Tax Policy and Investment in a Global Economy

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Abstract

We evaluate the 2017 Tax Cuts and Jobs Act by combining reduced-form estimates from tax data with a global investment model. Firms exposed to larger domestic tax cuts increased domestic investment relatively more. U.S. multinationals subject to novel foreign tax incentives increased foreign capital and further boosted domestic investment, indicating complementarity between domestic and foreign capital. In our general equilibrium model calibrated to match the reduced-form evidence, short-run domestic corporate investment increases 10% and long-run capital rises 6%. The tax revenue feedback from growth offsets 3% of pre-TCJA corporate revenue on average over ten years.

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1 Introduction

The Tax Cuts and Jobs Act (TCJA) of 2017 was the largest corporate tax reduction in the history of the United States.[1] It lowered the top statutory corporate tax rate from 35% to 21%, changed a host of investment incentives, and fundamentally altered the treatment of international income. Collectively, these corporate tax changes were scored to reduce corporate tax revenue by $100 to $150 billion per year (Joint Committee on Taxation, 2017; Congressional Budget Office, 2018). Yet, both at the time of passage and in its aftermath, economists have not reached consensus on ballpark estimates of its effects on corporate investment or tax revenue.[2]

This paper uses administrative tax data and a new model of global investment behavior to evaluate the TCJA corporate tax provisions and to illuminate the nature of global production. We have four main findings. First, the main domestic provisions—the reduction in the corporate rate and full expensing of investment—stimulated domestic investment substantially: firms with the mean tax change increased investment by 18% relative to firms experiencing no change. Second, novel international tax provisions that encouraged U.S. multinationals to increase their foreign tangible capital also stimulated *domestic* investment, indicating within-firm complementarity between foreign and domestic capital. Third, using our general equilibrium model that incorporates crowd-out due to rising wages, total C-corporation investment is 10% higher two years after the TCJA and the capital stock is 6% higher in the long run. Total non-residential domestic investment, which includes the non-corporate sector, increases by 6% in the two years after the TCJA. Finally, higher depreciation deductions largely offset additional labor and corporate tax revenue from capital accumulation. The resulting ten year revnue effect of the dynamic feedback from higher capital is 3% of pre-TCJA corporate tax revenue.

We begin by extending the workhorse tax-adjusted, user-cost theory of investment (Hall and Jorgenson, 1967) to a multinational firm facing domestic and foreign taxes. In our model, a firm operates domestic and foreign production lines using domestic and foreign capital, which may be complements or substitutes in production, along with flexible inputs such as local labor and materials. The firm pays a rate τ on domestic source income and $\bar{\tau}$ on foreign source income and receives an investment subsidy Γ on domestic investment and $\bar{\Gamma}$ on foreign in-

[1]The official name of the act is given in Public Law 115-97, "An Act to Provide for Reconciliation Pursuant to Titles II and V of the Concurrent Resolution on the Budget for Fiscal Year 2018." It was originally called the "Tax Cuts and Jobs Act," but this title was changed for procedural reasons.

[2]Auerbach (2018) reviews the range of estimates at the time of passage. Among respondents to a November 2023 poll of leading U.S. academic economists (Clark Center for Global Markets, 2023), 30% agreed with the statement that the corporate capital stock is substantially higher as a result of the TCJA, 33% disagreed, and 36% were uncertain. A larger share agreed that federal tax revenues are substantially lower as a result of the TCJA, a statement forcefully disputed by Goodspeed and Hassett (2022).

vestment. The domestic terms τ and Γ incorporate TCJA changes to the corporate tax rate and expensing of investment. For domestic-only firms, the model collapses to the canonical framework. The foreign tax terms accommodate the novel, more opaque changes to the international tax regime. We linearize the model across steady-states to characterize the investment response to $\tau, \Gamma, \bar{\tau}$, and $\bar{\Gamma}$ as a function of the ratio of pre-TCJA foreign-to-domestic capital and four key structural parameters: the returns-to-scale in capital (α), the elasticity of substitution between domestic and foreign capital (σ), and the relative importance of each source of capital in local profits (a and $\bar{a}$).

Our data set consists of a panel of mid-size and large C-corporation tax returns from the U.S. Treasury. We measure firm-level counterparts to each tax term. The domestic rate τ falls mainly because of the reduction in the statutory corporate rate from 35% to 21%. However, this change affects firms heterogeneously depending on their likelihood of having positive taxable income and their use of deductions and credits. In addition, the TCJA directly changed several deductions and credits. Building on Auerbach (1983), Shevlin (1990), and Graham (1996), we use pre-TCJA firm-specific income dynamics to simulate taxable income trajectories for each firm. We extend this work by incorporating firm-specific use of deductions and credits. We construct new firm-level marginal effective tax rates (METRs) with and without the TCJA as the additional present value of taxes paid when domestic revenue rises by 1%, taking account of the change in the statutory rate, new rules on net operating loss deductions, and the repeal of the Domestic Production Activities Deduction (DPAD) and Alternative Minimum Tax (AMT).

The domestic investment subsidy Γ changes directly because of the more generous expensing of equipment. The effect of this change also varies across firms, depending on the normal tax depreciation schedule of its investment mix as well as on whether the firm's pre-TCJA investment fell below the Section 179 limit. In addition to modeling these provisions and accounting for the firm-specific METRs, we incorporate the TCJA's Foreign-Derived Intangible Income (FDII) deduction, which reduces a firm's domestic tax on the export share of income exceeding 10% of its domestic tangible assets. For firms claiming this deduction, the lower FDII rate reduces τ, while the 10% exemption reduces the effective Γ.

We incorporate two main foreign provisions in TCJA. First, TCJA moved the U.S. from a global system, in which a U.S. corporation would pay U.S. taxes when repatriating foreign source income, to a territorial system, in which the U.S. corporate rate only applies to domestic source income. Second, to discourage the location of intangible capital abroad, the TCJA introduced a minimum tax of 10.5% on Global Intangible Low-Taxed Income (GILTI). The GILTI tax applies to foreign income exceeding 10% of foreign tangible capital, if that income would otherwise face a sufficiently low tax rate. The 10% deduction in GILTI increases the effective $\bar{\Gamma}$ for firms subject to it. Under the plausible assumption that firms expected a transition regime or tax holiday (as in 2004) with a marginal tax rate equal to the GILTI rate, our preferred measure of $\bar{\tau}$ is unchanged for all firms. We demonstrate the robustness of our results to alternative assumptions.

Motivated by the model structure, we estimate regressions in the cross-section of firms of the log change in domestic investment around the reform on the tax policy changes. Among firms that operate only domestically, we find elasticities to the domestic tax terms in line with earlier literature (see Zwick and Mahon (2017)), but at the lower end of the range. Firms with international operations likewise respond to the domestic tax terms. In addition, the domestic investment of firms with substantial international operations responds positively to the effective foreign subsidy $\bar{\Gamma}$. Our theory interprets this response as evidence of complementarity between domestic and foreign capital; the GILTI deduction encourages firms to increase foreign capital, which in turn causes domestic capital to increase when domestic and foreign capital are complements in production. We report robustness exercises that address concerns with the specification, such as testing for pre-trends; including detailed industry fixed effects; or controlling for the "trade war," firm size, lagged investment, profit shifting, and toll taxes.

The estimated regression coefficients, together with the pre-TCJA ratios of foreign-to-domestic capital and profits, provide moments to identify the model's structural parameters. If the regression dependent variable had measured the long-run change in investment, the mapping from these moments to parameters would follow directly from the model's steady state elasticity formulas. In our setting where the coefficients correspond to short-run elasticities, identification requires also determining the ratios of short-run to long-run elasticities, which in turn depend on adjustment costs. We show that under the empirically relevant case for our setting of minimal foreign adjustment costs that all tax elasticities scale by approximately the same ratio (χ_{SR}), which we externally calibrate. This method is exact for domestic-only firms and applies across a range of types of domestic adjustment costs (e.g., convex or fixed).

We then choose parameters to minimize the distance between the data and model-implied moments separately for domestic-only firms and firms with large and small foreign presence. A key advantage of externally calibrating χ_{SR} is the transparency of this procedure. For domestic-only firms, the theory dictates that the regression coefficients on τ and Γ have opposite signs of equal magnitude, each of which equals the inverse of $1-\alpha$ scaled by χ_{SR}. We obtain the scale parameter α for these firms using the coefficient from this restricted regression. For the multinational firms, we provide analytical mappings between the remaining parameters and the model moments. The estimated parameters have reasonable values: α implies returns-to-scale in the revenue function of roughly 0.9, σ ensures complementarity between local and foreign capital for the firms with large overseas operations, and a implies that domestic earnings depend largely on domestic rather than foreign capital.

We use the estimated model to quantify the response of corporate capital in partial versus general equilibrium, to disentangle which parts of the reform mattered most to investment, and to assess the revenue consequences. Applying the regression coefficients directly to the tax rate changes and scaling by χ_{SR} would imply a long-run increase in domestic corporate capital due to TCJA of 14.7%. Performing the analogous exercise with model-estimated parameters in partial equilibrium yields an increase in capital of 11.7%. However, because this exercise excludes the regression intercept, it omits any changes, such as in wages, that affect all firms.

The first main quantitative result from the model is a general equilibrium long-run increase in domestic corporate capital of 6.4%. To compute the general equilibrium increase, we solve jointly for the change in capital in each portfolio of firms and a representative non-C-corporate sector, holding aggregate labor fixed. The difference between the partial and general equilibrium responses stems from the offsetting effect of a higher wage, which rises by roughly 0.9% due to the higher capital stock. We show in a stripped-down version of our model that the cross-firm investment response along with the labor share together discipline the magnitude of general equilibrium dampening. In the short-run, domestic corporate investment is higher by 10.2% and total non-residential domestic investment by 5.7%. Actual non-residential investment in 2019:Q4 exceeded both professional and time-series pre-TCJA forecasts by about 6%, suggesting our model contains a plausible no-TCJA counterfactual path (see Appendix A).

The second quantitative result of the model concerns how the mechanical tax change and the dynamic capital response contribute to tax revenues. Applying the change in tax policy to the pre-TCJA steady state yields a mechanical reduction in corporate tax revenue of 42 percentage points. The dynamic response of corporate investment initially reduces corporate tax revenue due to increased adjustment costs and depreciation deductions. Over time, the profits from capital accumulation offset these forces. Labor income and taxes on that income increase as the capital stock grows, as do income taxes on corporate payouts. Together these forces add additional revenue by year 10 of 7 percentage points of pre-TCJA corporate tax revenue (17% of the mechanical reduction). Averaged over ten years, the personal income tax gains and higher profits from growth modestly outweigh increased deductions, raising revenue by 3 percentage points of pre-TCJA revenue (7% of the mechanical reduction). Looking across provisions, expensing has a smaller "cost-per-additional-capital" than changes to the marginal rate because it applies only to new investment, while the marginal rate also reduces revenue from existing capital.

This exercise is not intended to serve as a comprehensive dynamic score of the corporate provisions of the TCJA, as we focus only on the feedback to revenue from higher investment and growth. We exclude several response margins that would offset some of the mechanical revenue loss.[3] We also leave unmodeled several components of the reform, including the individual tax provisions and pass-through tax cuts.

We consider several extensions of our baseline model, including the interest rate response, alternative assumptions around the phase-out of the expensing provisions or pre-TCJA expectations of tax rates on future repatriated dividends, and varying the value of χ_{SR}. While some of these changes imply a larger investment response than our baseline and some a smaller response, none materially changes the results just described.

Related literature. We provide new estimates of the effects of the largest corporate tax cut in U.S. history. Due to its size and prominence, an early literature reported expected effects using calibrated models (Barro and Furman, 2018; Slemrod, 2018; Gale et al., 2019; Clausing, 2020) or filings with the U.S. Securities and Exchange Commission by public firms (Hanlon, Hoopes and Slemrod, 2019). Gale and Haldeman (2021); Kopp et al. (2019); Gravelle and Marples (2019) show that aggregate business investment immediately after TCJA exceeded pre-TCJA expectations while corporate revenue fell sharply, but conclude that the aggregate data alone do not provide sufficient basis to attribute the higher investment to the TCJA's changes to the tax-adjusted user cost of capital.[4] Garcia-Bernardo, Janský and Zucman (2022) use aggregate data and public filings to study the effect on profit shifting.[5] Like us, Kennedy et al. (2022) use firm-level tax return data. They exploit the variation in the domestic corporate rate cut across C-corporations and S-corporations of similar size. Though they focus on wage outcomes along the income distribution, they also report positive investment effects.

[3]For example, we do not model the reshoring of reported corporate profits in response to the reduction in the statutory rate and the GILTI and FDII incentives (Dharmapala, 2014; Goodspeed and Hassett, 2022), capital structure responses and their effects on tax collections (De Mooij, 2011), or corporate capital gains realization behavior (Desai and Gentry, 2004).

[4]Appendix A provides additional detail on aggregate trends. It also reconciles our findings with earlier work arguing for a limited short-run response to the reform based on aggregate data. For example, the BEA's upward revision of investment data closes a substantial share of the gap between our estimates and preliminary assessments.

[5]Our paper is not centrally concerned with profit shifting or the impact of the reform on this behavior. Nevertheless, we use theoretical extensions to clarify when profit shifting motives might interact with the firm's real investment decisions. We also confirm our main results are not driven by the small number of firms who are likely active profit shifters. Our findings complement recent work more focused on the real implications of profit shifting (Altshuler, Boller and Suárez Serrato, 2023).

Our paper broadens and sharpens the analysis of TCJA in three ways. First, we focus on a sample of mid-size and large firms, including the multinational corporations exposed to the novel tax policy provisions targeting foreign and intangible income. Second, we measure for each firm the impact of the key provisions of the TCJA on foreign and domestic marginal tax rates and the cost of capital.[6] Third, we deploy a structural model to analyze long-run aggregate effects in general equilibrium and explore policy counterfactuals.

We also contribute to the broader theoretical and empirical literature on tax policy and investment behavior.[7] Our reduced form estimates are within the range of past work in terms of responsiveness to tax term changes.[8] Our structural model builds on Hall and Jorgenson (1967) and Coen (1969). As in that framework, the elasticity of earnings (before interest, taxes, depreciation, and amortization) to capital determines the partial equilibrium response of capital to the tax-adjusted user cost for a domestic-only firm.[9] We extend that framework to the multinational setting and link the partial equilibrium response governed by the earnings elasticity to the general equilibrium response governed by the output elasticity. The parameters in our model governing the relationship between domestic and foreign capital within a firm have less antecedent, although this parameter matters centrally to international tax policy (Costinot and Werning, 2019). Desai, Foley and Hines Jr (2009) and Becker and Riedel (2012) are important exceptions and like us find evidence consistent with complementarity. Relative to their research designs, our direct measurement of a change to the foreign cost-of-capital offers a sharper test of production function complementarity.

Our quantitative model enables an analysis of policy counterfactuals. Indeed, many of the provisions of TCJA remain contested in the political arena. We decompose the effect of the

[6]Specifically, on the domestic side we advance the literature by calculating marginal tax rates that account for both income and loss dynamics as well as firm-specific use of credits and deductions and by calculating firm-specific exposure to bonus depreciation. On the international side, our measurement of actual FDII and GILTI claims overcomes the difficulty of inferring exposure from public accounting data that may explain the mixed results of these provisions found elsewhere in the literature (Beyer et al., 2023*a*; Krull and Wu, 2022; Samuel, 2023; Huang, Osswald and Wilson, 2023).

[7]See Hall and Jorgenson (1967); Summers (1981); Feldstein (1982); Poterba and Summers (1983); Auerbach and Hassett (1992); Cummins, Hassett and Hubbard (1994, 1996); Hines (1996); Chirinko, Fazzari and Meyer (1999); Devereux and Griffith (2003); Desai and Goolsbee (2004); House and Shapiro (2008); Edgerton (2010); Dharmapala, Foley and Forbes (2011); Yagan (2015); Zwick and Mahon (2017); Ohrn (2018); Giroud and Rauh (2019); Suárez Serrato (2018); Bilicka (2019); Curtis et al. (2021); Akcigit et al. (2021); Moon (2022).

[8]Hassett and Hubbard (2002) propose a consensus range of 0.5 to 1 for regressions of investment relative to capital on the tax term. In analogous specifications, we estimate coefficients of 0.52 (s.e.=0.07), 0.44 (s.e.=0.08), and 0.76 (s.e.=0.16) for all firms, domestic firms, and multinational firms, respectively. In Appendix B.12, we show how this specification relates to our model parameters.

[9]Hall and Jorgenson (1967) derive the tax-adjusted user cost and conduct counterfactual exercises for capital holding output fixed, implying a user cost elasticity of -1. Coen (1969) corrects their analysis to account for the feedback loop from capital to output, resulting in a user cost elasticity of -1 divided by 1 minus the earnings elasticity of capital when the price of other inputs such as the wage remains fixed.

reform into its constituent parts, such as expensing, lower rates, and international provisions. Future research can use our estimates to consider alternative policy proposals.

