perf. Comp.	5.908	6.361	2.308	4.454	7.608	3,379
Log CEO Perf. Comp.	1.684	0.688	1.196	1.696	2.153	3,379
CEO Total Comp.	7.214	7.015	3.235	5.616	9.059	3,379
Log CEO Total Comp.	1.899	0.616	1.443	1.890	2.308	3,379
CEO Salary	0.909	0.374	0.675	0.890	1.055	3,379
Log CEO Salary	0.630	0.180	0.516	0.637	0.720	3,379
CFO Perf. Comp.	2.113	2.585	0.986	1.558	2.475	2,822
Log CFO Perf. Comp.	1.008	0.452	0.686	0.939	1.246	2,822
CFO Total Comp.	2.804	2.740	1.527	2.195	3.246	2,822
Log CFO Total Comp.	1.233	0.406	0.927	1.162	1.446	2,822
CFO Salary	0.523	0.192	0.405	0.495	0.600	2,822
Log CFO Salary	0.414	0.115	0.340	0.402	0.470	2,822
Total Eligible Perf. Pay	12.236	11.169	4.487	9.450	16.278	3,364
Log (Total Elig. Perf. Pay / L. Total Assets)	-5.260	1.532	-5.828	-5.187	-4.550	3,357
Stock-Based Comp. Intensity	0.343	0.229	0.173	0.358	0.509	3,687
Option-Based Comp. Intensity	0.138	0.169	0.000	0.086	0.230	3,679
Non-Equity Comp. Intensity	0.180	0.142	0.064	0.170	0.260	3,663

Note: This table reports descriptive statistics for executive compensation variables for the years before TCJA. Mean, standard deviation (SD), and selected percentiles (P25, P50, P75) are shown along with the number of firm-year observations.

Table D.8: Pairwise Correlation Matrix

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
(1) Log R&D	1																				
(2) Log Capex	-0.085***	1																			
(3) Log Patents	0.603***	0.103***	1																		
(4) FirmAge	-0.207***	-0.025**	-0.150***	1																	
(5) ROA	-0.074***	0.049***	-0.024	0.061***	1																
(6) Sales Growth	0.120***	0.098***	0.083***	-0.082***	0.188***	1															
(7) Asset Turnover	-0.297***	0.190***	0.049***	-0.007	0.199***	0.105***	1														
(8) Market-to-Book	0.294***	0.035***	0.201***	-0.076***	0.317***	0.122***	-0.001	1													
(9) Leverage	-0.351***	-0.059***	-0.222***	0.090***	-0.131***	-0.049***	0.006	-0.098***	1												
(10) Cashflow/Assets	-0.078***	0.217***	-0.032**	0.066***	0.955***	0.180***	0.206***	0.344***	-0.120***	1											
(11) Employment	-0.458***	0.036***	-0.178***	0.115***	0.077***	-0.044***	0.124***	-0.022*	0.273***	0.079***	1										
(12) Labour Intensity	-0.308***	0.213***	-0.042***	-0.037***	0.048***	-0.061***	0.436***	-0.014	0.036***	0.107***	0.276***	1									
(13) Profitability	-0.069***	0.061***	-0.035**	0.072***	0.988***	0.187***	0.211***	0.373***	-0.121***	0.943***	0.090***	0.047***	1								
(14) Altman Z-Score	0.258***	0.060***	0.181***	-0.081***	0.299***	0.121***	0.083***	0.686***	-0.477***	0.290***	-0.099***	-0.010	0.325***	1							
(15) Tobin's q	0.304***	0.036***	0.193***	-0.074***	0.285***	0.151***	0.002	0.992***	-0.116***	0.320***	-0.022*	-0.026**	0.347***	0.686***	1						
(16) Log Delta	0.313***	0.068***	0.297***	-0.222***	0.136***	0.172***	0.178***	0.407***	-0.316***	0.122***	-0.313***	0.111***	0.140***	0.413***	0.399***	1					
(17) Log Vega	0.282***	0.035***	0.260***	-0.135***	-0.008	0.033***	0.064***	0.200***	-0.223***	-0.021*	-0.259***	0.079***	-0.007	0.223***	0.187***	0.656***	1				
(18) Board Size	-0.260***	-0.070***	-0.253***	0.181***	0.059***	-0.064***	-0.063***	-0.031**	0.313***	0.028**	0.339***	-0.073***	0.065***	-0.164***	-0.033***	-0.381***	-0.262***	1			
(19) Non-Executive Director Ratio	0.303***	-0.020	0.220***	-0.134***	-0.079***	0.041***	-0.019	0.040***	-0.197***	-0.067***	-0.247***	0.014	-0.080***	0.098***	0.043***	0.224***	0.190***	-0.749***	1		
(20) Log Knowledge Capital	0.946***	-0.101***	0.635***	-0.121***	-0.013	0.009	-0.167***	0.292***	-0.206***	-0.050***	-0.259***	-0.138***	-0.016	0.223***	0.292***	0.306***	0.310***	-0.164***	0.218***	1	
(21) Log Organizational Capital	0.069***	-0.078***	0.199***	-0.020*	0.057***	-0.062***	0.320***	0.108***	-0.084***	0.016	-0.116***	0.199***	0.054***	0.115***	0.081***	0.270***	0.224***	-0.095***	0.080***	0.235***	1

Note: Lower triangle reports pairwise correlations. Log variables denote the natural logarithm of variables normalized by lagged total assets. * p<0.10, ** p<0.05, *** p<0.01.

