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TAX POLICY AND INVESTMENT IN A GLOBAL ECONOMY

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ABSTRACT

We evaluate the 2017 Tax Cuts and Jobs Act. Combining reduced-form estimates from tax data with a global investment model, we estimate responses, identify parameters, and conduct counterfactuals. Domestic investment of firms with the mean tax change increases 20% versus a no-change baseline. Due to novel foreign incentives, foreign capital of U.S. multinationals rises substantially. These incentives also boost domestic investment, indicating complementarity between domestic and foreign capital. In the model, the long-run effect on domestic capital in general equilibrium is 7% and the tax revenue feedback from growth offsets only 2p.p. of the direct cost of 41% of pre-TCJA corporate revenue.

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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 even whether it would pay for itself.[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 20% relative to firms experiencing no change. Second, novel international tax provisions that incentivized 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, the long-run effects of the TCJA on domestic and total capital are 7% and 13%, respectively. Finally, higher depreciation deductions largely offset additional labor and corporate tax revenue from capital accumulation. As a result, the total effect on tax revenue over ten years, which includes dynamic feedback from growth, is within 2p.p. of the mechanical effect of a 41% decline in corporate tax collections.

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 and the model collapses to the canonical framework for domestic-only firms. The foreign tax terms accommodate the novel, more opaque changes to the international tax regime. We linearize the model across steady-states to derive an estimating equation that characterizes the investment elasticity to the changes 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 α, σ, a, and $\bar{a}$ that govern the returns-to-scale in capital, the elasticity of substitution between domestic and foreign capital, and the relative importance of each source of capital in local profits.

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 empirical 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, credits, and the cap on total General Business Credits (GBCs). We construct new firm-level marginal effective tax rates (METRs) with and without TCJA as the additional present value of taxes paid when taxable income in a year rises by a marginal amount, 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 increases mainly because of the change to full 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, we also 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.

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 incentivizes firms to increase foreign capital, which in turn causes domestic capital to increase when domestic and foreign capital are complements in production. We report several robustness exercises that address concerns with the specification, such as testing for pre-trends; including detailed industry fixed effects; or controls for the "trade war," firm size, lagged investment, profit shifting, and toll taxes.

The estimated elasticities 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 regression coefficients 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 characterize and verify conditions under which all tax elasticities scale by the same ratio, which we call χ_{SR} and externally calibrate. The theory then dictates that the coefficients on τ and Γ have opposite signs of equal magnitude in the sample of domestic-only firms, 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 multinational firms, we show analytically that the regression coefficients together with the pre-TCJA ratios of foreign-to-domestic capital and profits jointly identify the structural parameters. The estimated parameters have reasonable values: α ranges from 0.66 to 0.76, implying returns-to-scale in the revenue function of roughly 0.9, σ ensures sufficient complementarity between local and foreign capital for the firms with large overseas operations, and a implies that domestic earnings depend overwhelmingly on domestic rather than foreign capital.

We use the estimated model to quantify the response of corporate capital in general equilibrium, to disentangle which parts of the reform mattered most to investment, and to assess the revenue consequences. We first provide a nearly "model-free" quantification of the effect on corporate capital in partial equilibrium. We form several "portfolios" of firms based on their domestic/multinational status and pre- and post-TCJA tax rates. We then use the regression coefficients, tax rate changes, initial capital levels, and χ_{SR} to compute a regression-implied steady state increase in domestic corporate capital due to TCJA of 16%. However, because this exercise ignores the regression intercept, it omits any changes, such as in wages, that affect all firms. Performing the analogous exercise with a fixed wage in the model yields a model-implied partial equilibrium increase in capital of 13%.

The first main quantitative result from the model is a general equilibrium long-run increase in domestic corporate capital of 7.2%. 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 95% confidence interval taking account of the estimation uncertainty around the parameters excludes an increase in capital of less than 1.9% or greater than 12.5%. 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. Total capital owned by domestic firms rises by 13%, which reflects the incentive in the GILTI rule for firms to accumulate foreign capital.

Our second quantitative result evaluates the effect of several major provisions in isolation. The changes to the METR by themselves deliver an increase in domestic capital of about 3.5% after 15 years. The expensing provisions and GILTI on their own increase capital by about 2% and 1%, respectively. While changes to the tax rate have the largest effect on capital accumulation, they underperform expensing and GILTI on a bang-for-buck basis. In comparison to permanent expensing, phase-out of expensing has a similar effect on investment in the short run but materially reduces capital accumulation in the long run.

The third main quantitative model result is to estimate the tax revenue consequences.[3] Applying the change in tax policy to the pre-TCJA steady state in our model yields a mechanical reduction in corporate revenue of 41%. The dynamic response of corporate taxable income reduces corporate tax revenues initially due to increased adjustment costs and larger depreciation deductions. Over time, higher profits from capital accumulation offset these forces. However, because the negative revenue effect of higher depreciation deductions persists, total dynamic corporate revenue is negative over the first 10 years and remains below 1% of pre-TCJA revenue thereafter. Labor income and hence labor tax revenue increase as the cap-

[3]This exercise is not intended to serve as a formal dynamic score of the reform because we leave unmodeled several response margins and components of the reform (e.g., the individual tax provisions).

ital stock grows, as do personal income taxes on payouts from the corporate sector. Together these add additional revenue by year 10 of 6% of pre-TCJA corporate tax revenue. Averaged over the first ten years, the personal income tax gains only modestly outweigh the dynamic corporate reductions, leaving a fall in total corporate tax revenue of the same magnitude as the mechanical effect. In the longer run, the dynamic effects mitigate the revenue loss but still leave a decline of roughly one-third of pre-TCJA tax revenue.

We provide auxiliary validation of these results using multiple data sets. First, we directly test the foreign capital implications using tax data on the subsidiaries of U.S. multinationals. In both the data and the estimated model, the GILTI regime causes U.S. multinational firms to increase their foreign capital in the first two years following the law change by an additional 10–18%. The foreign capital response is concentrated in OECD and developing economies rather than tax havens.

Second, we validate our investment findings using an alternative approach with a non-US-based comparison group. We synthetically match publicly-traded U.S. firms to similar foreign firms using Compustat data and compare the evolution of investment before and after the TCJA. Investment at publicly-traded U.S. firms increases by around 15% relative to the control group in the first two years after the reform. This magnitude is smaller than but inside the confidence interval of the change in global investment by U.S. corporations in our model and could reflect differences in measurement of M&A activity. We corroborate the synthetic control results in several ways: backdating, using Canadian firms and the same method in a placebo analysis, leaving out groups of foreign countries from the set of comparison countries, and controlling directly for contemporaneous tariff shocks in the manufacturing sector.

Finally, we ask whether firms with more exposure to the reform saw higher stock market returns during the time period between the 2016 presidential election through passage in late 2017. We sort firms based on their predicted investment response using our reduced-form empirical estimates and map this fitted value into the model to derive predicted changes in firm value across steady states. The results provide strong evidence that stock returns incorporated the expected benefits of the reform. A long-short portfolio using predicted investment yields excess cumulative returns of around 10%, and a regression of the actual return on the predicted cross steady state change yields coefficients in the ballpark of those generated by our model.

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, Gelfond, Krupkin, Mazur and Toder, 2019; Clausing, 2020) or SEC filings from public firms (Hanlon, Hoopes and Slemrod, 2019). Garcia-Bernardo, Janský and Zucman (2022) use aggregate data and public filings to study the effect on profit shifting.[4] Our measurement of the TCJA firm-level shocks using Treasury tax returns, including specific forms that identify which firms deduct FDII or pay GILTI, allows us to link these provisions to firm real outcomes. Analysis of investment outcomes in a different sample comes from Kennedy, Dobridge, Landefeld and Mortenson (2022), who exploit the variation in the domestic corporate rate cut across C-corporations and S-corporations of similar size. We estimate investment effects that are quite close to theirs, despite using a different sample of firms and different tax rate variation.[5]

Our paper broadens 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 meticulously 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 responses to the reform, aggregate effects in general equilibrium, and policy counterfactuals, and validate the model using effects on foreign capital accumulation and firm valuation.

We also contribute to the broader theoretical and empirical literature on tax policy and investment behavior.[7] We develop a structural model with multinational production and estimate the model's parameters. The overall profits elasticity of capital appears in the canonical Hall and Jorgenson (1967) framework and links our results to evaluations of past corporate tax policy changes. Our estimates fall within the range of past work but at the lower end.[8] The

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[4]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).

[5]Though they focus on wage outcomes along the income distribution, in a regression of investment relative to lagged capital on the log of the net-of-tax rate, they find a coefficient of 0.52. Our closest model is in Table E.2, which shows an effect for domestic firms of 0.52 from the log change in the domestic tax term $(\hat{\Gamma} - \hat{\tau})$.

[6]Specifically, on the domestic side we advance the literature by calculating marginal tax rates that account for both income/loss dynamics and 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, Downes, Mathis and Rapley, 2023; Krull and Wu, 2022; Samuel, 2023; Huang, Osswald and Wilson, 2023).

[7]This literature includes 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, Garrett, Ohrn, Roberts and Suárez Serrato (2021); Akcigit, Grigsby, Nicholas and Stantcheva (2021); Moon (2022).

[8]Hassett and Hubbard (2002) propose a consensus range of 0.5 to 1 for regressions of investment relative

parameters 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 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.[9] 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;

to capital on the tax term. In analogous specifications, we estimate coefficients of 0.42 (s.e.=0.08) and 0.61 (s.e.=0.15) for domestic and multinational firms, respectively. In Appendix A.12, we show how this specification relates to our model parameters.

[9] 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.

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.

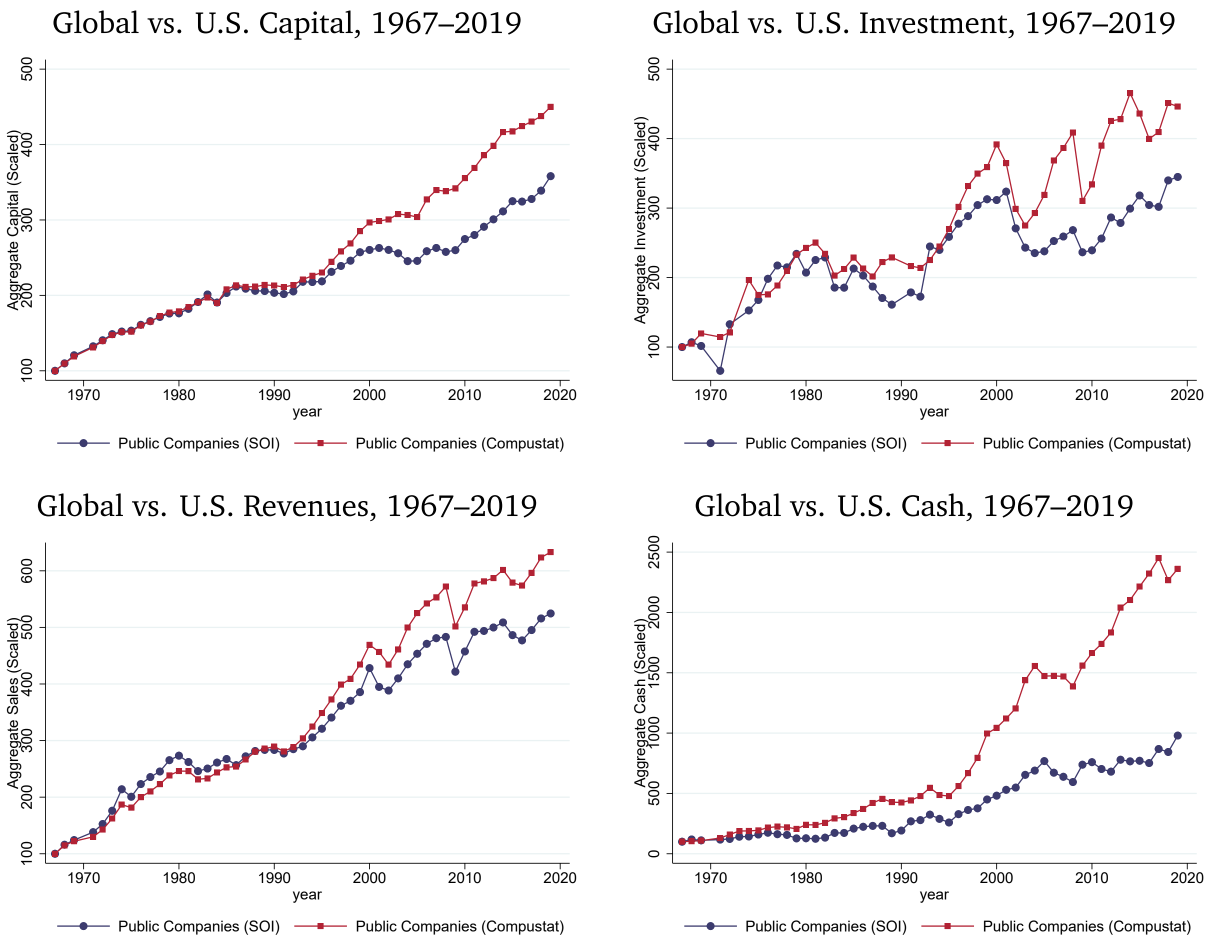
2.2 Main Corporate Provisions of the TCJA

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. The last column shows the estimated 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. In Section 7, we assess the effect of the dynamic changes in capital on revenue.

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 removing the ability of firms to carry back net operating losses (NOLs) to offset previous years' taxes; limiting the deduction from carrying forward previous years' 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.[10] Our

[10]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 (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.

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



Notes: These figures use merged Compustat–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 D.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.

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 A.8 that the FDII

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).

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. The new system replaces this worldwide approach with a territorial tax. Firms deduct the full amount of repatriated dividends from their domestic income, thereby exempting foreign profits from domestic income tax. The TCJA supplements this territorial system with a minimum tax on some foreign income, implemented via a foreign 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% ($=0.5\times21$) on its GILTI. We show in Appendix A.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), and explore sensitivity to this assumption through our quantitative model.[11] 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.[12]

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.

[11] 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.

[12] Nevertheless, we use both theoretical extensions and empirical robustness tests to show profit-shifting forces do not change our results.

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.

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 $\mathscr{M}(\alpha_{\mathscr{K}} + \alpha_L + \alpha_M) \leq 1$. 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 A.1 shows that this optimization problem results in an earnings function that depends only on capital:

$$F\left(K_t,\bar{K}_t;Z_t\right)\equiv P_tQ_t-P_t^LL_t-P_t^MM_t=Z_t\mathscr{K}_t^{\alpha}=Z_t\left(aK_t^{\frac{\sigma-1}{\sigma}}+(1-a)\bar{K}_t^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma\alpha}{\sigma-1}},\tag{3}$$

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 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: $\text{sign}\left(F_{K\bar{K}}\right)=\text{sign}\left(\alpha+1/\sigma-1\right)$. 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 A.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.

[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.

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.

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

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

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.

[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 $\zeta_t = \int_0^\infty e^{-rh} d_{h|t} dh$.

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 conditions for domestic investment and capital can be written (see Appendix A.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 $\Phi(I_t, K_t)$ 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 $\bar{K}^*$. We next totally differentiate this system to obtain 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

[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.

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

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 A.2 gives 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

[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 A.2.4. The ratio χ_R is directly a 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.

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 $k = (\hat{\Gamma} - \hat{\tau})/(1-\alpha)$. 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. 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.[17]

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 $F_{K\bar{K}} = 0$, 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.[18]

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.

We also can characterize the responses of foreign capital $\bar{k}$ and total capital $k^T = d\log\left(K + \bar{K}\right)$:

$$\bar{k} = \frac{\omega_{\bar{k},\bar{r}}\hat{\bar{\Gamma}} + \left(1-\omega_{\bar{k},\bar{r}}\right)\hat{\Gamma} - \omega_{\bar{k},\bar{\tau}}\hat{\bar{\tau}} - \left(1-\omega_{\bar{k},\bar{\tau}}\right)\hat{\tau} + \bar{\epsilon}}{1-\alpha}, \tag{19}$$

$$k^T = \frac{\omega^T_{k,r}\hat{\Gamma} + \left(1-\omega^T_{k,r}\right)\hat{\bar{\Gamma}} - \omega^T_{k,\tau}\hat{\tau} - \left(1-\omega^T_{k,\tau}\right)\hat{\bar{\tau}} + \epsilon^T}{1-\alpha}, \tag{20}$$

[17] Equation (15) nests several special cases: (i) the standard closed economy one factor model when $a = 1$, in which case domestic profits depend only on domestic capital, $\omega_{k,r} = \omega_{k,\tau} = 1$, and capital responds to the domestic "tax term" $(1-\Gamma)/(1-\tau)$ with elasticity $1/(1-\alpha)$; (ii) 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 (iii) *ex ante* symmetry with $\tau^* = \bar{\tau}^*, R^* = \bar{R}^*$, and $Z^* = \bar{Z}^*$, in which case $K^* = \bar{K}^*$ and hence $s_1 = \bar{s}_1 = s_{F_1} = s_{\bar{F}_1} = a$.

[18] 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 $\omega_{k,r}$.

where the expressions for $\omega_{\bar{k},\bar{r}}$, $\omega_{\bar{k},\bar{\tau}}$, $\omega_{k,r}^{T}$ and $\omega_{k,\tau}^{T}$ are given in Appendix A.2. The terms $\epsilon, \bar{\epsilon}$, and ϵ^{T} capture determinants of capital other than tax policy, including the foreign and domestic profit shifters z and $\bar{z}$, discount rates ρ and $\bar{\rho}$, depreciation rates δ and $\bar{\delta}$, and market prices of capital p^{K} and $p^{\bar{K}}$.

Equations (15) to (20) frame our empirical exercise. We use corporate tax returns to measure k and $\bar{k}$ 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 residuals $\epsilon, \bar{\epsilon}$, and ϵ^{T} may be correlated with changes in taxes motivates the measurement of ex ante tax shocks and robustness analysis.

3.3 Extensions

Appendix A.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. We use this result in the measurement of changes to Γ.

Appendices A.4 to A.7 extend the baseline environment. Appendix A.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 and a, and a new term arises if the user cost of intangible capital changes.

Appendix A.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 equations (15), (19) and (20) remain 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 A.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, Goodman, Isen and Smith (2024) find no investment effect of the TCJA's change in the interest limitation.

Finally, Appendix A.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 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, we 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 $X_t^D = X_t^S = X_t$. To preview, we impose an extreme but realistic calibration of the supply curves: we set $\nu_M = \nu_K = \infty$ 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 $\nu_L = 0$ in accordance with balanced growth path preferences.[19]

[19] 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 A.9 provides further details.

4 Data and Measurement of Tax Rates and Investment

This section describes the measurement of the key shock and outcome variables.

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 IRS Statistics of Income (SOI) division. 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 uses tax returns from 2011 through 2019, although we use data going back to 1993 when measuring some of the policy shocks.[20]

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 statement and balance sheet items, taxes, deductions, and credits, as well as basic firm characteristics such as industry. Form 4562 is required for a firm 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.[21] 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.

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.

[20]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.

[21]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.

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.[22] This treatment is consistent with the model extension to multiple types of investment in Appendix A.2. 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.

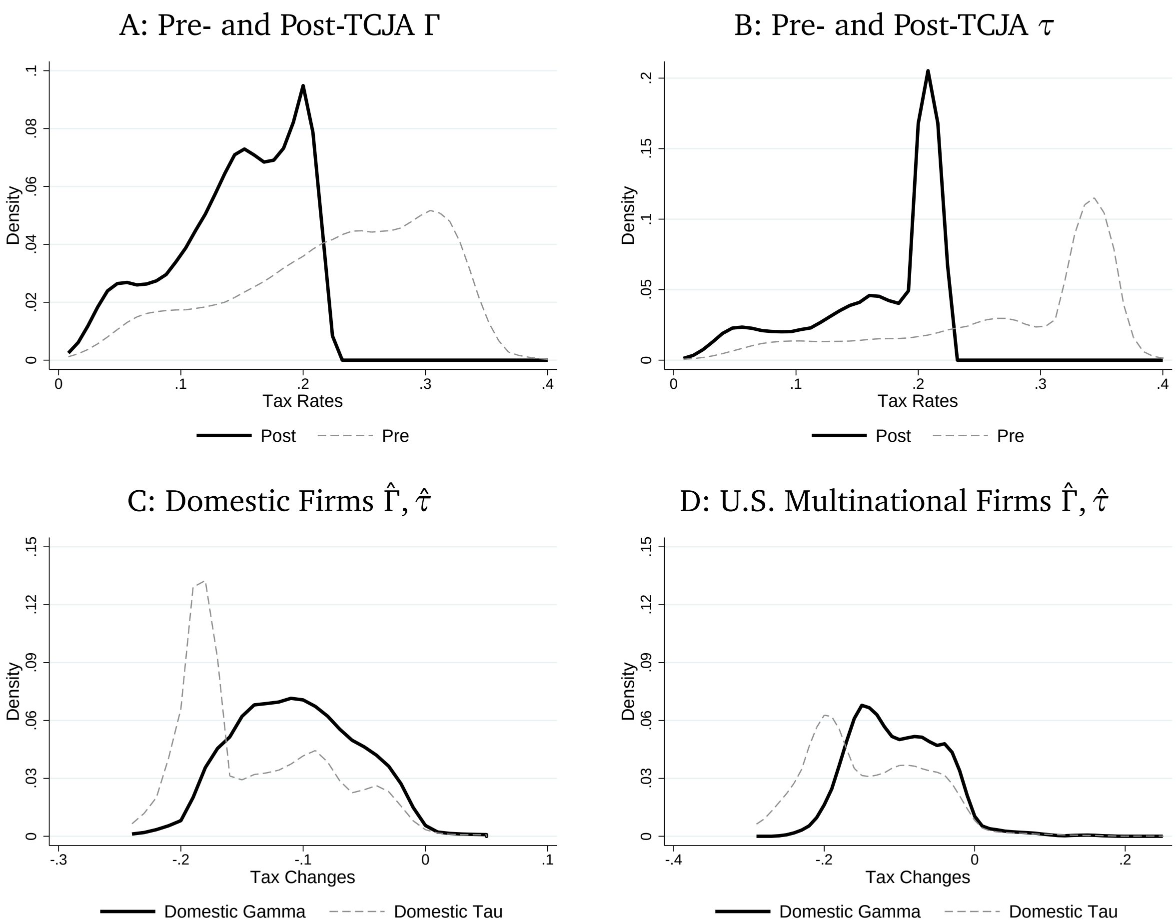
Exposure to FDII affects Γ because the FDII deduction applies to the export share of income in excess of 10% of domestic tangible capital. As a result, increasing domestic tangible capital mechanically increases income taxes by reducing the amount of the FDII deduction. Appendix A.8 incorporates FDII 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 $\Gamma_{i,t} = \tau_{i,t}\zeta_{i,t} - \tau_{i,t}^s \times \xi_i \times 0.375 \times 0.1/(\rho+\delta)$. 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.[23]

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. While these shares may relate to firm-specific technology, Curtis, Garrett, Ohrn, Roberts and Suárez Serrato (2021) argue that tax depreciation lives substantially reflect historical accident and do not closely correspond to economic depreciation. The variation in Γ further reflects the firm-specific METR and FDII-eligibility. 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.

[22] 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.

[23] Specifically, we define ξ_i as the section 250 (FDII) deduction reported on 1120 schedule C divided by $0.375\times$ taxable income (1120 line 30) less $0.1\times$ capital (1120 schedule L line 10a less 10b).

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.

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 foreign tax credit, general business credit, 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.

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 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 $\tau_{i,t} = \tau^s_{i,t}$.

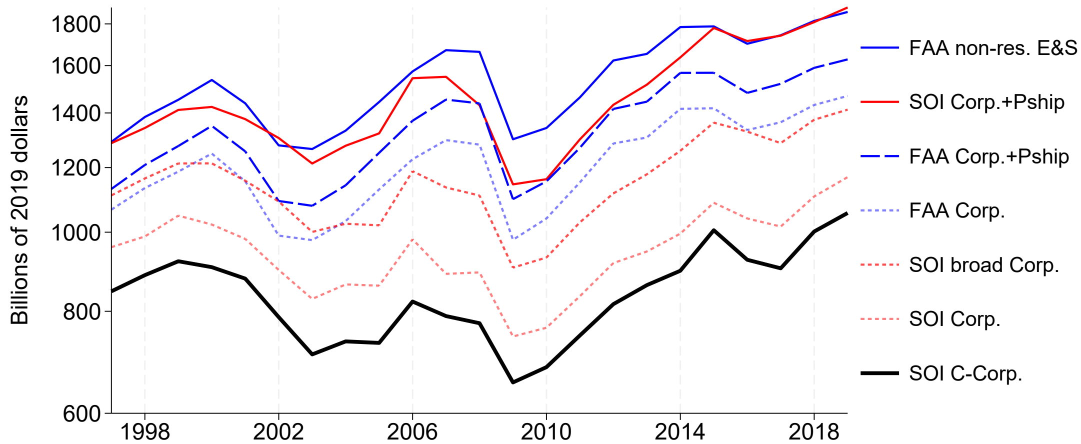
Panel B of Figure 2 plots the pre- and post-TCJA distributions of τ. Both have modes around their respective statutory rates of 35% and 21%. However, both also exhibit substantial mass below the modes, reflecting firm-specific use of deductions and credits as well as NOLs. As a result, panels C and D 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.

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 A.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.[24]

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. 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. If instead firms believed there would be another one-time "repatriation holiday" akin to the 5.25% rate allowed in 2004 under the American Jobs Creation Act (ACJA), then firms with foreign rates above the GILTI rate of 10.5% would have experienced no change in their foreign METR and firms with rates below would have experienced an increase. Our baseline METR change assumes the middle ground that firms anticipated a holiday or transition rate at the GILTI level of 10.5% (less FTCs), which in fact lies in the range of the 8% to 15.5% transition rate under TCJA (depending on a firm's asset composition). Practically, this assumption amounts to setting $\hat{\bar{\tau}} = 0$ for all firms and hence elides entirely the 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 empirical estimates will mis-attribute 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.

[24] 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 A.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 $\bar{\Gamma}$.

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.

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 by C-corporations accounted for 54% of total national accounts investment. Moreover, despite the series coming from completely separate source data, the correlation of annual changes in the logs of both series exceeds 0.7. 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 partnerships directly owned by corporations (the line labeled "SOI broad Corp." in the figure) increases the 2016 corporate share in the SOI data to 78%. 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.[25]

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 the median in the multinational sample).

The average change in the domestic composite tax term, which corresponds to $\hat{\Gamma} - \hat{\tau}$, is 4%. Appendix Tables E.13, E.14, and E.15 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.[26]

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):

$$Y_{i,t} = b_0 + b_1 \times \hat{\Gamma}_{i,t} + b_2 \times \hat{\bar{\Gamma}}_{i,t} + b_3 \times \hat{\tau}_{i,t} + b_4 \times \hat{\bar{\tau}}_{i,t} + \mathbf{b}_5' \times \mathbf{x}_{i,t} + e_{i,t}, \tag{21}$$

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.[27] We winsorize $Y_{i,t}$ at the 5% level.

[25] Such arrangements concentrate in a few industries, including utilities (NAICS 22), pipeline transportation (NAICS 486), and real estate (NAICS 531).