2 Policy Background

2.1 Motivation for the TCJA

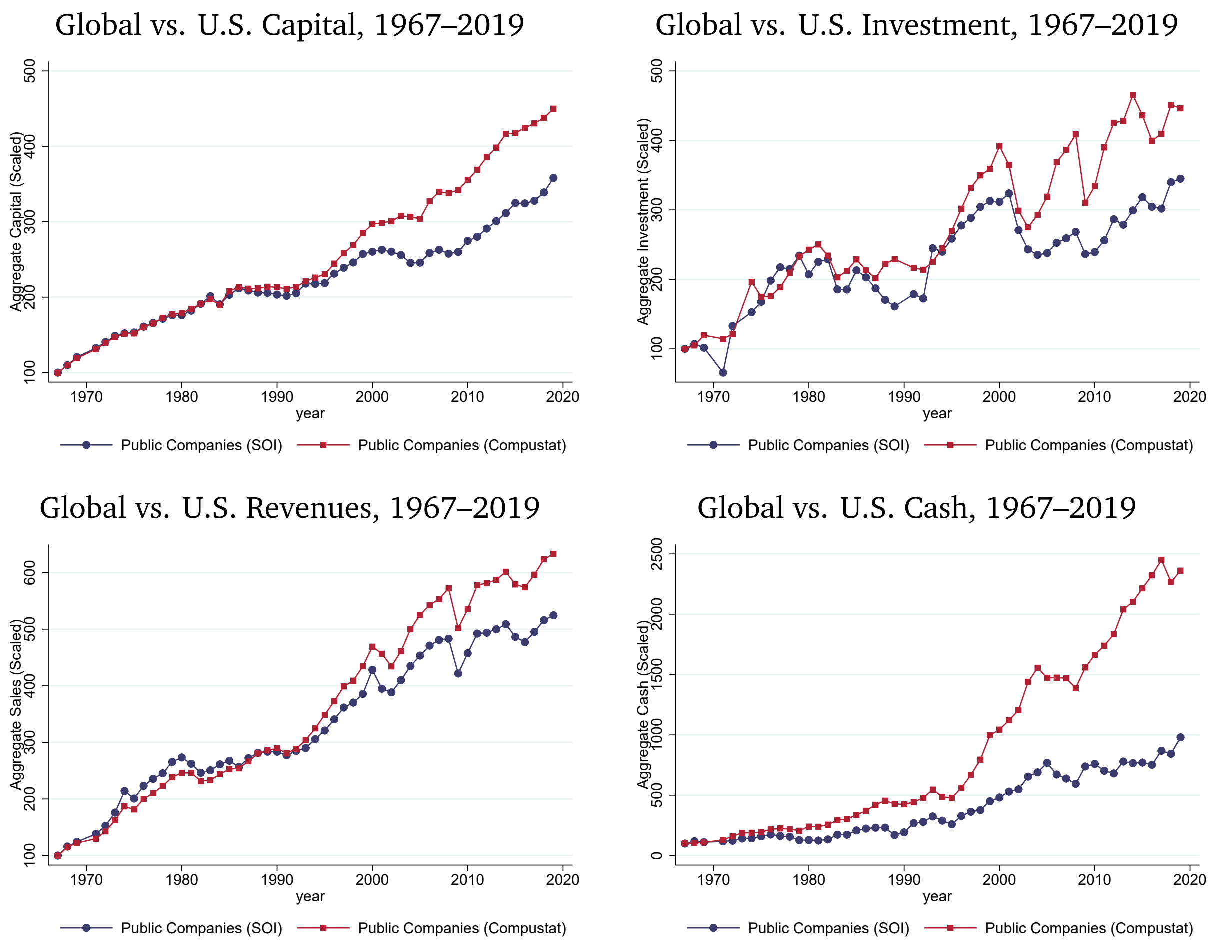
After several decades of frequent, large changes to the U.S. corporate tax system, the basic elements of the top corporate rate, the expensing regime, and international taxation remained relatively stable for 30 years following the Tax Reform Act of 1986.[10] During this time corporate tax rates fell in many other countries (Auerbach, 2018), and deepening globalization made international considerations increasingly relevant for domestic investment.

The main goal of the TCJA's corporate provisions was to increase U.S. competitiveness and investment by bringing rates in line with international levels. Policymakers argued that the U.S. corporate tax system was not competitive in terms of statutory tax rates and its worldwide rather than territorial structure (Council of Economic Advisers, 2018). These concerns came against the backdrop of sluggish domestic investment (Gutiérrez and Philippon, 2017; Alexander and Eberly, 2018) and deepening cross-border investment.

Figure 1 uses aggregates from our tax return data (described in detail in Section 4) and Compustat to contextualize the reform. The figure shows consistent series of domestic and global capital accumulation, investment, revenue, and cash holdings by U.S. publicly-traded firms from 1967-2019. Until the early 1990s, U.S. firms had very little foreign investment or capital. Since that time, most of the growth in global capital by U.S. public firms has occurred abroad. This pattern along with high foreign profits and cash holdings also led to concerns about profit-shifting. The international focus of TCJA differs from earlier corporate tax changes in the U.S. that occurred before the period of deep globalization and that have shaped much of our understanding of the investment effects of tax policy.

[10] Notable changes to corporate tax policy in the 25 years prior to the 1986 reform include the switch to the reserve ratio test for asset depreciation allowances and the introduction of the investment tax credit (ITC) in 1962; the 1964 corporate rate cut; suspension, restatement, repeal, and reimposition of the ITC between 1966 and 1971; the Vietnam War surcharge in 1968; the switch to the Asset Depreciation Range for depreciation allowances in 1971; the switch to the Accelerated Cost Recovery System (ACRS) for depreciation allowances in 1981; further changes to ACRS in 1982; and the switch to the Modified ACRS (MACRS), reduction in the corporate rate, and repeal of the ITC in 1986. After 1986, the top corporate rate changed from 40 to 34 in 1988 and to 35 in 1993 where it remained until 2017, while depreciation allowances moved with accelerated depreciation policies beginning in 2001. On the international side, the 1997 "check the box" regime allowed multinationals to avoid immediate taxation under Subpart F of passive income in disregarded entities; and the 2004 "repatriation holiday" temporarily reduced taxes on dividends paid to U.S. parents by their foreign subsidiaries.

Figure 1: Activity by U.S. Firms is Increasingly Global



Notes: These figures use merged Compustat and Statistics of Income (SOI) datasets to plot aggregates, for domestic variables versus global variables for firms we are able to merge each year. We scale each variable to 100 in 1967 after converting totals to 2019 dollars (Appendix Figure F.1 presents figures with unscaled totals). We use the following Compustat variables for global measures: PPENT for capital, CAPX for investment, SALE for revenues, and CHE+IVAO for cash. Pre-1993 SOI investment only includes investment-tax credit-(ITC)-eligible basis, understating the divergence in the figure. The last year of Compustat PPENT excludes capitalized operating leases per a change in accounting rules using data from Compustat Snapshot. We thank Yueran Ma for guidance on this correction.

2.2 Main Corporate Provisions of the TCJA

Tax policy affects firm investment through changing the marginal effective tax rate (METR) on corporate profits and the tax term in the cost of capital. Table 1 lists the major provisions affecting these components for either domestic or foreign activity, along with the 10-year tax revenue estimate from Joint Committee on Taxation (2017). These "static" estimates include some behavioral responses, such as income shifting between tax bases or changes in tax credit takeup, but they assume no effect of the TCJA on the aggregate capital stock.

Table 1: Main Provisions of the TCJA Affecting Investment

Provision	Pre-TCJA	Post-TCJA	Cost ($)
Domestic Provisions			
1. Top corporate rate	35%	21%	−1.35T
2. Accelerated depreciation	50% bonus	Full expensing for 5 years, then phase-out	−86B
3. Domestic Production Activities Deduction (DPAD)	9% of qualified production activity income	None	+98B
4. Alternative Minimum Tax	Applicable if mean revenues >$7.5M	None	−40B
5. Foreign-Derived Intangible Income (FDII)	None	37.5% deduction on export share of deemed intangible income	−64B
6. Net operating losses	2 year carryback + carryforward	No carryback and limited to 80% of income	+201B
Foreign Provisions			
1. Foreign subsidiary income	Taxable when repatriated	Not taxed	−224B
2. Global Intangible Low Tax Income (GILTI)	None	Minimum tax of 10.5% on foreign deemed intangible income	+112B
Total			−1.35T

Notes: The table describes the main provisions of the TCJA affecting corporate investment. The last column shows the estimated revenue impact over 2018-2027 from Joint Committee on Taxation (2017).

The most important provision for the domestic METR was the reduction in the statutory top corporate tax rate for C-corporations from 35% to 21%. Of course, for many firms the METR differs from the statutory rate because of credits or deductions that make taxable income negative or otherwise modify the effective rate. The TCJA also changed some of these provisions, including limiting the deduction from carrying forward previous net operating losses (NOLs) to 80% of taxable income; repealing the Domestic Production Activity Deduction (DPAD), which had reduced METRs for qualifying firms, especially in the manufacturing sector; and repealing the corporate Alternative Minimum Tax (AMT). Furthermore, the relevance of the statutory rate reduction for the METR depends on pre-TCJA behavior, because firms without taxable income (perhaps due to high use of deductions and credits) or those facing binding limits on credit usage do not face the statutory rate and hence do not experience the full rate reduction.[11]

[11] A firm without taxable income can still have a positive METR if the firm expects to pay taxes in the future, because of loss carryforwards. The leading example of binding credit usage concerns General Business Credits

Our measurement of METRs in Section 4 accounts for all of these features.

The TCJA made two changes that implicate the domestic effective cost of capital. The first directly targets the cost of capital by allowing firms to immediately expense equipment investment. The second occurs through a new deduction for Foreign Derived Intangible Income (FDII). This provision allows firms to deduct from domestic income 37.5% of the component deemed due to domestic intangible capital and sold abroad. The deduction is implemented as the export share of domestic income in excess of 10% of domestic tangible capital. While intended to encourage firms to report profits in the U.S., we show in Appendix B.8 that the FDII deduction has the same effect on investment incentives as a reduction in the domestic METR and an increase in the cost of capital for tangible assets. The latter effect owes to the exclusion of income up to 10% of domestic tangible capital; thus, a marginal increase in domestic tangible capital mechanically reduces the FDII deduction and increases taxes owed.

The reform also changed international taxation. Prior to the TCJA, U.S. firms paid domestic taxes on any foreign profits repatriated as dividends to the U.S. parent but could defer repatriation indefinitely. The new system replaced this worldwide approach with a territorial tax wherein firms deduct the full amount of repatriated dividends from their taxable income, thereby exempting foreign profits from domestic income tax. The TCJA supplements this territorial system with a provision analogous to the FDII deduction, known as the Global Intangible Low-Taxed Income (GILTI) tax. GILTI is foreign income in excess of 10% of foreign tangible capital. A corporation can deduct 50% of this income and further claim credits for 80% of foreign taxes paid. The GILTI provision often is described as a minimum tax, because a corporation with foreign income and no foreign taxes paid will pay 10.5% ($= 0.5 \times 21\%$) on its GILTI. We show in Appendix B.8 that GILTI may affect foreign investment incentives through both the foreign METR and the foreign cost of capital for tangible assets. The latter effect owes to the exclusion of income up to 10% of foreign tangible capital; thus, a marginal increase in the foreign tangible capital stock mechanically reduces GILTI tax.

The TCJA made several other changes that affect businesses but that we do not include in our baseline analysis. Most important, the provisions for bonus depreciation are scheduled to phase out over time and the rates in FDII and GILTI change as well. We assume that firms in 2018 and 2019 expected these provisions to be permanent, following Desai and Goolsbee (2004) and consistent with limited evidence of intertemporal substitution in House and Shapiro (2008) and Zwick and Mahon (2017). We explore sensitivity to this assumption through our

(GBCs), which are limited to 75% of taxable income. A firm for which this limit always binds has an effective marginal tax rate equal to 25% of the statutory marginal rate.

quantitative model.[12] Other domestic provisions do not directly change the marginal incentives for C-corporation investment in tangible capital, including those reducing the limit for interest deductions from 50% to 30% of income and the generosity of the Research and Experimentation tax credit. We consider theoretical extensions that show how our user cost equations change when incorporating these factors.

On the foreign side, the TCJA mandated a transition tax for firms with outstanding stocks of unrepatriated foreign earnings of 15.5% for cash and 8% for illiquid assets and gave firms eight years to pay this tax. The TCJA also implemented a base erosion and anti-abuse tax (BEAT), which imposed a tax on payments from U.S. firms to foreign affiliates in excess of 3% of total deductions. While important for tax revenues and profit shifting by multinationals, these provisions are less relevant for the investment behavior of these firms. We consider them in theoretical extensions and empirical robustness exercises.

The TCJA also reduced top individual income tax rates and created a deduction for qualifying business income under Section 199A, which reduced the effective tax rates for pass-through businesses and changed labor supply incentives. Estimating the impact of these provisions on aggregate investment is beyond the scope of our study.

3 Model

In this section we extend the canonical Hall and Jorgenson (1967) tax-adjusted user cost framework to a multinational setting. The model relates the response of investment to four tax terms: the METRs τ on domestic source income and $\bar{\tau}$ on foreign source income and the cost-of-capital subsidies Γ on domestic investment and $\bar{\Gamma}$ on foreign investment. This result guides our measurement and reduced-form empirical specification. Furthermore, the investment elasticities depend on a small set of parameters governing the scale of production, the elasticity of substitution between domestic and foreign capital, the relative importance of foreign capital in the domestic earnings function and vice versa, and the relative size of the foreign operation. Using regression coefficients from Section 5 and other moments, we estimate these parameters in Section 6 and then use them in quantitative exercises in Section 7.

[12]The TCJA allowed full expensing of equipment investment through 2022, after which the bonus amount declines by 20 p.p. per year until it reaches zero in 2027. The FDII deduction falls from 37.5% to 21.875% and the GILTI deduction from 50% to 37.5% beginning in 2026. If firms expected the expensing provisions to expire, our estimated investment elasticities likely overstate the investment response to a permanent change to full expensing because standard values for discount and depreciation rates imply that the intertemporal substitution toward investment in periods with higher expensing outweighs the lower steady-state capital value. In this sense, the paper's conclusions about the overall investment effects of the TCJA's corporate provisions provide an upper bound if firms expected the expensing provisions to expire.

3.1 Setup

Time is continuous and runs forever. Atomistic firms operate up to two locations, one domestic and the other international. Each location produces output using local and foreign capital and local labor and materials. We denote by X and $\bar{X}$ the domestic and international values of a variable X and describe the optimization problem of the domestic operation, with the international operation mirror-symmetric. We describe the decision problem of a single firm and omit firm-specific subscripts except when we discuss general equilibrium.

The domestic operation produces output Q_t by combining local and foreign capital K_t and $\bar{K}_t$ with local labor L_t and materials M_t:

$$Q_t = \left(A_t \mathscr{K}_t^{\alpha_{\mathscr{K}}} L_t^{\alpha_L} M_t^{\alpha_M}\right)^{\mathscr{M}}, \tag{1}$$

$$\text{where: } \mathscr{K} = \left(aK^{\frac{\sigma-1}{\sigma}} + (1-a)\bar{K}^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}}. \tag{2}$$

Here A_t denotes (scaled) total factor productivity, $\mathscr{K}$ is a composite of domestic and international capital with elasticity of substitution $\sigma > 0$, a governs the relative importance of foreign capital in determining domestic revenue, $\mathscr{M} \geq 1$ is the firm's equilibrium markup and arises from the demand constraint $Q_t \propto P_t^{-\frac{\mathscr{M}}{\mathscr{M}-1}}$, and $\mathscr{M}\left(\alpha_{\mathscr{K}} + \alpha_L + \alpha_M\right) \leq 1$. At each date t, the firm takes the capital stocks as pre-determined and factor prices P_t^L and P_t^M as exogenous and chooses L and M to maximize operating earnings $P_t Q_t - P_t^L L_t - P_t^M M_t$.

Appendix B.1 shows that this optimization problem results in a concentrated earnings function that depends only on capital:

$$F\left(K_t, \bar{K}_t; Z_t\right) \equiv P_t Q_t - P_t^L L_t - P_t^M M_t = Z_t \mathscr{K}_t^{\alpha} = Z_t \left(aK_t^{\frac{\sigma-1}{\sigma}} + (1-a)\bar{K}_t^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma\alpha}{\sigma-1}}, \tag{3}$$

where $\alpha \equiv \frac{\alpha_{\mathscr{K}}}{1-(\alpha_L+\alpha_M)} \subseteq [0,1]$ and $Z_t \propto A_t^{\alpha/\alpha_{\mathscr{K}}}$. Z is lower if Total Factor Productivity (TFP) A is lower or the factor cost of labor or materials is higher. Curvature in the profit function arises whenever the revenue function features diminishing returns to scale, $\alpha_{\mathscr{K}} + \alpha_L + \alpha_M < 1$, whether the diminishing returns result from market power ($\mathscr{M} > 1$) or diminishing returns to scale in production. The earnings function in the international location takes a similar form:

$$\bar{F}\left(\bar{K}_t, K_t; \bar{Z}_t\right) = \bar{Z}_t \left(\bar{a}\bar{K}_t^{\frac{\sigma-1}{\sigma}} + (1-\bar{a})K_t^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma\alpha}{\sigma-1}}. \tag{4}$$

The scale parameter α, elasticity of substitution σ, a and $\bar{a}$ which determine the importance of non-local capital in generating earnings, and the relative productivity $\bar{Z}/Z$ collectively characterize a firm. Immediately, a domestic-only firm has $a = 1$ and $\bar{Z} = 0$.[13]

The functions F and $\bar{F}$ embody any (gross) complementarity or substitution in production across locations, with the elasticity of substitution σ and the curvature α determining these forces: $\text{sign}(F_{K\bar{K}}) = \text{sign}(\alpha + 1/\sigma - 1)$. The literature on multinational location choice has given reasons for either complementarity or substitution to dominate. In Helpman (1984), more foreign tangible capital increases the productivity of domestic capital, because larger foreign scale increases brand recognition and hence demand for domestic output, and because it requires more managerial capacity that also benefits domestic production. Appendix B.4 incorporates such forces as part of a general accumulation of intangible capital that is non-rival within the firm and shows that they give rise to complementarity in the same sense as $F_{K\bar{K}} > 0$. Integrated production, or "global value chains", within the firm also generates complementarity between K and $\bar{K}$, because more foreign capital increases the upstream supply of imported inputs or downstream demand for domestic output, both of which raise the marginal product of domestic capital (Antrás and Chor, 2022). Alternatively, substitution may arise if local and foreign plants of the same firm compete to serve the same destinations, as greater foreign scale then crowds out domestic production. Brainard (1993) provides a model of this proximity-concentration trade-off. The functional form in equation (2) allows for all of these possibilities as well as the case of independence while being tractable enough to guide empirical work. Estimating the degree of complementarity or substitution is an outcome of the analysis.

Domestic capital evolves dynamically as $\dot{K}_t = I_t - \delta K_t$, where I_t is gross investment and δ is the rate of depreciation. The cost of a unit of domestic investment is $(1 - \Gamma_t) P_t^K$, where Γ_t contains the present value of depreciation allowances as well as any other tax provisions such as the FDII deduction that link taxes paid to tangible capital.[14] In addition, changing the capital stock incurs an adjustment cost $\Phi(I_t, K_t) = (\phi/(1+\gamma))(I_t/K_t - \delta)^{1+\gamma} K_t$ paid in tax-deductible units (e.g., labor). Total domestic taxable profits consist of operating earnings net of these adjustment costs, $F\left(K_t, \bar{K}_t; Z_t\right) - \Phi(I_t, K_t)$, and are taxed at rate τ_t. An analogous set of equations hold for international capital and profits.

[13] A slight generalization would require a firm to pay a fixed cost to operate foreign capital, in which case the parameters for a domestic-only firm might not lie in the corner. This model has the same implications as our baseline environment except that we preclude domestic-only firms from becoming multinationals in response to the TCJA.

[14] For example, if a firm faces a constant tax rate τ_t and can immediately deduct depreciation of θ_t ("bonus" depreciation) for an investment made at date t and subsequently deduct $(1-\theta_t)d_{h|t}$ at horizon h (not to be confused with economic depreciation of δ), then $\Gamma_t = \theta_t \tau_t + (1-\theta_t)\tau_t \zeta_t$ where $\zeta_t = \int_0^\infty e^{-rh} d_{h|t} dh$.