Table D.9: Correlation Matrix of Alternative Performance-Based Compensation Intensity Measures

	comp1	comp2	alt1	alt2	sec
comp1	1				
comp2	0.845***	1			
alt1	0.992***	0.844***	1		
alt2	0.654***	0.813***	0.667***	1	
sec	0.913***	0.763***	0.885***	0.596***	1

Note: This table reports pairwise Pearson correlation coefficients for various measures of performance-based compensation intensity for eligible executives, based on different total compensation definitions from the ExecuComp database.

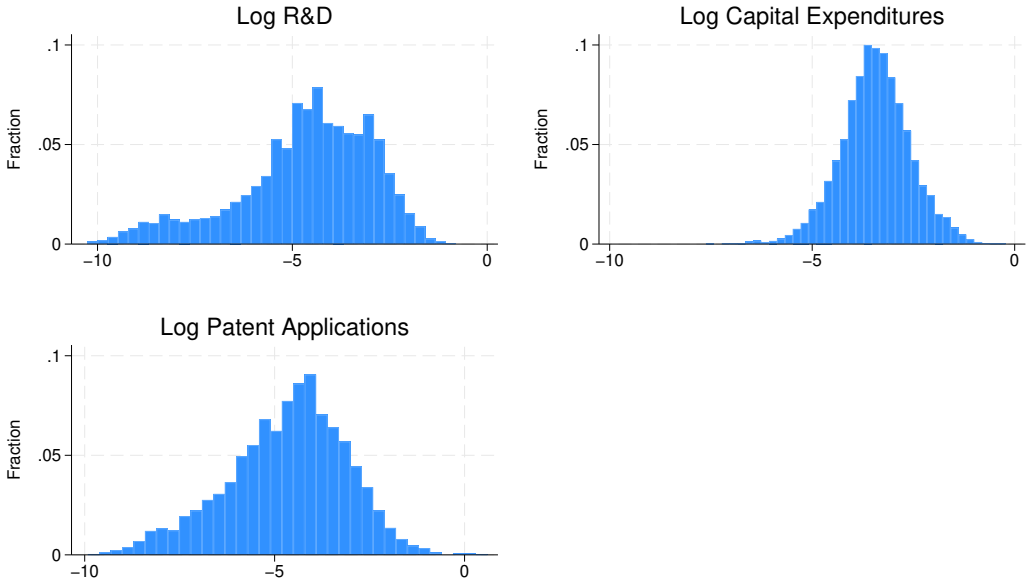
Table D.10: DiD Estimates: Full Regression Results

	(1) R&D	(2) Capex	(3) Patent Applications
Post × Exposure_{2017}	-0.131**	-0.062	-0.342**
	(0.066)	(0.091)	(0.162)
Post × MTR_{2017}	-0.016	0.196	-0.153
	(0.122)	(0.141)	(0.262)
Post × $\text{Interest Rate Deductibility}_{2017}$	-0.076	-0.155	-0.121
	(0.060)	(0.096)	(0.174)
L.FirmAge	-0.219*	-0.362**	-0.715**
	(0.116)	(0.155)	(0.337)
L.ROA	-3.540***	0.459	-0.522
	(0.823)	(0.924)	(1.844)
L.Sales	-0.175***	-0.059	-0.153
	(0.048)	(0.047)	(0.098)
L.AssetTurnover	0.169***	0.236***	0.202**
	(0.047)	(0.043)	(0.101)
L.Market-to-Book	0.043***	0.097***	0.027
	(0.007)	(0.013)	(0.020)
L.Leverage	-0.171*	-0.247**	-0.575***
	(0.088)	(0.099)	(0.213)
L.Cash Flow	3.218***	-0.307	-0.265
	(0.871)	(0.927)	(1.926)
L.Employees	-0.005***	-0.001	-0.009*
	(0.001)	(0.001)	(0.005)
L.LaborIntensity	0.025***	0.024***	0.040***
	(0.004)	(0.005)	(0.011)
Controls	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
R^2	0.988	0.851	0.906
Observations	4,537	7,101	3,702

Note: This table reports Difference-in-Differences (DiD) estimates of the effect of the firm-level exposure measure, following the full specification in column (4) of Table 2. All control variables are lagged. Standard errors (in parentheses) are clustered at the firm level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

E Additional Figures

Figure E.1: Histogram of Firm Outcomes



Note: This figure shows histograms of firm-level outcomes. Log variables denote the natural logarithm of variables normalized by lagged total assets.