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

[27] 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

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	0.23	0.08	0.24	0.10	0.32	9305	0.23	0.08	0.25	0.11	0.33	7044
Pre-TCJA $\bar{\Gamma}$	0.18	0.00	0.18	0.18	0.18	9307						
Pre-TCJA τ	0.27	0.09	0.32	0.13	0.35	9307	0.28	0.09	0.33	0.14	0.35	7046
$\hat{\Gamma} - \hat{\tau}$	0.04	0.03	0.03	0.00	0.08	9305	0.04	0.03	0.03	0.00	0.08	7044
$\hat{\Gamma}$	-0.11	0.05	-0.11	-0.17	-0.03	9305	-0.11	0.05	-0.11	-0.17	-0.04	7044
$\hat{\bar{\Gamma}}$	0.02	0.05	0.00	0.00	0.14	9307						
$\hat{\tau}$	-0.14	0.07	-0.17	-0.21	-0.05	9307	-0.14	0.06	-0.17	-0.20	-0.05	7046
$d\log$(Investment)	-0.04	0.99	0.04	-1.43	1.28	9307	-0.05	1.03	0.02	-1.52	1.35	7046
Pre-TCJA χ_K	0.09	0.28	0.00	0.00	0.25	9307						
Export Share	0.07	0.20	0.00	0.00	0.28	9307						
Relative Profit	0.13	0.42	0.00	0.00	0.31	9307						
Average Tax Rate	0.05	0.06	0.02	0.00	0.13	9287	0.05	0.06	0.02	0.00	0.14	7028
Lagged Capital ($M)	380.9	2999.2	15.5	2.1	350.0	9307	250.8	2193.3	10.9	1.8	164.1	7046

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	0.22	0.08	0.24	0.09	0.31	1113	0.22	0.08	0.24	0.09	0.32	1148
Pre-TCJA $\bar{\Gamma}$	0.18	0.00	0.18	0.18	0.18	1113	0.18	0.00	0.18	0.18	0.18	1148
Pre-TCJA τ	0.25	0.10	0.28	0.10	0.35	1113	0.26	0.10	0.30	0.11	0.35	1148
$\hat{\Gamma} - \hat{\tau}$	0.04	0.03	0.04	0.01	0.08	1113	0.04	0.03	0.04	0.01	0.07	1148
$\hat{\Gamma}$	-0.10	0.06	-0.11	-0.18	-0.02	1113	-0.11	0.05	-0.11	-0.17	-0.03	1148
$\hat{\bar{\Gamma}}$	0.07	0.07	0.10	0.00	0.14	1113	0.05	0.07	0.00	0.00	0.14	1148
$\hat{\tau}$	-0.14	0.08	-0.15	-0.24	-0.03	1113	-0.14	0.07	-0.16	-0.22	-0.04	1148
$d\log$(Investment)	0.02	0.84	0.08	-1.04	1.08	1113	-0.01	0.89	0.09	-1.18	1.11	1148
Pre-TCJA χ_K	0.68	0.51	0.48	0.19	1.66	1113	0.05	0.04	0.04	0.00	0.12	1148
Export Share	0.29	0.35	0.10	0.00	0.99	1113	0.14	0.24	0.00	0.00	0.50	1148
Relative Profit	0.69	0.76	0.36	0.00	2.00	1113	0.24	0.47	0.06	0.00	0.67	1148
Average Tax Rate	0.04	0.05	0.01	0.00	0.12	1113	0.04	0.05	0.02	0.00	0.12	1146
Lagged Capital ($M)	646.8	3002.6	72.9	4.4	1138.3	1113	921.5	5850.8	46.8	4.9	1065.5	1148

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 E.12 provides a few additional summary statistics for the tax term changes.

5.1 Identification

In the next section we use the regression coefficients from specification (21) 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 from the regression. Third, our baseline specification estimates the short-run elasticities of investment to tax changes, while equation (15) characterizes the 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 (21) 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, defined as a ratio of foreign-to-domestic tangible capital, $\chi_K = \bar{K}/K$, above or below 15% (roughly the median within the multinational sample). 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 (21) estimates changes in investment on changes in taxes, causal interpretation of the estimated coefficients requires the usual difference-in-difference 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 (21) 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

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 A.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.

along this dimension as well.

5.2 Non-Parametric Evidence

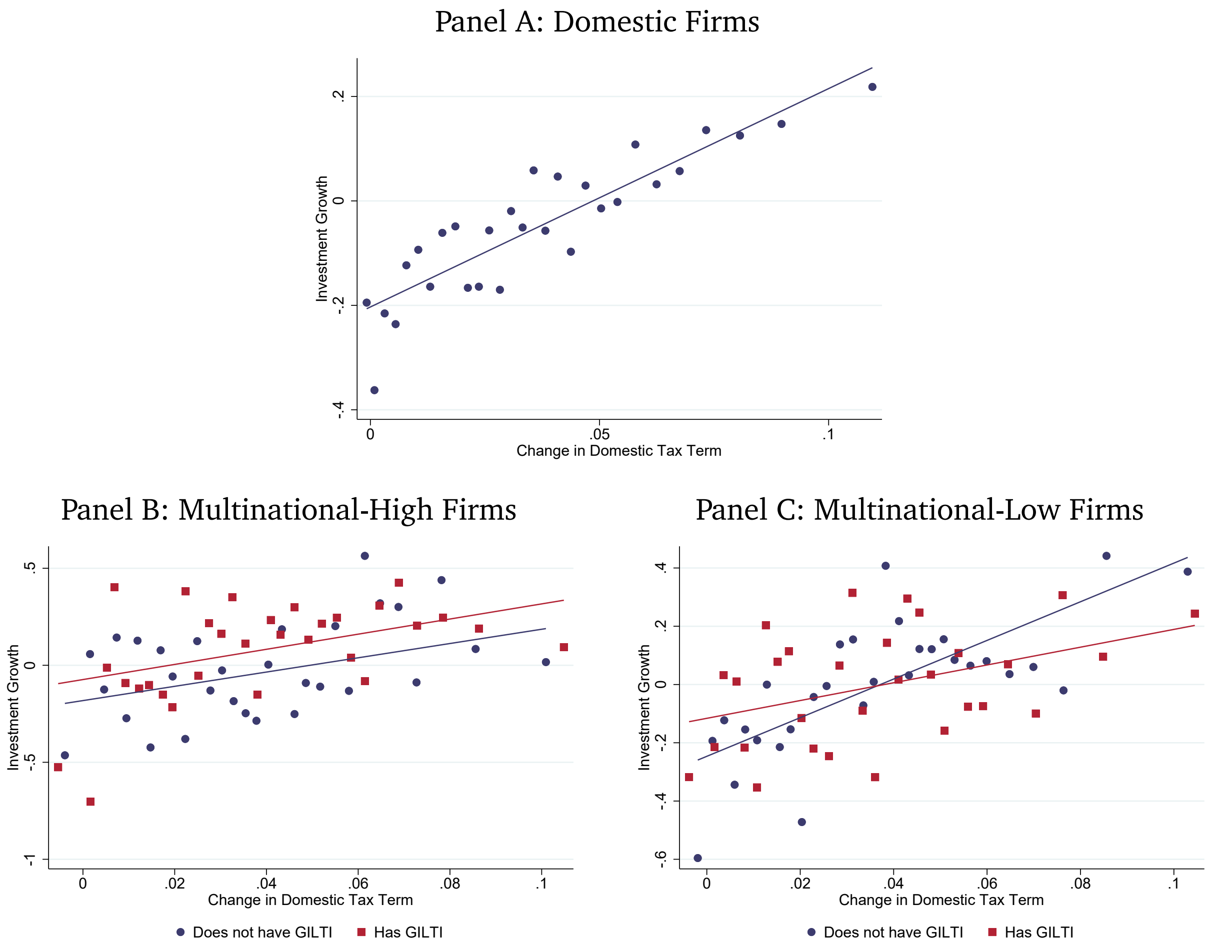
Figure 4 shows means of investment growth for different quantiles of the composite domestic tax term change $\hat{\Gamma} - \hat{\tau}$ ("binned" scatter plots). For domestic firms plotted in Panel A, this composite tax term exactly comports with economic theory. The tight upward slope reveals a positive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

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. Evaluated at the mean policy changes (in Γ, $\bar{\Gamma}$, and τ of -0.11, 0.02, and -0.14, respectively), the coefficients imply a 20% increase in domestic investment relative to non-exposed firms. 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

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.

contrast, and consistent with our model, the domestic investment of multinational-low firms responds little to the foreign cost-of-capital.

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.

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)
$\hat{\Gamma}$	3.05***	2.90***	3.97***	4.02***	4.55**	3.14
	(0.50)	(0.55)	(0.46)	(1.17)	(1.68)	(1.66)
$\hat{\hat{\Gamma}}$	0.63***			0.37	0.81*	−0.13
	(0.18)			(0.25)	(0.36)	(0.36)
$\hat{\tau}$	−3.77***	−3.82***	3.97***	−4.27***	−4.26***	−4.14**
	(0.41)	(0.47)	(0.46)	(0.90)	(1.29)	(1.26)
Constant	−0.26***	−0.29***	−0.19***	−0.21***	−0.17**	−0.27***
	(0.03)	(0.03)	(0.02)	(0.04)	(0.05)	(0.07)
Observations	9,305	7,044	7,044	2,261	1,113	1,148

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%. * $p < .05$, ** $p < .01$, *** $p < .001$

5.4 Robustness

Table 4 collects robustness tests designed to support a causal interpretation of the baseline regressions. For compactness, we report coefficients for the restricted domestic and multinational-high specifications. Appendix Table E.1 presents results for the multinational-low sample.[28]

The first row repeats the baseline coefficients. The next several rows add different covariates. Row 2 addresses the particular concern of the "trade war" in 2017 by including three trade war exposure measures within manufacturing industries from Flaaen and Pierce (2019): import protection, rising input costs, and foreign retaliation measures. Row 3 includes a control in the multinational sample for whether firms paid the "toll tax" on previously unrepatriated foreign earnings under Section 965. Row 4 adds a control for the intangible intensity of a firm's domestic operations, measured as the mean ratio of R&D expenditure relative to the sum of R&D expenditure and investment. We include this control via indicators by decile of intangible intensity. Row 5 controls for size bins defined over pre-TCJA capital. Each of these controls

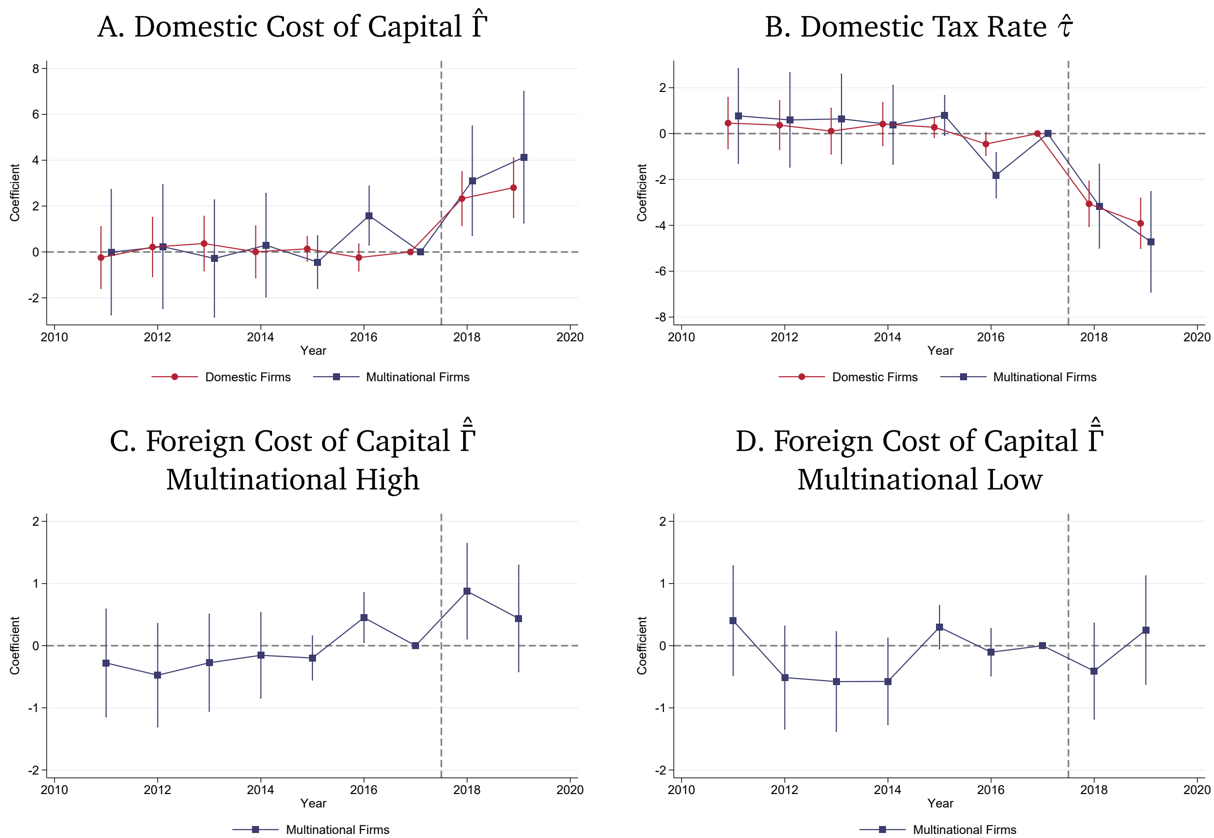
[28]Like for the multinational high-sample, we find similar estimates to the baseline across the variety of robustness specifications.

Table 4: Robustness of Baseline Regression Estimates

Sample:	Domestic		Multinational-High Firms			
Regressor	$\hat{\Gamma} - \hat{\tau}$	N	$\hat{\Gamma}$	$\hat{\hat{\Gamma}}$	$\hat{\tau}$	N
Specification:						
1. Baseline	3.97^{***}	7044	4.55^{**}	0.81^{*}	-4.26^{***}	1113
	(0.46)		(1.68)	(0.36)	(1.29)	
2. Trade Controls	4.03^{***}	7044	4.48^{**}	0.80^{*}	-4.20^{**}	1113
	(0.46)		(1.68)	(0.36)	(1.29)	
3. Toll Tax Control			4.59^{**}	0.83^{*}	-4.29^{***}	1113
			(1.68)	(0.37)	(1.29)	
4. Intangible Capital	4.00^{***}	7044	4.82^{**}	0.74^{*}	-4.59^{***}	1113
	(0.47)		(1.69)	(0.37)	(1.30)	
5. Size Controls	3.97^{***}	7044	4.52^{**}	0.81^{*}	-4.23^{**}	1113
	(0.46)		(1.68)	(0.36)	(1.29)	
6. Lagged Investment	4.25^{***}	6993	5.16^{***}	0.95^{**}	-4.97^{***}	1111
	(0.42)		(1.54)	(0.34)	(1.18)	
7. Industry FE (NAICS 3D)	3.67^{***}	7044	3.84^{*}	0.67	-3.67^{**}	1113
	(0.46)		(1.72)	(0.38)	(1.34)	
8. Industry FE (NAICS 4D)	3.72^{***}	7044	3.99^{*}	0.71	-3.63^{*}	1113
	(0.47)		(1.87)	(0.41)	(1.46)	
9. Weighted	3.64^{***}	7044	4.31^{**}	0.92^{**}	-4.09^{***}	1113
	(0.51)		(1.61)	(0.35)	(1.24)	
10. Drop Industries	4.00^{***}	6827	4.62^{**}	0.78^{*}	-4.31^{***}	1105
	(0.47)		(1.70)	(0.36)	(1.30)	
11. Drop Profit Shifters			5.06^{**}	0.62	-4.69^{**}	879
			(1.91)	(0.42)	(1.45)	
12. Simulated IV	3.71^{***}	7044	4.37^{**}	0.81^{*}	-4.12^{**}	1113
	(0.43)		(1.66)	(0.37)	(1.30)	

Notes: This table presents the results for regressions of $d\log(\text{Investment})$ on our tax terms for domestic firms and high foreign capital U.S. multinationals under different robustness specifications. Appendix Table E.1 presents the low foreign capital multinational results. Row 1 presents our baseline results. Row 2 includes controls for exposure to the trade war. Row 3 controls for firms paying the toll tax under Section 965. Row 4 controls for intangible capital intensity. Row 5 controls for pre-period capital, while row 6 controls for lagged investment growth. Rows 7 and 8 include 3-digit and 4-digit NAICS fixed effects. Row 9 weighs by the log of mean capital over 2015-2016. Row 10 drops industries with high baseline investment from partnerships (2-digit NAICS 22 and 3-digit NAICS 486 and 531, which represent utilities, pipeline transportation, and real estate). Row 11 drops firms with $\geq$ 50% of their foreign income in tax havens. Row 12 presents a simulated IV using post-TCJA tax rates. * $p < .05$, ** $p < .01$, *** $p < .001$

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 (21) 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%.

leaves the tax term coefficients essentially unchanged.

Row 6 adds a control for lagged investment growth, which slightly increases the magnitudes of the domestic tax terms in absolute value. Rows 7 and 8 show that the estimates are similar to the baseline with NAICS 3 or 4 digit fixed effects. These industry controls flexibly remove the influence of industry-by-time shocks, thus absorbing many possible confounding factors.

The remaining rows perturb the specification or sample. Row 9 weights the regression by lagged log capital. The tax elasticities remain quite similar. Row 10 drops industries with high investment through partnerships that our investment measure may miss, with small changes in the coefficients. Row 11 drops firms that have at least 50% of their foreign income in tax havens.[29] The results are similar to the baseline, suggesting firms likely to be active profit-shifters are not driving the results.

The final row reports coefficients from a simulated instrumental variables (IV) regression. In our baseline regression, $\hat{\tau}$ comes from applying pre and post-TCJA tax law to the projected income path starting from a firm's 2015 and 2016 tax returns to generate METRs for 2015 and 2016 with and without TCJA. The row 12 specification instead uses this measure as an excluded instrument, with the endogenous variable the difference between the average METR in 2015 and 2016, obtained by applying pre-TCJA tax law to the firm's 2015 and 2016 tax returns and simulated income paths, and in 2018 and 2019, obtained by applying post-TCJA tax law to the firm's 2018 and 2019 tax returns and simulated income paths. Differences between the excluded instrument and endogenous variable arise because of changes in firms' taxable income statuses or deductions and credits between these years. In practice these inputs are highly persistent and the simulated IV yields very similar coefficients.[30]

Appendix Tables E.2 and E.3 show 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. The investment-to-capital ratio increases strongly with the tax term change $\hat{\Gamma} - \hat{\tau}$ in the domestic sample. Both equipment and structures investment increase by a comparable magnitude, indicating that the total tangible investment response in the main specifications comes from a combination of both types of investment. The effects on domestic capital mirror those on investment. Various measures of labor compensation increase in the domestic sample, though the labor compensation effects in the multinational sample are less precise.[31] As expected, tax payments decline with the policy change. We also find some evidence of R&D expenditure effects but leave a full investigation of intangibles to future work.

6 Structural Parameters

This section estimates the key model parameters.

[29]For this categorization, we consider both income in dot havens like Bermuda and the Cayman Islands and non-dot havens like Ireland and the Netherlands. Within the sample of multinational firms, these firms account for 7% of the sample of firms and 30% of foreign and domestic capital.

[30]The simulated IV also addresses the possible role of measurement-error-induced attenuation coming from constructing the METRs using firm-level income simulations.

[31]The magnitudes for these other outcomes (e.g., capital, labor) may reflect M&A activity, which makes it difficult to compare them to our main investment results. Appendix C presents some analysis of M&A patterns for U.S. multinationals following prior work.

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.[32]

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 to zero, $\bar{\phi} = 0$, and show that 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.[33] Appendix A.10 proves the implication of common scaling of the short-run to long-run investment elasticities, which follows because the dynamic system governing the transition path then has a single non-explosive root.[34] The ratio χ_{SR} therefore serves as a sufficient and portable

[32] 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.

[33] 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.

[34] Appendix A.10 gives the linearized solution for the transition path from the old to new steady state and provides formulas for the short-run and long-run elasticities. In general, the 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 derivatives of the production function, which are small. We verify this equivalence numerically at our estimated parameter values. Intuitively, the difference between

statistic for the effect of domestic adjustment costs on the empirical moments. Our preferred value of $\chi_{SR} = 1.3$ comes from Winberry (2021) and we apply this value to each short-run elasticity.[35] Figure A.1 shows that the model-implied path of capital varies little over the first several years across values of χ_{SR} ranging from 1 to 1.6, which highlights the difficulty of estimating this parameter internally without observing long-run outcomes and the benefit of calibrating it transparently.

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. Using equation (15) and Appendix A.3, equations (22) to (26) illustrate identification by giving closed-form formulas for the set of model moments in terms of only θ, χ_{SR}, and χ_R:

$$b_1(\theta) = \chi_{SR}\omega_{k,r}/(1-\alpha), \tag{22}$$

$$b_2(\theta) = \chi_{SR}\left(1-\omega_{k,r}\right)/(1-\alpha), \tag{23}$$

$$b_3(\theta) = \chi_{SR}\omega_{k,\tau}/(1-\alpha), \tag{24}$$

$$\chi_K(\theta) = \chi_K, \tag{25}$$

$$\chi_\tau \chi_F(\theta) = \left(\frac{(1-a)\,\chi_K^{-\frac{1}{\sigma}} - a\chi_R}{(1-\bar{a})\,\chi_R - \bar{a}\chi_K^{-\frac{1}{\sigma}}}\right)\left(\frac{\bar{a}\chi_K^{\frac{\sigma-1}{\sigma}} + (1-\bar{a})}{a + (1-a)\,\chi_K^{\frac{\sigma-1}{\sigma}}}\right), \tag{26}$$

where $\omega_{k,r}$ and $\omega_{k,\tau}$ are functions of $\alpha, \sigma, a, \bar{a}$ and χ_K only, as given in equations (11) to (14), (16) and (17).[36]

Equations (22) to (26) 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 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

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. This feedback effect is small. For the same reason, the common scaling is exact for the domestic-only firms.

[35] Winberry (2021) estimates a rich model of 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 construct impulse responses of investment in his model to nearly permanent domestic tax changes and compute the ratio of the response at 10 years to the average response over the first two years. See Appendix A.11 for details.

[36] Since we do not have firm-by-firm information on foreign expensing, we set $\chi_R = 1$ and do not discuss this parameter further.

Table 5: Moments and Parameters

Panel A: Moments

	b_1		b_2		b_3		χ_K		$\chi_\tau \chi_F$	
	Data	Model	Data	Model	Data	Model	Data	Model	Data	Model
Group:										
Domestic	3.06	3.06			−3.06	−3.06				
Multinat. high	3.50	3.50	0.62	0.62	−3.27	−3.27	0.57	0.57	0.62	0.63
Multinat. low	2.41	3.00	−0.10	−0.10	−3.19	−2.83	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	0.76	1.25	0.95	0.88
Multinat. low	0.05	0.66	12.19	1.00	0.93

Panel C: Other Parameters

Symbol	Name	Value
ρ	Discount rate	0.06
δ	Depreciation rate	0.1
α_L	Labor share of revenue	0.65
$\{\phi^D, \phi^H, \phi^L\}$	Adjustment cost	{1.4,1.0,1.4}

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^g denote the covariance matrix of the data for group g, where the variances of χ_K and $\chi_\tau \chi_F$ come from the cross-sectional distribution in the appropriate sample 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 5 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. These firms are "almost domestic" both in their values of χ_K and $\chi_\tau \chi_F$ and in the small regression coefficient b_2; as a result, the model requires the absolute values of b_1 and b_3 to be closer than they are in the data.

Turning to parameters, the values of α range from 0.66 to 0.76 with the highest value for the multinational firms with high foreign presence. Combined with a labor share of revenue of 0.65, the estimated range of α implies total returns to scale in the revenue function of 0.88 to 0.92 ($= 0.65 + \alpha \times (1 - 0.65)$). 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 these firms of 1.25 implies gross complementarity between domestic and foreign capital given the value of α. The value of σ for the multinational firms with low foreign presence 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 $a = 0.95$ thus implies that incrementing domestic capital would increase domestic earnings by roughly 19 times as much as incrementing foreign capital would. These parameters have little antecedent for comparison.

6.2 Tax Changes and Other Parameters

We set several other parameters using external information, shown in Panel C of Table 5. 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. This parameter matters only for translating changes in capital into changes in wages and output. 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 A.10).

We group firms into "portfolios" based on their domestic/multinational high/low status and their tax changes. Table E.4 shows these portfolios, the share of capital in each, average capital per firm from SOI, and the pre- and post-TCJA tax rates. The "low-tax" firms had pre-TCJA domestic rates as low as 15% 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 on the firm or not. In addition to the firms representing the SOI, we add a domestic non-C-corporate sector calibrated using Figure 3 to be 29% of private sector capital.[37] 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 labor market clearing.[38]

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.36). We choose A to match the capital-per-firm shown in Table E.4. 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 6 reports the steady state partial equilibrium change in domestic capital (or equivalently investment), computed as the capital-weighted fitted values using the regressions reported in Table 3, adjusted by χ_{SR}. These changes correspond to 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. The regression coefficients directly imply capital rises by 12% for domestic-only firms, 18-21% for multinational firms, and 16% for the corporate sector as a whole. The standard errors provide tight bounds around these values.

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 6 reports the partial equilibrium effects in the model for comparison with the model-free estimates. We use the estimated parameters from Table 5 and the tax changes by group from Table E.4 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

[37] Since the top line in Figure 3 is private investment, this calibration implicitly segments the private sector from government. We assume the non-corporate sector has the same capital-per-firm as the domestic C-corporation sector, although this assumption matters little to our results.

[38] 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 6: Long-Run Steady State K and I by Group

	PE Data	PE Model	GE Model
Group:			
Domestic	12.31	11.62	6.05
	(1.43)	(1.44)	(2.20)
Multinat. high	18.89	19.61	13.32
	(3.75)	(4.63)	(4.98)
Multinat. low	21.09	8.16	3.13
	(4.68)	(5.96)	(6.25)
Total	16.15	12.83	7.20
	(1.66)	(2.02)	(2.71)

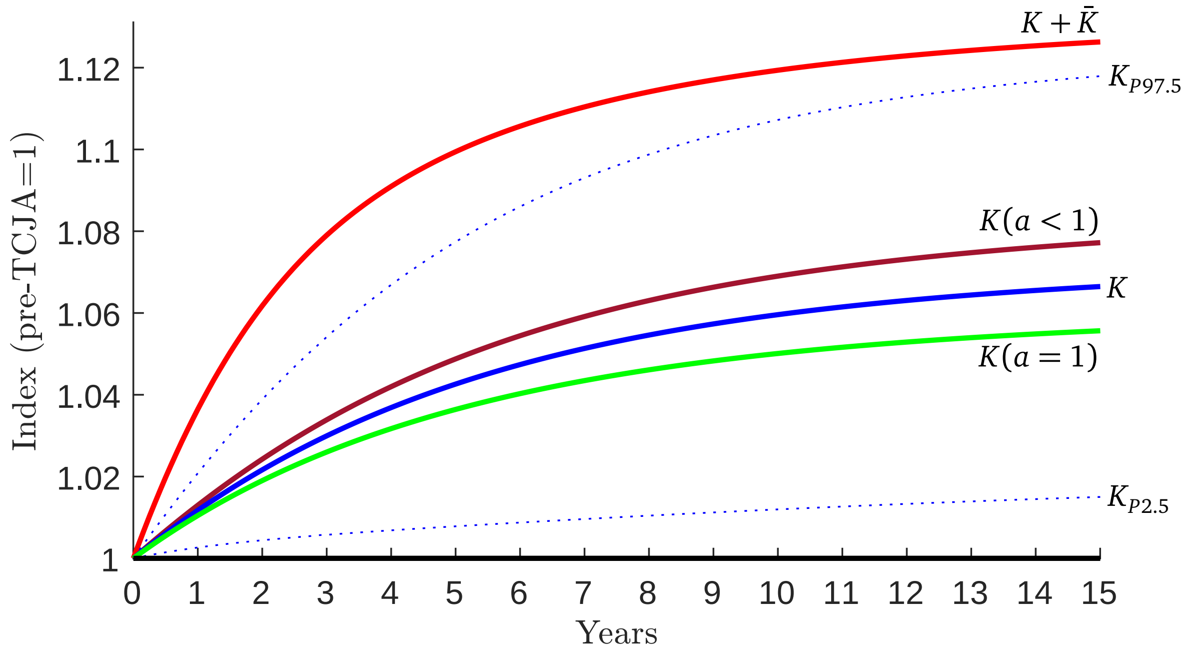
Notes: The table shows long-run changes in domestic corporate capital (or equivalently investment) for domestic-only firms, multinational firms with high foreign presence, multinational firms with low foreign presence, and in total. Column (1) directly applies the regression coefficients in Table 3, adjusted by χ_{SR}, to the tax changes by group in Appendix Table E.4. Column (2) uses the parameters estimated in Table 5 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.

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-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 5). The total corporate sector model-implied partial equilibrium increase in capital is 12.8% with a standard error of 2.0%.[39]

Column (3) of Table 6 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, the corporate provisions of the TCJA increase total corporate capital by 7.2% in the long-run, with a standard error of 2.7p.p.

[39] We compute standard errors for the model partial and general equilibrium values 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 the steady state response K/K_0 replacing θ_p with $\theta_p^+ = \theta_p + \epsilon$ and with $\theta_p^- = \theta_p - \epsilon$ for $\epsilon = 10^{-4}$. The Jacobian is then $J(p) = \left(K^*\left(\theta_p^+\right)/K_0\left(\theta_p^+\right) - K^*\left(\theta_p^-\right)/K_0\left(\theta_p^-\right)\right)/(2\epsilon)$. The variance is $J(p)'V(\theta)J(p)$, where $V(\theta)$ is the covariance matrix of the parameters computed as in Chamberlain (1982).

Figure 6: TCJA and Model-Implied Capital



Notes: The figure shows the model-implied paths of total domestic and foreign capital of domestic corporations (solid red line), total domestic corporate capital (solid blue line), and total domestic corporate capital of multinational (solid brown line) and domestic firms (solid green line). The dotted blue lines show the 95% confidence interval for the response of domestic corporate capital.