The cash flow returned to equity or debt holders each period is:

$$D_t = (1-\tau_t)\left(F\left(K_t, \bar{K}_t; Z_t\right) - \Phi\left(I_t, K_t\right)\right) + (1-\bar{\tau}_t)\left(\bar{F}\left(\bar{K}_t, K_t, \bar{Z}_t\right) - \bar{\Phi}\left(\bar{I}_t, \bar{K}_t\right)\right) \\ -(1-\Gamma_t) P_t^K I_t - \left(1-\bar{\Gamma}_t\right) P_t^{\bar{K}} \bar{I}_t. \tag{5}$$

The firm maximizes the present value of cash flows with a discount rate ρ, subject to initial conditions K_0 and $\bar{K}_0$ and the dynamic evolution equations.

We make three remarks on this setup. First, for now we do not need to keep track of which government collects the tax revenue generated by τ or $\bar{\tau}$ or the details of the subsidies Γ and $\bar{\Gamma}$; for the firm's choice of capital, all that matters is the marginal incentives it faces. We revisit this issue in Section 7.3 when assessing the revenue effects of TCJA. Second, we do not directly model the full system of tax credits and loss provisions, but will take account of these in the measurement of the marginal incentives $\tau, \Gamma, \bar{\tau}, \bar{\Gamma}$. Third, equation (5) makes clear that the functions $F(K, \bar{K}; Z)$ and $\bar{F}(\bar{K}, K, \bar{Z})$ provide mappings between local and foreign tangible capital and local and foreign taxable earnings. In the presence of profit-shifting, these mappings may differ from the physical production functions relating local and foreign capital to true local and foreign earnings. Nonetheless, because the firm maximizes after-tax profits, the functions $F(K, \bar{K}; Z)$ and $\bar{F}(\bar{K}, K, \bar{Z})$ determine the choice of capital. Section 3.3 discusses an extension that explicitly incorporates profit-shifting motives.

3.2 Dynamic System and Linearization Across Steady States

Denoting by λ_t and $\bar{\lambda}_t$ the costate variables associated with domestic and international capital accumulation, the necessary First Order Conditions (FOC) for domestic investment and capital can be written (see Appendix B.2):

$$\text{FOC } (I_t): \qquad \dot{K}_t / K_t = \left[\frac{1}{\phi}\left(\frac{\lambda_t - P_t^K (1-\Gamma_t)}{(1-\tau_t)}\right)\right]^{\frac{1}{\gamma}}, \tag{6}$$

$$\text{FOC } (K_t): \qquad \dot{\lambda}_t = (\rho+\delta)\lambda_t - (1-\tau_t)(F_1 - \Phi_2) - (1-\bar{\tau}_t)\bar{F}_2, \tag{7}$$

where F_n denotes the derivative of $F\left(K, \bar{K}; Z\right)$ and Φ_n denotes the derivative of $\Phi\left(I_t, K_t\right)$ with respect to argument n. In addition, the transversality condition requires $\lim_{T\to\infty} e^{\rho T}\lambda_T K_T = \lim_{T\to\infty} e^{\rho T}\bar{\lambda}_T \bar{K}_T = 0$. The analogous equations hold for foreign capital. The terminal values of λ and $\bar{\lambda}$ complete the system and are given by their values in steady state:

$$\lambda^* = (1-\Gamma^*) P^K,\ \bar{\lambda}^* = \left(1-\bar{\Gamma}^*\right) P^{\bar{K}}. \tag{8}$$

This framework admits a tractable and intuitive expression for the change in capital across the pre and post-reform steady states. Let $R^* = (\rho+\delta)(1-\Gamma^*) P^K$ denote the steady state user cost of capital.[15] Rearranging equation (7) and its foreign counterpart in the steady state with $\dot{\lambda}_t = \dot{\bar{\lambda}}_t = 0$ and substituting using equation (8) gives the steady state system:

$$(1-\tau^*) F_1^* + (1-\bar{\tau}^*) \bar{F}_2^* = R^*, \tag{9}$$

$$(1-\bar{\tau}^*) \bar{F}_1^* + (1-\tau^*) F_2^* = \bar{R}^*. \tag{10}$$

Since $F_1^* = F_1\left(K^*, \bar{K}^*; Z^*\right), F_2^* = F_2\left(K^*, \bar{K}^*; Z^*\right), \bar{F}_1^* = \bar{F}_1\left(\bar{K}^*, K^*; Z^*\right), \bar{F}_2^* = \bar{F}_2\left(\bar{K}^*, K^*; Z^*\right)$, equations (9) and (10) give a system of two non-linear equations in two unknowns K^* and $\bar{K}^*$. Totally differentiating this system gives an estimating equation relating capital to taxes.

As a preliminary step, let $\chi_K \equiv \bar{K}^*/K^*$ denote the steady state ratio of international to domestic capital, $\chi_R = \bar{R}^*/R^*$ the ratio of international to domestic steady state user cost, and:

$$s_1 \equiv \frac{a (K^*)^{\frac{\sigma-1}{\sigma}}}{a (K^*)^{\frac{\sigma-1}{\sigma}} + (1-a)\left(\bar{K}^*\right)^{\frac{\sigma-1}{\sigma}}} = \frac{a}{a+(1-a)\,\chi_K^{\frac{\sigma-1}{\sigma}}} \subseteq [0,1], \tag{11}$$

$$\bar{s}_1 \equiv \frac{\bar{a}\left(\bar{K}^*\right)^{\frac{\sigma-1}{\sigma}}}{\bar{a}\left(\bar{K}^*\right)^{\frac{\sigma-1}{\sigma}} + (1-\bar{a}) (K^*)^{\frac{\sigma-1}{\sigma}}} = \frac{\bar{a}\chi_K^{\frac{\sigma-1}{\sigma}}}{\bar{a}\chi_K^{\frac{\sigma-1}{\sigma}} + (1-\bar{a})} \subseteq [0,1], \tag{12}$$

$$s_{F_1} \equiv \frac{(1-\tau^*) F_1^*}{R^*} = \frac{a\left((1-\bar{a})\,\chi_R - \bar{a}\chi_K^{-\frac{1}{\sigma}}\right)}{(1-\bar{a}-a)\,\chi_K^{-\frac{1}{\sigma}}}, \subseteq [0,1], \tag{13}$$

$$s_{\bar{F}_1} \equiv \frac{(1-\bar{\tau}^*) \bar{F}_1^*}{\bar{R}^*} = 1 - \frac{(1-a)\left((1-\bar{a})\,\chi_R - \bar{a}\chi_K^{-\frac{1}{\sigma}}\right)}{(1-\bar{a}-a)\,\chi_R} \subseteq [0,1]. \tag{14}$$

denote shares of the capital inputs and marginal product terms, respectively. The second equalities show that these share terms depend on $\sigma, a, \bar{a}$ and the observable ratios χ_K and χ_R.[16] Let

[15]Dating back to Hall and Jorgenson (1967), most studies define the user cost as the implicit rental rate of capital after applying all taxes, that is, dividing the expression defining R^* by $(1-\tau)$. Equations (9) and (10) show that this convention does not easily extend to the multinational setting where a firm faces potentially many corporate tax rates.

[16]While the second equalities in equations (11) and (12) follow immediately by dividing the numerator and denominator by $(K^*)^{\frac{\sigma-1}{\sigma}}$, proving the second equalities in equations (13) and (14) requires using equations (9) and (10) and a substantial amount of algebra, which we detail in Appendix B.2.4. The ratio χ_R is directly a

$\tilde{\alpha} = \sigma(\alpha + 1/\sigma - 1) \subseteq (-\infty, 1]$.

The four tax terms central to our analysis are $\hat{\Gamma} = d\Gamma/(1-\Gamma)$, $\hat{\bar{\Gamma}} = d\bar{\Gamma}/\left(1-\bar{\Gamma}\right)$, $\hat{\tau} = d\tau/(1-\tau)$, $\hat{\bar{\tau}} = d\bar{\tau}/(1-\bar{\tau})$. Letting lower case $k, \bar{k}, i, \bar{i}, p^K, p^{\bar{K}}, r, \bar{r}, z, \bar{z}$ denote log deviations of their uppercase variables, Appendix B.2 proves the main result of this section:

$$k = \frac{\omega_{k,r}\hat{\Gamma} + \left(1-\omega_{k,r}\right)\hat{\bar{\Gamma}} - \omega_{k,\tau}\hat{\tau} - \left(1-\omega_{k,\tau}\right)\hat{\bar{\tau}} + \epsilon}{1-\alpha}, \tag{15}$$

$$\text{where: } \omega_{k,r} \equiv \frac{1 - \left((1-s_1) - s_{\bar{F}_1}(1-s_1-\bar{s}_1)\right)\tilde{\alpha}}{1-\left(1-s_{F_1}-s_{\bar{F}_1}\right)(1-s_1-\bar{s}_1)\tilde{\alpha}}, \tag{16}$$

$$\omega_{k,\tau} \equiv \frac{s_{F_1} + \left(1-s_{F_1}-s_{\bar{F}_1}\right)\bar{s}_1\tilde{\alpha}}{1-\left(1-s_{F_1}-s_{\bar{F}_1}\right)(1-s_1-\bar{s}_1)\tilde{\alpha}}, \tag{17}$$

$$\epsilon \equiv \omega_{k,\tau}z + \left(1-\omega_{k,\tau}\right)\bar{z} - \omega_{k,r}\left(\frac{d\rho + d\delta}{\rho+\delta} + p^K\right) - \left(1-\omega_{k,r}\right)\left(\frac{d\bar{\rho} + d\bar{\delta}}{\bar{\rho}+\bar{\delta}} + p^{\bar{K}}\right). \tag{18}$$

Thus, long-run capital responds according to the elasticity $1/(1-\alpha)$ to a weighted average of the deviations of domestic and foreign tax rates and costs of capital. The appearance of the returns to scale $1-\alpha$ in the denominator of the long-run elasticity is standard; in the case of a domestic-only firm, $\omega_{k,r} = \omega_{k,\tau} = 1$ and the long-run elasticity collapses to $k = (\hat{\Gamma} - \hat{\tau})/(1-\alpha)$.[17] Our contribution is to show that it carries over into the multinational setting with appropriately-defined weights $\omega_{k,r}$ and $\omega_{k,\tau}$ multiplying the domestic and foreign tax changes.[18] These weights are functions of the parameters $\alpha, \sigma, a, \bar{a}$ and the steady-state ratios of foreign-to-domestic capital and user cost.

Importantly, while the weights on domestic and international taxes sum to one, negative weights and hence elasticities on the foreign terms are possible. In the case of Γ and $\bar{\Gamma}$, the foreign weight is positive if and only if $F_{K\bar{K}} > 0$, i.e., if $\alpha + 1/\sigma > 1$. Intuitively, cheaper foreign capital ($\bar{\Gamma} \uparrow$) results in higher $\bar{K}$; whether this increase crowds out or in K depends on whether $F_{K\bar{K}}$ is positive or negative. The sign of the coefficient multiplying $\bar{\Gamma}$ therefore reveals whether domestic and foreign capital are (gross) complements or substitutes. In the special case where

function of parameters; the ratio χ_K is an equilibrium object that depends on $\alpha, \sigma, a, \bar{a}$ and the ratios of $\bar{Z}^*/Z^*$ and $(1-\bar{\tau}^*)/(1-\tau^*)$. The advantage of writing the shares in terms of χ_R and χ_K is that the unobserved firm-specific ratio of productivities $\bar{Z}^*/Z^*$ is replaced by observable factor quantities and prices.

[17] Equation (15) nests important special cases beyond the standard closed economy one factor model: (i) the closed economy two factor model when $\bar{Z}^* = s_{\bar{F}_1} = 0$ and $s_{F_1} = 1$, in which case $\omega_{k,\tau} = 1$ and $\omega_{k,r} = 1 - (1-s_1)\tilde{\alpha}$; and (ii) *ex ante* symmetry with $\tau^* = \bar{\tau}^*, R^* = \bar{R}^*$, and $Z^* = \bar{Z}^*$, in which case $K^* = \bar{K}^*$ and hence $s_1 = \bar{s}_1 = s_{F_1} = s_{\bar{F}_1} = a$. Appendix B.2 gives the expressions for $\bar{K}$ and total corporate capital.

[18] In fact, the property that the coefficients multiplying $\hat{\Gamma}$ and $\hat{\bar{\Gamma}}$ sum to the same total as the coefficients multiplying $\hat{\tau}$ and $\hat{\bar{\tau}}$ holds for any twice-differential production function defined over K and $\bar{K}$ (see Appendix B.2.3).

$F_{K\bar{K}} = 0$, the domestic capital decision does not depend on foreign capital and $\omega_{k,r}$ equals one just as in the domestic-only case. The determination of whether $\omega_{k,\tau}$ exceeds one is more complicated because foreign taxes directly affect both K and $\bar{K}$; in the special case of $F_{K\bar{K}} = 0$ and *ex ante* symmetry ($\tau^* = \bar{\tau}^*, R^* = \bar{R}^*, Z^* = \bar{Z}^* \Rightarrow K^* = \bar{K}^*$), the term $\omega_{k,\tau}$ simply equals the domestic capital share in the production function a.[19]

The dependence of the share weights $\omega_{k,r}$ and $\omega_{k,\tau}$ on underlying parameters introduces heterogeneity in the response of domestic capital to the tax terms. Of particular importance, as the share of the firm's capital located abroad approaches zero, the term $\omega_{k,r}$ converges to one irrespective of the value of σ. Intuitively, such firms are "almost domestic" and hence changes to the foreign cost of capital minimally affect domestic investment. We return to this prediction in our empirical results.

Equations (15) to (18) frame our empirical exercise. We use corporate tax returns to measure domestic investment and the policy shocks $\hat{\Gamma}, \hat{\tau}, \hat{\bar{\Gamma}}$, and $\hat{\bar{\tau}}$. The possibility that the firm-specific drivers of investment contained in the residual ϵ may be correlated with changes in taxes motivates the measurement of ex ante tax shocks and robustness analysis. Section 6 and Appendix B.10 describe how we connect the response of short-run investment to the cross-steady state formula in equation (15).

3.3 Extensions

Appendix B.2 extends the baseline model to allow for separate investment in equipment and structures, each with its own depreciation rate and cost-of-capital. Assuming a constant elasticity of substitution in the production function across different types of capital, equation (15) continues to hold for total capital, with the user cost terms replaced by appropriately-weighted changes in the user costs of each type.

Appendices B.4 to B.7 extend the baseline environment. Appendix B.4 explicitly models the dynamic accumulation of intangible capital. Intangible capital is fully non-rival within the firm; it increases the productivity of both the domestic and foreign operation. As in Helpman (1984), it therefore induces complementarity between domestic and foreign tangible capital, since cheaper foreign tangible capital results in more intangible capital accumulation which in turn makes domestic tangible capital more profitable. Equation (15) has two changes as a result: $\omega_{k,r}$ now reflects the complementarity arising from intangible capital as well as from σ

[19] As noted by Desai, Foley and Hines Jr (2009), the direct effect on K of $\bar{\tau}$, or isomorphically foreign productivity, complicates the interpretation of the evidence in their work and in Becker and Riedel (2012), which examine the response of K to variation in $\bar{K}$ induced by foreign GDP growth and foreign marginal tax rates, respectively. In our framework, these papers provide evidence on the sign of $\omega_{k,\tau}$ rather than $\omega_{k,r}$.

and a, and a new term arises if the user cost of intangible capital changes.

Appendix B.5 explicitly incorporates the location choice of intangible capital, as key provisions of TCJA such as FDII and GILTI targeted this margin. Unlike equipment and structures, by definition intangible capital does not have a physical location nor does its movement across borders leave a verifiable record in shipping or customs data, making the location of intangible capital and the associated profits in low-tax jurisdictions an attractive tax strategy. In our framework, if firms allocate intangible capital across jurisdictions to minimize taxes without any regard to the location of physical capital, then nothing changes in the firm's physical investment decision and equation (15) remains unaltered. In the case where the relative location of physical capital constrains the firm's location decision of intangible capital, two changes arise. First, in the realistic case of $\tau > \bar{\tau}$, the pre-TCJA domestic user cost rises and the foreign user cost falls, as the accumulation of domestic capital reduces the firm's ability to shift profits abroad using intangibles. Second, the reduction in the difference $\tau - \bar{\tau}$ under TCJA has the additional effect of reducing the wedge between the user costs.

Appendix B.6 incorporates the tax deduction of interest payments. Once again, if firms make their financial capital structure decision independently of their choice of physical capital, then nothing changes in the firm's physical investment decision. In the case where these decisions interact, perhaps because of a leverage constraint tying the optimal amount of debt to the quantity of physical capital, again two changes arise. First, the pre-TCJA domestic user cost falls, as the accumulation of domestic capital increases the firms' ability to issue tax-shielded debt. Second, the reduction in τ has a smaller effect on investment because it simultaneously reduces the value of the tax shield. Empirically, Richmond et al. (2024) find no investment effect of the TCJA's change in the interest limitation.

Finally, Appendix B.7 relates equation (3) to the problem of a firm operating a global value chain (GVC) with domestic and foreign inputs. This setup introduces the complication of how to assign revenues across tax jurisdictions; under the reasonable benchmark that revenue assignment mirrors costs, a GVC gives rise to equation (3) except with time-varying a and $\bar{a}$.

3.4 General Equilibrium

While equation (15) holds firm-by-firm, the residual ϵ contains changes to factor prices common to all firms. In the cross-section regressions in Section 5, these common changes appear in the constant term and do not affect the identification of the parameters governing the tax elasticities. For general equilibrium questions such as the effect of the TCJA on aggregate investment or revenue, however, higher factor demand will cause factor prices to increase if supply curves slope up. To model this feedback, subscript individual firms with i and let $X_t^D = \sum_i X_{i,t}$ denote aggregate demand for factor $X \in \{K, L, M\}$. Factor supply obeys $X_t^S / X_t^* = \left(P_t^X / \left(P_t^X\right)^*\right)^{\nu_X}$ and in equilibrium $X_t^D = X_t^S = X_t$. We impose an extreme but realistic calibration: (1) $\nu_M = \nu_K = \infty$ since raw materials tend to trade on international markets and recent literature does not find an effect of investment demand on the price of capital goods (House, Mocanu and Shapiro, 2022); and (2) $\nu_L = 0$ in accordance with balanced growth path preferences.[20] We consider alternative calibrations and additional general equilibrium forces in Section 7.4.