The general equilibrium dampening of 5.6p.p. relative to partial equilibrium stems from an increase in the domestic wage of about 0.9%.[40]

Figure 6 plots the model-implied general equilibrium transition paths of domestic and total corporate capital. The solid blue line shows that total domestic corporate capital achieves a roughly 7% increase after 15 years. For this series, we also report 95% confidence interval bands.[41] The red line shows the path of total domestic and foreign capital owned by the domes-

[40]Roughly, an increase of 0.9% reduces the multiplicative factor in the earnings function Z by about $\alpha_L/(1-\alpha_L)\times 0.9 = 1.8\%$ (see equation (A.3)). The capital-weighted elasticity of capital to Z or τ of roughly 3 (b_3 in Table 5) then accounts for the dampening. Of course, the size of the wage response, and hence the general equilibrium dampening and the impact on labor tax revenue discussed shortly, depends in general on the elasticity of substitution between capital and labor, which we set to 1 in order to allow the representation of the earnings function in equation (3). For context, while the 0.9% increase in the wage occurs in the long-run and in dollar amounts will scale up with secular wage growth, evaluated at the 2019 level of compensation per full-time equivalent of $81,900 a 0.9% increase corresponds to roughly $750.

[41]We compute confidence intervals using the same method to report standard errors in Table 6. Specifically, for each parameter $\theta_p \in \theta$, we recompute the impulse response of K/K_0 replacing θ_p with $\theta_p^+ = \theta_p + \epsilon$ and with $\theta_p^- = \theta_p - \epsilon$ for $\epsilon = 10^{-4}$. The pth row of the horizon h Jacobian is then $J(h,p) = \left(K_{t+h}\left(\theta_p^+\right)/K_0\left(\theta_p^+\right) - K_{t+h}\left(\theta_p^-\right)/K_0\left(\theta_p^-\right)\right)/(2\epsilon)$. The horizon h variance is $J(h,p)'V(\theta)J(h,p)$, where $V(\theta)$ is the covariance matrix of the parameters computed as in Chamberlain (1982).

tic 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. Due to the complementarity between foreign and domestic capital, total domestic capital at multinational firms (brown line) therefore also rises by more than total domestic capital at domestic firms (green line).

7.2 Role of Different Shocks and Phase-out

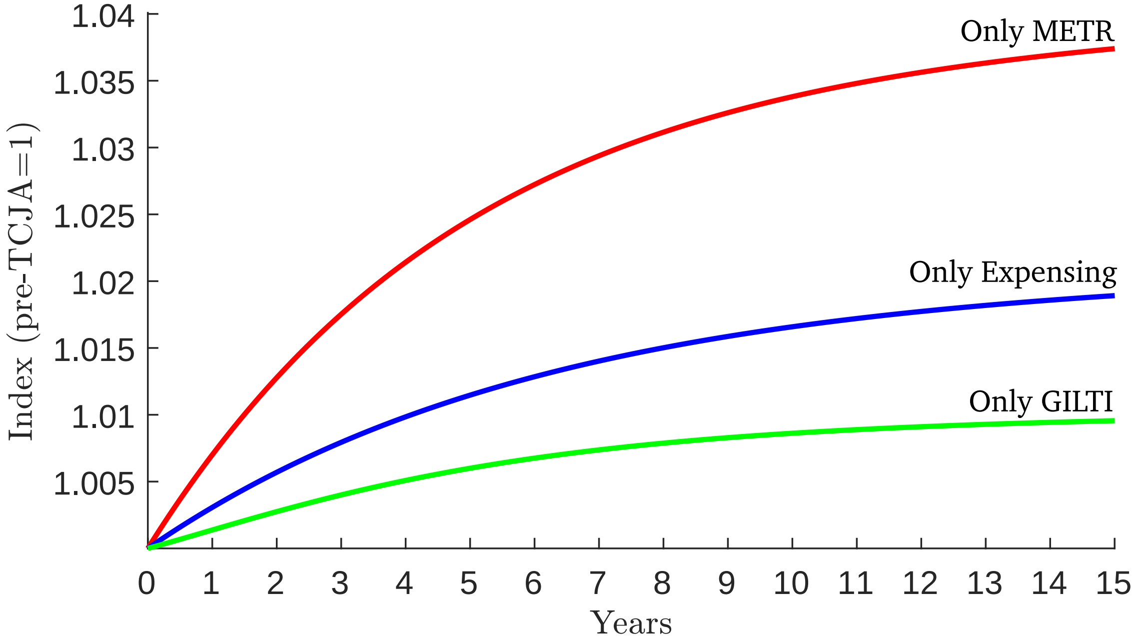
Figure 7 shows the role of the different tax variables in the response of total domestic capital. Changes in the METR τ alone would have increased capital by about 3.5% after 15 years, or about half of the total response. Moving from 50% to 100% bonus depreciation by itself would have increased capital by about 2%.[42] The incentive to accumulate foreign capital through GILTI and the induced increase in domestic capital alone account for about a 1% increase in domestic capital. We stress these calculations do not imply that one provision was more effective than another because they do not account for differences in the costs.

Figure 8 explores the importance of our baseline assumption that 100% bonus depreciation would become a permanent feature of tax policy and that firms anticipated this change. The green line shows the path of capital in a scenario where firms expected phase-out of expensing as written into the TCJA law, namely a decline of 100% to 80% in 2023 and further declines of 20 p.p. per year thereafter until reaching zero. In the short run, these expectations increase investment and capital relative to the permanent case. The short-run overreaction occurs because our values for discount and depreciation rates yield intertemporal substitution toward investment in periods with higher expensing that outweighs the dampening effect of a lower terminal capital stock.[43] The red line shows the path of capital if firms did not expect phase-out but it occurs anyway. This scenario results in the same short-run behavior of capital by construction but a lower terminal capital stock.

[42] Throughout this section, exercises labeled expensing-only also include 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.

[43] In this sense, our conclusions about the overall investment effects of the TCJA's corporate provisions provide an upper bound if firms expected the expensing provisions to expire, since some of the short-run investment response would then stem from the intertemporal incentive rather than the long-run tax policy changes to which we ascribe it.

Figure 7: Model-Implied Capital by TCJA Provision



Notes: The figure shows the model-implied paths of domestic corporate capital applying only the TCJA changes to the METR τ (red line), to expensing (blue line), or GILTI (green line).

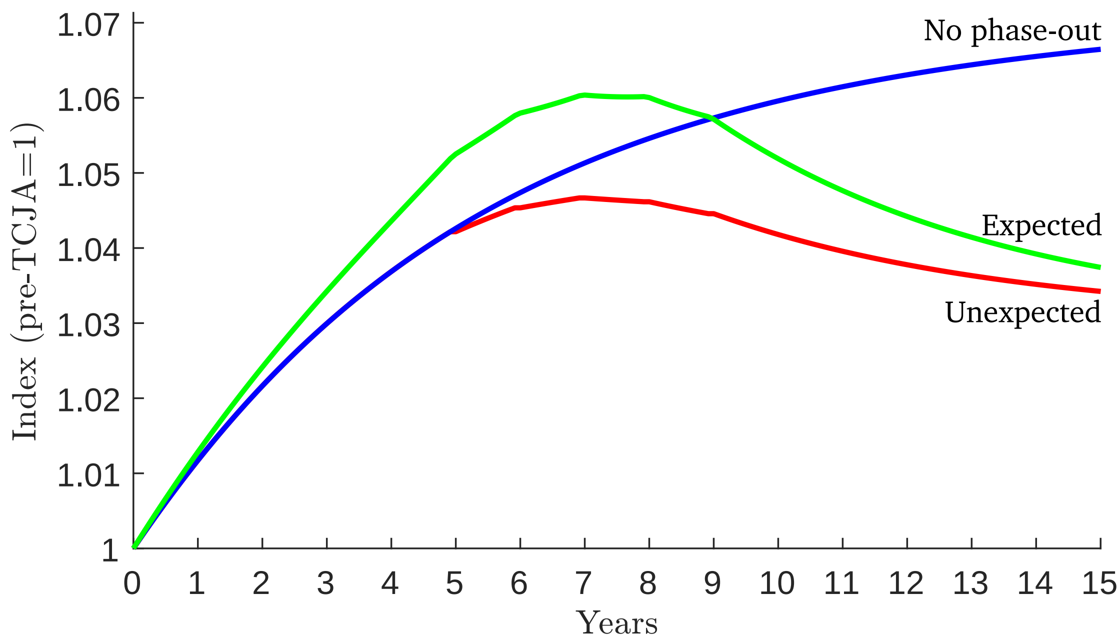
7.3 Tax Revenue

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:

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

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 (defined in Appendix B). 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,

Figure 8: Role of Expensing Phase-out



Notes: The figure shows the model-implied paths of domestic corporate capital under the baseline assumption of no phase-out or expected phase-out of the expensing provisions (blue line), when firms fully anticipate phase-out of expensing as written into the TCJA law (green line), or when firms are surprised each year that bonus depreciation ratchets down (red line).

with $\bar{\tau}^s$ denoting the average ex-GILTI foreign tax rate among GILTI payers of 7% (defined in Appendix B) and $\mathbb{I}\{\text{GILTI}\}$ denoting an indicator for paying GILTI tax.

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:

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

The first two lines of this expression give the mechanical contribution and the last two lines the dynamic contribution.

Panel A of Figure 9 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% 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 \$1.61 trillion.[44]

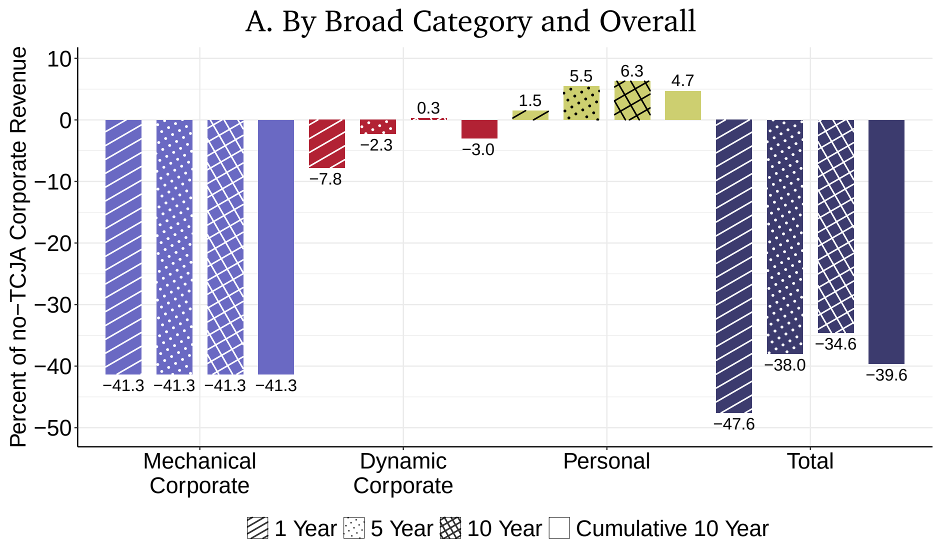
The dynamic response of corporate taxable income further reduces corporate tax revenues by 7.8% of T_0 in year 1 and switches to a small offset of less than 1% by year 10 (red bars). To better understand this time path, Panel B separates the dynamic corporate response into the two largest components, 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). Growth of capital quickly overcomes the higher adjustment costs and the effect on taxable income gross of depreciation deductions turns positive and by itself would result in higher tax revenue of 3.0% in year 5 and 4.6% in year 10. However, the negative revenue impact of higher depreciation deductions persists and offsets the revenue increase from higher gross income even in the medium run.

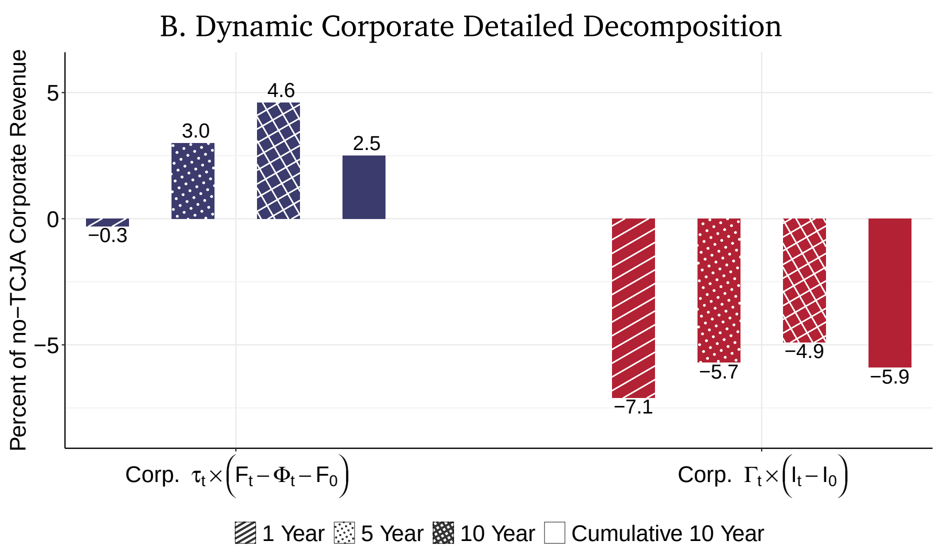
The explanation for a muted dynamic response of corporate tax revenue goes beyond the details of our model.[45] To see why, consider the case of a domestic firm with all bonus-eligible investment, so that $\Gamma = \tau$ post-TCJA (see Section 4.1), and focus on the long run. This firm chooses K to maximize $(1-\tau) F(K) - (1-\Gamma)(\rho+\delta) P^K = (1-\tau)\big(F(K) - (\rho+\delta) P^K K\big)$, 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 case 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

[44] Adding together the JCT cost estimates 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.

[45] While we are not aware of other estimates of the dynamic revenue effects of corporate tax and depreciation changes in isolation, the JCT 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" (Joint Committee on Taxation, 2017, footnote 8).

Figure 9: 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.

equals about 0.4 at our parameter values. Thus, diminishing returns to scale and depreciation allowances reduce the response of revenue to changes in K.

In addition to corporate tax revenue, personal income taxes also change, shown in the yellow bars in Panel A of Figure 9. 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. By year 10, the increase in the wage generates additional labor tax revenue of 5.5% of the pre-TCJA corporate tax revenue. 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 $\tau^D = 0.021$, which reflects the fact that only about one quarter 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, McClelland, Pearce, Prisinzano, Sullivan, Yagan, Zidar and Zwick, 2016).[46] Offsetting this gain, payouts to owners of pass-throughs decrease due to higher labor costs, which we evaluate at a 20% rate. In combination, accounting for payout taxes further offsets the corporate revenue decline by about 0.8p.p. in year 10. The long-run increase in total tax revenue due to changes in capital therefore largely arises from higher labor payments.

Overall, the dynamic revenue response and higher personal taxes over the first 10 years offset less than 2% 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 7 decomposes the 10 year revenue changes by major provision and compares the "cost-per-unit-of-capital". Changes to the METR have the largest effect on K but also cause the largest reduction in tax revenue. The reduction in revenue due to the METR change of -36% of baseline corporate revenue implies a unit cost of 10.7% of baseline revenue per year per additional 1p.p. of capital, the highest of any provision. The expensing provisions instead require 2.6% of no-reform corporate revenue per 1p.p. of capital. In contrast, 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 E.5 shows that these conclusions on the relative cost-per-capital of different provisions hold when extending the horizon to year 30. In addition, Appendix Table E.6 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.

[46] We treat all payouts as going to equity holders. See Moore and Pecoraro (2021) for further discussion.

Table 7: Revenue Effects through Year 10

	Percent of no-TCJA corporate revenue			
	METR only	Exp. only	GILTI only	Total
1. Mechanical corporate	−37.7	−3.4	0.0	−41.3
2. Dynamic and personal	1.6	−0.9	0.8	1.7
3. Total	−36.1	−4.4	0.8	−39.6
4 (memo): Year 10 K (%)	3.4	1.7	0.9	5.9
5 (memo): (3)/(4)	−10.7	−2.6	1.0	−6.7

Notes: The table shows the total (undiscounted) 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. Row 3 shows overall revenue effects. Row 4 shows the percent increase in domestic capital after 10 years.

8 Validation

8.1 Foreign Capital Response

Using tax data for foreign subsidiaries of U.S. multinationals from Form 5471, Table 8 turns to another key outcome, the response of foreign tangible capital. Through the lens of our theory, the short-run elasticity of foreign capital to $\bar{\Gamma}$ must be positive for complementarity to rationalize the positive $\bar{\Gamma}$ coefficients in Table 3. Panel A reports our baseline specification in the pooled multinational firm sample but with the log change in foreign capital as the dependent variable. The $\bar{\Gamma}$ coefficient of 0.66 is statistically significant and implies an increase in foreign capital of roughly 10% for firms subject to GILTI. For comparison, perturbing post-TCJA $\bar{\Gamma}$ around its mean value and calculating the two-year average log deviation of foreign capital $\bar{K}$ in the model yields a short-run elasticity of around 1.3. Panel B reports the location of foreign capital before and after TCJA. The foreign capital stock of U.S. multinationals grew in all regions, but grew fastest in the G7, BRIC, and other countries. The share of foreign tangible capital in tax havens fell, especially in the small island havens that had relatively low capital before TCJA. This geographic pattern suggests that the reported accumulation reflects actual foreign investment and not simply accounting gimmicks in response to GILTI and hence could plausibly complement domestic capital.

Table 8: Foreign Capital Growth

Panel A: Regression Estimates

Regressor:	$\hat{\Gamma}$	$\hat{\hat{\Gamma}}$	$\hat{\tau}$	N
$d\log$(Foreign Capital)	−0.74 (1.12)	0.66* (0.26)	−0.49 (0.87)	2102

Panel B: Changes in Foreign Capital by Region

Region:	Pre-Period $\bar{K}$ (\$B)	Post-Period $\bar{K}$ (\$B)	Share Pre (%)	Share Post (%)	Change in Share (p.p.)	Capital Growth (%)
Total	589.1	704.1				19.5
G7	154.6	179.2	26.2	25.5	−0.8	15.9
OECD (excluding G7)	106.7	131.3	18.1	18.7	0.5	23.1
BRIC	65.9	82.6	11.2	11.7	0.5	25.3
Developing (Non-BRIC)	24.4	30.8	4.1	4.4	0.2	26.1
Tax Haven Non-Islands	121.5	143.5	20.6	20.4	−0.2	18.1
Tax Haven Islands	73.8	79.4	12.5	11.3	−1.2	7.6
Other	42.2	57.3	7.2	8.1	1.0	35.7

Notes: Panel A presents the results of regressing $d\log$(Foreign Capital) on our tax terms. The sample consists of all U.S. multinational firms. We winsorize $d\log$(Foreign Capital) at the 5% level. Standard errors appear in parentheses. Panel B summarizes how foreign capital (by region) changes after the TCJA. Foreign capital (columns 1-2) is in billions of USD. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

8.2 Synthetic Controls Evidence for Publicly-traded Firms

We validate our investment effect estimates using an alternative approach that does not impose any model structure or tax shock measurement. To do so, we use synthetic controls to estimate how investment would have evolved in the United States in the absence of the TCJA. Specifically, let $Y^R_{i,t}$ and $Y^N_{i,t}$ denote the reform and no-reform outcome for a variable Y for firm i in year t. We estimate $\hat{Y}^N_{i,t} = \sum_n^N w_i Y_{n,t}$ as a weighed average of outcomes $Y_{n,t}$ of public firms headquartered outside the United States.

We use the Compustat North America and Compustat Global Databases to construct the sample for our synthetic controls research design. We begin with all non-financial publicly-traded firms in the Compustat North America database that are headquartered in the United States. We focus on a window around the 2017 tax reform that starts in 2011 and ends in 2021.

Appendix Table E.7 describes the construction of the matched analysis sample. We keep firms with non-missing assets (AT), property plant and equipment (PPENT), and sales (SALE) for at least four years in our sample period. We apply analogous sample restrictions to the Compustat Global database in addition to keeping only firms that list non-US-based headquarters (LOC). We convert all currencies to U.S. dollars using the official exchange rates from Table 4.16 of the World Development Indicators of the World Bank.

For each of the remaining firms, we estimate a firm-specific set of weights w_i, which are restricted to be non-negative and sum to one. We restrict the pool of potential "donors" for each U.S. firm to global firms in the same 4-digit NAICS industry.[47] We then assign weights to minimize the mean squared prediction error between the following variables during the pre-reform period of 2011-2017: annual investment (CAPX), annual sales (SALE), and the pre-period mean of property plant and equipment (PPENT).[48]

Appendix Table E.8 provides summary statistics for our closely matched U.S. firms and their closely matched global firms. We define a firm as closely matched if the average pre-reform capital expenditure of the synthetic firm is within 10% of the U.S. firm. All subsequent analyses are conducted using the closely matched sample. The rows represent different outcomes and firm characteristics of interest in either the pre-reform years from 2011-2017 or the post-reform years 2018-2019. The table provides means and medians for each. All values are inflation adjusted to be in 2019 dollars. Comparing the pre-reform means to the post-reform means of capital expenditures shows that the capital expenditures of U.S. firms in the closely matched sample increased, whereas they decreased among global firms. Specifically, the average capital expenditure for a closely matched U.S. firm increased from \$441 million to \$459 million.

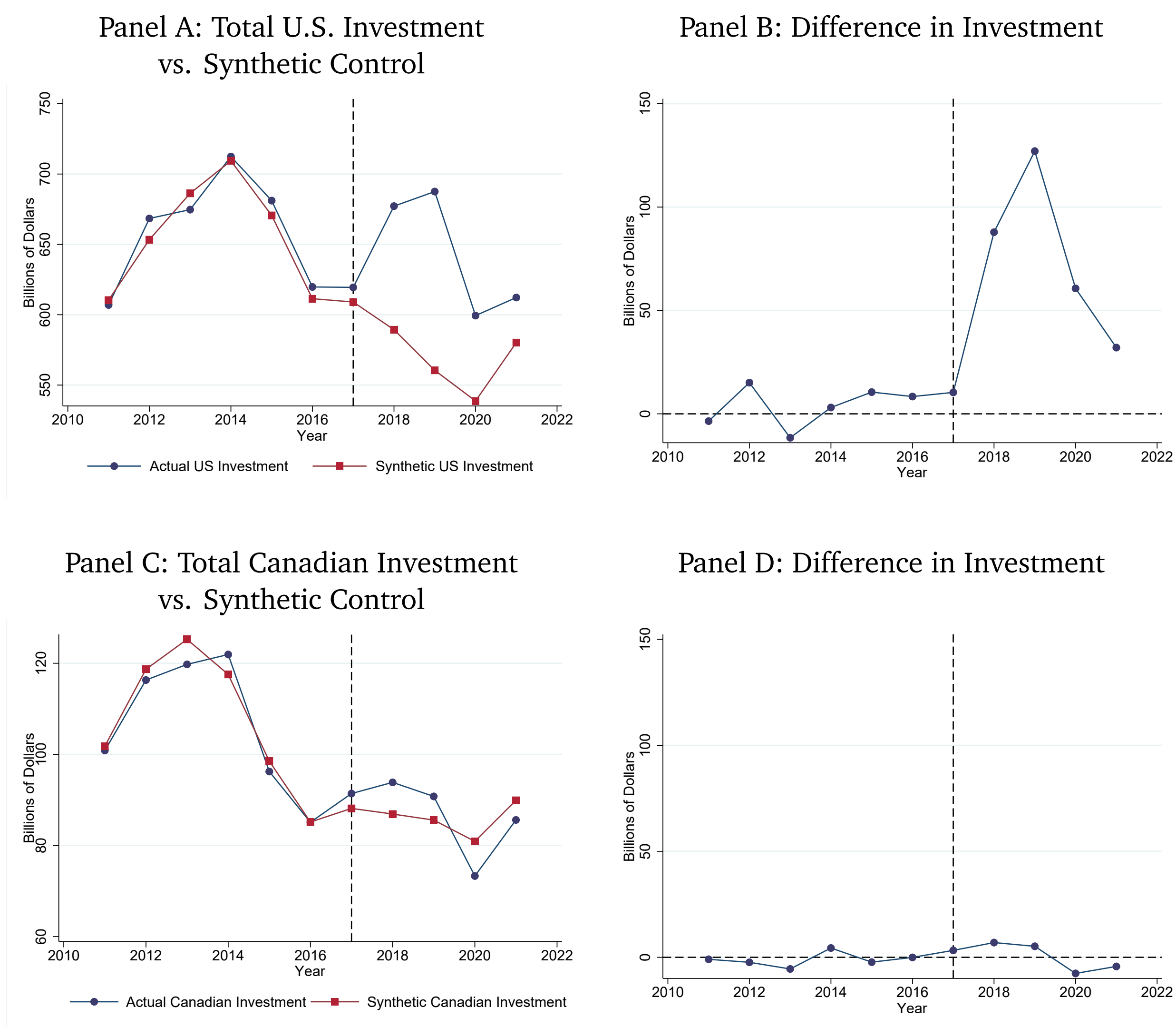
Panel A of Figure 10 plots the evolution of the aggregate annual capital expenditure of U.S. firms in our closely matched analysis sample as well as the aggregate annual capital expenditure of their synthetic controls. The aggregate capital expenditure of the matched controls closely tracks that of the U.S. firms in the pre-reform period before sharply increasing in 2018. The aggregate capital expenditure of U.S. firms in 2018 and 2019 greatly exceeds the aggregate capital expenditure of the control group.[49] Panel C validates our approach by plotting

[47] Appendix table E.7 presents a waterfall table of our sample.

[48] See Abadie (2021) equation (7) and the surrounding discussion for additional details. We use the average PPENT to account for differences in physical assets, and annual sales to help account for growth trajectories. Our results are not especially sensitive to the selection of these pre-period controls. We establish this assertion by documenting raw investment effects in a simple difference-in-difference regression that uses pre-period PPENT, annual sales, four-digit-industry fixed effects and other pre-period variables as controls in the pooled sample of US-based and non-US-based public firms.

[49] Appendix Table E.9 decomposes these aggregate differences by two-digit NAICS industry codes. We sum each firm and its synthetic control in a given industry, and report these totals and their difference. The table

Figure 10: Global Investment of U.S. Public Firms versus Synthetic Control Firms



Notes: The figure plots aggregate investment (CAPX) of U.S. publicly-traded firms and compares it to the investment of synthetically matched global firms. Panel A shows the two series separately, and Panel B plots the difference. Panels C and D show the analogous plots when we create synthetic matches for Canadian firms instead of U.S. firms.

the evolution of the capital expenditures of Canadian firms relative to closely matched synthetic controls in a placebo analysis. The sharp increase around the TCJA is not present for our sample of Canadian firms and only occurs in the U.S. series.

shows that Utilities ($71 billion), Manufacturing ($24 billion), and Mining ($18 billion) were the three largest contributors to the total difference in investment among public firms in our matched sample and their synthetic control counterparts.

Table 9: The Effect on Global Investment of U.S. Public Firms (Synthetic Control)

	(1)	(2)	(3)	(4)
Post	0.167***	0.159***	0.167***	0.159***
	(0.027)	(0.007)	(0.006)	(0.007)
Observations	13,203	12,177	13,203	12,177
Controls	No	Yes	No	Yes
NAICS 4-digit FEs	No	No	Yes	Yes

Notes: Standard errors in parentheses are clustered at the firm level. The outcome variable is log(CAPX of treated firms) - log(CAPX of synthetic firms). The controls include trade shocks and the mean pre-period (2011-17) values of CAPX, assets, sales and property, plant and equipment (PPENT) of treated firms. All regressions are weighted by the mean pre-period CAPX of treated firms. The post-period is defined as 2018-2019. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

We further validate our results with a backdating approach that uses earlier years, 2011 to 2015, in the pre-period to estimate the weights. This enables us to compare the outcomes from 2016-2017 to see if the treatment and control groups still evolve similarly in the pre-reform period. Appendix Figure D.2 presents the results from this approach. The figure shows both that the US firms evolve similarly, and that there is a still a sharp increase in the TCJA period in the U.S. firms relative to the controls. We also conduct leave-one out analyses that drop countries from the donor pool of synthetic controls to ensure that foreign shocks are not driving the results. Appendix Table E.10 shows the results of our leave-one out analyses. Finally, we also include controls for other contemporaneous shocks such as tariff changes.

Table 9 summarizes these effects by reporting difference-in-difference estimates within the analysis sample, weighted by pre-period average capital expenditures. Capital expenditures increase by around 17% across specifications that do and do not control for pre-reform firm characteristics as well as four-digit industry fixed effects. For comparison, global investment in the estimated model is roughly 20-25% higher over the first years following the reform and the 95% confidence interval cannot reject a 17% increase. Furthermore, the model measure includes mergers and acquisitions that Compustat does not include in capital expenditure, making it plausible that the difference between the synthetic control estimates and the model are smaller than they appear.[50]

[50] In Appendix C, we survey the literature on the effect of the TCJA on M&A activity and replicate some key findings that suggest an increase in U.S. M&A after the reform. Using the Dunker, Overesch and Pflitsch (2022) sample described in Appendix Table C.1, we find that the aggregate annual U.S. M&A activity increased by $19.6B. This represents a 3% increase relative to the aggregate annual pre-period CAPX.

8.3 Asset Pricing

Lower taxes and the resulting higher capital both increase the present value of after-tax cash flows to owners. Firms with more exposure to the reform should therefore see higher returns upon the law's passage. We use stock price data for the public companies in our sample to test this prediction.

We consider two measures of exposure. The first is the firm-level fitted value of the change in investment, $\hat{I}$. The second measure approximates the change in firm value, $\hat{V}$. Namely, in steady state a domestic firm's cash flows are $D = (1-\tau)K^{\alpha} - (1-\Gamma)\delta K$. Using the first order condition $\alpha(1-\tau)K^{\alpha-1} = (\rho+\delta)(1-\Gamma)$, the cross steady-state change in firm value is $\hat{V} = \alpha k - \hat{\tau}$ (see Appendix A.13). Intuitively, αk is the increase in pre-tax earnings and $\hat{\tau}$ is the reduction in taxes. This expression is not exact for multinational firms and applies across steady states rather than at the moment of the policy change, but nonetheless offers a useful refinement to the predicted change in investment only.

Our data include daily stock returns from CRSP for 1,570 companies in our sample with balanced coverage from November 2, 2016 through December 31, 2017. We aggregate daily raw and excess returns into cumulative returns over this window and winsorize this aggregate at the 5% level.[51] For each firm, we construct the investment prediction $\hat{I}$ using the pooled regression from column 1 of Table 3. We combine $\hat{I}$ with firm-specific $\hat{\tau}$s and α estimates for domestic and multinational firms from Table 5 to construct the prediction for firm value $\hat{V}$.

For measurement purposes, the ideal reform would be passed in a single, unanticipated event. In reality, information about the chance of the TCJA's passage and the its key parts emerged gradually from the 2016 election through passage in late 2017. We address this issue by focusing on cumulative returns over this 13-month time period.

Table 10 presents two sets of analyses, one based on $\hat{I}$ and one based on $\hat{V}$. In Panel A, we report means for cumulative raw returns as well as excess 1-factor and 3-factor returns for five portfolios sorted by $\hat{I}$. For each return measure, cumulative returns are higher for firms with more predicted investment growth. The effects are not concentrated in the tails of these portfolio sorts. The long-short portfolio for Q5 versus Q1 generates cumulative returns of 7.7%, 11.9%, and 10.9% for the raw, 1-factor, and 3-factor measures, respectively, which reflect substantial changes in firm value as a result of the TCJA.

In Panel B, we report regressions of cumulative returns on $\hat{V}$. For each cumulative return measure, the table reports an unweighted specification, a regression weighted by the log of

[51] Excess returns use either the 1-factor or 3-factor portfolios from Ken French's website and firm betas estimated using the 250 days prior to November 2, 2016.

Table 10: Stock Market Returns during the Tax Reform Debate

Panel A: Cumulative Returns for Portfolios Sorted on Predicted Investment

Quantile	Raw Returns	1-Factor Returns	3-Factor Returns
Q1	0.258	−0.121	−0.095
Q2	0.276	−0.076	−0.049
Q3	0.337	−0.020	0.005
Q4	0.304	−0.020	0.004
Q5	0.335	−0.002	0.014
Q5-Q1	0.077	0.119	0.109

Panel B: Cumulative Returns and Model-Implied Valuation Effects

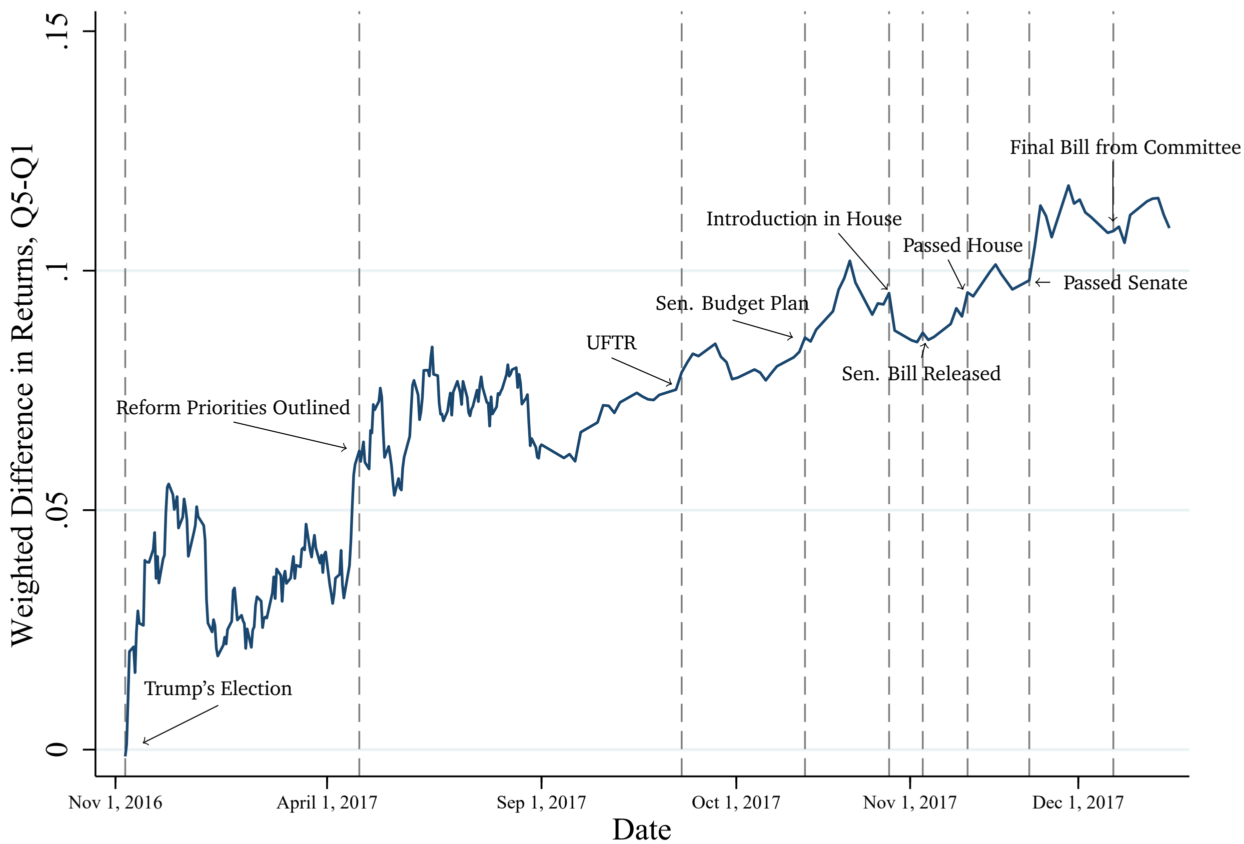
	Raw Returns			1-Factor Returns			3-Factor Returns		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\hat{V}$	0.18^{*}	0.17^{*}		0.29^{***}	0.31^{***}		0.27^{***}	0.28^{***}	
	(0.08)	(0.07)		(0.06)	(0.05)		(0.06)	(0.05)	
$\hat{V}$ × Dom			0.17			0.44^{***}			0.42^{***}
			(0.13)			(0.10)			(0.10)
$\hat{V}$ × MNC			0.17^{*}			0.29^{***}			0.26^{***}
			(0.07)			(0.05)			(0.05)
Constant	0.28^{***}	0.28^{***}	0.28^{***}	-0.09^{***}	-0.09^{***}	-0.10^{***}	-0.06^{***}	-0.07^{***}	-0.07^{***}
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
N	1570	1551	1551	1570	1551	1551	1570	1551	1551
Weighted	N	Y	Y	N	Y	Y	N	Y	Y

Notes: Panel A reports raw returns, 1-factor returns, and 3-factor returns by quintile of predicted investment using the pooled regression from column 1 of Table 3. The sixth row reports Q5 (row 5) minus Q1 (row 1). All returns are winsorized at the 5% level. Panel B reports regression results for 8 different specifications. Columns 1-3 use raw returns as the outcome. Columns 4-6 use 1-factor returns as the outcome. Columns 7-9 use 3-factor returns as the outcome. Regressors appear as row names. The final row indicates whether or not we weighted by log(market value). All outcome variables are winsorized at the 5% level in this panel as well. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

market value in 2016, and with a multinational indicator interacted with $\hat{V}$. The results accord with those from Panel A. Our preferred specification is the log-value-weighted, 3-factor cumulative returns in column (9), in which the elasticity of firm value to V is 0.42 (s.e.=0.10) for domestic firms and 0.26 (s.e.=0.05) for multinationals. Not shown in the table, we have also included an indicator for paying the "toll tax" on accumulated, deferred foreign earnings under Section 965, which never changes the coefficients by more than 0.01, likely because few firms faced this tax.

For comparison, we estimate the same regression in the model across the firm portfolios defined in Table E.4, with the dependent variable the model-implied log change in the present

Figure 11: Cumulative Stock Returns Before TCJA Passage



Notes: This figure uses stock price data from CRSP to plot the difference between mean market cap-weighted cumulative returns since Election Day 2016 for firms in the top and bottom quintile of predicted investment. The figure also notes the timing of events affecting the probability of tax reform passage or the generosity of its provisions, as described in Appendix F. Dates from September 1, 2017 until bill passage are rescaled to four times their normal size on the x-axis to make events occurring during the legislative session easier to see.

value of dividends immediately after the tax change. This exercise yields a coefficient of 0.61 for domestic-only firms and 0.52 for multinational firms.[52] The difference may reflect a combination of uncertainty over the persistence of the reform as well as the implementation details, many of which were left to the IRS and Treasury to specify. Nevertheless, the results present another independent validation of our empirical strategy identifying the impact of the reform on corporate behavior. They also affirm the value of using asset prices to assess corporate tax policy changes (Summers, 1981).

[52]The smaller instantaneous than long-run response reflects the required increase in investment in the short run. Additionally, the theory's predictions concern the unlevered value of the firm. Adjusting our estimates for leverage modestly widens the gap between the data and theory, but does not affect our qualitative conclusion.

Figure 11 shows the time path of cumulative returns for the long-short $\hat{I}$ portfolio and labels several key events.[53] The excess returns accrue during three phases. The first is right after the election, the outcome of which increased the chances of a corporate tax cut at some point. The second phase occurs around when tax reform emerges as an administration priority in the late spring of 2017. The final phase, which accounts for more than half of the cumulative increase, takes place during the debate in Congress when most of the legislative details came into view.

9 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 complementarity between domestic and foreign capital in production. Overall, we estimate a long-run increase in domestic corporate capital of roughly 7.2% 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.

Many of the provisions of the TCJA remain contested in the political arena. Our results highlight the potentially unintended consequences of including deductions for the normal return to tangible capital in the GILTI and FDII provisions. Our framework is well suited to consider the impacts of policy reforms that change this deduction.

Our quantitative model enables an analysis of other policy counterfactuals. We decompose

[53] Several studies have looked at stock market reactions to TCJA events for various subsamples of firms. This work generally finds positive effects for more exposed firms (Blanchard, Collins, Jahan-Parvar, Pellet and Wilson, 2018; Wagner, Zeckhauser and Ziegler, 2018*a*,*b*; Gaertner, Hoopes and Williams, 2020), though there is some disagreement based on methodology and the choice of event dates (Diercks, Soques and Waller (2021); cf., Borochin, Celik, Tian and Whited (2021)). Appendix F synthesizes and describes the events collected in these studies and plotted in Figure 11.

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 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 U.S. presence.

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Tax Policy and Investment in a Global Economy

Online Appendix

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A Model Appendix

A.1 Derivation of Profit Function (3)

The static optimization is $\max_{L,M} P_t Q_t - P_t^L L_t - P_t^M M_t$, with the demand constraint $Q_t = Q^* P_t^{-\frac{\mathscr{M}}{\mathscr{M}-1}}$. Let $Y_t = P_t Q_t = Q_t^{\frac{1}{\mathscr{M}}} Q^{*\frac{\mathscr{M}-1}{\mathscr{M}}} = A_t \mathscr{K}_t^{\alpha_{\mathscr{K}}} L_t^{\alpha_L} M_t^{\alpha_M}$, where to keep notation simple we have redefined A_t to absorb the demand intercept Q^*. The FOC are:

$$\text{FOC } (L_t): \qquad P_t^L = \frac{\alpha_L Y_t}{L_t},$$

$$\text{FOC } (M_t): \qquad P_t^M = \frac{\alpha_M Y_t}{M_t}.$$

By definition and substituting the FOC gives:

$$F(\mathscr{K}_t; Z_t) \equiv Y_t - P_t^L L_t - P_t^M M_t = (1 - \alpha_L - \alpha_M) Y_t. \tag{A.1}$$

Using

$$M_t = \left(\frac{\alpha_M}{P_t^M}\right)\left(\frac{\alpha_L}{P_t^L}\right)^{-1} L_t$$

and the FOC for L_t we get an expression for revenue as a function of capital:

$$\begin{aligned}
\text{Def.:} \qquad & Y_t = A_t \mathscr{K}_t^{\alpha_{\mathscr{K}}} L_t^{\alpha_L} M_t^{\alpha_M} \\
\text{Subst. prev. line:} \qquad & = \left(\frac{\alpha_M}{P_t^M}\right)^{\alpha_M} \left(\frac{\alpha_L}{P_t^L}\right)^{-\alpha_M} A_t \mathscr{K}_t^{\alpha_{\mathscr{K}}} L_t^{\alpha_L + \alpha_M} \\
\text{Subst. FOC } (L): \qquad & = \left(\frac{\alpha_M}{P_t^M}\right)^{\alpha_M} \left(\frac{\alpha_L}{P_t^L}\right)^{-\alpha_M} A_t \mathscr{K}_t^{\alpha_{\mathscr{K}}} \left(\frac{\alpha_L}{P_t^L} Y_t\right)^{\alpha_L + \alpha_M} \\
& = \left(\frac{\alpha_M}{P_t^M}\right)^{\frac{\alpha_M}{1-(\alpha_L+\alpha_M)}} \left(\frac{\alpha_L}{P_t^L}\right)^{\frac{\alpha_L}{1-(\alpha_L+\alpha_M)}} A_t^{\frac{1}{1-(\alpha_L+\alpha_M)}} \mathscr{K}_t^{\frac{\alpha_{\mathscr{K}}}{1-(\alpha_L+\alpha_M)}}.
\end{aligned}$$

We then have:

$$F(\mathscr{K}_t; Z_t) = (1 - \alpha_L - \alpha_M) Y_t = Z_t \mathscr{K}_t^{\alpha}, \tag{A.2}$$

$$\text{where: } Z_t \equiv (1 - \alpha_L - \alpha_M) \left(\frac{\alpha_M}{P_t^M}\right)^{\frac{\alpha_M}{1-(\alpha_L+\alpha_M)}} \left(\frac{\alpha_L}{P_t^L}\right)^{\frac{\alpha_L}{1-(\alpha_L+\alpha_M)}} A_t^{\frac{1}{1-(\alpha_L+\alpha_M)}}, \tag{A.3}$$

$$\alpha \equiv \frac{\alpha_{\mathscr{K}}}{1 - (\alpha_L + \alpha_M)}. \tag{A.4}$$

A.2 Derivations of Equations (11) to (20) Relating Capital to Tax Changes

This appendix derives the main result of Section 3 relating the cross steady-state change in capital to the changes in taxes.

We start by extending the model to allow for multiple types of domestic and international capital. Let $K_{s,t}$ and $K_{e,t}$ denote structures and equipment capital. We assume:

$$K_t = g\left(K_{s,t}, K_{e,t}\right)$$

and likewise for international capital. Each type of capital has its own price and depreciation schedule and obeys its own dynamic evolution equation. The firm maximizes the present value of dividends with a discount rate ρ, subject to initial conditions and the dynamic evolution equations for each type of domestic and international capital.

A.2.1 First Order Conditions and Steady State

We write the Hamiltonian:

$$\mathscr{H}\left(I_{s,t}, K_{s,t}, I_{e,t}, K_{e,t}, \bar{I}_{s,t}, \bar{K}_{s,t}, \bar{I}_{e,t}, \bar{K}_{e,t}\right) = D_t + \sum_{i\in\{s,e\}}\left(\lambda_{i,t}\left(I_{i,t} - \delta^i K_{i,t}\right) + \bar{\lambda}_{i,t}\left(\bar{I}_{i,t} - \bar{\delta}^i \bar{K}_{i,t}\right)\right).$$

Necessary conditions for $i \in \{s, e\}$:

$$I_{i,t}: \quad (1-\tau_t)\Phi_1\left(I_{i,t}, K_{i,t}\right) + \left(1 - \Gamma_{i,t}\right)P^K_{i,t} = \lambda_{i,t}, \tag{A.5}$$

$$\bar{I}_{i,t}: \quad (1-\bar{\tau}_t)\bar{\Phi}_1\left(\bar{I}_{i,t}, \bar{K}^i_t\right) + \left(1 - \bar{\Gamma}_{i,t}\right)P^{\bar{K}}_{i,t} = \bar{\lambda}_{i,t}, \tag{A.6}$$

$$K_{i,t}: \quad \frac{(1-\tau_t)\left(F_1\left(\partial K_t/\partial K_{i,t}\right) - \Phi_2\left(I_{i,t}, K_{i,t}\right)\right) + (1-\bar{\tau}_t)\bar{F}_2\left(\partial K_t/\partial K_{i,t}\right) - \delta^i\lambda_{i,t} + \dot{\lambda}_{i,t}}{\lambda_{i,t}} = \rho, \tag{A.7}$$

$$\bar{K}_{i,t}: \quad \frac{(1-\bar{\tau}_t)\left(\bar{F}_1\left(\partial \bar{K}_t/\partial \bar{K}_{i,t}\right) - \bar{\Phi}_2\left(\bar{I}_{i,t}, \bar{K}_{i,t}\right)\right) + (1-\tau_t)F_2\left(\partial \bar{K}_t/\partial \bar{K}_{i,t}\right) - \bar{\delta}^i\bar{\lambda}_{i,t} + \dot{\bar{\lambda}}_{i,t}}{\bar{\lambda}_{i,t}} = \rho. \tag{A.8}$$

Substituting the adjustment costs:

$$\text{FOC } (I_{i,t}): \quad \dot{K}_{i,t}/K_{i,t} = \left[\frac{1}{\phi}\left(\frac{\lambda_{i,t} - P^K_{i,t}\left(1-\Gamma_{i,t}\right)}{(1-\tau_t)}\right)\right]^{\frac{1}{\gamma}}, \tag{A.9}$$

$$\text{FOC}(K_{i,t}): \quad \dot{\lambda}_{i,t} = \left(\rho + \delta^i\right)\lambda_{i,t} - (1-\tau_t)\left(F_1\left(\partial K_t/\partial K_{i,t}\right) - \Phi_2\left(I_{i,t}, K_{i,t}\right)\right) - (1-\bar{\tau}_t)\bar{F}_2\left(\partial K_t/\partial K_{i,t}\right). \tag{A.10}$$

The analogous equations hold for foreign capital.

In steady state, $\dot{K}_{i,t} = \dot{\lambda}_{i,t} = 0$, giving:

$$\lambda^*_i = (1 - \Gamma_i)P^K_i. \tag{A.11}$$

Let $R^*_i \equiv \left(\rho + \delta^i\right)\lambda^*_i$ and likewise for foreign. From equation (A.10) we have the system of equations for the steady state:

$$\left((1-\tau)F_1^*+(1-\bar{\tau})\bar{F}_2^*\right)\left(\partial K^*/\partial K_s^*\right)=R_s^*, \tag{A.12}$$
$$\left((1-\tau)F_1^*+(1-\bar{\tau})\bar{F}_2^*\right)\left(\partial K^*/\partial K_e^*\right)=R_e^*, \tag{A.13}$$
$$\left((1-\bar{\tau})\bar{F}_1^*+(1-\tau)F_2^*\right)\left(\partial \bar{K}^*/\partial \bar{K}_s^*\right)=\bar{R}_s^*, \tag{A.14}$$
$$\left((1-\bar{\tau})\bar{F}_1^*+(1-\tau)F_2^*\right)\left(\partial \bar{K}^*/\partial \bar{K}_e^*\right)=\bar{R}_e^*. \tag{A.15}$$

Recognizing that $F_1^*=F_1\left(K^*,\bar{K}^*;Z^*\right), F_2^*=F_2\left(K^*,\bar{K}^*;Z^*\right), \bar{F}_1^*=\bar{F}_1\left(\bar{K}^*,K^*;Z^*\right), \bar{F}_2^*=\bar{F}_2\left(\bar{K}^*,K^*;Z^*\right)$, this is a system of four non-linear equations in four unknowns $K_s^*,K_e^*,\bar{K}_s^*,\bar{K}_e^*$.

We assume that structures and equipment combine according to:

$$K=g\left(K_s,K_e\right)=\left(a_s^{\frac{1}{\nu}}K_s^{\frac{\nu-1}{\nu}}+a_e^{\frac{1}{\nu}}K_e^{\frac{\nu-1}{\nu}}\right)^{\frac{\nu}{\nu-1}} \tag{A.16}$$

and define $R^*\equiv\left(a_s\left(R_s^*\right)^{1-\nu}+a_e\left(R_e^*\right)^{1-\nu}\right)^{\frac{1}{1-\nu}}$, and likewise for international capital. Standard CES derivations give:

$$\frac{\partial K^*}{\partial K_i^*}=a_i^{\frac{1}{\nu}}\left(\frac{K_i^*}{K^*}\right)^{-\frac{1}{\nu}}=\left(\frac{R_i^*}{R^*}\right). \tag{A.17}$$

Equation (A.17) allows us to collapse the four steady state conditions into two, as in the main text:

$$(1-\tau)F_1^*+(1-\bar{\tau})\bar{F}_2^*=R^*, \tag{A.18}$$
$$(1-\bar{\tau})\bar{F}_1^*+(1-\tau)F_2^*=\bar{R}^*. \tag{A.19}$$

A.2.2 Equations (15) to (18)

Substituting functional forms:

$$R^*=\alpha\left[(1-\tau^*)aZ^*(\mathscr{K}^*)^{\alpha+1/\sigma-1}+(1-\bar{\tau}^*)(1-\bar{a})\bar{Z}^*\left(\bar{\mathscr{K}}^*\right)^{\alpha+1/\sigma-1}\right](K^*)^{-\frac{1}{\sigma}}, \tag{A.20}$$
$$\bar{R}^*=\alpha\left[(1-\bar{\tau}^*)\bar{a}\bar{Z}^*\left(\bar{\mathscr{K}}^*\right)^{\alpha+1/\sigma-1}+(1-\tau^*)(1-a)Z^*(\mathscr{K}^*)^{\alpha+1/\sigma-1}\right]\left(\bar{K}^*\right)^{-\frac{1}{\sigma}}, \tag{A.21}$$

where recall $\mathscr{K}=\left(aK^{\frac{\sigma-1}{\sigma}}+(1-a)\bar{K}^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}}$ and $\bar{\mathscr{K}}=\left(\bar{a}\bar{K}^{\frac{\sigma-1}{\sigma}}+(1-\bar{a})K^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}}$.

Let $\tilde{\alpha}\equiv\sigma\alpha+(1-\sigma)=1-\sigma(1-\alpha)\subseteq[1-\sigma,1]$ be the elasticity-adjusted returns to scale, i.e., $\alpha=1\Rightarrow\tilde{\alpha}=1$ and $\alpha=0\Rightarrow\tilde{\alpha}=1-\sigma$, with $\tilde{\alpha}=\alpha$ if $\sigma=1$. Let $\mathbb{E}_w(x,y)\equiv wx+(1-w)y$ denote the weighted average of x and y.[1] Defining $\hat{\tau}=d\tau/(1-\tau)$ and $\hat{\Gamma}=d\Gamma/(1-\Gamma)$ and using equations (11) to (14), the log-linearization around the steady state gives:

[1]Note the following properties which we use in the derivation that follows:

$$\mathbb{E}_w(1-x,y)=1-\mathbb{E}_w(x,1-y),$$
$$\mathbb{E}_w(x,1-y)+\mathbb{E}_{\bar{w}}(y,1-x)-1=(1-w-\bar{w})(1-x-y),$$
$$\mathbb{E}_{\bar{w}}(y,1-x)=1-x-\bar{w}(1-x-y),$$
$$(1-\bar{w})(1-\mathbb{E}_w(x,1-y))-w\mathbb{E}_{\bar{w}}(y,1-x)=(1-w-\bar{w})y.$$

$$(A.20): \quad r+(1/\sigma)k = s_{F_1}\left(z-\hat{\tau}+\left(\frac{\tilde{\alpha}}{\sigma}\right)\left(s_1 k+(1-s_1)\bar{k}\right)\right)+\left(1-s_{F_1}\right)\left(\bar{z}-\hat{\bar{\tau}}+\left(\frac{\tilde{\alpha}}{\sigma}\right)\left(\bar{s}_1\bar{k}+(1-\bar{s}_1)k\right)\right),$$

$$\sigma r+k = -\sigma\mathbb{E}_{s_{F_1}}\left(\hat{\tau}-z,\hat{\bar{\tau}}-\bar{z}\right)+\tilde{\alpha}\left(\mathbb{E}_{s_{F_1}}\left(s_1,1-\bar{s}_1\right)k+\left(1-\mathbb{E}_{s_{F_1}}\left(s_1,1-\bar{s}_1\right)\right)\bar{k}\right),$$

$$k = \frac{\left(1-\mathbb{E}_{s_{F_1}}\left(s_1,1-\bar{s}_1\right)\right)\tilde{\alpha}\bar{k}-\sigma\left(r+\mathbb{E}_{s_{F_1}}\left(\hat{\tau}-z,\hat{\bar{\tau}}-\bar{z}\right)\right)}{1-\mathbb{E}_{s_{F_1}}\left(s_1,1-\bar{s}_1\right)\tilde{\alpha}}, \tag{A.22}$$

$$(A.21): \quad \bar{k} = \frac{\left(1-\mathbb{E}_{s_{\bar{F}_1}}\left(\bar{s}_1,1-s_1\right)\right)\tilde{\alpha}k-\sigma\left(\bar{r}+\mathbb{E}_{s_{\bar{F}_1}}\left(\hat{\bar{\tau}}-\bar{z},\hat{\tau}-z\right)\right)}{1-\mathbb{E}_{s_{\bar{F}_1}}\left(\bar{s}_1,1-s_1\right)\tilde{\alpha}}. \tag{A.23}$$

Substituting equation (A.23) into equation (A.22):

$$\left(1-\mathbb{E}_{s_{F_1}}\left(s_1,1-\bar{s}_1\right)\tilde{\alpha}\right)k$$
$$=\left(1-\mathbb{E}_{s_{F_1}}\left(s_1,1-\bar{s}_1\right)\right)\tilde{\alpha}\left(\frac{\left(1-\mathbb{E}_{s_{\bar{F}_1}}\left(\bar{s}_1,1-s_1\right)\right)\tilde{\alpha}k-\sigma\left(\bar{r}+\mathbb{E}_{s_{\bar{F}_1}}\left(\hat{\bar{\tau}}-\bar{z},\hat{\tau}-z\right)\right)}{1-\mathbb{E}_{s_{\bar{F}_1}}\left(\bar{s}_1,1-s_1\right)\tilde{\alpha}}\right)$$
$$-\sigma\left(r+\mathbb{E}_{s_{F_1}}\left(\hat{\tau}-z,\hat{\bar{\tau}}-\bar{z}\right)\right).$$

Grouping terms and simplifying:

$$k = -\frac{\omega_{k,r}r+\left(1-\omega_{k,r}\right)\bar{r}+\omega_{k,\tau}\left(\hat{\tau}-z\right)+\left(1-\omega_{k,\tau}\right)\left(\hat{\bar{\tau}}-\bar{z}\right)}{1-\alpha}, \tag{A.24}$$

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

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

$$r = -\hat{\Gamma}+\frac{d\rho+d\delta}{\rho+\delta}+p^K,$$

$$\bar{r} = -\hat{\bar{\Gamma}}+\frac{d\bar{\rho}+d\bar{\delta}}{\bar{\rho}+\bar{\delta}}+p^{\bar{K}}.$$

Equations (15) to (18) in the main text follow from substituting the expressions for r and $\bar{r}$

and re-grouping terms to isolate the tax variables. Note that with multiple types of capital $r = a_s r_s + a_e r_e$ is a weighted average of the change in user cost of different types of capital, with the weights given by steady state expenditure shares.