4 Data and Measurement of Tax Rates and Investment

4.1 U.S. Corporate Tax Files

We measure firm-level tax rates and investment for a representative sample of C-corporations using information reported on corporate tax returns. Our data set starts from the size-stratified samples of roughly 100,000 C-corporation and S-corporation returns per year that are produced and cleaned by the Statistics of Income (SOI) division at the Internal Revenue Service (IRS). Firms selected into the SOI sample remain in the sample unless they change tax identifier or fall into a size stratum with a lower sampling probability, giving us a panel (see Zwick and Mahon (2017) for details). We drop S corporations (∼50% of the sample), financial firms (NAICS 52), firms with less than \$1 million in domestic tangible assets (∼25%), and firms with insufficient history to permit measurement of each policy shock variable. These refinements leave a sample of approximately 12,000 firms. We augment the SOI Corporate Sample with variables and tax years drawn from the population of corporate returns. Our main analysis sample of 9,231 firms uses tax returns from 2011 through 2019, although we use data going back to 1993 when measuring some of the policy shocks.[21]

For each firm-year, we combine data from Forms 1120, 4562, 5471, and 1118. Form 1120 is the corporate income tax return required of all domestic corporations and contains income

[20] House, Mocanu and Shapiro (2022) show that the early and influential evidence of capital prices responding to investment incentives in Goolsbee (1998) disappears when using more recent vintages of data on the Goolsbee sample or extending the sample period. The factor supply function for labor can be microfounded from workers with utility $C^{1-\gamma}/(1-\gamma) - \nu L^{1+\chi}/(1+\chi)$ and no saving technology, $C = wL$. Setting the wage proportional to the marginal rate of substitution and solving gives $L_t \propto \left(P_t^L\right)^{\nu_L}$, with $\nu_L \equiv \frac{1-\gamma}{\chi+\gamma}$. Keeping L constant on a balanced growth path requires $\gamma = 1$ and hence $\nu_L = 0$; intuitively, with balanced growth preferences the equilibrium quantity of labor does not respond to shifts in the labor demand curve. Appendix B.9 provides further details.

[21] The analysis sample is approximately 10% the size of the sample in Zwick and Mahon (2017), which included more small firms, S-corporations, and a longer panel.

statement and balance sheet items, taxes, deductions, and credits, as well as firm characteristics such as industry. Form 4562 is required to claim depreciation and amortization and contains investment expenditure by tax duration bin. Form 5471 is required of corporations with ownership stakes in foreign corporations and includes the foreign subsidiary income statement and balance sheet items as well as foreign taxes paid (see Dowd, Landefeld and Moore (2017) for details). We define multinational firms as having positive 5471 tangible capital.[22] Form 1118 covers foreign tax credits and in particular contains information related to GILTI obligations. Using information on these forms, we develop measures of the impact of the reform on the tax terms $(\Gamma, \tau, \bar{\Gamma}, \bar{\tau})$ and firm-level outcomes (see Appendix C for additional details).

Domestic Cost of Capital (Γ). The effective discount to the cost of capital for firm i, $\Gamma_{i,t}$, starts with the time-varying present value of depreciation allowances in each of $j \in J$ asset types. Denoting the no-bonus present value of depreciation allowances as $\zeta_{j,0} = \int_0^\infty e^{-rh} d_{j,h|t} dh$, the level of bonus depreciation as θ_t, and bonus eligibility as $\mathbb{I}\{\text{eligible}\}$, the total present value of allowances of asset type j is $\zeta_t^j = \mathbb{I}\{\text{eligible}\}\left(\theta_t + (1-\theta_t)\zeta_{j,0}\right) + (1-\mathbb{I}\{\text{eligible}\})\zeta_{j,0}$. We calculate this present value for each depreciable life category on Form 4562 under both pre-TCJA bonus depreciation of $\theta = 0.5$ and post-TCJA bonus depreciation of $\theta = 1$.

We aggregate the asset-level depreciation allowances ζ_t^j to the firm level using firm-specific investment shares, defined following Zwick and Mahon (2017) as the firm's pre-2011 average share of depreciable investment in each Form 4562 depreciable life category.[23] Denoting by $\zeta_{i,t}$ the firm-level weighted-average present value of allowances, the present value of tax savings is $\tau_{i,t}\zeta_{i,t}$, where $\tau_{i,t}$ is the firm's marginal tax rate defined below.

Exposure to FDII affects Γ because the FDII deduction applies to the export share of income in excess of 10% of domestic tangible capital. As a result, increasing domestic tangible capital mechanically increases income taxes by reducing the amount of the FDII deduction. Appendix B.8 incorporates FDII into the firm's optimization problem in Section 3 and shows that the implications for investment are isomorphic to a lower marginal tax rate and smaller Γ. Putting all of these elements together, using the FDII deduction of 0.375 of eligible income, the deemed intangible income threshold of 0.1, and denoting ξ the share of domestic income from exports and τ^s the ex-FDII marginal tax rate, we define $\Gamma_{i,t} = \tau_{i,t}\zeta_{i,t} - \tau^s_{i,t} \times \xi_i \times 0.375 \times$

[22] A handful (roughly 100) of firms in our sample have positive but *de minimus* foreign presence, which we define as having 5471 capital and earnings both less than 1% of their domestic counterpart. We put these firms in the domestic group as well.

[23] We expand on Zwick and Mahon (2017) by (1) incorporating investment shares and depreciation rules for investment ineligible for bonus depreciation and (2) relying on firm-level rather than industry-level measures of ζ, allowing us to consider the impact of the reform on longer-lived investment and to identify causal effects using within-industry variation in exposure to the depreciation rules.

$0.1/(\rho+\delta)$. To implement this formula, we apply a common $\rho = 0.06$ and $\delta = 0.1$ and obtain ξ_i by inverting the FDII deduction reported after TCJA on Form 1120.

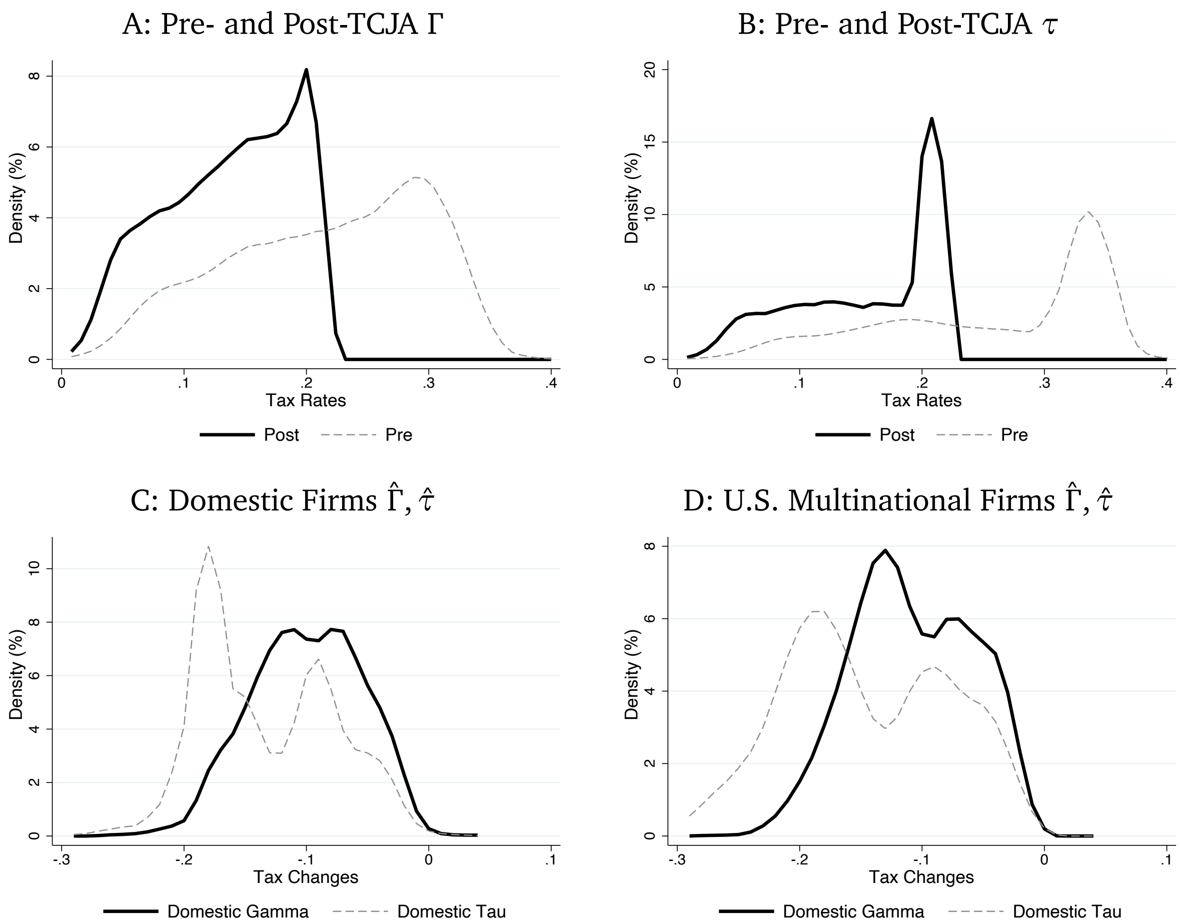
Panel A of Figure 2 plots the pre- and post-TCJA distributions of Γ. Both exhibit substantial variation. Variation across asset types arises because equipment but not structures are bonus eligible and because of variation in depreciation lives within each category. Variation in Γ then reflects the firm-level investment shares in each asset type, as well as the firm-specific METR and FDII-eligibility.[24] Panels C and D show substantial variation in $\hat{\Gamma} = d\Gamma/(1-\Gamma)$, the variable that enters into the regression, across both domestic and U.S. multinational firms.

Domestic Marginal Tax Rate (τ). Changes to the effective marginal tax rate, $\tau_{i,t}$, reflect the reduced statutory rate, repeal of the Domestic Production Activities Deduction (DPAD) and corporate Alternative Minimum Tax (AMT), reform to the net operating loss (NOL) regime, and the introduction of FDII. We translate these components into changes in each firm's METR building on Auerbach (1983), Shevlin (1990), and Graham (1996). As in this work, we simulate firm-level taxable income trajectories starting in year t using a firm-specific standard deviation for income changes estimated using historical data. These trajectories determine the impact of the NOL regime, which makes the present value of taxes depend on past and future income in addition to current income. We go beyond past work by also simulating the future use (if available) of the general business credits, DPAD, and AMT using the historical firm-specific propensity to use each credit or deduction (conditional on having positive taxable income) and the amount of the credit or deduction conditional on use. Appendix C.4 provides more detail on the simulation and validation exercises.

Using these simulated paths of taxable income, credits, and deductions, we define the marginal rate $\tau^s_{i,t}$ as the change in the present value of taxes from increasing income by one percent of revenue in year t, divided by one percent of revenue in year t. We compute $\tau^s_{i,t}$ under both pre- and post-TCJA rates, credits, deductions, and NOL rules for income in $t = 2015$ and $t = 2016$ and average the rates for these two years to arrive at our pre- and post-TCJA $\tau^s_{i,t}$. Changes in $\tau^s_{i,t}$ thus incorporate both the changes to the statutory rate, credits, and deductions as well as the heterogeneous impact of these components depending on a firm's pre-TCJA taxes. For firms subject to FDII, the effective marginal rate also accounts for the FDII deduction and

[24] Curtis et al. (2021) argue that tax depreciation lives substantially reflect historical accident and do not necessarily correspond to economic depreciation. Consistent with this idea, the correlation at the 3-digit level between economic depreciation based on BEA data and tax depreciation from Zwick and Mahon (2017) is 0.38. The analogous correlation between economic depreciation and $\hat{\Gamma}$ is 0.05. We conduct a robustness exercise that uses 3-digit fixed effects to isolate the residual variation in Γ holding economic depreciation fixed at that level and find the results unchanged.

Figure 2: Kernel Density Distribution of Tax Changes



Notes: Panels A and B depict kernel density estimates for the domestic tax terms of interest. Panel C provides kernel density estimates for $\hat{\Gamma}$ and $\hat{\tau}$ for domestic firms. Panel D provides kernel density estimates for $\hat{\Gamma}$ and $\hat{\tau}$ for U.S. multinationals.

is $\tau_{i,t} = (1 - 0.375 \times \xi_i) \times \tau^s_{i,t}$. For other firms and prior to the TCJA we set $\tau_{i,t} = \tau^s_{i,t}$.

Panel B of Figure 2 plots the pre- and post-TCJA distributions of τ. Both have modes around their respective statutory rates of 35% and 21%. However, both also exhibit substantial mass below the modes, reflecting firm-specific use of deductions and credits as well as NOLs. As a result, Panels C and D show substantial variation in how much different firms' METRs changed, with larger percent reductions for firms with higher pre-TCJA METRs and smaller reductions for firms directly affected by the repeal of DPAD or AMT.

To decompose the sources of variation in τ, we develop several tax rate measures that isolate variation from different sources: base year income differences, net operating losses, tax credits (e.g., general business credits), and base provisions (e.g., DPAD and the AMT). We find that each of these sources generate firm-level variation, but that base year income is the most important source of heterogeneity across firms. Net operating losses and the AMT also account for material amounts of variation, whereas DPAD and business credits contribute a positive but smaller amount. See Appendix C.5 for more detail.

Foreign Cost of Capital ($\bar{\Gamma}$). We measure the pre-TCJA foreign effective discount to the cost of capital, $\bar{\Gamma}_{i,t}$, using the OECD average present value of depreciation allowances from Foertsch (2022). TCJA affects this variable through the GILTI provision because the GILTI tax applies to foreign income in excess of 10% of foreign tangible capital. As a result, increasing foreign tangible capital by $1 mechanically reduces GILTI by $0.10 and hence reduces U.S. income tax. Appendix B.8 incorporates GILTI into the firm's problem in Section 3 and shows the implications for investment. Using this framework, we implement the cost of capital incentive for firms with GILTI tax liability in 2018 or 2019 by lowering post-TCJA $\bar{\Gamma}_{i,t}$ by $0.21 \times 0.5 \times 0.1/(\rho + \delta)$, where 0.21 is the U.S. post-TCJA statutory rate, 0.5 is the GILTI deduction, 0.1 is the deemed intangible income threshold, and the denominator $\rho + \delta$ converts the flow tax savings into a present value. We assign GILTI liability if 0.21×GILTI income net of deductions exceeds deemed foreign taxes paid, where each of these variables is obtained from Form 1118.[25]

Foreign Marginal Tax Rate ($\bar{\tau}$). Measurement of the pre-TCJA tax rate on foreign subsidiary income faces the difficulty of determining firms' expectations of what rate they would eventually pay when repatriating that income (Dharmapala, 2018). In fact, the literature presents mixed conclusions about the effect of the reform on foreign marginal effective rates. Appendix D.3 gives a partial review.

If firms believed they would have to pay the pre-TCJA U.S. statutory rate of 35%, then the change to a territorial system with GILTI would imply a reduction in the foreign METR for almost all firms. However, the widespread use of deferral of foreign dividends suggests firms instead believed there would be another one-time "repatriation holiday" akin to the lower rate in

[25] Several technical details merit mention. First, a non-trivial minority of firms have GILTI liability only because of expense reallocation making the foreign tax credit (FTC) limit bind (Dharmapala, 2018); for these firms their GILTI liability depends only on their expense reallocation and in particular does not depend on their foreign tangible capital (see Appendix B.8). We code these firms as having no change in their foreign cost of capital. Second, our baseline GILTI formula omits the reduction in FTCs in proportion to the GILTI share of foreign income. We find it plausible that firms did not recognize this interaction (it requires a multi-step calculation across schedules of multiple tax forms and an "explainer" of GILTI from the Tax Foundation omitted it entirely (Bunn, 2021)), and this assumption circumvents having to rely on imprecise measures of firm-level foreign tax rates. We include the FTC offsets below when assessing implications for U.S. tax revenue. Third, firms increasing their foreign capital to avoid GILTI tax have a strong incentive to acquire capital with low economic depreciation so as to avoid recurring investment outlays. We therefore set $\delta = 0.05$ for the purpose of determining the impact of GILTI on $\bar{\Gamma}$.

2004 under the American Jobs Creation Act (AJCA). In this case, firms with foreign tax credits (FTCs) in excess of the anticipated transition rate and the 10.5% GILTI level would experience no change with the TCJA, as these firms expected to pay no taxes to the U.S. government on foreign source income either before or after TCJA. Depending on the holiday tax rate, some firms with smaller FTCs might have expected to experience a tax increase, and others might have expected a tax decrease.

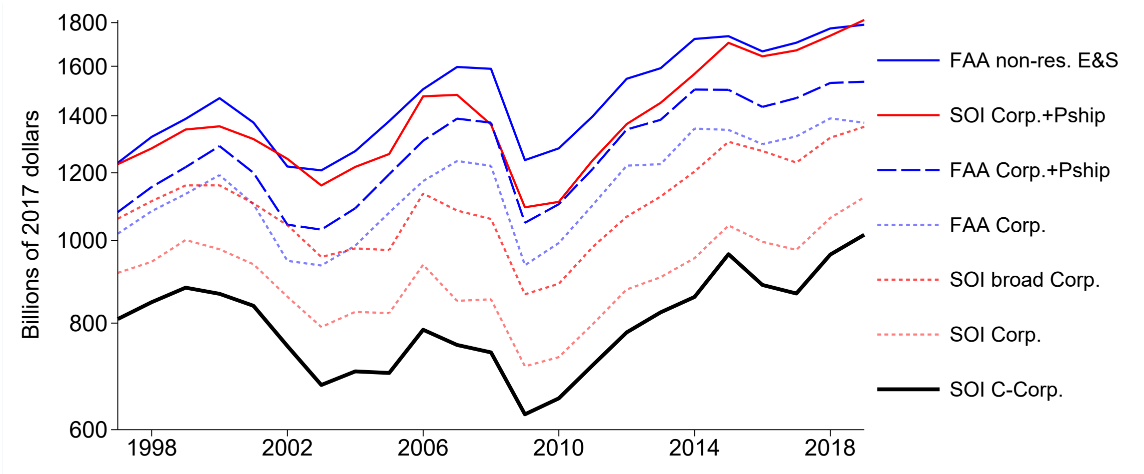
If firms anticipated a transition rate at the GILTI level of 10.5% with 80% of FTCs allowed, then no firm experienced a change in their METR on foreign source income under TCJA. We make this case our baseline assumption, both because we find it reasonable as the actual transition rate was in the neighborhood of 10.5% (depending on the firm's illiquid asset share) and because it amounts to setting $\hat{\hat{\tau}} = 0$ for all firms. Accordingly, this assumption elides the difficult task of computing foreign tax rates.