A.2.3 Equations (19) and (20)

The expressions for $\bar{k}$ follow from symmetry of the setup and are given by:

$$\bar{k} = \frac{\omega_{\bar{k},\bar{r}}\hat{\bar{\Gamma}} + \left(1-\omega_{\bar{k},\bar{r}}\right)\hat{\Gamma} - \omega_{\bar{k},\bar{\tau}}\hat{\bar{\tau}} - \left(1-\omega_{\bar{k},\bar{\tau}}\right)\hat{\tau} + \bar{\epsilon}}{1-\alpha}, \tag{A.25}$$

$$\text{where: } \omega_{\bar{k},\bar{r}} \equiv \frac{1-\left((1-\bar{s}_1)-s_{F_1}(1-s_1-\bar{s}_1)\right)\tilde{\alpha}}{1-\left(1-s_{F_1}-s_{\bar{F}_1}\right)(1-s_1-\bar{s}_1)\tilde{\alpha}}, \tag{A.26}$$

$$\omega_{\bar{k},\bar{\tau}} \equiv \frac{s_{\bar{F}_1}+\left(1-s_{F_1}-s_{\bar{F}_1}\right)s_1\tilde{\alpha}}{1-\left(1-s_{F_1}-s_{\bar{F}_1}\right)(1-s_1-\bar{s}_1)\tilde{\alpha}}, \tag{A.27}$$

$$\bar{\epsilon} \equiv \omega_{\bar{k},\bar{\tau}}\bar{z} + \left(1-\omega_{\bar{k},\bar{\tau}}\right)z - \omega_{\bar{k},\bar{r}}\left(\frac{d\bar{\rho}+d\bar{\delta}}{\bar{\rho}+\bar{\delta}}+p^{\bar{K}}\right) - \left(1-\omega_{\bar{k},\bar{r}}\right)\left(\frac{d\rho+d\delta}{\rho+\delta}+p^{K}\right). \tag{A.28}$$

Finally, let $s_K = K/\left(K+\bar{K}\right)$. The total capital response (scaled by the returns to scale) is:

$$\begin{aligned}(1-\alpha)\left(s_K k + (1-s_K)\bar{k}\right) &= s_K\left(\omega_{k,r}\hat{\Gamma} + \left(1-\omega_{k,r}\right)\hat{\bar{\Gamma}} - \omega_{k,\tau}\hat{\tau} - \left(1-\omega_{k,\tau}\right)\hat{\bar{\tau}} + \epsilon\right)\\ &\quad + (1-s_K)\left(\omega_{\bar{k},\bar{r}}\hat{\bar{\Gamma}} + \left(1-\omega_{\bar{k},\bar{r}}\right)\hat{\Gamma} - \omega_{\bar{k},\bar{\tau}}\hat{\bar{\tau}} - \left(1-\omega_{\bar{k},\bar{\tau}}\right)\hat{\tau} + \bar{\epsilon}\right)\\ &= \omega^T_{k,r}\hat{\Gamma} + \left(1-\omega^T_{k,r}\right)\hat{\bar{\Gamma}} - \omega^T_{k,\tau}\hat{\tau} - \left(1-\omega^T_{k,\tau}\right)\hat{\bar{\tau}} + \epsilon^T,\end{aligned} \tag{A.29}$$

$$\text{with: } \omega^T_{k,r} \equiv s_K\omega_{k,r} + (1-s_K)\left(1-\omega_{\bar{k},\bar{r}}\right) = \omega_{k,r} - (1-s_K)\left(\frac{1-\tilde{\alpha}}{1-\left(1-s_{F_1}-s_{\bar{F}_1}\right)(1-s_1-\bar{s}_1)\tilde{\alpha}}\right), \tag{A.30}$$

$$\omega^T_{k,\tau} \equiv s_K\omega_{k,\tau} + (1-s_K)\left(1-\omega_{\bar{k},\bar{\tau}}\right) = \omega_{k,\tau} + (1-s_K)\left(\frac{\left(1-s_{F_1}-s_{\bar{F}_1}\right)(1-\tilde{\alpha})}{1-\left(1-s_{F_1}-s_{\bar{F}_1}\right)(1-s_1-\bar{s}_1)\tilde{\alpha}}\right). \tag{A.31}$$

A.2.4 Equations (11) to (14)

Let $\chi_K \equiv \bar{K}^*/K^*$ denote the steady state ratio of international to domestic capital, $\chi_{\mathcal{K}} \equiv \bar{\mathcal{K}}^*/\mathcal{K}^*$, and $\chi_\tau \equiv (1-\bar{\tau})/(1-\tau)$, $\chi_Z \equiv \bar{Z}^*/Z^*$, $\chi_R = \bar{R}^*/R^*$, $\chi_a = \bar{a}/a$. Then:

$$s_1 = \frac{a}{a+(1-a)\chi_K^{\frac{\sigma-1}{\sigma}}}, \tag{A.32}$$

$$\bar{s}_1 = \frac{\bar{a}\chi_K^{\frac{\sigma-1}{\sigma}}}{\bar{a}\chi_K^{\frac{\sigma-1}{\sigma}} + (1-\bar{a})}. \tag{A.33}$$

Moreover:

$$\begin{aligned}
F_1^* &= \alpha a Z^* (K^*)^{-\frac{1}{\sigma}} (\mathscr{K}^*)^{\alpha+1/\sigma-1}, \\
\bar{F}_1^* &= \alpha \bar{a} \bar{Z}^* \left(\bar{K}^*\right)^{-\frac{1}{\sigma}} \left(\bar{\mathscr{K}}^*\right)^{\alpha+1/\sigma-1} = \chi_Z \chi_K^{-\frac{1}{\sigma}} \chi_{\mathscr{K}}^{\alpha+1/\sigma-1} \chi_a F_1^*, \\
F_2^* &= \alpha (1-a) Z^* \left(\bar{K}^*\right)^{-\frac{1}{\sigma}} (\mathscr{K}^*)^{\alpha+1/\sigma-1} = \left(\frac{1-a}{a}\right) \chi_K^{-\frac{1}{\sigma}} F_1^*, \\
\bar{F}_2^* &= \alpha (1-\bar{a}) \bar{Z}^* (K^*)^{-\frac{1}{\sigma}} \left(\bar{\mathscr{K}}^*\right)^{\alpha+1/\sigma-1} = \left(\frac{1-\bar{a}}{\bar{a}}\right) \chi_K^{\frac{1}{\sigma}} \bar{F}_1^* = \left(\frac{1-\bar{a}}{a}\right) \chi_Z \chi_{\mathscr{K}}^{\alpha+1/\sigma-1} F_1^*,
\end{aligned}$$

giving:

$$s_{F_1} = \frac{(1-\tau^*) F_1^*}{(1-\tau^*) F_1^* + (1-\bar{\tau}^*) \bar{F}_2^*} = \frac{a}{a + (1-\bar{a}) \chi_\tau \chi_Z \chi_{\mathscr{K}}^{\alpha+1/\sigma-1}}, \tag{A.34}$$

$$\begin{aligned}
1 - s_{\bar{F}_1} &= \frac{(1-\tau^*) F_2^*}{(1-\bar{\tau}^*) \bar{F}_1^* + (1-\tau^*) F_2^*} = \frac{\left(\frac{1-a}{a}\right) \chi_K^{-\frac{1}{\sigma}}}{\chi_\tau \chi_Z \chi_K^{-\frac{1}{\sigma}} \chi_{\mathscr{K}}^{\alpha+1/\sigma-1} \chi_a + \left(\frac{1-a}{a}\right) \chi_K^{-\frac{1}{\sigma}}} \\
&= \frac{1-a}{(1-a) + \bar{a} \chi_\tau \chi_Z \chi_{\mathscr{K}}^{\alpha+1/\sigma-1}}.
\end{aligned} \tag{A.35}$$

Finally, multiplying equation (A.18) by χ_R, dividing the resulting expression and equation (A.19) by $(1-\tau)$, and equating, we have that $\chi_R \left(F_1^* + \chi_\tau \bar{F}_2^*\right) = \chi_\tau \bar{F}_1^* + F_2^*$. Substituting the derivatives and manipulating gives:

$$\chi_\tau \chi_Z \chi_{\mathscr{K}}^{\alpha+1/\sigma-1} = \frac{(1-a) \chi_K^{-\frac{1}{\sigma}} - a \chi_R}{(1-\bar{a}) \chi_R - \bar{a} \chi_K^{-\frac{1}{\sigma}}}, \tag{A.36}$$

which shows that s_{F_1} and $s_{\bar{F}_1}$ are functions of a, χ_R, χ_K. Moreover, this expression implicitly defines χ_K as a function of $a, \sigma, \alpha, \chi_Z$, and χ_τ. Repeating equations (A.32) and (A.33) and substituting equation (A.36) into equations (A.34) and (A.35), the four share terms that enter into the elasticity formulae are:

$$s_1 = \frac{a}{a + (1-a) \chi_K^{\frac{\sigma-1}{\sigma}}}, \tag{A.37}$$

$$\bar{s}_1 = \frac{\bar{a}\chi_K^{\frac{\sigma-1}{\sigma}}}{\bar{a}\chi_K^{\frac{\sigma-1}{\sigma}} + (1-\bar{a})}, \tag{A.38}$$

$$s_{F_1} = \frac{a\left((1-\bar{a}) \chi_R - \bar{a} \chi_K^{-\frac{1}{\sigma}}\right)}{(1-\bar{a}-a) \chi_K^{-\frac{1}{\sigma}}}, \tag{A.39}$$

$$1-s_{\bar{F}_1}=\frac{(1-a)\left((1-\bar{a})\,\chi_R-\bar{a}\chi_K^{-\frac{1}{\sigma}}\right)}{(1-\bar{a}-a)\,\chi_R}. \tag{A.40}$$

A.3 Derivation of Steady-state Relative Profits

This appendix derives the final moment condition relating relative profits to parameters. Let $\chi_F=\bar{F}\left(\bar{K}_t,K_t;\bar{Z}_t\right)/F\left(K_t,\bar{K}_t;Z_t\right)$ denote the ratio of foreign to domestic taxable income. Then:

$$\chi_F=\chi_Z\chi_{\mathcal{K}}^{\alpha},$$

$$\text{where: }\chi_{\mathcal{K}}=\left(\frac{\bar{a}\chi_K^{\frac{\sigma-1}{\sigma}}+(1-\bar{a})}{a+(1-a)\,\chi_K^{\frac{\sigma-1}{\sigma}}}\right)^{\frac{\sigma}{\sigma-1}}.$$

Using this definition together with equation (A.36) gives the moment:

$$\chi_\tau\chi_F=\left(\frac{(1-a)\,\chi_K^{-\frac{1}{\sigma}}-a\chi_R}{(1-\bar{a})\,\chi_R-\bar{a}\chi_K^{-\frac{1}{\sigma}}}\right)\chi_{\mathcal{K}}^{1-1/\sigma}=\left(\frac{(1-a)\,\chi_K^{-\frac{1}{\sigma}}-a\chi_R}{(1-\bar{a})\,\chi_R-\bar{a}\chi_K^{-\frac{1}{\sigma}}}\right)\left(\frac{\bar{a}\chi_K^{\frac{\sigma-1}{\sigma}}+(1-\bar{a})}{a+(1-a)\,\chi_K^{\frac{\sigma-1}{\sigma}}}\right).$$

Under the interpretation that adjustment costs are paid in units of labor (so total paid labor is split between production labor L and capital installation labor), we can associate F and $\bar{F}$ with taxable income before credits and deductions.

A.4 Dynamic Accumulation of Intangible Capital Extension

This extension shows that a dynamic choice of intangible capital provides one possible microfoundation for complementarity between domestic and foreign capital.

We introduce intangible capital by augmenting the domestic and foreign production functions to include the factor $\mathcal{H}_t$:

$$Q_t=\left(A_t\mathcal{H}_t^{\alpha_{\mathcal{H}}}\mathcal{K}_t^{\alpha_{\mathcal{K}}}L_t^{\alpha_L}M_t^{\alpha_M}\right)^{\mathcal{M}}, \tag{A.41}$$

$$\bar{Q}_t=\left(\bar{A}_t\mathcal{H}_t^{\alpha_{\mathcal{H}}}\bar{\mathcal{K}}_t^{\alpha_{\mathcal{K}}}\bar{L}_t^{\alpha_L}\bar{M}_t^{\alpha_M}\right)^{\mathcal{M}}. \tag{A.42}$$

Importantly, the same quantity $\mathcal{H}_t$ enters into both the domestic and foreign production functions; the non-rivalry of $\mathcal{H}_t$ distinguishes it as intangible capital. The domestic concentrated earnings function becomes:

$$F\left(K_t,\bar{K}_t,\mathcal{H}_t;Z_t\right)=Z_t\mathcal{H}_t^{\alpha_{\mathcal{H}}\alpha/\alpha_{\mathcal{K}}}\mathcal{K}_t^{\alpha}, \tag{A.43}$$

and likewise for the foreign operation. We assume $\alpha_{\mathcal{H}}<\alpha_{\mathcal{K}}/\alpha=1-\alpha_L-\alpha_M$, so that there are not increasing returns to intangible capital in the earnings function. A natural benchmark is that intangible capital is tangible capital-augmenting, so that $\alpha_H=\alpha_{\mathcal{K}}$. Intangible capital obeys the law of motion $\dot{\mathcal{H}}_t=I_{\mathcal{H},t}-\delta^{\mathcal{H}}\mathcal{H}_t$, with adjustment costs $\Phi^{\mathcal{H}}\left(I_{\mathcal{H},t},\mathcal{H}_t\right)$. We assume for simplicity that all intangible investment (i.e. R&D) occurs domestically.[2]

The necessary conditions for tangible investment and capital remain unaltered in this setup. With convex adjustment costs, the new necessary conditions relating to the accumulation of intangible capital are:

$$\text{FOC } (I_{\mathscr{H},t}): \qquad \dot{\mathscr{H}}_t/\mathscr{H}_t = \left[\frac{1}{\phi^{\mathscr{H}}}\left(\frac{\lambda_{\mathscr{H},t}-P_t^{\mathscr{H}}\left(1-\Gamma_{\mathscr{H},t}\right)}{(1-\tau_t)}\right)\right]^{\frac{1}{\gamma}}, \tag{A.44}$$

$$\text{FOC}(\mathscr{H}_t): \qquad \dot{\lambda}_{\mathscr{H},t} = \left(\rho+\delta^{\mathscr{H}}\right)\lambda_t^{\mathscr{H}} - (1-\tau_t)\left(F_3-\Phi_2^{\mathscr{H}}\right) - (1-\bar{\tau}_t)\bar{F}_3. \tag{A.45}$$

Combining these equations, the steady state has the additional condition:

$$\begin{aligned} R^*_{\mathscr{H}} &= (1-\tau)F_3^* + (1-\bar{\tau})\bar{F}_3 && \text{(A.46)}\\ &= \frac{\alpha_{\mathscr{H}}\alpha}{\alpha_{\mathscr{K}}}\left[(1-\tau)F\left(K^*,\bar{K}^*,\mathscr{H}^*;Z^*\right)+(1-\bar{\tau})\bar{F}\left(\bar{K}^*,K^*,\mathscr{H}^*;\bar{Z}^*\right)\right](\mathscr{H}^*)^{-1}, && \text{(A.47)}\end{aligned}$$

with $R^*_{\mathscr{H}} = \left(\rho+\delta^{\mathscr{H}}\right)P^{\mathscr{H}}\left(1-\Gamma_{\mathscr{H}}\right)$ being the user cost of intangible capital.

As in the baseline model, we derive the long-run response of capital to changes in tax policy. As a preliminary step, define the revenue shares:

$$\begin{aligned} s_{RK} &= \frac{R^*K^*}{(1-\tau)F\left(K^*,\bar{K}^*,\mathscr{H}^*;Z^*\right)+(1-\bar{\tau})\bar{F}\left(\bar{K}^*,K^*,\mathscr{H}^*;\bar{Z}^*\right)},\\ s_{\bar{R}\bar{K}} &= \frac{\bar{R}^*\bar{K}^*}{(1-\tau)F\left(K^*,\bar{K}^*,\mathscr{H}^*;Z^*\right)+(1-\bar{\tau})\bar{F}\left(\bar{K}^*,K^*,\mathscr{H}^*;\bar{Z}^*\right)},\end{aligned}$$

and note:

$$\frac{\alpha_{\mathscr{H}}\alpha}{\alpha_{\mathscr{K}}} = \frac{R^*_{\mathscr{H}}\mathscr{H}^*}{(1-\tau)F\left(K^*,\bar{K}^*,\mathscr{H}^*;Z^*\right)+(1-\bar{\tau})\bar{F}\left(\bar{K}^*,K^*,\mathscr{H}^*;\bar{Z}^*\right)}.$$

Let $\hbar = d\log\mathscr{H}$. It is straightforward to show that the numerators in the expressions for k and $\bar{k}$ in equations (A.22) and (A.23) gain the new term $-\alpha_{\mathscr{H}}\alpha\hbar/\alpha_{\mathscr{K}}$. In addition, linearizing equation (A.47) gives:

$$\alpha_{\mathscr{H}}\alpha\hbar/\alpha_{\mathscr{K}} = \zeta_{\mathscr{H}}\left(s_{RK}k + s_{\bar{R}\bar{K}}\bar{k} - r_{\mathscr{H}}\right), \tag{A.48}$$

$$\text{where:} \qquad \zeta_{\mathscr{H}} = \frac{\alpha_{\mathscr{H}}\alpha/\alpha_{\mathscr{K}}}{1-\alpha_{\mathscr{H}}\alpha/\alpha_{\mathscr{K}}} = \frac{\alpha_{\mathscr{H}}}{1-\alpha_L-\alpha_M-\alpha_{\mathscr{H}}} \subseteq [0,\infty].$$

Substituting equation (A.48) into the augmented equations (A.22) and (A.23) and solving gives the result for the response of tangible capital in the presence of dynamic accumulation

[2]This assumption is inessential to the results characterizing how the presence of intangible capital affects the responses of domestic and foreign tangible capital to the main tax terms.

of intangible capital:

$$k = -\frac{\omega_{k,r} r + \left(1-\omega_{k,r}\right)\bar{r} + \omega_{k,\tau}\left(\hat{\tau}-z\right) + \left(1-\omega_{k,\tau}\right)\left(\hat{\bar{\tau}}-\bar{z}\right) + \zeta_{\mathscr{H}} r_{\mathscr{H}}}{1-\alpha-\zeta_{\mathscr{H}}\left(s_{RK}+s_{\bar{R}\bar{K}}\right)}, \tag{A.49}$$

$$\text{where: } \omega_{k,r} \equiv \frac{1-\zeta_{\mathscr{H}}\sigma s_{\bar{R}\bar{K}} - \mathbb{E}_{s_{\bar{F}_1}}\left(\bar{s}_1, 1-s_1\right)\tilde{\alpha}}{1-\left(\mathbb{E}_{s_{F_1}}\left(s_1,1-\bar{s}_1\right)+\mathbb{E}_{s_{\bar{F}_1}}\left(\bar{s}_1,1-s_1\right)-1\right)\tilde{\alpha}},$$

$$\omega_{k,\tau} \equiv \frac{s_{F_1} + \left(1-s_{F_1}-s_{\bar{F}_1}\right)\left(\zeta_{\mathscr{H}}\sigma s_{\bar{R}\bar{K}} + \bar{s}_1\tilde{\alpha}\right)}{1-\left(\mathbb{E}_{s_{F_1}}\left(s_1,1-\bar{s}_1\right)+\mathbb{E}_{s_{\bar{F}_1}}\left(\bar{s}_1,1-s_1\right)-1\right)\tilde{\alpha}}.$$

In particular, equation (A.49) shows that intangible capital introduces a force akin to complementarity between K and $\bar{K}$. Indeed, setting $a = \bar{a} = s_1 = \bar{s}_1 = s_{F_1} = s_{\bar{F}_1} = \mathbb{E}_{s_{F_1}}\left(s_1, 1-\bar{s}_1\right) = \mathbb{E}_{s_{\bar{F}_1}}\left(\bar{s}_1, 1-s_1\right) = 1$ so that foreign capital does not directly enter the domestic production function, we have:

$$\omega_{k,r}\left(a=\bar{a}=1\right) = \frac{1-\zeta_{\mathscr{H}}\sigma s_{\bar{R}\bar{K}}-\tilde{\alpha}}{1-\tilde{\alpha}} = \frac{1-\alpha-\zeta_{\mathscr{H}} s_{\bar{R}\bar{K}}}{1-\alpha} < 1. \tag{A.50}$$

The positive response of domestic capital to the foreign cost of capital occurs because the accumulation of foreign tangible capital induces more intangible investment, which also benefits domestic tangible capital. In addition to this force on $\omega_{k,r}$, the additional term in the denominator of the expression for k tends to increase the capital elasticities, because of the crowding in of intangible investment.

A.5 Intangible Capital Location Choice Extension

This extension augments our baseline environment to allow the firm to choose the location of intangible capital in order to shift profits into low tax jurisdictions. The firm has a stock of intangible capital of $\mathscr{H}_t$, divided into intangible capital booked domestically H_t and booked abroad $\bar{H}_t$. To focus on the location choice, we now take the overall stock $\mathscr{H}$ as exogenous. Intangible capital is non-rival and multiplicatively scales Z_t and $\bar{Z}_t$; since it is now exogenous, the precise elasticity of earnings to intangible capital does not matter.

The firm applies a transfer price p_t^H to the use of intangible capital located in a different jurisdiction. Let $\Delta_{H,t} = \bar{H}_t - H_t$ denote the stock located abroad in excess of the domestic stock. Hence the domestic branch receives net royalties $p_t^H\left(H_t-\bar{H}_t\right) = -p_t^H\Delta_{H,t}$ and the foreign branch receives net royalties $p_t^H\Delta_{H,t}$. The firm may pay a cost from too-aggressive transfer pricing, given by $\Psi^H\left(\Delta_{H,t}, K_t, \bar{K}_t\right)$. This cost represents the legal risk and compliance cost of locating intangible capital differently from the location of tangible capital. Total cash flows are thus augmented by transfer pricing profits net of costs $\left(\tau_t-\bar{\tau}_t\right)p_t^H\Delta_{H,t} - \Psi^H\left(\Delta_{H,t}, K_t, \bar{K}_t\right)$.

With this setup, equation (6) and its foreign counterpart remain unchanged. The necessary conditions for K and $\bar{K}$ and the new necessary condition for Δ_H become:

$$K_t: \qquad \dot{\lambda}_t = \left(\rho+\delta\right)\lambda_t - \left(1-\tau_t\right)\left(F_1-\Phi_2\right) - \left(1-\bar{\tau}_t\right)\bar{F}_2 + \Psi_2^H\left(\Delta_{H,t}, K_t, \bar{K}_t\right), \tag{A.51}$$

$$\bar{K}_t: \qquad \dot{\bar{\lambda}}_t = \left(\rho+\delta\right)\bar{\lambda}_t - \left(1-\bar{\tau}_t\right)\left(\bar{F}_1-\bar{\Phi}_2\right) - \left(1-\tau_t\right)F_2 + \Psi_3^H\left(\Delta_{H,t}, K_t, \bar{K}_t\right), \tag{A.52}$$

$$\Delta_{H,t}: \qquad \Psi_1^H = (\tau_t - \bar{\tau}_t) p_t^H. \tag{A.53}$$

The FOC ($\Delta_{H,t}$) says that at the margin increasing foreign intangible assets generates tax savings $(\tau_t - \bar{\tau}_t) p_t^H$ and increases the transfer pricing burden by Ψ_1^H.

Define the steady state user cost as $R^* = (\rho + \delta)(1 - \Gamma^*) P^K + \Psi_2^H \left(\Delta_{H,t}, K_t, \bar{K}_t\right)$. The following linearized relationship still holds with the parameters $\omega_{k,r}$, $\omega_{k,\tau}$ defined as in equations (16) and (17):

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

Immediately, if the decision to shift profits via the location of intangible capital does not depend on physical capital, $\Psi_2^H \left(\Delta_{H,t}, K_t, \bar{K}_t\right) = 0$, then nothing changes in the firm's physical capital decision.

To understand the implications for investment when the location choice depends on physical capital, we parameterize $\Psi^H \left(\Delta_{H,t}, K_t, \bar{K}_t\right) = \left(\psi_1^H / 2\right) \left(\Delta_{H,t} - \psi_2^H \left(\bar{K}_t - K_t\right)\right)^2$. With this functional form, we have:

$$\Delta_{H,t} - \psi_2^H \left(\bar{K}_t - K_t\right) = \frac{(\tau_t - \bar{\tau}_t) p_t^H}{\psi_1^H}. \tag{A.54}$$

The difference between the allocation of intangible and tangible capital is increasing in the tax gap and decreasing in the cost shifter ψ_1^H. The parameter ψ_2^H specifies how the allocation of intangibles moves with tangible capital. The domestic user cost becomes: $R^* = (\rho + \delta)(1 - \Gamma^*) P^K + \psi_2^H (\tau_t - \bar{\tau}_t) p_t^H > (\rho + \delta)(1 - \Gamma^*) P^K$. The additional term arises because an additional unit of domestic capital requires an additional ψ_2^H of reallocation of intangibles, which costs $(\tau_t - \bar{\tau}_t) p_t^H$ of total profits. Thus, a reduction in τ reduces the user cost and stimulates investment above the usual effect, because the lost profits from reduced intangible-shifting that come with higher K are smaller when τ falls, so there is less disincentive to accumulate K. At the same time, the steady state user cost is larger, which implies a larger coefficient on $\hat{\Gamma}$. The foreign user cost becomes: $\bar{R}^* = \left(\bar{\rho} + \bar{\delta}\right)\left(1 - \bar{\Gamma}^*\right) P^K - \psi_2^H (\tau_t - \bar{\tau}_t) p_t^H < \left(\bar{\rho} + \bar{\delta}\right)\left(1 - \bar{\Gamma}^*\right) P^K$.

To see how these changes modify equation (15), define the share contributions of the intangible terms to the user cost:

$$s_H = \frac{\psi_2^H (\tau - \bar{\tau}) p^H}{R^*} \subseteq [0, 1], \qquad \bar{s}_H = \frac{\psi_2^H (\tau - \bar{\tau}) p^H}{\bar{R}^*}.$$

Then:

$$r = -(1 - s_H) \hat{\Gamma} + s_H \frac{d(\tau - \bar{\tau})}{\tau - \bar{\tau}}, \qquad \bar{r} = -(1 + \bar{s}_H) \hat{\bar{\Gamma}} - \bar{s}_H \frac{d(\tau - \bar{\tau})}{\tau - \bar{\tau}}$$

and hence:

$$k = \frac{\omega_{k,r} (1 - s_H) \hat{\Gamma} + \left(1 - \omega_{k,r}\right)(1 + \bar{s}_H) \hat{\bar{\Gamma}} - \omega_{k,\tau} \hat{\tau} - \left(1 - \omega_{k,\tau}\right) \hat{\bar{\tau}} + \left(\left(1 - \omega_{k,r}\right) \bar{s}_H - \omega_{k,r} s_H\right) \frac{d(\tau - \bar{\tau})}{\tau - \bar{\tau}} + \epsilon}{1 - \alpha}. \tag{A.55}$$

A.6 Interest Deduction Extension

A firm with debt of B_t can deduct interest $i_t B_t$ from its taxable earnings. We assume the firm also pays a cost (i.e., insurance) that is increasing in its (domestic) leverage and given by $\Psi^B(B_t, K_t)$. Cash flows are therefore augmented by $\tau_t i_t B_t - \Psi^B(B_t, K_t)$. The changes to the necessary conditions are:

$$K_t: \qquad \dot{\lambda}_t = (\rho+\delta)\lambda_t - (1-\tau_t)(F_1 - \Phi_2) - (1-\bar{\tau}_t)\bar{F}_2 + \Psi_2^B(B_t, K_t), \tag{A.56}$$

$$B_t: \qquad \tau_t i_t = \Psi_1^B. \tag{A.57}$$

Define the steady state user cost as $R^* = (\rho+\delta)(1-\Gamma^*)P^K - \Psi_2^B(B_t, K_t)$. The following linearized relationship still holds with the parameters $\omega_{k,r}, \omega_{k,\tau}$ defined as in equations (16) and (17):

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

Immediately, if the financial capital structure decision does not depend on physical capital, $\Psi_2^B\left(\Delta_{B,t}, K_t\right) = 0$, then nothing changes in the firm's physical capital decision.

To understand the implications for investment when the financial capital structure decision does depend on physical capital, we follow Barro and Furman (2018) and parameterize $\Psi^B(B_t, K_t) = \psi^B\left(B_t/\left(P_t^K K_t\right)\right)^{1+\theta} P_t^K K_t/(1+\theta)$. With this functional form, the steady state domestic user cost becomes $R^* = (\rho+\delta)(1-\Gamma^*)P^K - \frac{\theta\left(\psi^B\right)^{-1/\theta} P^K}{1+\theta}(\tau^* i^*)^{1+1/\theta}$. Defining $s_B \equiv \frac{\frac{\theta}{1+\theta}\tau_t i_t B_t/K_t}{R^*}$, we have:

$$k = \frac{\omega_{k,r}(1-s_B)\hat{\Gamma} + \left(1-\omega_{k,r}\right)\hat{\bar{\Gamma}} - \left(\omega_{k,\tau} - s_B\left(\frac{1+\theta}{\theta}\right)\left(\frac{\tau}{1-\tau}\right)\right)\hat{\tau} - \left(1-\omega_{k,\tau}\right)\hat{\bar{\tau}} + \epsilon}{1-\alpha}. \tag{A.58}$$

A.7 Global Value Chain Interpretation

This extension derives expressions analogous to equation (3) for a firm maximizing composite global output of locally-produced inputs. The production and revenue functions are:

$$\text{Domestic input: } Q_t = A_t K_t^{\alpha_K} L_t^{\alpha_L},$$
$$\text{Foreign input: } \bar{Q}_t = \bar{A}_t \bar{K}_t^{\alpha_K} \bar{L}_t^{\alpha_L},$$
$$\text{Final output: } Y_t = \left(a_Y Q_t^{\frac{\sigma_Y - 1}{\sigma_Y}} + (1-a_Y)\bar{Q}_t^{\frac{\sigma_Y-1}{\sigma_Y}}\right)^{\frac{\sigma_Y}{\sigma_Y - 1}}.$$

The firm's static maximization problem is:

$$\max_{L,\bar{L}} Y_t - P_t^L L_t - P_t^{\bar{L}} \bar{L}_t.$$

The FOC are:

$$P_t^L = a_Y \alpha_L \frac{Q_t}{L_t} \left(\frac{Q_t}{Y_t} \right)^{-\frac{1}{\sigma_Y}}, \; P_t^{\bar{L}} = (1 - a_Y) \alpha_L \frac{\bar{Q}_t}{\bar{L}_t} \left(\frac{\bar{Q}_t}{Y_t} \right)^{-\frac{1}{\sigma_Y}}.$$

Substituting the FOC and solving gives:

$$\begin{aligned}
Q_t &= \left(Z_t^Q\right)^{\frac{\sigma_Y}{\sigma_Y - 1}} K_t^{\frac{\alpha_K}{1-\alpha_L\left(\frac{\sigma_Y-1}{\sigma_Y}\right)}} Y_t^{\frac{\alpha_L}{\alpha_L + (1-\alpha_L)\sigma_Y}}, \\
\bar{Q}_t &= \left(\bar{Z}_t^Q\right)^{\frac{\sigma_Y}{\sigma_Y - 1}} \bar{K}_t^{\frac{\alpha_K}{1-\alpha_L\left(\frac{\sigma_Y-1}{\sigma_Y}\right)}} Y_t^{\frac{\alpha_L}{\alpha_L + (1-\alpha_L)\sigma_Y}}, \\
\text{with: } Z_t^Q &\equiv \left(A_t \left(\frac{a_Y \alpha_L}{P_t^L} \right)^{\alpha_L} \right)^{\frac{\sigma_Y}{(1-\alpha_L)\sigma_Y - 1}} \\
\bar{Z}_t^Q &\equiv \left(\bar{A}_t \left(\frac{a_Y \alpha_L}{P_t^{\bar{L}}} \right)^{\alpha_L} \right)^{\frac{\sigma_Y}{(1-\alpha_L)\sigma_Y - 1}}.
\end{aligned}$$

Thus:

$$\begin{aligned}
Y_t &= \mathscr{K}_t^{\alpha}, \\
\text{where: } \mathscr{K}_t &\equiv \left(a_t K_t^{\frac{\sigma-1}{\sigma}} + \bar{a}_t \bar{K}_t^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}, \\
a_t &\equiv a_Y Z_t^Q, \\
\bar{a}_t &\equiv (1 - a_Y) \bar{Z}_t^Q, \\
\sigma &\equiv \frac{\alpha_L + (1-\alpha_L)\sigma_Y}{\alpha_L + \alpha_K + (1 - \alpha_K - \alpha_L)\sigma_Y}, \\
\alpha &\equiv \frac{\alpha_K}{1 - \alpha_L}.
\end{aligned}$$

Domestic and foreign current costs are:

$$\begin{aligned}
P_t L_t &= \alpha_L s_t Y_t, \\
\bar{P}_t \bar{L}_t &= \alpha_L (1 - s_t) Y_t, \\
\text{where: } s_t &= a_Y \left(\frac{Q_t}{Y_t} \right)^{\frac{\sigma_Y - 1}{\sigma_Y}}.
\end{aligned}$$

If a share s_t of total revenues are assigned to the domestic jurisdiction for tax purposes, then total domestic and foreign taxable incomes are:

$$F\left(K_t, \bar{K}_t; A_t, \bar{A}_t\right) = s_t (1 - \alpha_L) \mathscr{K}_t^{\alpha}, \tag{A.59}$$

$$\bar{F}\left(\bar{K}_t, K_t; \bar{A}_t, A_t\right) = (1 - s_t)(1 - \alpha_L) \mathscr{K}_t^{\alpha}. \tag{A.60}$$

Equations (A.59) and (A.60) take the same form as equation (3), with the additional restriction that $\mathscr{K} = \bar{\mathscr{K}}$ and with time-varying shares in the composite capital variable.

A.8 FDII and GILTI

Let $\tau^s, \bar{\tau}^s, \Gamma^s, \bar{\Gamma}^s$ denote the ex-FDII and ex-GILTI domestic and foreign marginal tax rates and present values of allowances ("s" for statutory), which we now distinguish from the GILTI and FDII-inclusive effective marginal tax rates and costs of capital.

The GILTI (Global Intangible Low Taxed Income) Internal Revenue Code (IRC) Section 951A tax applies to foreign income. The TCJA defines global deemed intangible income as after-tax foreign income in excess of $\theta_t^{\text{GILTI-T}} = 0.1$ of foreign tangible property ("T" for tangible), i.e., GILTI $= (1-\bar{\tau}^s)\bar{F}\left(\bar{K}_t, K_t, \bar{Z}_t\right) - \bar{\Phi}\left(\bar{I}_t, \bar{K}_t\right) - \theta_t^{\text{GILTI-T}}\bar{K}_t$.[3] To account for GILTI being defined on an after-tax basis, firms must then "gross up" their GILTI, yielding a pre-deduction and credit tax base of $\bar{F}\left(\bar{K}_t, K_t, \bar{Z}_t\right) - \bar{\Phi}\left(\bar{I}_t, \bar{K}_t\right) - \theta_t^{\text{GILTI-T}}\bar{K}_t/(1-\bar{\tau}^s)$.[4] The Section 250 deduction of $\theta_t^{\text{GILTI-D}} = 0.5$ ("D" for deduction) of the GILTI+Gross-up makes the effective U.S. tax rate 10.5% on this income. Firms can further apply foreign tax credits (FTCs) of $\theta_t^{\text{GILTI-C}} = 0.8$ ("C" for credit) of foreign taxes paid on this income. Thus, after-tax foreign profits for a GILTI-taxed firm are:

$$
\begin{aligned}
&\overbrace{\left(1-\bar{\tau}_t^s\right)\left(\bar{F}\left(\bar{K}_t, K_t, \bar{Z}_t\right) - \Phi\left(\bar{I}_t, \bar{K}_t\right)\right)}^{\text{Profits net of foreign taxes}} \\
&-\underbrace{\left(\tau_t^s\left(1-\theta_t^{\text{GILTI-D}}\right) - \theta_t^{\text{GILTI-C}}\bar{\tau}_t^s\right)\left(\bar{F}\left(\bar{K}_t, K_t, \bar{Z}_t\right) - \Phi\left(\bar{I}_t, \bar{K}_t\right) - \theta_t^{\text{GILTI-T}}\bar{K}_t/\left(1-\bar{\tau}_t^s\right)\right)}_{\text{GILTI tax net of foreign tax credit}} \\
&= \left(1-\bar{\tau}_t\right)\left(\bar{F}\left(\bar{K}_t, K_t, \bar{Z}_t\right) - \Phi\left(\bar{I}_t, \bar{K}_t\right)\right) + \left(\bar{\tau}_t - \bar{\tau}_t^s\right)\theta_t^{\text{GILTI-T}}\bar{K}_t/\left(1-\bar{\tau}_t^s\right), \\
&\text{where: } \bar{\tau}_t \equiv \bar{\tau}_t^s\left(1-\theta_t^{\text{GILTI-C}}\right) + \tau_t^s\left(1-\theta_t^{\text{GILTI-D}}\right).
\end{aligned}
$$

The GILTI tax is often described as a minimum tax because at $\bar{\tau}_t^s = 0$ it nonetheless implies $\bar{\tau}_t = \tau_t^s\left(1-\theta_t^{\text{GILTI-D}}\right)$. It ceases to apply when $\bar{\tau}_t^s \geq \tau_t^s\left(1-\theta_t^{\text{GILTI-D}}\right)/\theta_t^{\text{GILTI-C}} = 0.1312$.

The FDII (Foreign Derived Intangible Income) deduction applies to domestic income derived from foreign sources, i.e., exports. Let ξ denote the (fixed) share of a firm's domestic income attributable to exports. The TCJA defines DII (deemed intangible income) as domestic income in excess of $\theta_t^{\text{FDII-T}} = 0.1$ of domestic tangible property, i.e., DII $= F\left(K_t, \bar{K}_t, Z_t\right) - \Phi\left(I_t, K_t\right) - \theta_t^{\text{FDII-T}}K_t$, and FDII as the foreign part of DII, i.e., FDII $= \xi\left(F\left(K_t, \bar{K}_t, Z_t\right) - \Phi\left(I_t, K_t\right) - \theta_t^{\text{FDII-T}}K_t\right)$. A corporation can deduct $\theta_t^{\text{FDII-D}} = 0.375$ of FDII against domestic taxable income. Thus, after-tax domestic profits for a firm with domestic income exceeding $\theta_t^{\text{FDII-T}}K_t$ are:

$$
\begin{aligned}
&F\left(K_t, \bar{K}_t, Z_t\right) - \Phi\left(I_t, K_t\right) - \tau_t^s\left(F\left(K_t, \bar{K}_t, Z_t\right) - \Phi\left(I_t, K_t\right) - \underbrace{\theta_t^{\text{FDII-D}}\xi\left(F\left(K_t, \bar{K}_t, Z_t\right) - \Phi\left(I_t, K_t\right) - \theta_t^{\text{FDII-T}}K_t\right)}_{\text{FDII deduction}}\right) \\
&= \left(1-\tau_t\right)\left(F\left(K_t, \bar{K}_t, Z_t\right) - \Phi\left(I_t, K_t\right)\right) - \tau_t^s\xi\theta_t^{\text{FDII-D}}\theta_t^{\text{FDII-T}}K_t,
\end{aligned}
$$

[3] For simplicity, the exposition here omits tangential factors such as the exclusion of certain categories of income from the GILTI base, allocable deductions, interest expenses in the calculation of the deemed tangible return, and interactions of multiple subsidiaries some of which may not have taxable income. The technical term for tangible property is Qualified Business Asset Investment (QBAI).

[4] The IRC Section 78 gross-up approach follows the treatment of foreign income under Subpart F. The division of $\bar{K}$ by $(1-\bar{\tau}^s)$ occurs due to the interaction of the gross-up approach and the GILTI QBAI deduction and has been called "getting the math wrong" by Caballero (2020).

where: $\tau_t = \tau_t^s \left(1 - \theta_t^{\text{FDII-D}} \xi\right)$.

Putting FDII and GILTI together, the necessary conditions become:

$$
\begin{aligned}
I_t: &\quad \lambda_t = (1-\tau_t)\,\Phi_1(I_t, K_t) + \left(1-\Gamma_t^s\right) P_t^K, && \text{(A.61)}\\
\bar{I}_t: &\quad \bar{\lambda}_t = (1-\bar{\tau}_t)\,\bar{\Phi}_1\left(\bar{I}_t, \bar{K}_t\right) + \left(1-\bar{\Gamma}_t^s\right) P_t^{\bar{K}}, && \text{(A.62)}\\
K_t: &\quad \dot{\lambda}_t = R_t - (1-\tau_t)\left(F_1 - \Phi_2(I_t, K_t)\right) - (1-\bar{\tau}_t)\,\bar{F}_2, && \text{(A.63)}\\
\bar{K}_t: &\quad \dot{\bar{\lambda}}_t = \bar{R}_t - (1-\bar{\tau}_t)\left(\bar{F}_1 - \bar{\Phi}_2\left(\bar{I}_t, \bar{K}_t\right)\right) - (1-\tau_t)\,F_2, && \text{(A.64)}\\
\text{where:} &\quad R_t = (\rho+\delta)\,\lambda_t + \tau_t^s\,\xi\,\theta_t^{\text{FDII-D}}\theta_t^{\text{FDII-T}}, && \text{(A.65)}\\
&\quad \bar{R}_t = (\rho+\delta)\,\bar{\lambda}_t - \theta_t^{\text{GILTI-T}}\left(\bar{\tau}_t - \bar{\tau}_t^s\right)/\left(1-\bar{\tau}_t^s\right). && \text{(A.66)}
\end{aligned}
$$

In particular, equations (A.61) to (A.64) characterize exactly the same dynamic system as equations (6) and (7) and their foreign counterparts, but with the redefined effective marginal tax rates and user costs. The user cost terms can be rewritten as:

$$
R_t = (\rho+\delta)\left((1-\tau_t)\,\Phi_1(I_t, K_t) + (1-\Gamma_t)\,P_t^K\right),\ \Gamma_t \equiv \Gamma_t^s - \frac{\tau_t^s\,\xi\,\theta_t^{\text{FDII-D}}\theta_t^{\text{FDII-T}}}{(\rho+\delta)\,P_t^K},
$$

$$
\bar{R}_t = (\rho+\delta)\left((1-\bar{\tau}_t)\,\bar{\Phi}_1\left(\bar{I}_t, \bar{K}_t\right) + \left(1-\bar{\Gamma}_t\right) P_t^{\bar{K}}\right),\ \bar{\Gamma}_t \equiv \bar{\Gamma}_t^s + \frac{\left(\bar{\tau}_t - \bar{\tau}_t^s\right)\theta_t^{\text{GILTI-T}}}{\left(1-\bar{\tau}_t^s\right)(\rho+\delta)\,P_t^{\bar{K}}}.
$$

In this sense, the investment incentives of GILTI go through the foreign marginal tax rate and cost of capital and the incentives of FDII go through the domestic marginal tax rate and cost of capital. The impacts on the costs of capital arise because both GILTI and FDII exempt profits up to 10% of tangible capital, which implies that marginal changes in the tangible capital stock directly affect taxes owed.

Our measurement of the GILTI incentives requires additional clarifications. First, IRC 904 limits FTCs to the foreign income share of tax owed calculated as if all global income were subject to U.S. tax. In making this calculation, firms must reallocate a part of certain U.S. expenses (such as overhead or interest expenses) to their foreign subsidiaries.[5] This expense reallocation can reduce allowable FTCs by enough that firms with foreign tax rates well above the purported 13.125% limit still owe GILTI tax. However, for such firms, their GILTI tax depends only on the reallocated expenses; denoting the reallocated expenses by X_t, the FTC limitation is:

$$
\tau_t^s\left(1-\theta_t^{\text{GILTI-D}}\right)\left(\bar{F}\left(\bar{K}_t, K_t, \bar{Z}_t\right) - \Phi\left(\bar{I}_t, \bar{K}_t\right) - \theta_t^{\text{GILTI-T}}\bar{K}_t/\left(1-\bar{\tau}_t^s\right)\right) - \tau_t^s X_t,
$$

and hence if this limit binds their GILTI tax is simply $\tau_t^s X_t$ and in particular does not depend on $\bar{K}_t$. We therefore code these firms as not subject to GILTI. Second, for the reasons discussed in the main text, our preferred implementation sets $\bar{\tau}_t^s = 0$ in determining the effect of GILTI on $\bar{R}_t$ in equation (A.66).

[5]See IRS form 1118 Schedule A column 15 and Schedule B lines 7-11 (revision 2018).

A.9 Labor Market Clearing Condition

This appendix provides the labor market clearing condition. We assume an aggregate labor supply curve $L_t/L_t^* = \left(P_t^L\right)^{\nu_L}$. For firm i with capital $\left\{K_{i,t}, \bar{K}_{i,t}\right\}$, technology $\left\{A_{i,t}, \bar{A}_{i,t}\right\}$, and taking as given the wages $\left\{P_t^L, \bar{P}_t^L\right\}$, domestic labor demand is:

$$\begin{aligned} L_{i,t} &= \frac{\alpha_L Y_{i,t}}{P_t^L} = \frac{\alpha_L Z_{i,t} \mathscr{K}_{i,t}^{\alpha}}{(1-\alpha_L-\alpha_M) P_t^L} \\ &= \frac{\alpha_L \mathscr{K}_{i,t}^{\alpha}}{(1-\alpha_L-\alpha_M) P_t^L} (1-\alpha_L-\alpha_M)^{\frac{\mathscr{M}-\mathscr{M}(\alpha_L+\alpha_M)}{1-\mathscr{M}(\alpha_L+\alpha_M)}} \left(\frac{\alpha_M}{P_t^M}\right)^{\frac{\mathscr{M}\alpha_M}{1-\mathscr{M}(\alpha_L+\alpha_M)}} \left(\frac{\alpha_L}{P_t^L}\right)^{\frac{\mathscr{M}\alpha_L}{1-\mathscr{M}(\alpha_L+\alpha_M)}} \left(\int_i A_{i,t}^{\frac{1}{1-(\alpha_L+\alpha_M)}} \mathscr{K}_{i,t}^{\alpha} di\right)^{\frac{\mathscr{M}-1}{1-\mathscr{M}(\alpha_L+\alpha_M)}} A_{i,t}^{\frac{1}{1-(\alpha_L+\alpha_M)}} \\ &= (1-\alpha_L-\alpha_M)^{\frac{\mathscr{M}-1}{1-\mathscr{M}(\alpha_L+\alpha_M)}} \left(\frac{\alpha_M}{P_t^M}\right)^{\frac{\mathscr{M}\alpha_M}{1-\mathscr{M}(\alpha_L+\alpha_M)}} (\alpha_L)^{\frac{1-\mathscr{M}\alpha_M}{1-\mathscr{M}(\alpha_L+\alpha_M)}} \left(\int_i A_{i,t}^{\frac{1}{1-(\alpha_L+\alpha_M)}} \mathscr{K}_{i,t}^{\alpha} di\right)^{\frac{\mathscr{M}-1}{1-\mathscr{M}(\alpha_L+\alpha_M)}} A_{i,t}^{\frac{1}{1-(\alpha_L+\alpha_M)}} \mathscr{K}_{i,t}^{\alpha} \left(P_t^L\right)^{-\frac{1-\mathscr{M}\alpha_M}{1-\mathscr{M}(\alpha_L+\alpha_M)}}. \end{aligned}$$

Denote the pre-determined part of aggregate labor demand:

$$X^L\left(\left\{\mathscr{K}_{i,t}, A_{i,t}\right\}\right) = (1-\alpha_L-\alpha_M)^{\frac{\mathscr{M}-1}{1-\mathscr{M}(\alpha_L+\alpha_M)}} \left(\frac{\alpha_M}{P_t^M}\right)^{\frac{\mathscr{M}\alpha_M}{1-\mathscr{M}(\alpha_L+\alpha_M)}} (\alpha_L)^{\frac{1-\mathscr{M}\alpha_M}{1-\mathscr{M}(\alpha_L+\alpha_M)}} \left(\int_i A_{i,t}^{\frac{1}{1-(\alpha_L+\alpha_M)}} \mathscr{K}_{i,t}^{\alpha} di\right)^{\frac{\mathscr{M}-\mathscr{M}(\alpha_L+\alpha_M)}{1-\mathscr{M}(\alpha_L+\alpha_M)}}.$$

Then labor market clearing requires:

$$P_t^L = \left(\frac{X^L\left(\left\{\mathscr{K}_{i,t}, A_{i,t}\right\}\right)\left(P_t^L\right)^{-\frac{1-\mathscr{M}\alpha_M}{1-\mathscr{M}(\alpha_L+\alpha_M)}}}{L_t^*}\right)^{1/\nu_L} \left(\frac{X^L\left(\left\{\mathscr{K}_{i,t}, A_{i,t}\right\}\right)}{L_t^*}\right)^{\frac{1-\mathscr{M}(\alpha_L+\alpha_M)}{\nu_L(1-\mathscr{M}(\alpha_L+\alpha_M))+1-\mathscr{M}\alpha_M}}.$$

With balanced growth preferences ($\nu_L = 0$), no markup ($\mathscr{M} = 1$), and no materials ($\alpha_M = 0$), this becomes:

$$P_t^L = \left(\frac{X^L\left(\left\{\mathscr{K}_{i,t}, A_{i,t}\right\}\right)}{L_t^*}\right)^{1-\alpha_L}. \tag{A.67}$$

We implement equation (A.67) by guessing a path for P_t^L (starting at the steady state), obtaining $Z_{i,t}$ and hence $\mathscr{K}_{i,t}$ for each portfolio of firms, computing X^L, and then using equation (A.67) to update the guess for the path of P_t^L until convergence.

A.10 Transition Dynamics and Short Versus Long-Run Investment Response

This appendix shows that in the case of no foreign adjustment costs, $\bar{\phi} \to 0$, the short-run and long-run elasticities of investment to the four tax terms all scale by approximately the same factor, denoted χ_{SR}. Furthermore, χ_{SR} is a sufficient statistic for the role of domestic adjustment costs.

Linearized dynamic system. We show these results using a linear approximation of the transition dynamics with quadratic adjustment costs ($\gamma = 1$). Define:

$$h\left(\lambda;\tau,\Gamma,P^K,\phi,\gamma\right) = \left[\frac{1}{\phi}\left(\frac{\lambda - P^K(1-\Gamma)}{(1-\tau)}\right)\right]^{\frac{1}{\gamma}}, \tag{A.68}$$

$$\text{with: } h(\lambda^*) = 0,$$

$$h'(\lambda^*) = 0^{\frac{1}{\gamma}-1}\frac{1}{\phi\gamma(1-\tau^*)}. \tag{A.69}$$

The dynamic system then takes the form:

$$\text{FOC }(I_t):\quad \dot{K}_t/K_t = h\left(\lambda_t;\tau_t,\Gamma_t,P_t^K,\phi,\gamma\right), \tag{A.70}$$

$$\text{FOC }(K_t):\quad \dot{\lambda}_t = (\rho+\delta)\lambda_t - (1-\tau_t)\left(F_1 + ((\gamma/(1+\gamma))h(\lambda_t)+\delta)\phi h(\lambda_t)^{\gamma}\right) - (1-\bar{\tau}_t)\bar{F}_2, \tag{A.71}$$

$$\text{FOC }(\bar{I}_t):\quad \dot{\bar{K}}_t/\bar{K}_t = h\left(\bar{\lambda}_t;\bar{\tau}_t,\bar{\Gamma}_t,P_t^{\bar{K}},\bar{\phi},\bar{\gamma}\right), \tag{A.72}$$

$$\text{FOC }(\bar{K}_t):\quad \dot{\bar{\lambda}}_t = (\rho+\delta)\bar{\lambda}_t - (1-\bar{\tau}_t)\left(\bar{F}_1 + \left((\bar{\gamma}/(1+\bar{\gamma}))h\left(\bar{\lambda}_t\right)+\delta\right)\bar{\phi}h\left(\bar{\lambda}_t\right)^{\bar{\gamma}}\right) - (1-\tau_t)F_2. \tag{A.73}$$

We take a Taylor expansion in the neighborhood of the steady state. Let $k_{t,s} = (K_t - K_s)/K_s \approx \log(K_t/K_s)$ denote the percent deviation of K_t from K_s. In particular, $k_{t,*} = (K_t - K^*)/K^*$ is the deviation from the new steady state and $k_{*,0} = (K^* - K_0)/K_0$ is the long-run percent change, simply denoted by k elsewhere in the manuscript. Note that $\dot{k}_{t,*} = \dot{K}_t/K^*$. The linear system associated with the Taylor expansion is:[6]

$$\begin{pmatrix} \dot{k}_{t,*} \\ \dot{\lambda}_t \\ \dot{\bar{k}}_{t,*} \\ \dot{\bar{\lambda}}_t \end{pmatrix} = \mathbf{A}\begin{pmatrix} k_{t,*} \\ \lambda_t - \lambda^* \\ \bar{k}_{t,*} \\ \bar{\lambda}_t - \bar{\lambda}^* \end{pmatrix}, \tag{A.74}$$

with:

$$\mathbf{A} = \begin{pmatrix} 0 & h'(\lambda^*) & 0 & 0 \\ a_{21} & \rho+\delta & a_{23} & 0 \\ 0 & 0 & 0 & h'\left(\bar{\lambda}^*\right) \\ a_{41} & 0 & a_{43} & \rho+\delta \end{pmatrix},$$

$$a_{21} = -(1-\tau^*)K^*F_{11}\left(K^*,\bar{K}^*;Z^*\right) - (1-\bar{\tau}^*)K^*\bar{F}_{22}\left(\bar{K}^*,K^*;\bar{Z}^*\right) > 0,$$

$$a_{23} = -(1-\tau^*)\bar{K}^*F_{12}\left(K^*,\bar{K}^*;Z^*\right) - (1-\bar{\tau}^*)\bar{K}^*\bar{F}_{21}\left(\bar{K}^*,K^*;\bar{Z}^*\right),$$

$$a_{41} = -(1-\bar{\tau}^*)K^*\bar{F}_{12}\left(\bar{K}^*,K^*;\bar{Z}^*\right) - (1-\tau^*)K^*F_{21}\left(K^*,\bar{K}^*;Z^*\right) = a_{23}\chi_K^{-1},$$

$$a_{43} = -(1-\bar{\tau}^*)\bar{K}^*\bar{F}_{11}\left(\bar{K}^*,K^*;\bar{Z}^*\right) - (1-\tau^*)\bar{K}^*F_{22}\left(K^*,\bar{K}^*;Z^*\right) > 0.$$

[6] To ease notation, we omit general equilibrium terms relating to changes in Z. These do not change the conclusions of this section.