If in fact firms anticipated a higher transition rate or simply increased foreign investment in response to the statutory certainty that TCJA provided for the taxation of foreign income, our baseline empirical estimates will misattribute some of the investment response of multinational firms to the GILTI tangible capital deduction rather than to the other changes to taxation of foreign income. This change would not however affect our qualitative conclusions concerning complementarity of foreign and domestic capital. We consider alternative assumptions about the change in the foreign marginal rate in theoretical extensions in Section 7.4 and empirical extensions in Appendix D.3.

Key Outcomes. Our main outcome is *investment*. This variable includes expenditures for all equipment and structures investment put in place in the U.S. during the current year, obtained from Form 4562. In some specifications, we restrict attention to the expenditures for which bonus depreciation and Section 179 incentives apply, which we refer to as *equipment*. *Capital* includes the book value of tangible, depreciable assets net of accumulated depreciation per books. This measure includes the capital from consolidated domestic subsidiaries but typically excludes that from foreign subsidiaries. *Foreign capital* includes the total book value of tangible, depreciable assets reported for controlled foreign corporations on all Form 5471 filings attached to the firm's Form 1120 corporate filing, net of accumulated depreciation.

Figure 3 shows that investment as reported on tax forms closely tracks national accounts aggregates. The figure plots several measures of investment in non-residential equipment and structures, all deflated using the GDP price index. In 2016, our tax-based measure of investment directly by C-corporations accounted for 53% of total national accounts investment.

Figure 3: Investment Benchmark



Notes: Fixed Asset Accounts (FAA) non-res. E&S is investment in non-residential equipment and structures (FAA table 2.7 lines 3 and 36). FAA Corp. and Pship is private investment in non-residential equipment and structures by C or S corporations (FAA table 4.7 lines 18 and 19) or partnerships (FAA table 4.7 lines 62 and 63). SOI Corp.+Pship is total non-residential investment by SOI corporations or partnerships. SOI Corp. includes only investment by corporations and SOI C-Corp. investment by C corporations. SOI broad Corp. includes the part of partnership investment that can be allocated to direct corporate owners of the partnership.

Moreover, despite the series coming from completely separate source data, the correlation of annual changes in the logs of both series is 0.75. The figure also shows that most of the gap between SOI C-Corporate and national accounts investment occurs because of investment in other sectors identifiable in SOI, including S-corporations and partnerships. Including investment by S-corporations and partnerships directly owned by corporations (the line labeled "SOI broad Corp." in the figure) increases the 2016 SOI corporate share to 76% of the national accounts total and 98% of national accounts corporate investment. Fully allocating partnership investment to corporate owners introduces substantial logistical hurdles due to multiple tiers of ownership and entities not in the SOI corporate sample, however, so our firm-level analysis focuses on investment directly attributable to C-corporations.[26]

Table 2 reports summary statistics. Panel A reports statistics for the full sample and the domestic sample, which includes firms with less than one percent of their income and capital from foreign operations. Panel B provides statistics for the multinationals with high and low levels of foreign activity. Specifically, the "multinational high" and "multinational low" samples include U.S. multinationals not in the domestic sample with respectively more than or less than 15% of their pre-TCJA capital abroad (i.e., pre-TCJA $\chi_K \geq 0.15$ or $\chi_K < 0.15$, which is roughly

[26]Such arrangements concentrate in a few industries, as defined by the North American Industry Classification System (NAICS), which include utilities (NAICS 22), pipeline transportation (NAICS 486), and real estate (NAICS 531).

the median in the multinational sample).

The average value of $\hat{\Gamma} - \hat{\tau}$ is 4%. Appendix Tables G.15, G.16, and G.17 report tax change statistics by industry in the full sample, the domestic sample, and the foreign sample, respectively. This number is smaller than the analogous prediction in Barro and Furman (2018). They report a change in the user cost of capital due to the TCJA being made permanent of 10% for equipment and 11% for structures. The difference between our estimate and theirs can be explained by their use of the statutory corporate tax rate and by our inclusion of 50% bonus depreciation in the pre-period.[27]

5 Regression Estimates

In this section, we present our main empirical results of the effects of TCJA on investment of U.S. C-corporations. The regression specification mirrors model equation (15):

$$Y_{i,t} = b_0 + b_1 \times \hat{\Gamma}_{i,t} + b_2 \times \hat{\bar{\Gamma}}_{i,t} + b_3 \times \hat{\tau}_{i,t} + b_4 \times \hat{\bar{\tau}}_{i,t} + \mathbf{b}_5' \times \mathbf{x}_{i,t} + e_{i,t}, \tag{19}$$

where $Y_{i,t}$ is an outcome, $\Gamma, \bar{\Gamma}, \tau, \bar{\tau}$ are defined as in Section 4, $\hat{q} = dq/(1-q)$ for a tax term q, and $\mathbf{x}$ contains any controls. The main outcome is investment growth, $Y_{i,t} = d \log I_{i,t}$, measured as the log difference between pre-TCJA average investment over 2015-2016 and post-TCJA average investment over 2018-2019.[28] We winsorize $Y_{i,t}$ at the 5% level.

5.1 Identification

In the next section we use the regression coefficients from specification (19) to recover the structural coefficients given in equation (15). Five issues merit mention now because they affect the empirical implementation.

First, across pre- and post-TCJA steady states where $I_i^* = \delta K_i^*$, investment growth and capital growth coincide. We prefer investment as an outcome because of superior measurement in the tax data. Second, our preferred measure of $\hat{\bar{\tau}}_{i,t} = 0$ for all firms removes this variable

[27] Barro and Furman (2018) also include state corporate taxes in their user cost model and adjust for debt finance. However, accounting for these factors is not necessary to explain the difference between our estimates.

[28] This specification differs from the common approach of regressing the investment-capital ratio on the level of the tax terms and a proxy for λ (see, e.g., Desai and Goolsbee, 2004; Edgerton, 2010). Besides the obvious fact that we cannot compute λ using the stock market capitalization for the privately held firms in our sample, the benchmark result of Hayashi (1982) does not apply to our model with decreasing returns to scale. Moreover, we show in Appendix B.12 that the common regression does not recover structural parameters unless λ is properly measured, because λ changes endogenously in response to a tax reform.

Table 2: Summary Statistics

Panel A: Pooled and Domestic Samples

	All Firms						Domestic Firms					
	Mean	Std. Dev.	Median	P10	P90	N	Mean	Std. Dev.	Median	P10	P90	N
Pre-TCJA Γ	0.22	0.08	0.23	0.10	0.32	9231	0.22	0.08	0.23	0.10	0.32	6973
Pre-TCJA $\bar{\Gamma}$	0.18	0.00	0.18	0.18	0.18	9231						
Pre-TCJA τ	0.26	0.09	0.30	0.12	0.35	9231	0.26	0.09	0.31	0.13	0.35	6973
$\hat{\Gamma} - \hat{\tau}$	0.04	0.03	0.03	0.00	0.07	9231	0.03	0.03	0.03	0.00	0.07	6973
$\hat{\Gamma}$	-0.10	0.05	-0.10	-0.16	-0.04	9231	-0.10	0.05	-0.10	-0.16	-0.04	6973
$\hat{\hat{\Gamma}}$	0.02	0.05	0.00	0.00	0.14	9231						
$\hat{\tau}$	-0.14	0.06	-0.15	-0.20	-0.05	9231	-0.13	0.06	-0.15	-0.19	-0.05	6973
$d\log$(Investment)	-0.05	1.04	0.04	-1.42	1.28	9231	-0.06	1.08	0.02	-1.52	1.35	6973
Pre-TCJA χ_K	0.09	0.31	0.00	0.00	0.25	9231	0.00	0.00	0.00	0.00	0.00	6973
Export Share	0.07	0.20	0.00	0.00	0.28	9231	0.02	0.10	0.00	0.00	0.01	6973
Relative Profit	0.13	0.42	0.00	0.00	0.32	9231	0.00	0.00	0.00	0.00	0.00	6973
Average Tax Rate	0.05	0.06	0.02	0.00	0.13	9214	0.05	0.06	0.02	0.00	0.14	6958
Lagged Capital ($M)	383.6	3011.4	15.7	2.1	352.7	9231	253.0	2204.6	11.0	1.9	165.6	6973

Panel B: Multinational Samples

	Multinational-High						Multinational-Low					
	Mean	Std. Dev.	Median	P10	P90	N	Mean	Std. Dev.	Median	P10	P90	N
Pre-TCJA Γ	0.21	0.08	0.23	0.09	0.31	1112	0.22	0.08	0.23	0.10	0.31	1146
Pre-TCJA $\bar{\Gamma}$	0.18	0.00	0.18	0.18	0.18	1112	0.18	0.00	0.18	0.18	0.18	1146
Pre-TCJA τ	0.25	0.09	0.28	0.11	0.35	1112	0.25	0.09	0.29	0.11	0.35	1146
$\hat{\Gamma} - \hat{\tau}$	0.04	0.03	0.04	0.01	0.08	1112	0.04	0.03	0.03	0.01	0.07	1146
$\hat{\Gamma}$	-0.11	0.05	-0.11	-0.18	-0.04	1112	-0.11	0.05	-0.11	-0.16	-0.04	1146
$\hat{\hat{\Gamma}}$	0.07	0.07	0.10	0.00	0.14	1112	0.05	0.07	0.00	0.00	0.14	1146
$\hat{\tau}$	-0.15	0.07	-0.16	-0.24	-0.05	1112	-0.14	0.06	-0.15	-0.21	-0.05	1146
$d\log$(Investment)	0.02	0.87	0.08	-1.04	1.08	1112	-0.02	0.92	0.09	-1.17	1.11	1146
Pre-TCJA χ_K	0.72	0.58	0.48	0.19	1.95	1112	0.05	0.04	0.04	0.00	0.12	1146
Export Share	0.29	0.35	0.10	0.00	0.99	1112	0.14	0.24	0.00	0.00	0.50	1146
Relative Profit	0.67	0.74	0.36	0.00	1.96	1112	0.24	0.46	0.06	0.00	0.67	1146
Average Tax Rate	0.04	0.05	0.01	0.00	0.12	1112	0.04	0.05	0.02	0.00	0.12	1144
Lagged Capital ($M)	646.6	3003.9	72.8	4.4	1149.2	1112	923.0	5855.8	46.8	4.9	1065.5	1146

Notes: This table provides summary statistics for four samples. Panel A includes summary statistics for all firms (Columns 1-6), and domestic firms (Columns 7-12). Panel B includes summary statistics for U.S. multinationals with high foreign-to-domestic capital (Columns 1-6), and U.S. multinationals with low foreign-to-domestic capital (Columns 7-12). Capital is in millions of USD. We define $d\log$(Investment) as the change in mean investment over 2015–16 versus 2018–2019, and we winsorize it from above and below at the 5% level. We winsorize Relative Profit and Pre-TCJA χ_K from above at the 10% level. For disclosure reasons, we do not report true medians (or other percentiles). Instead, we report the average of observations in neighboring percentile bins. Table G.14 provides a few additional summary statistics for the tax term changes.

from the regression. Effectively, we estimate a dummy variable for GILTI binding and interpret the coefficient by scaling it by $\hat{\hat{\Gamma}}$ for GILTI payers. In Section 7.4 we consider alternative interpretations where the effect of GILTI includes both $\hat{\hat{\Gamma}}$ and a non-zero change in $\hat{\hat{\tau}}$.

Third, our baseline specification estimates short-run elasticities of investment to tax changes, while equation (15) characterizes long-run elasticities. Section 6 provides conditions under which the short-run elasticities all scale to the long-run elasticities by the same factor, preserving equation (19) as a valid representation of the structural data generating process.

Fourth, the elasticities in equation (15) depend on firm-specific factors. Most important, domestic firms have $\omega_{k,r} = \omega_{k,\tau} = 1$, implying $b_2 = b_4 = 0$ and $b_1 = -b_3$. We therefore report regressions separately for domestic and multinational firms. Furthermore, within multinational firms the relative values of b_1 and b_2 depend on the degree of foreign presence. Intuitively, holding fixed the production function parameters, firms with very little foreign capital have a smaller domestic investment response to the foreign cost-of-capital. We therefore also report regressions splitting multinational firms by high and low foreign presence. These splits also allow the other structural coefficients to vary across these sets of firms.

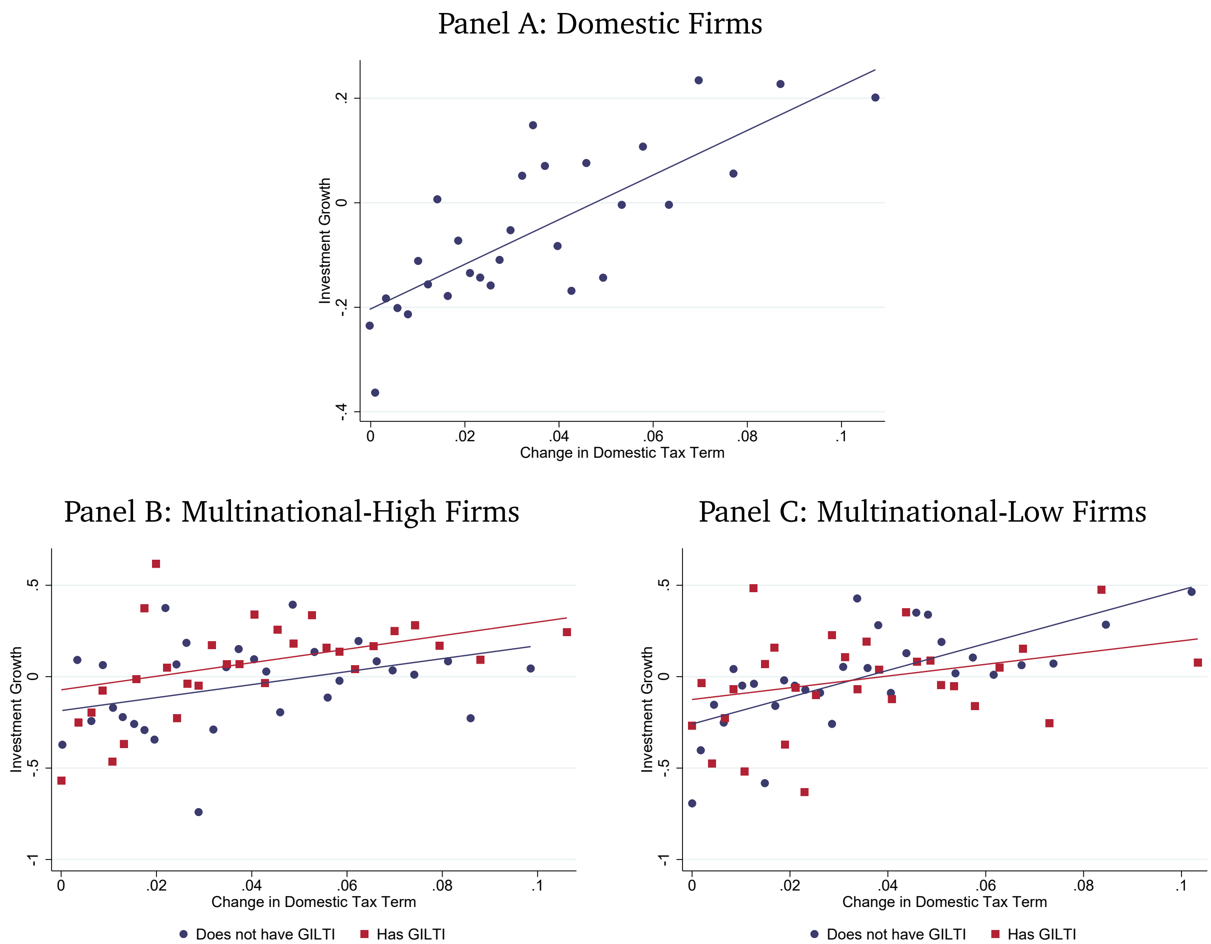
Fifth, the residual $e_{i,t}$ contains non-tax determinants of investment growth such as changes in productivity or the price of the firm's capital goods. Since equation (19) estimates changes in investment on changes in taxes, causal interpretation of the estimated coefficients requires the usual difference-in-differences assumption that firms more exposed to TCJA were otherwise on parallel investment paths with firms less exposed. We present evidence of absence of pre-trends and several robustness exercises that control for potential confounds to bolster the plausibility of this assumption. Furthermore, since equation (19) contains multiple, non-binary right hand side variables, in the presence of treatment effect heterogeneity the estimated coefficients are not necessarily convex averages of the individual treatment effects. The sample splits help along this dimension as well.

5.2 Non-Parametric Evidence

Figure 4 shows means of the log change in investment for different quantiles of the composite domestic tax term change $\hat{\Gamma} - \hat{\tau}$ ("binned" scatter plots).[29] For domestic firms plotted in Panel A, this composite tax term exactly comports with economic theory. The tight upward slope reveals

[29]The negative intercepts in Figure 4 reflect our use of the log change in investment as the dependent variable and the large cross-sectional variance in investment growth rates. By Jensen's inequality, the mean of the log change in each bin is substantially below the mean percent change in investment in each bin. Specifically, using the percent change in investment yields a positive intercept and a slope that is positive and statistically indistinguishable from the slope in Figure 4. In other words, the figure does not imply that total investment fell for firms that received the smallest tax change.

Figure 4: Investment Growth versus Tax Shocks for Domestic and Multinational Firms



Notes: This figure presents binscatter plots for domestic firms and U.S. multinationals with high or low foreign-to-domestic-capital. The x-axis is $\hat{\Gamma} - \hat{\tau}$ (the change in the domestic tax term) and the y-axis is $d\log(\text{Investment})$. We winsorize $d\log(\text{Investment})$ at the 5% level. We further categorize U.S. multinationals by whether or not they are GILTI payers in 2018 or 2019.

a positive investment elasticity to taxation around TCJA. For the multinational firms plotted in Panels B and C, our theory no longer dictates a single elasticity to $\hat{\Gamma}$ and $\hat{\tau}$. Nonetheless, the upward slopes indicate a positive investment elasticity in these samples. Furthermore, these panels show the investment responses separately for firms with and without GILTI liability. For the multinational firms with high foreign presence in Panel B, firms with GILTI liability have higher investment growth at any given value of the composite domestic tax term. This shift up in the schedule of GILTI versus non-GILTI firms manifests as a positive value of b_2 in the regression. Our calibrated model accounts for it by imposing complementarity between foreign and domestic capital in production.