The two stable eigenvalues of **A** are:

$$d_1 = \frac{\rho+\delta}{2} - \sqrt{\left(\frac{\rho+\delta}{2}\right)^2 + \frac{\left(h'(\lambda^*)a_{21} + h'\left(\bar{\lambda}^*\right)a_{43}\right) + \sqrt{\left(h'(\lambda^*)a_{21} + h'\left(\bar{\lambda}^*\right)a_{43}\right)^2 - 4h'(\lambda^*)h'\left(\bar{\lambda}^*\right)\left(a_{21}a_{43} - a_{23}a_{41}\right)}}{2}},$$
$$d_2 = \frac{\rho+\delta}{2} - \sqrt{\left(\frac{\rho+\delta}{2}\right)^2 + \frac{\left(h'(\lambda^*)a_{21} + h'\left(\bar{\lambda}^*\right)a_{43}\right) - \sqrt{\left(h'(\lambda^*)a_{21} + h'\left(\bar{\lambda}^*\right)a_{43}\right)^2 - 4h'(\lambda^*)h'\left(\bar{\lambda}^*\right)\left(a_{21}a_{43} - a_{23}a_{41}\right)}}{2}},$$

with the eigenvector associated with the n^{th} eigenvalue:

$$\mathbf{f}_n = \begin{pmatrix} 1 \\ \frac{d_n}{h'(\lambda^*)} \\ -\left(a_{43}h'\left(\bar{\lambda}^*\right) + (\rho+\delta-d_n)\,d_n\right)^{-1} a_{41}h'\left(\bar{\lambda}^*\right) \\ -\left(a_{43}h'\left(\bar{\lambda}^*\right) + (\rho+\delta-d_n)\,d_n\right)^{-1} a_{41}d_n \end{pmatrix}.$$

The linearized solution is:

$$k_{t,*} = \frac{c_1}{k_{0,*}}k_{0,*}e^{d_1 t} + \frac{c_2}{k_{0,*}}k_{0,*}e^{d_2 t} = \left(s_{k,d}e^{d_1 t} + \left(1-s_{k,d}\right)e^{d_2 t}\right)k_{0,*}, \tag{A.75}$$
$$\bar{k}_{t,*} = \frac{c_1\mathbf{f}_1(3)}{\bar{k}_{0,*}}\bar{k}_{0,*}e^{d_1 t} + \frac{c_2\mathbf{f}_2(3)}{\bar{k}_{0,*}}\bar{k}_{0,*}e^{d_2 t} = \left(s_{\bar{k},d}e^{d_1 t} + \left(1-s_{\bar{k},d}\right)e^{d_2 t}\right)\bar{k}_{0,*}, \tag{A.76}$$

$$\text{where: } s_{k,d} \equiv \frac{c_1}{k_{0,*}} = \frac{\mathbf{f}_2(3) - \chi_{k_{0,*}}}{\mathbf{f}_2(3) - \mathbf{f}_1(3)} = \left(\frac{a_{23}h'(\lambda^*)}{d_2d_3 - d_1d_4}\right)\left(\frac{a_{41}h'\left(\bar{\lambda}^*\right)}{a_{43}h'\left(\bar{\lambda}^*\right) + d_2d_3} + \chi_{k_0}\right),$$
$$s_{\bar{k},d} \equiv \frac{c_1\mathbf{f}_1(3)}{\bar{k}_{0,*}} = \frac{\mathbf{f}_1(3)\left(\mathbf{f}_2(3)\,\chi_{k_{0,*}}^{-1} - 1\right)}{\mathbf{f}_2(3) - \mathbf{f}_1(3)}.$$

Thus, the weighted average $s_{k,d}e^{d_1 t} + \left(1-s_{k,d}\right)e^{d_2 t}$ determines the speed of convergence of domestic capital. Furthermore:

$$\dot{k}_{t,0} = \frac{\dot{K}_t}{K_0} = \left(\frac{K^*}{K_0}\right)\dot{k}_{t,*} = \left(\frac{K^*}{K_0}\right)\left(s_{k,d}d_1e^{d_1 t} + \left(1-s_{k,d}\right)d_2e^{d_2 t}\right)k_{0,*} = -\left(s_{k,d}d_1e^{d_1 t} + \left(1-s_{k,d}\right)d_2e^{d_2 t}\right)k_{*,0}.$$

For example, the short-run response of net investment is:

$$\dot{k}_{0,0} = \dot{K}_0/K_0 = -\left(s_{k,d}d_1 + \left(1-s_{k,d}\right)d_2\right)k_{*,0}. \tag{A.77}$$

Short-run versus long-run elasticities. We now relate the tax elasticities of short-run investment, I_0/K_0, to the long-run change, $dk_{*,0}$, where:

$$dk_{*,0} = \frac{\omega_{k,r}d\hat{\Gamma} + \left(1-\omega_{k,r}\right)d\hat{\bar{\Gamma}} + \omega_{k,\tau}d\hat{\tau} + \left(1-\omega_{k,\tau}\right)d\hat{\bar{\tau}}}{1-\alpha} = b_1d\hat{\Gamma} + b_2d\hat{\bar{\Gamma}} + b_3d\hat{\tau} + b_4d\hat{\bar{\tau}}.$$

Totally differentiating I_0/K_0 and letting $**$ denote the steady state at the base values of the tax changes, we obtain:

$$d\dot{k}_{0,0} = dI_0/K_0 = \delta dI_0/I_0 = -\left(s_{k,d}^{**}d_1^{**} + \left(1-s_{k,d}^{**}\right)d_2^{**}\right)dk_{*,0} - \sum_{x\in\left\{\hat{\tau},\hat{\Gamma},\hat{\bar{\tau}},\hat{\bar{\Gamma}}\right\}} k_{**,0}\frac{\partial\left[s_{k,d}d_1 + \left(1-s_{k,d}\right)d_2\right]}{\partial x}dx. \tag{A.78}$$

The first term scales the long-run change by a common factor $\left(s_{k,d}^{**}d_1^{**} + \left(1-s_{k,d}^{**}\right)d_2^{**}\right)$. The second term implies possibly different short-run speeds of adjustments to different tax terms.

Equation (A.78) usefully simplifies in the case of no foreign adjustment costs, $\bar{\phi} \to 0$. In particular, while $d_1 \to -\sqrt{h'\left(\bar{\lambda}^*\right)a_{43}} \to -\infty$, an application of L'Hopital's rule yields that $\lim_{\bar{\phi}\to 0} s_{k,d}d_1 + \left(1-s_{k,d}\right)d_2 = d_2$. Thus, the second term of equation (A.78) only involves derivatives of d_2. These involve third derivatives of the production function and hence are small relative to the first term. 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, because of the feedback from growing domestic capital to foreign capital. This feedback effect is small. In our calibration, the ratio of the short-to-long run elasticity varies by less than 10% across the tax variables.

Ratio χ_{SR}. The average deviation of investment over period 0 to T relative to date 0 is:

$$\begin{aligned}
\int_0^T \left(\frac{\dot{K}_t + \delta\left(K_t - K_0\right)}{T\delta K_0}\right)dt &= \frac{1}{\delta T}\int_0^T \left(\delta k_{t,0} - \left(s_{k,d}d_1e^{d_1t} + \left(1-s_{k,d}\right)d_2e^{d_2t}\right)k_{*,0}\right)dt \\
&\approx \frac{1}{\delta T}\int_0^T \left(\delta\left(k_{t,*} + k_{*,0}\right) - \left(s_{k,d}d_1e^{d_1t} + \left(1-s_{k,d}\right)d_2e^{d_2t}\right)k_{*,0}\right)dt \\
&\approx k_{*,0} - \frac{k_{*,0}}{\delta T}\int_0^T \left(\delta\left(s_{k,d}e^{d_1t} + \left(1-s_{k,d}\right)e^{d_2t}\right) + \left(s_{k,d}d_1e^{d_1t} + \left(1-s_{k,d}\right)d_2e^{d_2t}\right)\right)dt \\
&= k_{*,0}\left(1 - s_{k,d}\left(1+\frac{\delta}{d_1}\right)\left(\frac{e^{d_1T}-1}{\delta T}\right) - \left(1-s_{k,d}\right)\left(1+\frac{\delta}{d_2}\right)\left(\frac{e^{d_2T}-1}{\delta T}\right)\right).
\end{aligned}$$

The long run deviation of investment is:

$$\frac{\delta\left(K^* - K_0\right)}{\delta K_0} = k_{*,0}.$$

Thus, the ratio is:

$$\chi_{SR} = 1 - s_{k,d}\left(1+\frac{\delta}{d_1}\right)\left(\frac{e^{d_1T}-1}{\delta T}\right) - \left(1-s_{k,d}\right)\left(1+\frac{\delta}{d_2}\right)\left(\frac{e^{d_2T}-1}{\delta T}\right).$$

Table A.1: Ratio of Short-run to Long-run

Exercise	Quarters 0-8	Quarter 40	Ratio
Winberry; TFP; PE	13.50	9.09	1.49
Winberry; Invest Stim.; PE	7.81	6.55	1.19
Winberry; TFP; GE	3.09	2.74	1.13
Winberry; Invest Stim.; GE	1.64	2.33	0.70
BCE; TFP; GE	2.66	1.48	1.80
BCE; Invest Stim.; GE; Implied rate	1.44	1.26	1.14

In particular, as $\bar{\phi} \to 0$, $\chi_{SR} \to 1 - \left(1 + \frac{\delta}{d_2}\right)\left(\frac{e^{d_2 T} - 1}{\delta T}\right)$. Inverting this expression gives the domestic adjustment cost as a function of χ_{SR}.

A.11 Adjustment Cost Moments

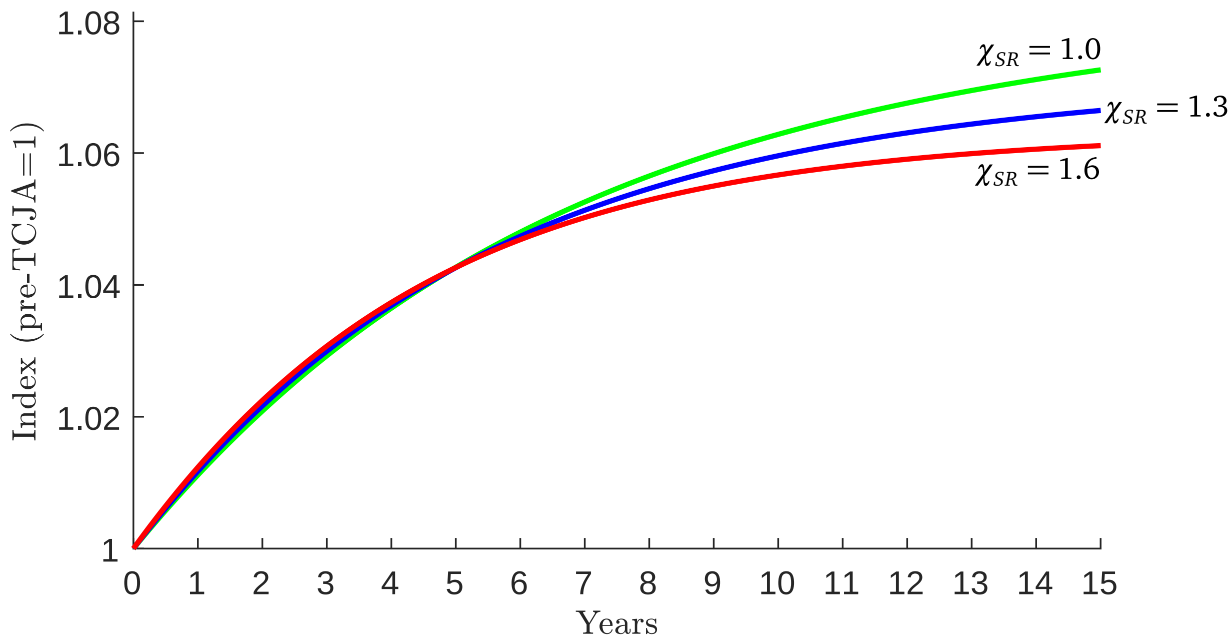
This appendix describes our analysis of the Winberry (2021) calibration. Winberry (2021) estimates a rich model of fixed and convex adjustment costs to match interest rate dynamics and, crucially, three targets of the firm-level investment distribution based on the SOI sample over 1998-2010, drawn from Zwick and Mahon (2017): the average investment rate, the standard deviation of investment rates, and the fraction of firm-years with an investment rate above 20%.

Using the Winberry (2021) replication code, we produce impulse responses of investment to a TFP shock and to an investment stimulus shock, similar to those shown in Figures 5 and 7 of his paper. In partial equilibrium, the TFP shock has the same effect on investment as a change in $1-\tau$ and the investment stimulus shock the same as a shock to $1-\Gamma$. We start each impulse response at the model steady state and set the quarterly persistence of each shock to 0.999. We report in Appendix Table A.1 the average response of investment over the first 8 quarters of the impulse response, the same horizon over which we measure the effects of TCJA, and after 10 years, which we equate with the long-run, as well as the ratio of these responses.

Our preferred value of $\chi_{SR} = 1.3$ falls in the middle of the ratios in partial equilibrium, shown in the first two rows. We target the partial equilibrium impulse responses because we do not incorporate an upward supply of capital in our model. For completeness, the next two rows show the responses and ratios in Winberry's general equilibrium environment. Because his is a real business cycle model with time-to-build, output is fixed in the short-run and there is instantaneous GE dampening of investment stimulus shocks despite the presence of adjustment costs. The last two rows report the ratios from performing the same exercise in another leading estimate of adjustment costs, Bachmann, Caballero and Engel (2013).

Figure A.1 shows the robustness of the response of domestic capital in the model to values of χ_{SR} ranging from 1 to 1.6. For each value, we re-estimate the parameters θ and set the domestic adjustment cost parameter ϕ such that short-run to long-run ratio of investment matches the value. The response of capital at year 15 varies by less than 1.5p.p. across values of χ_{SR}. This small difference partly reflects the larger adjustment costs required to rationalize a smaller value of $\chi_{SR} = 1$, as the path with $\chi_{SR} = 1.6$ has essentially converged to its long-run value by year 15 while the path with $\chi_{SR} = 1$ has a steeper slope. In the short-run, the smaller adjustment costs required to generate a larger χ_{SR} offset the smaller terminal value and the trajectory of capital is nearly indistinguishable across a range of values of χ_{SR}.

Figure A.1: Robustness of K/K_0 to χ_{SR}



A.12 Interpretation of a Levels Regression

This appendix considers the common regression specification of the investment-capital ratio on the level of the "tax term" in the context of our model. For simplicity, we restrict attention to domestic-only firms.

A common regression specification is:

$$\frac{I_{j,t}}{K_{j,t}} = c_1 TT_{j,t} + \alpha_j + \nu_t + e_{j,t},$$

where $TT_{j,t} = \left(1 - \Gamma_{j,t}\right) / \left(1 - \tau_{j,t}\right)$ denotes the "tax term." It simplifies matters to take first differences and consider the specification around a tax change at date 0:

$$\frac{I_{j,0^+}}{K_{j,0}} - \frac{I_{j,0}}{K_{j,0}} = c_0 + c_1 \left(TT_j^* - TT_{j,0}\right) + \Delta e_{j,t}, \quad \text{(A.79)}$$

where $X_{j,0^+}$ denotes the value of a variable just after the tax change and TT_j^* the new tax term. We now provide an expression for c_1.

In the case of domestic-only firms, the system of (A.74) becomes:

$$\begin{pmatrix} \dot{k}_{t,*} \\ \dot{\lambda}_t \end{pmatrix} = \mathbf{A} \begin{pmatrix} k_{t,*} \\ \lambda_t - \lambda^* \end{pmatrix}, \tag{A.80}$$

with:

$$\mathbf{A} = \begin{pmatrix} 0 & h'(\lambda^*) \\ a_{21} & \rho + \delta \end{pmatrix},$$
$$a_{21} = -(1-\tau^*) K^* F_{11}(K^*; Z^*) > 0.$$

The solution is:

$$k_{t,*} = k_{0,*} e^{d_1 t}, \tag{A.81}$$
$$\lambda_t - \lambda^* = k_{0,*} d_1 \phi (1 - \tau^*) e^{d_1 t}, \tag{A.82}$$

where $d_1 = \frac{\rho+\delta}{2} - \sqrt{\left(\frac{\rho+\delta}{2}\right)^2 - \phi^{-1} K^* F_{11}(K^*; Z^*)}$ is the stable eigenvalue. Furthermore, the steady state of the (domestic-only version of the) system equations (6) and (7) gives $k_{0,*} = \left(\frac{1}{1-\alpha}\right) \log(TT^*/TT_0)$, $\lambda_0 = 1 - \Gamma_0$, $\lambda^* = 1 - \Gamma^*$.

We now obtain an expression for c_1. Using equation (A.82) and the steady-state conditions gives an expression for the impact change in after-tax λ:

$$\frac{\lambda_{0^+}}{1-\tau^*} - \frac{\lambda_0}{1-\tau_0} = (TT^* - TT_0) + \left(\frac{d_1 \phi}{1-\alpha}\right) \log(TT^*/TT_0). \tag{A.83}$$

FOC (6) relates equation (A.79) to the model:

$$\frac{I_{0^+}}{K_0} - \frac{I_0}{K_0} = \frac{1}{\phi}\left(\frac{\lambda_{0^+}}{1-\tau^*} - \frac{\lambda_0}{1-\tau_0} - (TT^* - TT_0)\right). \tag{A.84}$$

Combining equations (A.79), (A.83) and (A.84), we find:

$$\begin{aligned} c_1 &= \frac{Cov\left(\frac{I_{0^+}}{K_0} - \frac{I_0}{K_0}, TT^* - TT_0\right)}{Var(TT^* - TT_0)} \\ &= \frac{Cov\left(\frac{1}{\phi}\left((TT^* - TT_0) + \left(\frac{d_1\phi}{1-\alpha}\right)\log(TT^*/TT_0) - (TT^* - TT_0)\right), TT^* - TT_0\right)}{Var(TT^* - TT_0)} \\ &= \left(\frac{d_1}{1-\alpha}\right) \frac{Cov(\log(TT^*/TT_0), TT^* - TT_0)}{Var(TT^* - TT_0)} \\ &\approx \left(\frac{d_1}{1-\alpha}\right) \times \frac{1}{TT_0}. \end{aligned} \tag{A.85}$$

The final expression in equation (A.85) contains a much more complicated mapping of parameters and policy variables into the regression coefficient than our preferred specification (see e.g. Auerbach and Hassett, 1992, for an example of this approach). Moreover, because around a tax reform firm-level heterogeneity in TT_0 likely is correlated with TT^*-TT_0, a cross-sectional regression need not even produce an appropriate weighted-average of $\left(\frac{d_1}{1-\alpha}\right)\times\frac{1}{TT_0}$.

A variant of equation (A.79) involves including Tobin's Q (scaled by $1-\tau$) as a separate regressor as in Desai and Goolsbee (2004). On the one hand, with quadratic adjustment costs, inspection of equation (6) shows that the regression coefficients on both $\left(\lambda_{j,0^+}-\lambda_{j,0}\right)/\left(1-\tau_{j,0}\right)$ and $\left(TT_j^*-TT_{j,0}\right)$ equal $1/\phi$, the inverse of the adjustment cost scalar. However, if the change in λ is measured with any error (e.g., because marginal Q is not observed), this approach does not consistently estimate coefficients with any clear structural interpretation.

A.13 Derivation of $\hat{V}$ for a Domestic Firm

This Appendix provides algebraic detail for the construction of $\hat{V}$ in Section 8.3. In steady state, $\rho V_t = D_t$. For a domestic-only firm, the steady state dividend is $D=(1-\tau)K^\alpha-(1-\Gamma)\delta K$, giving:

$$\rho V=(1-\tau)K^\alpha-(1-\Gamma)\delta K=\left((1-\tau)K^{\alpha-1}-(1-\Gamma)\delta\right)K. \tag{A.86}$$

The FOC (9) gives:

$$\alpha(1-\tau)K^{\alpha-1}=(\rho+\delta)(1-\Gamma).$$

Substituting the FOC into equation (A.86):

$$\rho V=\left((1-\tau)K^{\alpha-1}-\left(\frac{\alpha(1-\tau)K^{\alpha-1}}{\rho+\delta}\right)\delta\right)K=\left(1-\frac{\alpha\delta}{\rho+\delta}\right)(1-\tau)K^\alpha.$$

Then across steady states, $\hat{V}=\alpha k-\hat{\tau}$.

B Data Definitions and Variable Construction

B.1 Variable Definitions in U.S. Treasury Tax Data

For firm- and industry-level variables, we use the following lines from the following tax forms: 1120, 1118, 1125-A, 3800, 4562, and 5471.

- Investment
  - Sum of Form 4562, Page 1, part I lines 7 and 8, part II line 14, part III lines 19a(c)-19i(c) and 20a(c)-20c(c), and part IV line 12.
- Capital
  - Capital is depreciable assets less accumulated depreciation.
  - Line 10a(c) less line 10b(c) on Form 1120, Page 5, Schedule L.
- Foreign Capital
  - Line 8a column b less line 8b column b on Form 5471, Schedule F.

- Liquid Assets
  - Liquid assets are cash, government obligations, and tax-exempt securities.
  - Sum of lines 1(d), 4(d), and 5(d) on Form 1120, Page 5, Schedule L.
- Revenue
  - Line 1c on Form 1120, Page 1.
- Profits
  - Line 11 less line 27 on Form 1120, Page 1.
- Sales
  - Line 11 on Form 1120, Page 1 plus line 8 on Form 1125-A.
- EBITD
  - We calculate EBITD as the sum of profits, interest paid, and net depreciation.
  - Sum of lines 11, 18, 20, less line 27 on Form 1120, Page 1.
- Labor Compensation
  - Labor compensation is compensation of officers, salaries and wages, pension, profit-sharing, and other plans, employee benefit programs, and cost of labor.
  - Sum of lines 12, 13, 23, 24 on Form 1120, Page 1, and line 3 on Form 1125-A.
- Taxable Income
  - Line 30 on Form 1120, Page 1.
- Net Foreign Income
  - Line 5a on Form 1120M-3, Page 1, part I.
- Net Foreign Loss
  - Line 5b on Form 1120M-3, Page 1, part I.
- Profits Margin
  - Profits divided by sales.
  - Line 11 less line 27 from Form 1120, Page 1; all divided by the sum of line 11 on Form 1120, Page 1, and line 8 on Form 1125-A.
- EBITD Margin
  - EBITD divided by sales.

  - Sum of lines 11, 18, 20, less line 27 on Form 1120, Page 1.; all divided by the sum of line 11 on Form 1120, Page 1, and line 8 on Form 1125-A.

- Dividends
  - Line 19(a) on Form 1120, Page 2, Schedule C.

- Company age
  - Difference between year of tax record and line C on Form 1120, Page 1.

- Industry
  - SOI Industry Code determined by SOI from principal business activity code (line 2a on Form 1120, Page 3, Schedule K), prior year data, and references.

- Marginal Effective Tax Rate (METR)
  - Authors' calculations.

- GILTI Tax
  - GILTI calculations rely on fields on Form 1118 identified with the separate category code "951A." We identify firms as GILTI payers if the GILTI inclusion less 50% deduction times 21% is greater than the separate foreign tax credit. However, we do not assign GILTI tax rates to firms paying GILTI due to credit limitations. These are GILTI payers with foreign taxes before credit limitation greater than the credit limitation.
  - GILTI inclusion less 50% deduction is Schedule A, 3(a) plus 3(b) less 14(c).
  - The separate foreign tax credit is Schedule B, line 12.
  - Foreign taxes before credit limitation is Schedule B, line 6.
  - The credit limitation is Schedule B, line 11.

- Form 5471 Tax Rate
  - The average of total amount of income, war profits, and excess profits taxes paid or accrued in USD divided by the amount of total foreign income minus the total of foreign deductions, and the total amount of income, war profits, and excess profits taxes paid or accrued in USD divided by the amount of current earnings and profits in USD.
  - Average of Schedule E, line 8 divided by Schedule C, line 18, column 2 and Schedule E, line 8 divided by Schedule H, line 5d; all on Form 5471.

- Alternative Minimum Tax
  - Line 14 on Form 4626.

- Average Tax Rate

- Equal to the total tax settlement less net section 965 tax liability paid, divided by the sum of taxable income, labor compensation, and net depreciation.
- Line 11 less line 12 on Form 1120, Page 3, Schedule J; all divided by the sum of lines 12, 13, 20 23, 24, 30 on Form 1120, Page 1, and line 3 on Form 1125-A.

- Net Operating Loss Carryforwards
  - Schedule K, line 12 on Form 1120.
- General Business Credits
  - Schedule J, line 5c for credits used.
  - Sum of Form 3800, Part 1, line 6; Part II, line 25; and Part II, line 36 for credits available.
- Foreign Tax Credits
  - Schedule J, line 5a for credits used.
- Domestic Production Activities Deduction
  - Line 25 on Form 1120 prior to TCJA, disallowed post-TCJA.

B.2 Definitions of Control Variables for Robustness Table

- 3-digit NAICS code
  - First 3 digits of the NAICS code of the firm. Used to control for industry fixed effects.
- 4-digit NAICS code
  - First 4 digits of the NAICS code of the firm. Used to control for industry fixed effects.
- Trade Shock Controls from Flaaen and Pierce (2019)
  - Cumulative new tariff rate import share of consumption.
  - Cumulative new tariff rate export share of output.
  - Cumulative new tariff share of costs.
- Pre-period Capital
  - Capital as defined above, but before 2018. Used as a control for firm size.
- Pre-period Investment
  - Investment as defined above, but before 2018. Used to control for lagged investment.
- Intangible Capital

– Defined as research expenses divided by the sum of research expenses and investment. Divided into deciles for use a control for intangible capital.
– Research expenses are defined as the sum of lines 9 and 28 on Form 6765: qualified expenses for credit and qualified expenses for alternative simplified credit, respectively.

- Toll Tax Paid
  – Flag for positive toll tax. Used as a control.
  – Flag for positive value in line 12 on Form 1120, Page 3, Schedule J.

B.3 Additional Discussion of METR and GILTI Calculations

To estimate marginal effective tax rates (METRs) we simulate future income, deductions, and credits using firm-specific parameters. These parameters are estimated using a panel of tax return data from 2004 to 2016 for firms that appear in the SOI corporate sample in base years 2015 and 2016.[7] In years where the firm does not appear in the corporate sample, we supplement with information from the population of Form 1120 filings.

For each firm, we calculate the standard deviation of year-over-year change in profits, or net income. We then simulate income trajectories 20 years into the future where year-over-year changes in income are drawn from a normal distribution with mean zero and the firm's calculated standard deviation. Firms begin the simulation with the observed stock of net operating loss (NOL) carryforwards in the base year. Firms carry forward losses and deduct them against income in future years. We do not model NOL carrybacks for computational tractability and because most firms choose not to amend prior tax returns to carry back losses (Zwick, 2021).

In evaluating out-of-sample prediction, we find that some firms are assigned a probability of switching between profit and loss that is too low. Further, we observe that losses are less persistent than gains, an asymmetry not captured by our standard deviation measure. To better match observed income dynamics, we make two adjustments to the simulated change in income. First, the standard deviation used to simulate changes in income is restricted to a minimum of half of the absolute value of base year net income. This ensures each firm has a non-trivial chance of switching between profit and loss. Second, in years immediately following losses, we assign change in income from a distribution where the standard deviation is doubled. This better matches the observed asymmetrical income volatility following profit or loss.

We calculate historical take-up of credits and deductions in two parts. We first calculate a binary take-up rate as the share of years in which the firm claimed the credit or deduction conditional on having positive tax liability after carryforwards but before credits. For foreign tax credits (FTCs), General Business Credits (GBCs) and the Domestic Production Activity Deduction (DPAD), claiming rates are approximately zero for firms with no regular tax liability before credits.

In the second step, we calculate firm specific credit or deduction amounts conditional on claiming. For DPAD and FTCs, we scale claimed amounts by net income then take natural

[7] In robustness analysis, we construct "endogenous" METRs using 2018 and 2019 as base years and instrument these with the METRs derived from pre-TCJA years.

logs. We then calculate the firm-level mean and standard deviation of log values. For GBCs we assign the log mean and standard deviation of credits available as opposed to credits claimed because the repeal of corporate AMT relaxes some of the limitations on use of GBCs following TCJA.

For GBCs, FTCs, and DPAD, we assign for each simulated firm year a binary indicator for claiming the credit or deduction set to 1 with probability equal to the firm-specific take-up rate. We also assign a conditional credit or deduction amount drawn from a log normal distribution with firm-specific mean and standard deviation. To estimate post-TCJA METRs, simulated DPAD is added to income with a probability equal to the firm's DPAD take-up rate.

Each simulated trajectory of income, deductions and credits is compared with a trajectory that is identical except base year income is increased by one percent of revenue. Pre-TCJA and Post-TCJA tax schedules and net operating loss rules are applied to both the baseline simulation and the simulation receiving an income shock. METRs are estimated as the increase in the net present value of tax divided by the income shock. The net present value is calculated with a discount rate of 6%. We run this simulation 50 times for base years 2015 and 2016, then take the average value as our METR.

To model the corporate AMT in the pre-TCJA period, we estimate a linear probability model for whether a firm pays AMT in 2017 based on separate indicators for paying the AMT in 2015 or 2016. The final METR is a weighted average of the corporate AMT rate (20%) and the simulated METR with the weight being the predicted probability of paying the AMT. For firms with predicted probability of paying the AMT less than 5%, we set the weight on the AMT rate to zero.

C Mergers and Acquisitions

C.1 Related Literature

While Lyon (2020) finds that the value of U.S. acquisitions of foreign firms increased by 50% and that the acquisition of U.S. assets by foreign firms declined by 25% immediately following the passage of the TCJA, Amberger and Robinson (2023) and Dunker, Overesch and Pflitsch (2022) find that U.S. acquisitions of foreign firms decreased. Using a difference-in-differences design to compare U.S. and non-U.S. firms, Amberger and Robinson (2023) find that the probability of a U.S. firm acquiring a foreign firm decreased by 3.5-4.5 percentage points, while there was no change in the foreign mergers and acquisitions behavior of non-U.S. firms. Dunker, Overesch and Pflitsch (2022) similarly find that U.S. firms acquire firms in low-tax countries and tax havens significantly less often following the passage of the TCJA. They find that these changes are mainly driven by GILTI-affected firms and that there is no evidence of changes in mergers and acquisitions activity for firms that are unaffected.

C.2 Construction of Mergers and Acquisitions Sample

Following Dunker, Overesch and Pflitsch (2022), we construct a sample of mergers and acquisitions using the Refinitiv SDC Mergers and Acquisitions data. Starting with a sample of all cross-border mergers and acquisitions from 2010 to 2019 with non-missing deal values and non-U.S. targets, we remove deals that are declared as internal restructurings or where the acquirer does not hold a majority stake in the target. We then merge with Compustat data, only keeping deals where the acquirer is not missing financial data and dropping deals with firms in the financial or utility industries. Finally, we drop deals where the target country has fewer than 10 deals observed or where the target country switched between the low-tax and high-tax group during the sample period. A complete waterfall table comparing our sample to the sample in Dunker, Overesch and Pflitsch (2022) can be found in Appendix Table C.1. We follow them in defining GILTI-affected firms for this section.