Table 3: The Effect of Tax Term Shocks on Investment Growth

Dep. Var.:	$d\log(\text{Investment})$					
Sample:	Pooled	Domestic Firms		Multinational Firms		
		Unrestricted	Restricted	All	High	Low
	(1)	(2)	(3)	(4)	(5)	(6)
$\hat{\Gamma}$	3.28***	3.12***	4.27***	4.38***	4.76*	4.10*
	(0.57)	(0.63)	(0.51)	(1.30)	(1.88)	(1.79)
$\hat{\bar{\Gamma}}$	0.50**			0.28	0.90*	−0.26
	(0.19)			(0.27)	(0.40)	(0.38)
$\hat{\tau}$	−4.04***	−4.08***	−4.27***	−4.57***	−4.23**	−4.95***
	(0.45)	(0.52)	(0.51)	(0.94)	(1.35)	(1.32)
Observations	9,231	6,973	6,973	2,258	1,112	1,146

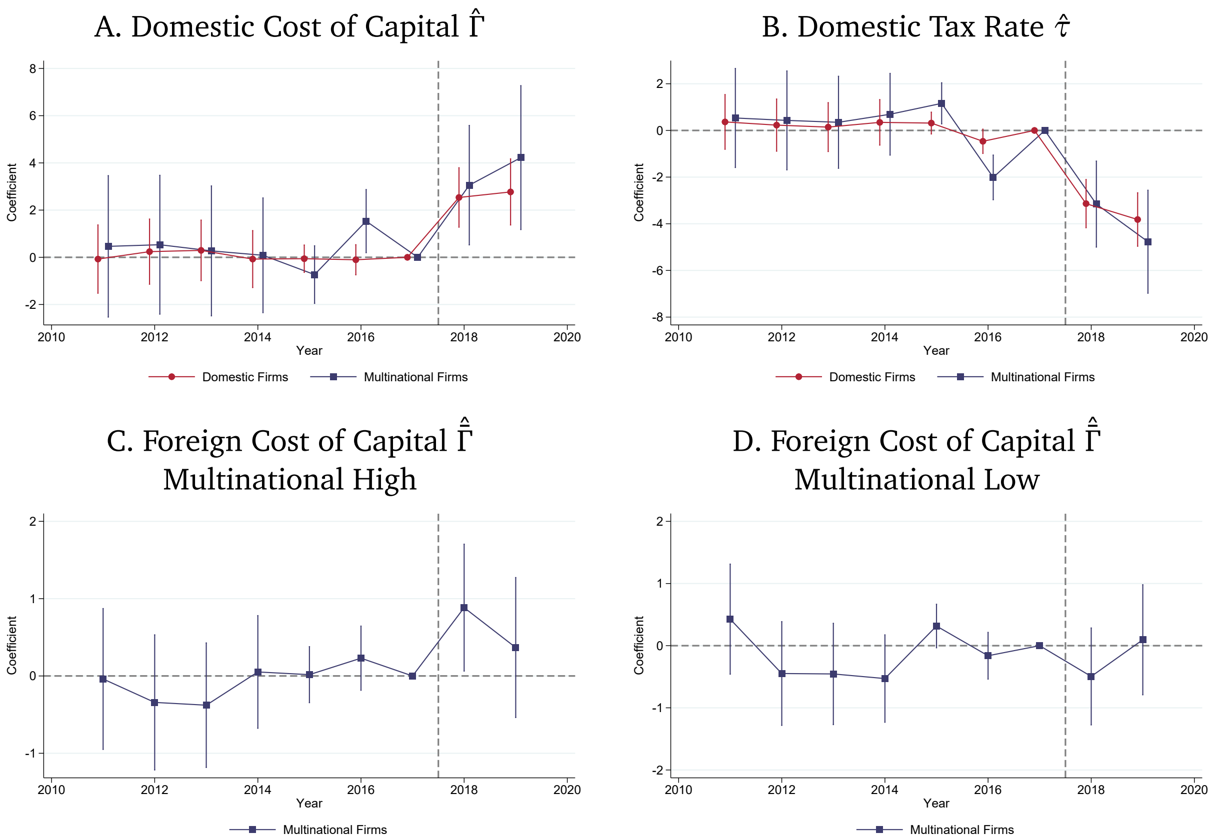
Notes: This table presents the results for regressions of $d\log(\text{Investment})$ on our tax terms across different samples. We winsorize $d\log(\text{Investment})$ at the 5% level. Column 1 presents the results for our pooled sample of both domestic firms and U.S. multinational firms, while columns 2 and 3 report the results for domestic firms. Column 4 provides the results for all U.S. multinational firms, while columns 4 and 5 partition U.S. multinational firms into those with high and low foreign capital, where high foreign capital firms have a ratio of foreign to domestic capital above 15%. * $p < .05$, ** $p < .01$, *** $p < .001$

5.3 Baseline Regressions

Table 3 reports the main regression results for the elasticities of domestic investment. Column (1) pools the entire sample and shows positive and highly statistically significant investment elasticities to the domestic and foreign costs-of-capital Γ and $\bar{\Gamma}$ and a statistically significant negative elasticity to the domestic tax rate τ. Motivated by our theory, the remaining columns report results for various sub-samples. Columns (2) and (3) focus on domestic firms, which comprise about three-quarters of the sample. Column (2) presents an unrestricted specification, and column (3) restricts the coefficients on the domestic cost-of-capital and tax rate to be equal and opposite by including only the composite tax term $\hat{\Gamma} - \hat{\tau}$. The elasticities of investment with respect to the domestic tax terms remain of similar magnitude and highly statistically significant in this group.

Column (4) reports results for multinational firms and columns (5) and (6) for sub-samples of multinational firms split by their degree of multinational activity. Multinational firms exhibit positive elasticities to Γ and negative elasticities to τ. Consistent with Panel B of Figure 4, multinational-high firms also have a large, statistically significant positive elasticity to $\bar{\Gamma}$. In contrast, and consistent with our model, the domestic investment of multinational-low firms responds little to the foreign cost-of-capital.

Figure 5: Year-by-Year Investment Effects by Tax Term Component and Group



Notes: These figures plot the tax-term coefficients between 2011-2019 from the regression specified in equation (19) using our firm-level corporate tax data. The coefficients in each year come from separate regressions with the dependent variable the log change in investment between 2017 and the year shown and the right hand side variables fixed at their pre-to-post TCJA change. Panels A and B report separate coefficients for the domestic-only and pooled multinational firm samples. Panels C and D report the $\hat{\hat{\Gamma}}$ coefficients from regressions in the samples of U.S. multinationals with high and low foreign capital, respectively, where high foreign capital is defined as having a ratio of foreign to domestic capital above 15%. The solid vertical lines depict 95% confidence intervals.

To summarize the investment response in the reduced-form regressions, we apply the mean policy changes to the coefficients from columns (3) and (4) and weight predicted effects by pre-TCJA capital. This calculation gives an 18% increase in domestic investment relative to firms experiencing no change.

Figure 5 displays the evolution of the regression coefficients as the horizon for investment growth changes, holding the right hand side variables fixed at their pre-to-post TCJA change. For each plot, we report separately the paths of coefficients in the domestic and multinational samples. Firms with larger and smaller changes in Γ or τ from TCJA have very similar investment trajectories over the pre-TCJA period, supporting a causal interpretation of the post-TCJA responses. The coefficients for $\bar{\Gamma}$ bounce around a little more in the pre-TCJA period but display no evidence of pre-trends in the years immediately before passage.

Responses of foreign capital offer further validation of these results (Appendix D.1). We use tax data for foreign subsidiaries of U.S. multinationals from Form 5471 to examine the change in net foreign tangible capital, which is a key transmission mechanism in our model. We also decompose the growth in foreign capital into contributions from large economies versus tax havens. We find growth in foreign tangible capital, evidenced by a statistically significant and economically sizable coefficient on $\hat{\bar{\Gamma}}$. The growth in foreign capital occurred in all regions, with relatively stronger growth outside of tax havens.[30]

We conduct robustness exercises designed to support a causal interpretation of the baseline regressions and assess the sensitivity of our quantitative estimates (Appendix D.2). We report regressions including detailed industry fixed effects; weighted regressions by firm size; and a set of regressions with controls for the "trade war," firm size, lagged investment, intangible intensity, and toll tax payments. We also report regressions that exclude likely profit shifters, and regressions that use a simulated IV strategy with alternative sources of tax rate variation in the instrument. To assess whether industries with heterogeneous depreciation rates exhibit different responsiveness to taxes, we report a regression that interacts 3-digit depreciation rates with our tax shocks. Finally, we consider augmented regressions that implement different assumptions about expectations for $\bar{\tau}$ in the absence of the reform (Appendix D.3).

Appendix D.4 presents results for other firm outcomes: the investment to capital ratio, log domestic capital accumulation, log investment by subcomponent, log tax payments, log labor compensation, log salaries and wages, log officer compensation, and log R&D. These estimates generally support the result that firms expanded their domestic operations in response to the reduced tax burdens. In a companion paper, we study the impact of the reform on financial outcomes, including stock market valuations, and find these tax changes are materially incorporated into asset prices during the 2017 reform debate (Chodorow-Reich et al., 2025).

[30]One potential limitation of this evidence is the possibility that after the TCJA, multinationals have an incentive to account for foreign assets more carefully (or perhaps even to overstate them). If this is the case, there is a potential concern that some of the results may be driven by differential reporting incentives and not by real changes in investment. For this reason, we do not incorporate these responses into our model estimation.

6 Structural Parameters

6.1 Estimated Parameters

We use the method of moments to recover the parameters $\alpha, \sigma, a, \bar{a}$, and χ_K. We obtain separate sets of parameters for domestic-only, multinational with high foreign presence, and multinational with low foreign presence firms. We start from five empirical moments in our data: the regression coefficients b_1, b_2, b_3, the ratio of capital at foreign subsidiaries to the domestic parent, χ_K, and the ratio of after-tax profits, denoted $\chi_\tau \chi_F$. We measure χ_K as the ratio of foreign tangible capital from Form 5471 to domestic tangible capital from Form 1120, Schedule L. We measure χ_F by summing all foreign non-dividend income reported on Form 5471.[31]

If the regression coefficients had come from specifications with long-run changes in capital or investment as the dependent variable, these moments would suffice to identify the parameters, as we show shortly. In our setting where the coefficients correspond to short-run elasticities, identification requires also determining the ratios of short-run to long-run elasticities, which in turn depend on the capital adjustment costs. We proceed in two steps, first describing our procedure for handling adjustment costs and then the identification of the parameters of interest conditional on the short-to-long-run ratios.

In the first step, we externally calibrate the foreign adjustment costs $\bar{\phi} = 0$. With this parameterization, the tax term elasticities b_1, b_2, b_3 all scale by approximately the same ratio of short-run to long-run investment, denoted χ_{SR}. The large relative magnitude of the $\bar{\Gamma}$ elasticity in column (5) of Table 3 *requires* negligible foreign adjustment costs, because domestic investment responds to $\bar{\Gamma}$ only through its impact on foreign capital.[32] Appendix B.10 derives the linearized solution for the transition path from the old to new steady state, provides formulas for the short-run and long-run elasticities, and proves the implication of common scaling.[33]

[31] The exclusion of dividend income avoids double-counting of income generated by tiered ownership structures, partly addressing the concerns of Blouin and Robinson (2020). Per conversations with experts, double-counting of tangible capital in these data is less of a concern due to fixed asset consolidation practices. For both χ_K and χ_F, we minimize the influence of outliers by computing weighted means after winsorizing the top and bottom quartile of observations.

[32] More precisely, the magnitude of the $\bar{\Gamma}$ coefficient relative to the Γ coefficient requires much larger domestic than foreign adjustment costs, because domestic investment responds directly to changes in Γ but only indirectly to changes in $\bar{\Gamma}$ through the accumulation of foreign capital and production complementarity. The prevalence of mergers and acquisitions (M&A) rather than acquisition of newly built capital may explain low foreign adjustment costs. Since our main model outcomes concern domestic rather than foreign capital, whether U.S. firms increase their foreign capital stock through new investment or M&A does not matter to aggregation. For computational reasons we calibrate $\bar{\phi} = 0.05$.

[33] Technically, the general dynamic system has two non-explosive roots that determine the speed of convergence and the short-run elasticities depend heterogeneously on each root. With no foreign adjustment costs, the dynamic system has only one root, in which case the elasticities all scale by the same amount up to terms involving third

The ratio χ_{SR} then serves as a sufficient and portable summary of the effect of domestic adjustment costs on the empirical moments.[34] We apply our preferred value of $\chi_{SR} = 1.4$ (Winberry, 2021) to adjust each short-run elasticity.[35] Section 7.4 shows that the main outcomes of our model vary relatively little across values of this ratio between 1.0 and 1.8 as far out as 10 years; intuitively, our empirical estimates directly discipline the response of investment in the first several years.

In the second step, we choose parameters to minimize the distance between the data and model-implied moments. Let $\theta = (\alpha, \sigma, a, \bar{a}, \chi_K)'$ denote the parameter set. An advantage of externally calibrating χ_{SR} is the transparency it provides for estimation of the remaining parameters. Using equation (15) and Appendix B.3, equations (20) to (24) illustrate identification by giving closed-form formulas for the set of model moments in terms of θ, χ_{SR}, and χ_R:

$$b_1(\theta) = \chi_{SR}\omega_{k,r}/(1-\alpha), \tag{20}$$

$$b_2(\theta) = \chi_{SR}\left(1-\omega_{k,r}\right)/(1-\alpha), \tag{21}$$

$$b_3(\theta) = -\chi_{SR}\omega_{k,\tau}/(1-\alpha), \tag{22}$$

$$\chi_K(\theta) = \chi_K, \tag{23}$$

$$\chi_\tau \chi_F(\theta) = \left(\frac{(1-a)\chi_K^{-\frac{1}{\sigma}} - a\chi_R}{(1-\bar{a})\chi_R - \bar{a}\chi_K^{-\frac{1}{\sigma}}}\right)\left(\frac{\bar{a}\chi_K^{\frac{\sigma-1}{\sigma}} + (1-\bar{a})}{a + (1-a)\chi_K^{\frac{\sigma-1}{\sigma}}}\right), \tag{24}$$

where, as shown in equations (11) to (14), (16) and (17), $\omega_{k,r}$ and $\omega_{k,\tau}$ are functions of $\alpha, \sigma, a, \bar{a}, \chi_K$, and χ_R (which we set to 1).

Equations (20) to (24) contain the following intuition for parameter identification. For domestic firms, $\omega_{k,r} = \omega_{k,\tau} = 1$ and hence the coefficients on τ and Γ have opposite signs of

derivatives of the production function, which are small. Intuitively, the difference between the ratio of short-run to long-run elasticities to e.g., Γ and $\bar{\Gamma}$ arises primarily because both ratios depend on the magnitude of domestic adjustment costs but the short-run elasticity to $\bar{\Gamma}$ also depends on the foreign adjustment cost. When $\bar{\phi} \to 0$, the only remaining difference occurs because foreign capital does not quite jump immediately to its long-run value due to the feedback from growing domestic capital to foreign capital. For the same reason, the common scaling is exact for the domestic-only firms.

[34] By portable, we mean that the same value can apply across across different models. For example, non-instantaneous adjustment of capital could arise because of (convex or fixed) costs of installing the capital or because firms face financial frictions that prevent them from immediately raising funds to cover the cost of the additional investment. While the value of ϕ (the coefficient multiplying the convex adjustment cost term) implied by χ_{SR} would vary with the presence of these other features, χ_{SR} is in principle a moment of the data.

[35] Winberry (2021) estimates a model with fixed and convex adjustment costs using moments of the investment distribution from Zwick and Mahon (2017) that come from the same SOI sample as our data set. We use his replication code to obtain impulse responses of investment to permanent domestic tax changes and compute the ratio of the response at 10 years to the average response over the first two years. We perform an analogous exercise using the model in Chen et al. (2023), which is estimated from Chinese manufacturing data, and find a value of $\chi_{SR} = 1.2$. See Appendix B.11 for details.

equal magnitude, each of which equals the inverse of $1-\alpha$ multiplied by χ_{SR}. We impose this condition already in the regression in column (3) of Table 3. For multinational firms, instead the sums of the coefficients on Γ and $\bar{\Gamma}$ and on τ and $\bar{\tau}$ equate, with each sum equaling the rescaled inverse of $1-\alpha$. Furthermore, given the profit elasticity α, the response of domestic capital to a subsidy to foreign capital (the coefficients on $\bar{\Gamma}$ in Table 3) bounds the admissible elasticity of substitution between foreign and domestic capital σ. The magnitudes of the regression coefficients and the profit ratio inform the relative magnitudes of σ, a, and $\bar{a}$.

We operationalize the estimation as follows. For domestic firms we have the set of data moments $\hat{m}^D = (b_1, b_3)'$ and for each group of multinational firms the set of data moments $\hat{m}^M = (b_1, b_2, b_3, \chi_K, \chi_\tau \chi_F)'$. Let $m^D(\theta) = (b_1(\theta), b_3(\theta))'$and $m^M(\theta) = (b_1(\theta), b_2(\theta), b_3(\theta), \chi_K(\theta), \chi_\tau \chi_F(\theta))'$ denote the corresponding model-implied moments. Let V denote the covariance matrix of the data, where the variances of χ_K and $\chi_\tau \chi_F$ come from the cross-sectional distribution in the appropriate sample of firms. For each group of firms, we obtain $\hat{\theta}$ to minimize $(m(\theta)-\hat{m})' W (m(\theta)-\hat{m})$ for a weight matrix $W = (\text{diag}(V))^{-1}$.

Panels A and B of Table 4 list the moments and resulting parameters. For domestic firms, the value of α follows directly from the value of $b_1 = -b_3$ and χ_{SR}. The fitted moments for the multinational-high firms match their data counterparts almost exactly, indicating that the point estimates of the data coefficients satisfy the cross-equation restrictions imposed by the model. For the multinational firms with low foreign presence, the model regression coefficients b_1 and b_3 do not exactly match the data. The model requires $b_1 + b_2 = -(b_3 + b_4)$, and even though we do not have a value of b_4 to target in the data, the small values of χ_K and $\chi_\tau \chi_F$ for these "almost-domestic" firms limit the scope for $b_1 + b_2$ to exceed $-b_3$.

Turning to parameters, the values of α range from 0.67 to 0.75. Combined with a labor share of revenue of 0.65, these values imply total returns to scale in the revenue function of 0.88 to 0.91 ($= 0.65 + \alpha \times (1-0.65)$). As a point of comparison, our estimates exhibit modestly higher returns to scale than the corresponding calibrated figure of 0.85 from Winberry (2021).

The value of σ for the multinational-high firms implies gross complementarity between domestic and foreign capital given the value of α. The value of σ for multinational-low firms is much larger but not well-identified given the theoretical restriction that b_2 for these firms cannot differ too much from zero. To interpret the values of a and $\bar{a}$, note that $\chi_K = 1 \Rightarrow a/(1-a) = F_1(K, \bar{K})/F_2(K, \bar{K})$, that is, for a firm with equal foreign and domestic capital, $a/(1-a)$ equals the ratio of the marginal product of domestic earnings with respect to domestic and foreign capital. A value of $a = 0.85$ thus implies that domestic capital increases domestic earnings by roughly 6 times as much as does foreign capital.

Table 4: Moments and Parameters

Panel A: Moments

	b_1/χ_{SR}		b_2/χ_{SR}		b_3/χ_{SR}		χ_K		$\chi_\tau \chi_F$	
	Data	Model	Data	Model	Data	Model	Data	Model	Data	Model
Group:										
Domestic	3.05	3.05			−3.05	−3.05				
Multinat. high	3.40	3.40	0.64	0.64	−3.02	−3.02	0.57	0.57	0.63	0.63
Multinat. low	2.92	3.43	−0.19	−0.19	−3.54	−3.24	0.05	0.05	0.12	0.11

Panel B: Parameters Chosen to Match Moments

	χ_K	α	σ	a	$\bar{a}$
Group:					
Domestic		0.67			
Multinat. high	0.57	0.75	1.75	0.85	0.79
Multinat. low	0.05	0.69	1608	1.00	0.95

Panel C: Other Parameters

Symbol	Name	Value
ρ	Discount rate	0.06
δ	Depreciation rate	0.1
α_L	Labor Share of Revenue rate	0.65
$\{\phi^D, \phi^H, \phi^L\}$	Adjustment cost	{1.7,1.3,1.6}

6.2 Tax Changes and Other Parameters

We set several other parameters using external information, shown in Panel C of Table 4. We set the discount rate ρ to 0.06 and the depreciation rate δ to 0.1, consistent with our measurement of the tax shocks. We set the labor share of revenue α_L to 0.65. We ignore materials inputs and markups for simplicity, $\alpha_M = 0, \mathscr{M} = 1$. We internally set the adjustment cost parameters ϕ^D, ϕ^H, ϕ^L for domestic-only, multinational-high, and multinational-low, respectively, to match the value of χ_{SR} (see Appendix B.10).

We group firms into "portfolios" based on their domestic/multinational-high/low status and their tax changes. Appendix Table G.11 shows these portfolios, the share of capital in each, average capital per firm, and the pre- and post-TCJA tax rates. The "low-tax" firms had pre-TCJA domestic marginal rates as low as 16% while the "high-tax" firms essentially face the statutory rate. Accordingly, the low-tax firms had smaller tax changes. For multinational firms, we further divide by whether GILTI was binding or not. We also add a domestic non-C-corporate sector calibrated using Figure 3 to be 30% of private sector capital.[36] Since we study the effects of the provisions of TCJA affecting C-corporations, we assign no tax changes to this sector and including it matters only for general equilibrium market clearing.[37]

Finally, we need to assign productivities A and $\bar{A}$ to each firm. Given $\alpha, \sigma, a, \chi_K$, and α_L, the ratio $\chi_A = \bar{A}/A$ follows immediately from equation (A.30). We choose A to match the capital-per-firm shown in Appendix Table G.11. This procedure assigns higher productivity to the larger multinational firms than the domestic firms.

7 Model Quantification

7.1 Capital and Investment

We start with a (nearly) "model-free" quantification. Column (1) of Table 5 reports the steady state change in domestic capital (or equivalently investment) using the fitted values of the tax elasticities in Table 3, adjusted by χ_{SR}. This exercise is partial equilibrium because we compute the fitted values without the constant term and hence omit any general equilibrium effects, such as changes in wages, that affect all firms. Applying the regression coefficients directly would imply capital rises by 12% for domestic-only firms, 16-20% for multinational firms, and 15% for the corporate sector as a whole.

Imposing the model structure allows us to move from partial to general equilibrium, decompose the role of different tax changes, and explore policy counterfactuals. Column (2) of Table 5 reports the partial equilibrium effects in the model for comparison with the model-free estimates. We use the estimated parameters from Table 4 and the tax changes by group from Appendix Table G.11 to compute the steady-state change for each group if wages remain fixed. For domestic firms, the model imposes no additional restrictions beyond those already imposed on the data by combining the $\hat{\Gamma}$ and $\hat{\tau}$ into a single regressor $\hat{\Gamma} - \hat{\tau}$. The partial equilibrium responses from the data and the model therefore nearly agree by construction. For multinational-high firms, the data and model partial equilibrium effects also nearly agree, but in this case because the multinational-high regression coefficients obey the additional cross-

[36] Since the top line in Figure 3 is private investment, this calibration segments the private sector from government. We assume the non-corporate sector has the same capital-per-firm as the domestic C-corporation sector.

[37] The expensing provisions applied to non-C-corporations as well. However, these entities also were affected by several other changes in the TCJA such as reductions in personal income tax rates, making it conceptually cleaner to consider exercises affecting taxation of C-corporations only.

Table 5: Long-Run Steady State K and I by Group

	PE Data	PE Model	GE Model
Group:			
Domestic	11.50	10.87	5.65
	(1.38)	(1.38)	(2.42)
Multinat. high	16.30	16.32	10.97
	(4.42)	(5.25)	(6.03)
Multinat. low	19.70	8.75	3.32
	(4.92)	(7.10)	(7.50)
Total	14.70	11.74	6.43
	(1.78)	(2.28)	(3.26)

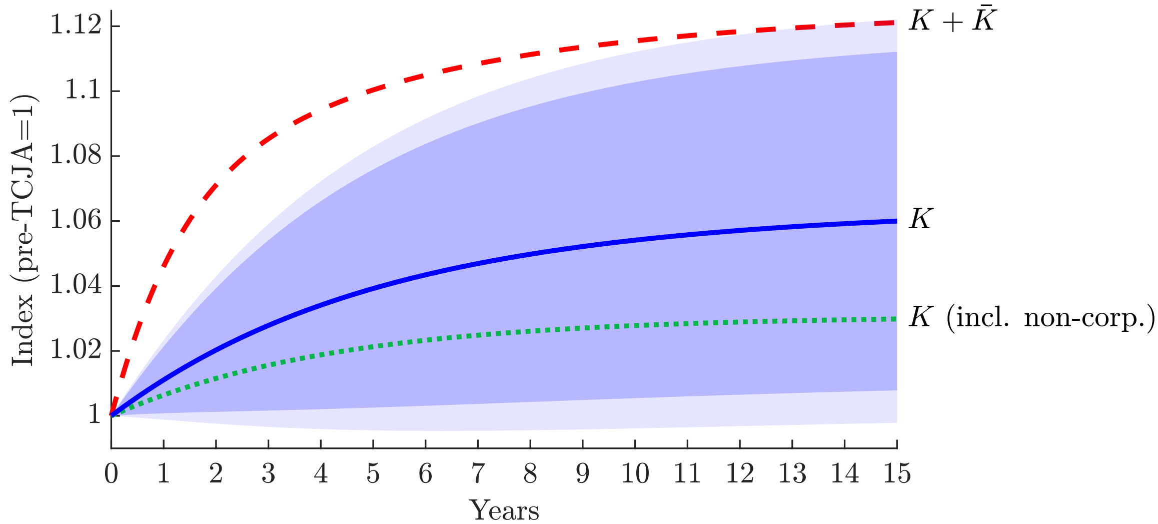
Notes: The table shows long-run changes in domestic corporate capital (or equivalently investment) for domestic-only firms, multinational firms with high foreign presence, multinational firms with low foreign presence, and in total. Column (1) directly applies the regression coefficients in Table 3, adjusted by χ_{SR}, to the tax changes by group in Appendix Table G.11. Column (2) uses the parameters estimated in Table 4 to compute the model-implied change when the aggregate economy faces perfectly elastic labor supply and the wage remains fixed. Column (3) repeats the exercise from column (2) but when the aggregate economy faces inelastic labor supply. Standard errors in parentheses are computed via the Delta method.

equation restrictions in the model. For the multinational-low group, the data response exceeds the model response, because the model's cross-equation restrictions yield parameters that imply a larger response to $\hat{\Gamma}$ and smaller response to $\hat{\tau}$ than the regression coefficients (see Table 4). The total corporate sector model-implied partial equilibrium increase in capital is 11.7%.[38]

Column (3) of Table 5 shows the general equilibrium change in domestic capital in the model, meaning when wages rise and the total supply of labor to the domestic corporate and non-corporate sector remains fixed. In general equilibrium, total corporate capital increases by 6.4% in the long-run. The general equilibrium dampening of 5.4p.p. relative to partial equilibrium stems from an increase in the domestic wage of about 0.9% in the long run. At the 2019 level of compensation per full-time equivalent of $81,900, a 0.9% increase corresponds to roughly $750.

[38] We compute standard errors for the model partial and general equilibrium values in Table 5 and Figure 6 using the parameter covariance matrix and the Delta method. These standard errors therefore account for sampling variation in the target moments of the parameter estimation. Specifically, let the superscripts D, H, L refer to parameters estimated for the domestic, multionational-high, and multinational-low firms, respectively, and define the full parameter vector as $\theta \equiv \{\alpha^D, \alpha^H, \sigma^H, a^H, \bar{a}^H, \chi_K^H, \alpha^L, \sigma^L, a^L, \bar{a}^L, \chi_K^L\}$. For each parameter $\theta_p \in \theta$, we recompute K/K_0 replacing θ_p with $\theta_p^+ = \theta_p + \epsilon$ and with $\theta_p^- = \theta_p - \epsilon$ and define the Jacobian $J(p) = \left(K^*\left(\theta_p^+\right)/K_0\left(\theta_p^+\right) - K^*\left(\theta_p^-\right)/K_0\left(\theta_p^-\right)\right)/(2\epsilon)$. The variance is $J(p)'V(\theta)J(p)$, where $V(\theta)$ is the covariance matrix of the parameters computed as in Chamberlain (1982). In practice, uncertainty over σ^H accounts for about half of the confidence interval width.

Figure 6: TCJA and Model-Implied Capital



Notes: The figure shows the model-implied paths of total domestic corporate capital (solid blue line), total domestic and foreign capital of domestic corporations (dashed red line), total non-residential domestic capital including the non C-corporate sector (dotted green line), and the 90 and 95% confidence intervals for domestic corporate capital (blue regions).

The solid blue line and regions in Figure 6 plot the model-implied general equilibrium transition path of domestic corporate capital and the 90 and 95% confidence intervals. Domestic corporate capital increases by 5.9% after 15 years. The transition path implies C-corporation investment higher by 10.2% two years after TCJA. Total non-residential investment in the model (dotted green line), which includes the non C-corporate sector, increases by 3.0% after 15 years, with investment higher by 5.7% two years after TCJA. Appendix A shows that actual non-residential investment in 2019:Q4 exceeded both time series and professional forecasts by roughly 6p.p., suggesting that our model contains a reasonable no-TCJA counterfactual.

The dashed red line in Figure 6 shows the path of total domestic and foreign capital owned by the domestic corporate sector. This measure corresponds to total capital in a data set such as Compustat that does not separate domestic from foreign capital. Total capital owned by domestic firms rises by proportionately more than domestic capital, primarily due to the strong incentive in the GILTI rule for firms to accumulate foreign capital.

7.2 General Equilibrium Intuition

We illustrate what disciplines the degree of general equilibrium dampening using a simplified version of our model with domestic-only firms. In steady state, each firm solves:

$$\max_{K,L} (1-\tau)\left(AK^{\alpha_K} L^{\alpha_L} - P^L L\right) - (1-\Gamma)(\rho+\delta)K.$$

Optimizing the choice of labor as in equation (3) yields the concentrated objective of $\max_K (1-\tau) ZK^{\alpha} - (1-\Gamma)(\rho+\delta)K$, where $\alpha = \frac{\alpha_K}{1-\alpha_L}$ and $Z \propto \left(A/\left(P^L\right)^{\alpha_L}\right)^{\frac{1}{1-\alpha_L}}$. Taking the first order condition, the long-run change in capital is:

$$k = \frac{(\hat{\Gamma}-\hat{\tau})+z}{1-\alpha} = \frac{(\hat{\Gamma}-\hat{\tau}) - \left(\frac{\alpha_L}{1-\alpha_L}\right)p^L + \left(\frac{1}{1-\alpha_L}\right)a}{1-\alpha}. \tag{25}$$

In partial equilibrium, firms take the wage P^L as fixed; the common component of k of $\left(\frac{\alpha_L}{1-\alpha_L}\right)p^L$ is absorbed by the constant term in the cross-firm regression.

In general equilibrium with fixed aggregate labor supply, the wage rises. Rather than solve directly for wage growth p^L, we re-characterize the firm's problem when all firms face the same change in taxes. In the symmetric equilibrium, each firm also effectively faces a fixed supply of labor. The optimization problem then becomes $\max_K (1-\tau)AK^{\alpha_K} - (1-\Gamma)(\rho+\delta)K$. Taking the first order condition, the long-run general equilibrium change in capital is:

$$k = \frac{(\hat{\Gamma}-\hat{\tau})+a}{1-\alpha_K}. \tag{26}$$

The difference between the partial and general equilibrium elasticity of capital to $(\hat{\Gamma}-\hat{\tau})$ is therefore whether α or α_K appears in the denominator of equations (25) and (26).[39]

The cross-firm partial equilibrium investment response (along with χ_{SR}) identifies $\alpha \approx 0.7$ (Table 4), which governs the overall returns to scale in the earnings function. Using $\alpha_K = (1-\alpha_L)\alpha$ and the calibrated labor share of revenue $\alpha_L = 0.65$ then yields $\alpha_K \approx 0.25$, giving a general equilibrium elasticity of roughly 1.33. Applying this elasticity to the average user cost change of 4.1% implies an increase in the capital stock of roughly 5.4%. Our quantitative model differs from this simpler version by incorporating multinational firms, foreign tax changes, and heterogeneous changes in taxes across firms. Nonetheless, the simpler version illustrates how

[39] Allowing for part of the diminishing returns to scale in the earnings function to come from a gross markup $\mathscr{M}$ does not change equation (25). In equation (26), the production function elasticity of capital $\mathscr{M}\alpha_K$ replaces the revenue share of capital α_K in the denominator, since in the symmetric equilibrium all firms keep the same market share.

the cross-firm evidence disciplines the general equilibrium calculation by pinning down the total returns to scale in the production function.

7.3 Tax Revenue

Determining the implications for domestic tax revenue requires an accounting beyond simply the marginal tax rates that govern the investment decision. With obvious notation shorthand (e.g., $F_t = F\left(K_t, \bar{K}_t; Z_t\right)$), we define domestic corporate tax revenue as:

$$T_t = \tau_t \left(F_t - \Phi_t - B_0\right) - \Gamma_t^s I_t + 0.375\tau_t^s \times \xi \times 0.1K + \mathbb{I}\left\{\text{GILTI}\right\}\left(0.105 - 0.8\bar{\tau}^s\right)\left(\bar{F}_t - 0.1\bar{K}_t\right). \tag{27}$$

The first term is the product of the domestic marginal tax rate and the tax base gross of depreciation allowances, where B_0 denotes a lump-sum deduction that incorporates credits and deductions inframarginal for determining investment and is calibrated to match the pre-TCJA average tax rate in each portfolio of firms (see Appendix C). The second term subtracts depreciation allowances, which requires distinguishing the present value of allowances Γ_t^s from the FDII component $0.375\tau_t^s \times \xi \times 0.1/(\rho+\delta)$, where $\tau_t^s = \tau_t/(1-0.375\xi)$ denotes the ex-FDII domestic marginal tax rate. The third term corrects for the FDII deduction not applying to income below 10% of tangible capital. The fourth term adds domestic revenue from GILTI, with $\bar{\tau}^s$ denoting the average ex-GILTI foreign tax rate among GILTI payers of 7%.

The total effect of the TCJA's corporate provisions on corporate tax revenue combines two forces: (i) the mechanical revenue effect of the tax changes holding the capital stock fixed, and (ii) the revenue consequences of the dynamic changes in capital induced by the law:

$$\begin{aligned}
T_t - T_0 = &\Big[\left(\tau_t - \tau_0\right)\left(F_0 - B_0\right) - \left(\Gamma_t^s - \Gamma_0\right) I_0 + 0.375\tau_t^s \times \xi \times 0.1K_0 \\
&+ \mathbb{I}\left\{\text{GILTI}\right\}\left(0.105 - 0.8\bar{\tau}_t^s\right)\left(\bar{F}_0 - 0.1\bar{K}_0\right)\Big] \text{ (Mechanical)} \\
&+ \Big[\tau_t\left(F_t - \Phi_t - F_0\right) - \Gamma_t^s\left(I_t - I_0\right) + 0.375\tau_t^s \times \xi \times 0.1\left(K_t - K_0\right) \\
&+ \mathbb{I}\left\{\text{GILTI}\right\}\left(0.105 - 0.8\bar{\tau}_t^s\right)\left(\bar{F}_t - \bar{F}_0 - 0.1\left(\bar{K}_t - \bar{K}_0\right)\right)\Big] \text{ (Dynamic)}.
\end{aligned}$$

Panel A of Figure 7 reports the mechanical, dynamic, and total revenue changes in years 1, 5, and 10 post-reform as well as the 10 year average, expressed as a share of no-law-change corporate revenue T_0. The mechanical decline in corporate income tax equals 41.6% of no-reform revenue and by construction does not depend on the horizon (purple bars). For comparison with the revenue estimates in Table 1, Congressional Budget Office (2017) forecast \$3.9 trillion of corporate income taxes over the 10-year 2018-2027 window in the absence of TCJA, implying a mechanical reduction of \$1.62 trillion.[40]

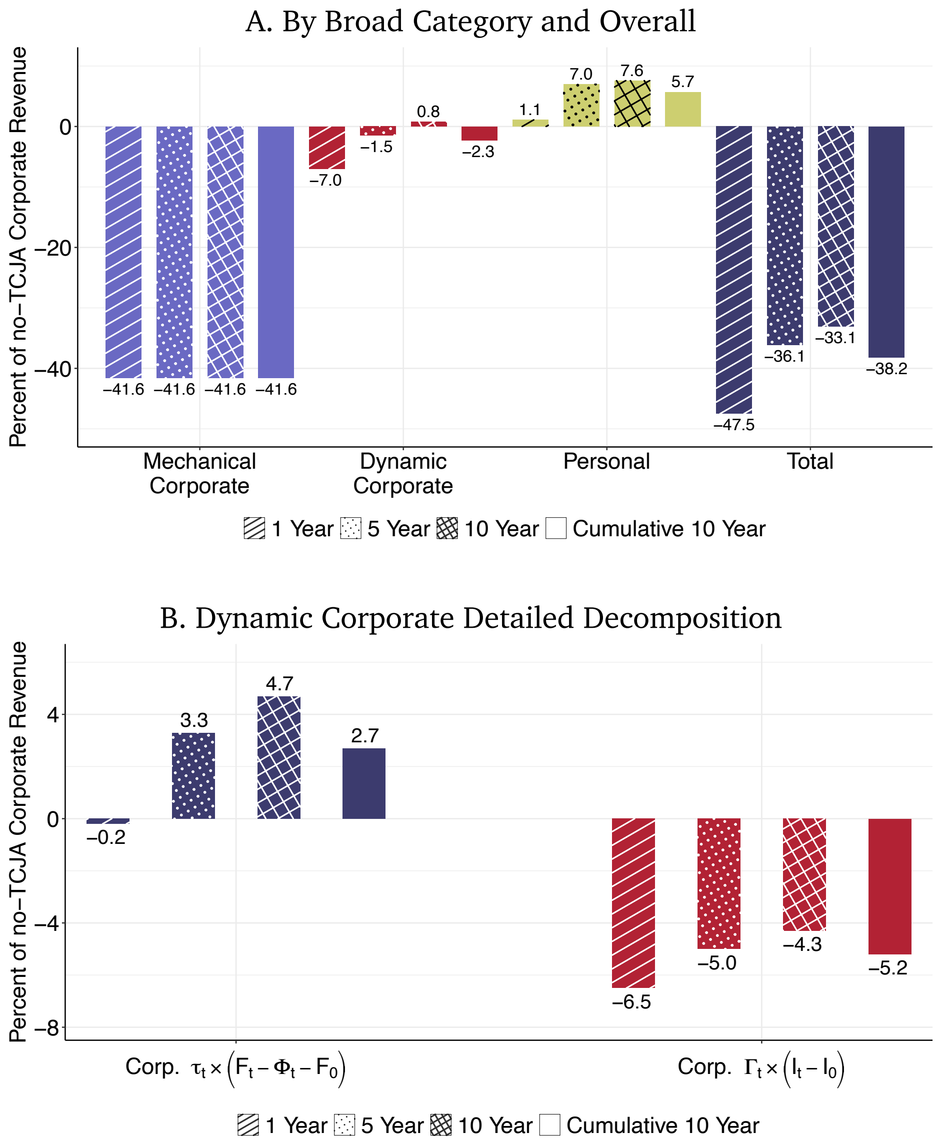
The dynamic response of corporate taxable income further reduces corporate tax revenues by 6.9% of T_0 in year 1 and switches to a small offset of less than 1% by year 10 (red bars). Panel B separates the dynamic corporate response into the two largest components, the part due to the change in the base gross of deductions, $\tau_t (F_t - \Phi_t - F_0)$, and the part due to the change in investment, $\Gamma_t^s (I_t - I_0)$. The impact reduction in dynamic corporate tax revenue occurs because capital does not jump at the time of the law change, leaving F_t unchanged initially, but the immediate increase in investment incurs adjustment costs that depress taxable income (left bars) and also increases depreciation deductions (right bars). Higher capital quickly overcomes the adjustment costs and the effect on taxable income gross of depreciation deductions turns positive and by itself would result in higher tax revenue of 3.2% in year 5 and 4.7% in year 10. However, the negative revenue impact of higher depreciation persists and offsets the revenue increase from higher gross income even in the medium run.[41]

In addition to corporate tax revenue, personal income taxes also change, as shown in the yellow bars in Panel A of Figure 7. The change in personal income taxes occurs for two reasons. First, the general equilibrium change in the wage increases labor tax revenue by $\tau^L \left(p_t^L - p_0^L\right) L_0$, which we evaluate at the pre-TCJA 2007-16 average marginal labor tax rate of $\tau^L = 0.28$ (Congressional Budget Office, 2019). Since the wage depends on the capital stock, it does not jump at the time of the law change but instead rises over time. Second, the lower corporate rate and higher capital stock increase payouts to shareholders, generating additional tax revenue of $\tau^D (D_t - D_0)$. We set $\tau^D = 0.04$, which reflects the fact that only about one half

[40]Adding together the cost estimates by the Joint Committee on Taxation (JCT) of the changes to the top corporate rate, DPAD, the AMT, NOLs, and FDII yields -\$1.54 trillion. Conceptual differences between the JCT estimates and our calculation include the timing of tax payments (our τ_t includes marginal taxes paid in future years for firms currently in loss and our Γ_t^s includes the present value of depreciation deductions, whereas JCT forecasts on a cash-flow accounting basis) as well as several elements included in the JCT static score such as the re-labeling of income, additional tax revenue from payout taxes, and changes in corporate form. Our model-implied mechanical changes should be viewed neither as affirmation nor refutation of the JCT.

[41]The explanation for a muted dynamic response of corporate tax revenue goes beyond the details of our model. Consider a domestic firm with all bonus-eligible investment, so that $\Gamma = \tau$ post-TCJA. Absent adjustment costs, this firm chooses K to maximize $(1-\tau)\left(F(K) - (\rho+\delta) P^K K\right)$, giving $K^* = (\alpha/(\rho+\delta))^{1/(1-\alpha)}$. In addition to illustrating the well-known result (Hall and Jorgenson, 1971) that when $\tau = \Gamma$ changes in taxes do not distort capital, this result also implies that the elasticity of long-run corporate revenue $\tau K^\alpha - \Gamma \delta K$ to K is $\alpha\rho/(\rho + (1-\alpha)\delta)$, which equals about 0.4 at our parameter values. While we are not aware of other estimates of the dynamic revenue effects of corporate tax and depreciation changes in isolation, Joint Committee on Taxation (2017, footnote 8) notes the offsetting revenue impacts of higher depreciation allowances when they discuss their dynamic scoring methodology: "The extension of bonus depreciation in the bill is an important contributor to increased investment incentives created by the bill. Because of the more generous deduction created for new investment by this provision, the increased investment reduces the taxable base during the time period when this provision is in force, thus reducing the amount of revenue feedback associated with the increase in GDP."

Figure 7: Revenue Effects by Component over Various Horizons



Notes: Panel A shows the mechanical corporate (purple bars), dynamic corporate (red bars), personal (yellow bars), and total (blue bars) revenue effects of the TCJA corporate provisions in years 1, 5, and 10 after the TCJA as well as the cumulative effect over 10 years. Panel B decomposes the dynamic corporate response into the part coming from changes in taxable income gross of depreciation allowances (blue bars) and the part coming from changes in investment (red bars). The bars in Panel B do not exactly sum to the red bars in Panel A because they omit the dynamic effects of FDII and GILTI.

of C-corporation shares are held by taxable entities (Rosenthal and Burke, 2020) and the preferential tax rate on dividend and capital gains income (Cooper et al., 2016).[42] Offsetting this

[42] We use a 12.1% average marginal payout tax rate for taxable domestic accounts (25% of payouts) and a 16.8% average withholding tax rate on dividends paid to foreign owners (25% of ownership, 45% of which is subject to withholding). Following Cooper et al. (2016), 50% of payouts are dividends. We treat all payouts as

gain, payouts to owners of pass-throughs decrease due to higher labor costs, which we evaluate at a 20% rate. In combination, higher personal taxes offset 7.7% of the corporate revenue decline in year 10.

Overall, the dynamic revenue response and higher personal taxes over the first 10 years offset 3.4% of pre-TCJA corporate revenue. As a result, the total revenue effect closely mirrors the mechanical corporate effect. After year 10 these additional changes close roughly 20% of the mechanical revenue decline.

Table 6 decomposes the 10 year revenue changes by major provision and compares the "cost-per-unit-of-capital".[43] Changes to the METR have the largest effect on K but also cause the largest reduction in tax revenue, with a unit cost of 10.0% of baseline revenue per year per additional 1p.p. of capital. Expensing has much lower cost-per-unit-of-capital, reflecting that it applies only to new investment while the corporate rate reduction also affects income accruing to the existing capital stock. GILTI raises revenue in addition to increasing domestic capital. This result follows because of complementarity; had we instead estimated substitution between domestic and foreign capital, GILTI would have raised revenue but reduced domestic capital. Appendix Table G.12 shows that these conclusions on the relative cost-per-capital of different provisions hold when extending the horizon to year 30. Appendix Table G.13 shows that the 10 year revenue decline diminishes by roughly 10% with phase-out of bonus expensing, although the effect on the capital stock also diminishes in this scenario.

7.4 Robustness

Table 7 shows how our conclusions vary with alternative model assumptions. The table reports four outcomes: the percent change in domestic C-corporation investment two years after the policy, the percent change in the C-corporate capital stock after 10 years, the percent change in the wage after 10 years, and the percent change in tax revenue over the first 10 years relative to pre-TCJA corporate revenue. The first row reproduces our baseline model output.

Rows 2 and 3 consider changes in the discount rate that cause general equilibrium dampening. Row 2 parameterizes the interest rate sensitivity using a semi-elasticity of savings to the interest rate of 50 (Moll, Rachel and Restrepo, 2022), causing the discount rate to slowly rise toward a value roughly 5 basis points higher in the new steady state. Row 3 instead parameter-

going to equity holders. See Moore and Pecoraro (2021) for further discussion. Marginal tax rates and the share subject to withholding come from Office of Tax Analysis (2015) and IRS published statistics (`https://www.irs.gov/statistics/soi-tax-stats-foreign-recipients-of-us-income-statistics`).

[43]The expensing column also includes the effect of the FDII 10% threshold, which amounts to an additional tax change of 37.5% × the marginal rate × the export share × 10% of domestic tangible capital.

Table 6: 10 Year Revenue Effects

	Percent of no-TCJA corporate revenue			
	METR only	Exp. only	GILTI only	Total
1. Mechanical corporate	−39.0	−3.5	0.0	−41.6
2. Dynamic and personal	2.2	−1.0	1.4	3.4
3. Total	−36.8	−4.5	1.4	−38.2
4 (memo): Year 10 K (%)	3.7	1.8	0.6	5.4
5 (memo): (3)/(4)	−9.9	−2.5	2.5	−7.1

Notes: The table shows the present value of total corporate and personal income tax changes for changes to the METR only, to expensing only, to GILTI only, and for all tax changes simultaneously, expressed as a share of no-TCJA steady state corporate revenue. Row 1 shows the corporate revenue effects of changes in $\Gamma, \bar{\Gamma}, \tau, \bar{\tau}$ holding K and $\bar{K}$ fixed at their no-TCJA level. Row 2 shows the revenue effects of changes in K and $\bar{K}$ evaluated at the TCJA tax rates and of payout taxes. Rows 3 shows overall revenue effects in the 10 year window. Row 4 shows the percent increase in domestic capital after 10 years.

izes the interest rate change as a one-time permanent increase at date 0 using a sensitivity of 2.0 basis points per percentage point of federal debt (Neveu and Schafer, 2024; Mian, Straub and Sufi, 2022) applied to the cumulated ten year deficit of 0.65% of GDP in Joint Committee on Taxation (2017). In both scenarios, investment and capital respond modestly less than in the baseline. Of course, firms may pay less attention to small changes in interest rates versus large changes in corporate taxes (Gormsen and Huber, 2023).

Row 4 incorporates an upward-sloping supply of capital goods (Orchard, Ramey and Wieland, 2023). Like an increase in the discount rate, higher capital goods prices increase general equilibrium dampening. However, the most recent evidence on the supply elasticity of capital goods does not find any price response even at short horizons (House, Mocanu and Shapiro, 2022), and we would expect if anything a smaller response at longer horizons.

Rows 5 and 6 incorporate forces that reduce dampening. In partial equilibrium, a higher markup dampens the response of investment to taxes for any given level of the returns to scale in the production function, because it makes the firm's revenue function slope downward more steeply. However, we directly recover the revenue function curvature α. Fixing this parameter, a higher markup implies less diminishing returns to scale in production, which governs the general equilibrium response (see footnote 39). Thus, attributing part of the concavity of the revenue function to markups results in a higher response of capital in row 5. Likewise, allowing in row 6 for a positive uncompensated labor supply of 0.2 (Congressional Budget Office, 2012) yields less general equilibrium dampening than in our baseline.

Table 7: Robustness to Other GE Features

Feature	I_2	K_{10}	P^L_{10}	$(1/10)\int_{h=0}^{10} \text{Taxes}_h dh$
1. Baseline	10.3	5.4	0.8	−38.2
Additional GE forces				
2. Savings semi-elasticity = 50	9.6	5.0	0.7	−38.3
3. Discount rate $\rho \uparrow$ 13 b.p.	8.0	4.3	0.5	−38.2
4. Investment supply elasticity = 5	8.1	4.6	0.6	−39.0
5. Markup $\mathscr{M} = 1.25$	10.7	5.7	1.1	−36.8
6. Labor supply $\nu_L = 0.2$	10.5	5.5	0.8	−37.6
Bonus phase-out				
7. Unexpected bonus phase-out	10.3	4.1	0.6	−36.3
8. Anticipated bonus phase-out	11.4	4.7	0.7	−35.7
Alternative χ_{SR}				
9. $\chi_{SR} = 1.8$	10.6	5.1	0.7	−37.8
10. $\chi_{SR} = 1.0$	9.6	5.6	0.9	−38.4
GILTI payers' $\hat{\hat{\tau}} \neq 0$				
11. $\hat{\hat{\tau}} = +0.05$	9.6	5.0	0.7	−38.6
12. $\hat{\hat{\tau}} = -0.05$	10.4	5.5	0.8	−37.7

Notes: The column labeled I_2 shows the percent change in domestic corporate investment after 2 years. The column labeled K_{10} shows the percent change in the domestic corporate capital stock after 10 years. The column labeled P^L_{10} shows the percent change in the domestic wage after 10 years. The final column shows the 10 year average percent change in revenue relative to pre-TCJA corporate revenue. Row (1) repeats our baseline calibration. Row (2) sets $\rho_t = \rho_0 + \ln\left(\tilde{K}_t/\tilde{K}_0\right)/50$, where $\tilde{K}$ denotes total business capital including the non-corporate sector. Row (3) assumes ρ jumps by 13 basis points at date 0. Row (4) sets $P^K_t = \left(\tilde{I}_t/\tilde{I}_0\right)^{1/5}$. Row (5) sets the markup $\mathscr{M} = 1.25$. Row (6) sets the uncompensated labor supply elasticity $\nu^L = 0.2$. Row (7) assumes unexpected phase-out of bonus depreciation. Row (8) assumes firms expected phase-out of bonus depreciation. Row (9) assumes a higher ratio of short-to-long-run capital of $\chi_{SR} = 1.8$. Row (10) assumes a lower ratio of short-to-long-run capital of $\chi_{SR} = 1.0$. Row (11) assumes the foreign marginal keep rate $1 - \bar{\tau}$ for GILII payers increases by 5%. Row (12) assumes the foreign marginal keep rate $1 - \bar{\tau}$ for GILII payers decreases by 5%. The results in rows (9)-(12) are based on re-estimated parameters.

Rows 7 and 8 explore the importance of our baseline assumption that 100% bonus depreciation would become a permanent feature of tax policy (Appendix Figure F.4 plots the dynamic response). Row 7 assumes firms did not expect phase-out but it occurs anyway. This scenario results in the same short-run behavior by construction but a lower terminal capital stock. Row 8 assumes that firms expected phase-out of expensing as written into the TCJA law. In the short run, these expectations increase investment and capital relative to the permanent case because the intertemporal substitution toward investment in periods with higher expensing outweighs the dampening effect of a lower terminal capital stock. By year 10, capital is slightly below the baseline case.[44]

Rows 9 and 10 report robustness to higher and lower values of χ_{SR}, where for each alternative value we re-estimate the other model parameters. These changes do not substantially affect aggregate investment in the short-run. Intuitively, our data contain the short-run firm-level response, making this horizon relatively insensitive to χ_{SR} even in general equilibrium. It follows that the long-run capital response roughly scales with χ_{SR}. However, even at year 10 the capital stock and wage are relatively insensitive to the precise value, which also highlights the difficulty of calibrating adjustment costs to match impulse response dynamics.

Finally, rows 11 and 12 consider alternative assumptions for the change in the foreign marginal tax rate. Row 11 re-estimates the model parameters and computes the general equilibrium objects under the condition that the change from global taxation with deferral and firm expectations of a repatriation holiday to the GILTI regime increased the foreign marginal tax rate for GILTI payers.[45] Row 12 reports the same exercise but under the assumption that the foreign marginal tax rate fell. These alternative assumptions change the model parameters; for example, an increase in $\bar{\tau}$ implies lower foreign capital accumulation and hence requires greater complementarity to rationalize why domestic investment increased for GILTI payers, so σ falls and α rises. However, whether the domestic investment response in the data arises from less foreign capital accumulation and greater complementarity or vice versa, the implications for domestic investment, capital, and wages remain relatively unchanged.

8 Conclusion

This paper combines administrative tax data and a model of global investment behavior to investigate the effects of the TCJA—the largest corporate tax cut in U.S. history—on the level and location of investment and capital. The model characterizes four channels through which this tax policy affected investment: domestic and foreign cost-of-capital subsidies and domestic and foreign corporate tax rates. Both domestic and foreign investment of U.S. multinationals increased due to the TCJA, with the increase in domestic investment larger both at firms experiencing more favorable domestic tax changes as well as at firms with larger incentives to accumulate foreign capital. Our model interprets the latter increase as evidence of comple-

[44] The changes in rows 2-7 do not affect the identification of parameters, which does not depend on general equilibrium forces. Anticipation of bonus phase-out would affect parameter identification and in particular would break the common-scaling assumption. For comparability with row 7, row 8 reports the effects of anticipated phase-out holding the parameters fixed at their baseline values.

[45] The 5% increase is effectively an upper bound given that GILTI payers pay an average rate of 7% to foreign governments.

mentarity between domestic and foreign capital in production. Overall, we estimate a long-run increase in domestic corporate capital of 6.4% due to the TCJA's corporate provisions.

Despite the dynamic response of capital, the model produces small dynamic revenue effects. While higher investment increases corporate income and labor payments, the extra tax revenue from this activity is offset by the higher cost of depreciation deductions, which can be immediately expensed in the years following the enactment of the tax reform. Consequently, the total effect on corporate tax revenue is close to the mechanical effect, which is large given the 14-percentage-point tax rate cut and immediate expensing.

Our quantitative model enables an analysis of other policy counterfactuals. We decompose the effect of the reform into its constituent parts, such as expensing, lower rates, and international provisions, but much more can be done. For example, future research might extend our approach to consider other policy proposals such as a global minimum tax, country-by-country provisions, or other reforms.

A second avenue for further research concerns the consequences of the TCJA beyond our primary focus on tangible capital accumulation. Much more could be done to understand the effects of the TCJA's provisions on research and development (R&D), including the transition from expensing to amortization. Likewise, more work could be done using administrative data to assess whether the TCJA affected profit-shifting behavior by both U.S. multinationals and foreign multinationals with a U.S. presence.

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