We also use the same raw Refinitiv SDC Mergers and Acquisitions data to build a sample of U.S. mergers and acquisitions following Lyon (2020). We restrict the samples to deals where either the acquiring or target firm is based in the U.S. and at least 20% of the target firm is acquired. We also drop transactions with missing deal values or unknown locations for the target or acquirer. This results in a dataset that matched the $14.2T in M&A deal value from Lyon (2020).

C.3 Mergers and Acquisitions Results

Appendix Figure C.1 plots the average annual M&A deal value by U.S. acquirers before and after the passage of the TCJA. Panels A and B replicate panels B and E in Figure 1 of Dunker, Overesch and Pflitsch (2022), where deals are divided by their target country. Low-tax target countries are defined as those below the 25^{th} percentile of the sample distribution. Like Dunker, Overesch and Pflitsch (2022), we find that there is an increase in the annual value of U.S. M&As after the TCJA was passed, and that this is driven by GILTI-affected firms acquiring firms in high-tax foreign countries. The GILTI-affected firms spend less on M&As in low-tax countries in the post-period.

We also used our replication of the Lyon (2020) sample to investigate the claims made in Lyon (2020) and Goodspeed and Hassett (2022). Panels C and D in Appendix Figure C.1 show that the dollar-value of U.S. acquisitions increased by 19% after 2017 and that foreign acquisitions of U.S. firms decreased by 38%. Lyon (2020) instead finds that the dollar-value of U.S. acquisitions increased by 50% and that foreign acquisitions decreased by 25%.[8]

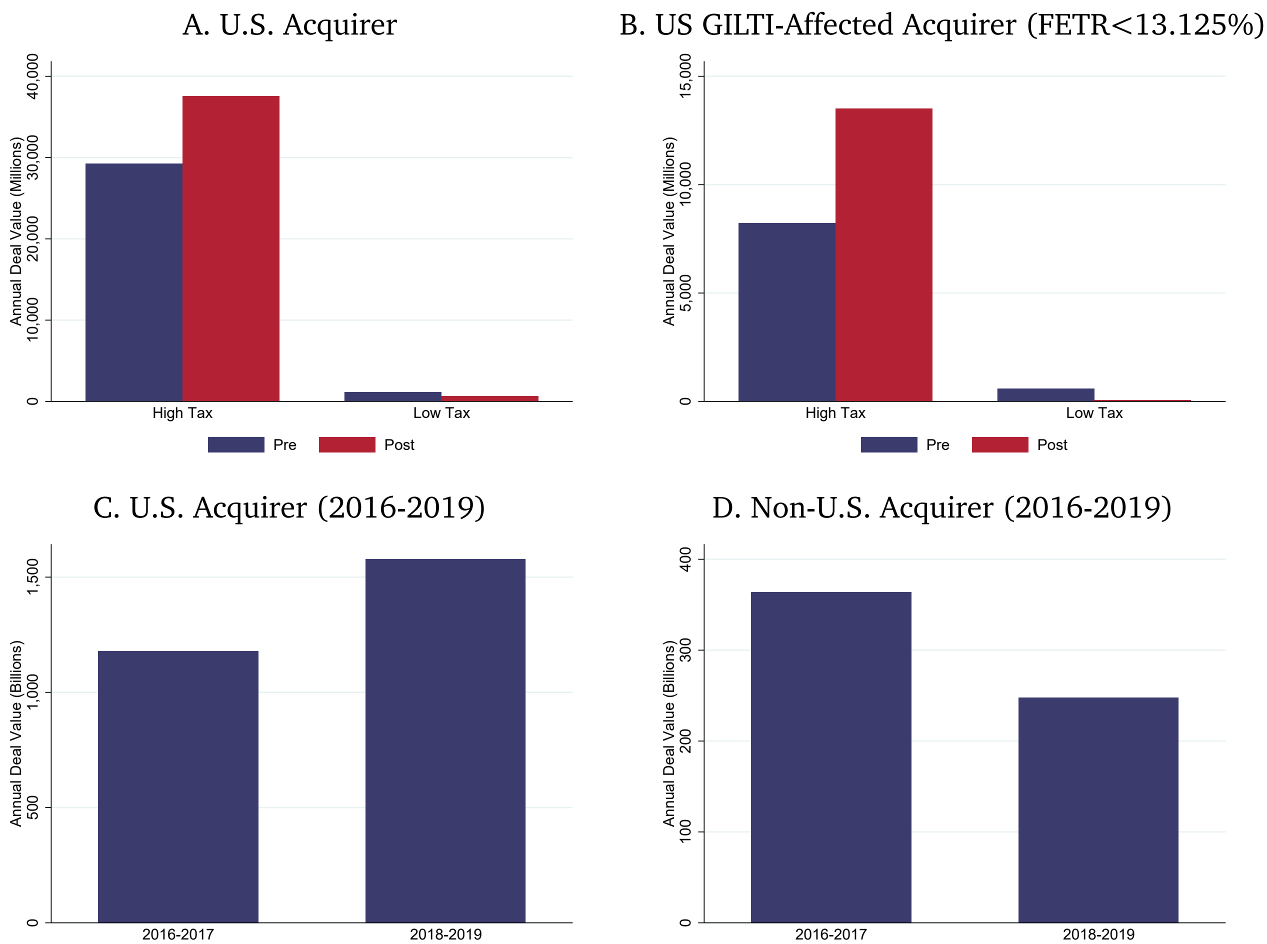
[8] Note that our sample is different from that of Lyon (2020). While we were able to replicate the initial dataset, which had $14.2 trillion in domestic and cross-border M&A transactions by U.S. firms from 2010 to 2019, Lyon (2020) then reclassified $8.5T in redomiciliations of U.S. firms as acquisitions by foreign firms instead of acquisitions by U.S. firms. We are unable to account for these inversions in our dataset.

Table C.1: Mergers and Acquisitions Waterfall

Description	Dunker et al. (2023)	Our Sample
All cross-border M&A deals with non-missing deal value of U.S. and non-U.S. acquirers announced between 2010 and 2019 (Source: SDC Platinum). Deals with U.S. targets are excluded.	45,861	34,520
Less: M&A deals in which the acquirer does not or will not hold a majority stake in the target and deals that are declared as internal restructurings.	(11,006)	(9,069)
Less: M&A deals of acquirers not included in Compustat.	(16,918)	(17,355)
Less: M&A deals of firms from the financial and utility industries	(3,808)	(917)
Less: M&A deals with missing financial data. Also requiring at least 10 deals per target country and eliminating target countries that switch between a low-tax and high-tax group during the sample period.	(4,048)	(2,512)
Final Sample	**10,081**	**4,667**

Notes: The financial data that are required include the Compustat variables ch, at, ppent, intan, dltt, pi, sale, act, and lct in year t-1 and sale in year t-2.

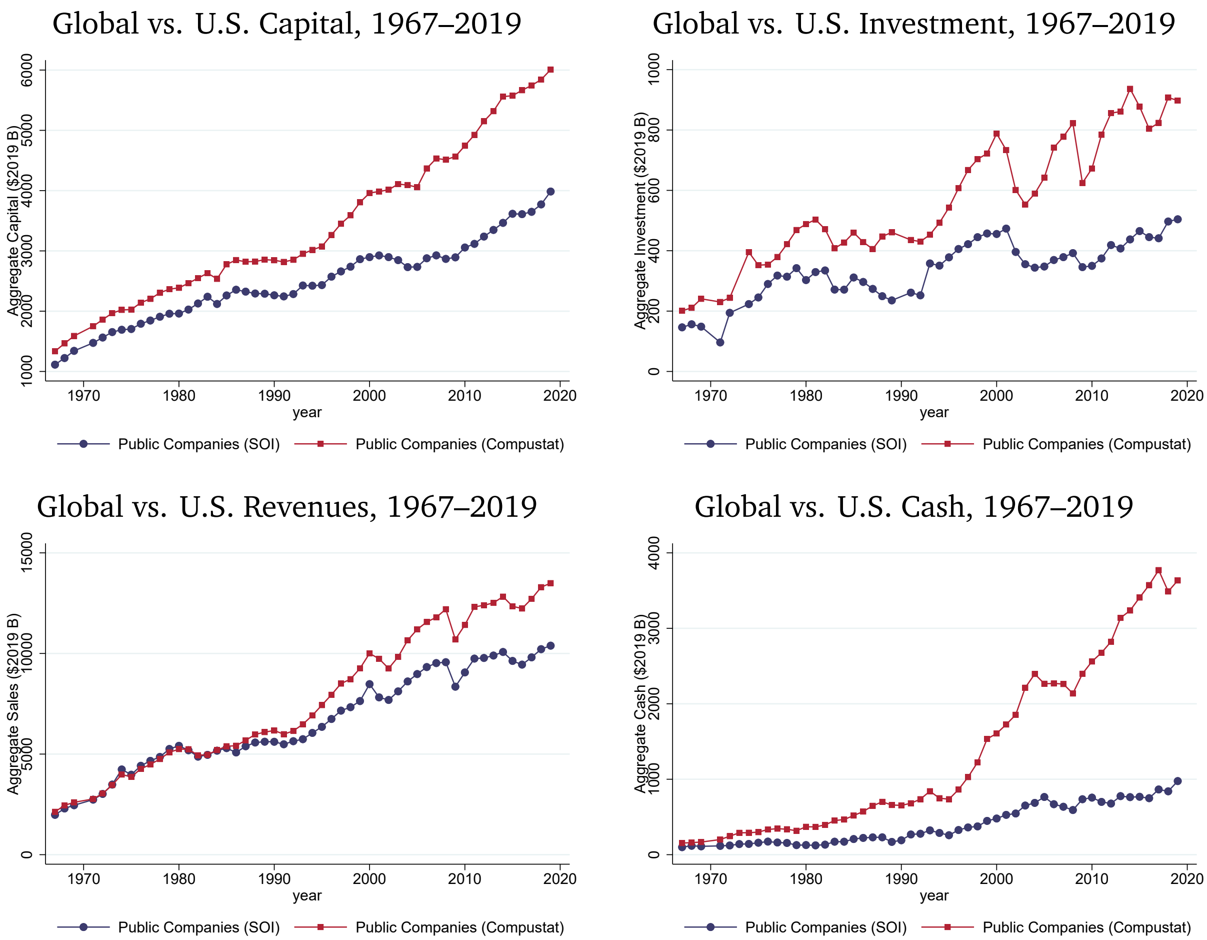
Figure C.1: Annual Aggregate Cross-Border Merger and Acquisition Deal Value Before and After the TCJA



Notes: Panels A and B use the dataset from Refinitiv following the sample restrictions from Dunker, Overesch and Pflitsch (2022), and panels C and D use the Refinitiv data with a separate set of restrictions that follow Lyon (2020). The definition of GILTI-affected in panel B follows Dunker, Overesch and Pflitsch (2022) in using a FETR threshold of 13.125%, which is the threshold at which GILTI ceases to bind.

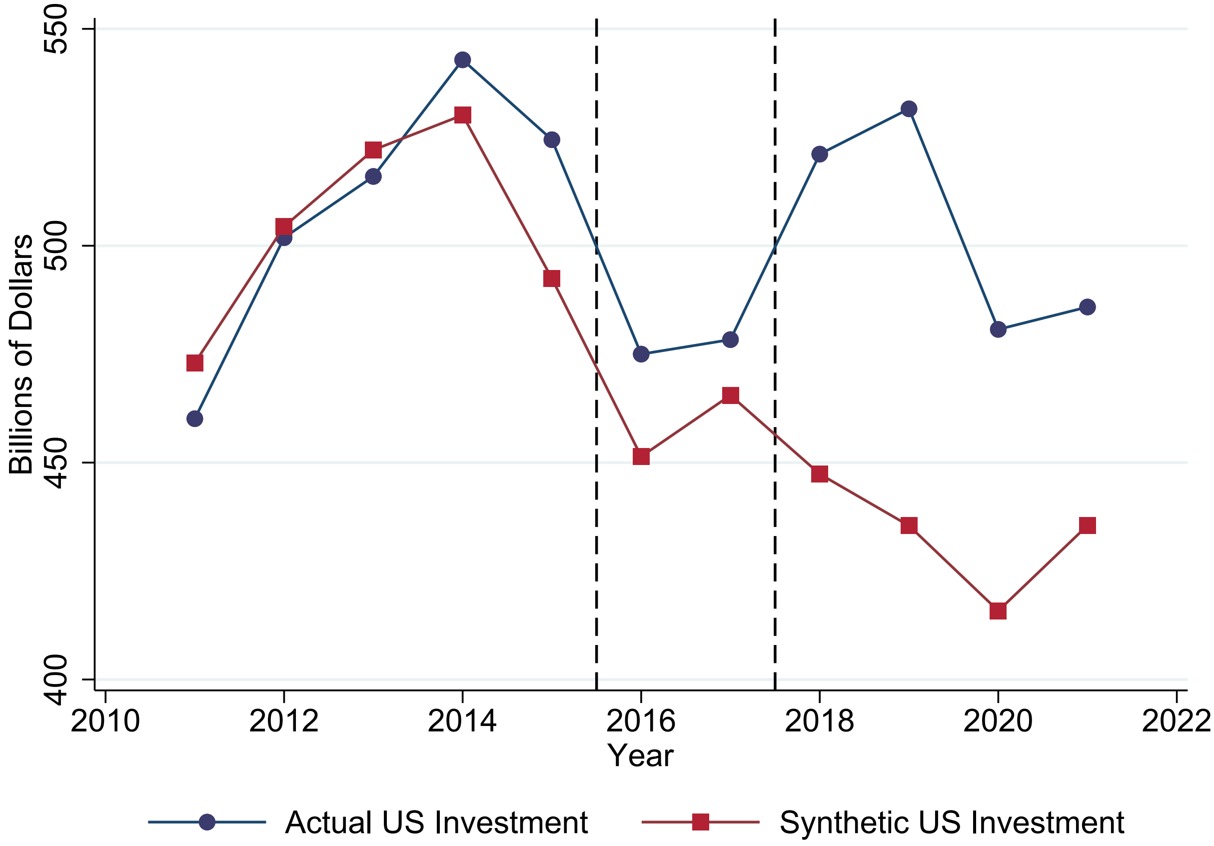
D Appendix Figures

Figure D.1: Activity by U.S. Firms is Increasingly Global (Unscaled)



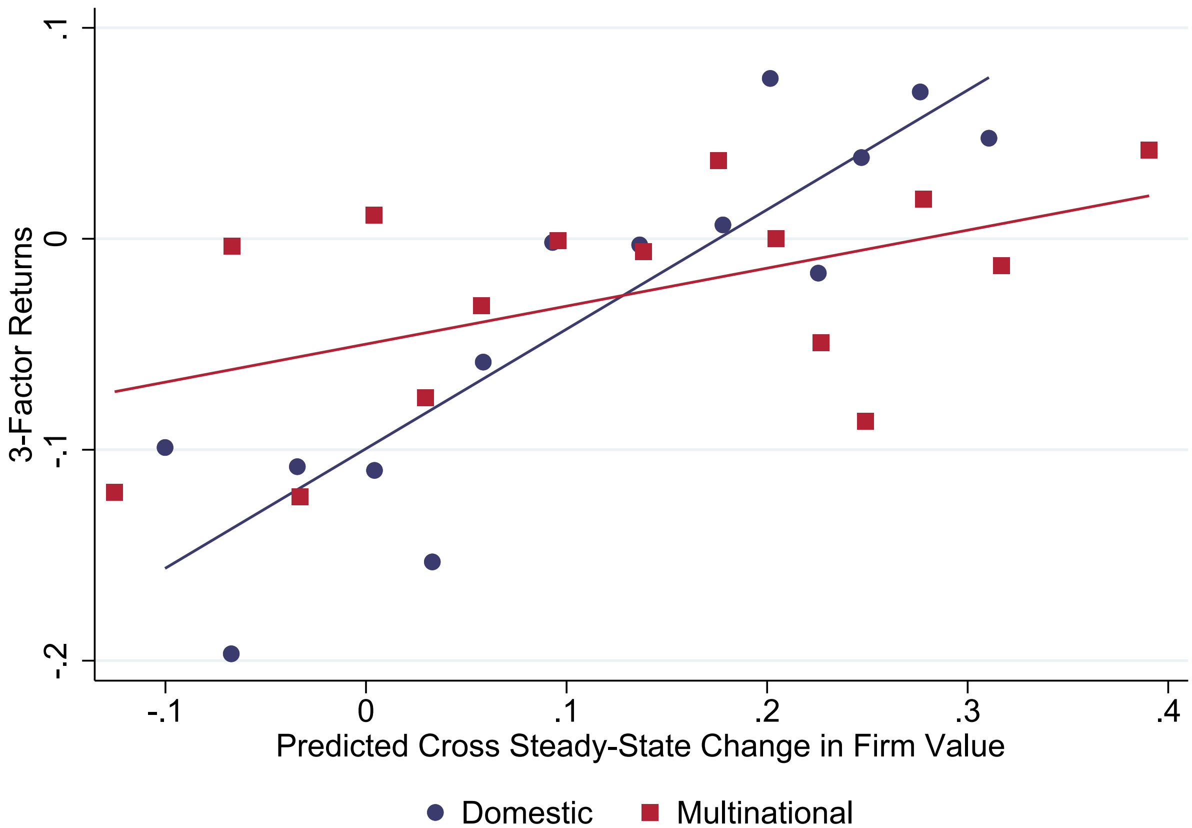
Notes: These figures present the unscaled versions of the figures in Figure 1. They use Compustat–SOI datasets to plot aggregates for domestic variables versus global variables for firms we are able to merge each year. We use the following Compustat variables for global measures: PPENT for capital, CAPX 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.

Figure D.2: Investment of Public Firms in U.S. and Similar Foreign Firms: Backdated Approach



Notes: The figure plots aggregate investment (capital expenditures) of US public firms and compares it to the investment of synthetically matched global firms. Synthetic firms were matched based on the values of firm characteristics between 2011 and 2015, which allows the 2016 and 2017 pre-reform values to serve as a validation test of the match. This figure does not contain data from tax returns.

Figure D.3: Stock Market Returns by Predicted Change in Firm Value



Notes: This figure plots the binscatter of cumulative 3-factor returns against $\hat{V}$ for domestic and multinational firms. We winsorize 3-factor returns at the 5% level.

E Appendix Tables

Table E.1: Regression Robustness Checks for Low Foreign Capital Multinationals

Sample:	Domestic		Multinational-Low Firms			
Regressor	$\hat{\Gamma} - \hat{\tau}$	N	$\hat{\Gamma}$	$\hat{\hat{\Gamma}}$	$\hat{\tau}$	N
Specification:						
1. Baseline	3.97***	7044	3.14	−0.13	−4.14**	1148
	(0.46)		(1.66)	(0.37)	(1.26)	
2. Trade Controls	4.03***	7044	3.16	−0.11	−4.12**	1148
	(0.46)		(1.67)	(0.37)	(1.27)	
3. Toll Tax Control			3.10	−0.14	−4.09**	1148
			(1.66)	(0.37)	(1.26)	
4. Intangible Capital	4.00***	7044	3.11	−0.05	−4.23***	1148
	(0.47)		(1.65)	(0.37)	(1.26)	
5. Size Controls	3.97***	7044	3.11	−0.15	−4.13**	1148
	(0.46)		(1.66)	(0.37)	(1.26)	
6. Lagged Investment	4.25***	6993	3.15*	0.07	−4.38***	1145
	(0.42)		(1.55)	(0.35)	(1.18)	
7. Industry FE (NAICS 3D)	3.67***	7044	2.83	0.07	−3.95**	1148
	(0.46)		(1.62)	(0.40)	(1.25)	
8. Industry FE (NAICS 4D)	3.72***	7044	2.38	0.22	−3.41*	1148
	(0.47)		(1.73)	(0.43)	(1.33)	
9. Weighted	3.64***	7044	1.61	−0.24	−2.78*	1148
	(0.51)		(1.71)	(0.36)	(1.31)	
10. Drop Industries	4.00***	6827	3.05	−0.13	−4.16***	1136
	(0.47)		(1.67)	(0.37)	(1.26)	
11. Drop Profit Shifters			3.80*	−0.34	−4.73***	1034
			(1.73)	(0.39)	(1.31)	
12. Simulated IV	3.71***	7044	2.99	−0.03	−3.80**	1148
	(0.43)		(1.60)	(0.37)	(1.26)	

Notes: This table presents the results for regressions of $d\log(\text{Investment})$ on our tax terms for domestic firms and low foreign capital U.S. multinationals under different robustness specifications. Row 1 presents our baseline results. Row 2 includes controls for trade shocks. Row 3 controls for firms paying the toll tax. Row 4 controls for intangible capital. Row 5 controls for pre-period capital, while row 6 controls for lagged investment growth. Rows 7 and 8 include 3-digit and 4-digit NAICS fixed effects. Row 9 weighs by the log of the mean capital from 2015-2016. Row 10 drops industries with high baseline investment from partnerships (2-digit NAICS 22 and 3-digit NAICS 486 and 531, which represent utilities, pipeline transportation, and real estate). Row 11 drops firms with $\geq 50\%$ of their foreign income in tax havens. Row 12 presents a simulated IV using post-TCJA tax rates. * $p < .05$, ** $p < .01$, *** $p < .001$

Table E.2: The Effect of Tax Term Shocks on Additional Outcomes (High Foreign Capital)

Sample:	Domestic Firms		Multinational-High Firms			
Regressor:	$\hat{\Gamma} - \hat{\tau}$	N	$\hat{\Gamma}$	$\hat{\hat{\Gamma}}$	$\hat{\tau}$	N
Outcome:						
$d\,\frac{\text{Investment}}{\text{Capital}}$	0.52***	6963	0.51	0.11	−0.56	1107
	(0.09)		(0.39)	(0.09)	(0.30)	
d log(Domestic Capital)	1.55***	6955	0.21	0.50**	−0.76	1090
	(0.16)		(0.76)	(0.18)	(0.58)	
d log(Equipment)	4.14***	7008	4.51**	0.70*	−4.16***	1109
	(0.42)		(1.58)	(0.35)	(1.22)	
d log(R&D)	1.43*	1336	3.46*	0.61*	−3.14**	738
	(0.59)		(1.36)	(0.27)	(1.04)	
d log(Structures)	3.64**	3579	0.28	1.17	−1.33	733
	(1.22)		(4.36)	(0.96)	(3.34)	
d log(Tax Payments)	−1.95**	4145	1.43	0.61	3.94*	659
	(0.61)		(2.39)	(0.72)	(1.95)	
d log(Labor Comp.)	0.76***	6029	−0.31	0.24	−0.03	976
	(0.11)		(0.53)	(0.13)	(0.42)	
d log(Salaries & Wages)	0.92***	5892	0.17	0.18	−0.51	972
	(0.14)		(0.66)	(0.16)	(0.51)	
d log(Officer Comp.)	0.52*	5046	−2.21*	−0.47	1.59	887
	(0.21)		(1.10)	(0.25)	(0.85)	

Notes: This table contains coefficients from regressions after restricting the sample to domestic firms (columns 1-2), and U.S. multinationals with high foreign capital (columns 3-6). Outcome variables appear as row names. All outcomes are winsorized at the 5% level. Standard errors appear in parentheses. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

Table E.3: The Effect of Tax Term Shocks on Additional Outcomes (Low Foreign Capital)

Regressor:	$\hat{\Gamma}$	$\hat{\hat{\Gamma}}$	$\hat{\tau}$	N
Outcome:				
$d\,\frac{\text{Investment}}{\text{Capital}}$	0.39	−0.04	−0.67*	1137
	(0.42)	(0.09)	(0.31)	
d log(Domestic Capital)	1.20	0.19	−2.16***	1124
	(0.73)	(0.18)	(0.56)	
d log(Equipment)	2.36	−0.22	−3.62**	1146
	(1.54)	(0.35)	(1.18)	
d log(R&D)	−0.01	−0.01	−1.03	660
	(1.32)	(0.30)	(0.99)	
d log(Structures)	1.24	1.20	−2.99	744
	(4.33)	(0.94)	(3.20)	
d log(Tax Revenue)	1.53	0.60	3.23	677
	(2.13)	(0.64)	(1.87)	
d log(Labor Comp.)	0.18	−0.07	−0.51	1013
	(0.44)	(0.12)	(0.34)	
d log(Salaries & Wages)	0.11	−0.04	−0.50	1010
	(0.50)	(0.14)	(0.39)	
d log(Officer Comp.)	−0.18	0.23	0.28	926
	(0.90)	(0.23)	(0.67)	

Notes: This table contains coefficients from regressions after restricting the sample to U.S. multinationals with low foreign capital. Outcome variables appear as row names. All outcomes are winsorized at the 5% level. Standard errors appear in parentheses. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

Table E.4: Tax Change Portfolios

	Share	K_0/ firm	$100 \times \Gamma$		$100 \times \bar{\Gamma}$		$100 \times \tau$		$100 \times \bar{\tau}$		N
			Pre	Post	Pre	Post	Pre	Post	Pre	Post	
Group:											
Domestic 1	18.5	139	14.4	9.5			17.2	10.2			2916
Domestic 2	1.8	65	23.9	16.3			34.8	22.2			606
Domestic 3	2.8	103	24.0	14.6			27.3	15.7			605
Domestic 4	12.2	92	30.0	19.7			34.6	21.5			2917
Multinat. high 1	4.1	282	11.5	9.9	17.7	18.0	13.5	11.1	27.4	27.4	320
Multinat. high 2	4.1	435	14.3	11.3	17.7	29.4	16.7	11.7	7.0	7.0	208
Multinat. high 3	0.6	673	21.9	14.3	17.7	29.4	29.3	18.0	7.0	7.0	21
Multinat. high 4	0.2	365	24.4	15.8	17.7	29.4	26.9	16.6	7.0	7.0	10
Multinat. high 5	0.1	103	27.2	19.0	17.7	18.1	29.6	19.9	13.3	13.3	18
Multinat. high 6	1.9	197	27.4	16.7	17.7	26.7	34.5	20.1	19.9	19.9	209
Multinat. high 7	7.2	500	28.4	16.6	17.7	29.4	33.1	17.7	7.0	7.0	318
Multinat. low 1	4.7	266	17.2	12.6	17.7	17.8	20.0	13.6	24.9	24.9	388
Multinat. low 2	2.3	373	18.3	13.3	17.7	29.4	21.1	13.8	7.0	7.0	136
Multinat. low 3	0.3	278	21.8	14.0	17.7	18.0	34.8	22.1	23.1	23.1	23
Multinat. low 4	0.5	456	22.7	14.6	17.7	29.4	34.0	21.3	7.0	7.0	24
Multinat. low 5	0.4	266	25.5	16.7	17.7	17.9	27.1	17.1	26.5	26.5	32
Multinat. low 6	0.2	354	28.8	20.5	17.7	29.4	32.0	21.3	7.0	7.0	15
Multinat. low 7	4.3	319	29.5	19.2	17.7	21.0	33.9	21.0	20.7	20.7	294
Multinat. low 8	4.7	444	29.6	18.7	17.7	29.4	34.1	20.4	7.0	7.0	231
Non C-corp.	29.0	116	23.0	23.0			28.0	28.0			

Notes: Share is the share of domestic capital at firms in the group, in percent. K_0/ firm is average domestic capital per firm in billions of dollars. Pre and post refer to 2015-2016 and 2018-2019 averages.

Table E.5: 30 Year Revenue Effects

	Percent of no-TCJA corporate revenue			
	METR only	Exp. only	GILTI only	Total
1. Mechanical corporate	−37.7	−3.4	0.0	−41.3
2. Dynamic and personal	2.7	−0.2	1.6	4.1
3. Total	−35.0	−3.6	1.6	−37.2
4 (memo): Year 30 K (%)	4.0	2.1	1.0	7.1
5 (memo): (3)/(4)	−8.7	−1.7	1.5	−5.2

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 30 year window. Row 4 shows the percent increase in domestic capital after 30 years.

Table E.6: 10 Year Revenue Effects

	Percent of no-TCJA corporate revenue		
	Baseline	Unexp. phaseout	Exp. phaseout
1. Mechanical corporate	−41.3	−39.1	−39.1
2. Dynamic and personal	1.7	2.4	3.0
3. Total	−39.6	−36.8	−36.2
4 (memo): Year 10 K (%)	5.9	4.2	5.2
5 (memo): (3)/(4)	−6.7	−8.8	−6.9

Notes: The table shows the present value of total corporate and personal income tax changes over 10 years for our baseline with permanent full expensing, unexpected phaseout of expensing, and anticipated phaseout of expensing, 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. Row 3 shows the overall revenue effects. Row 4 shows the percent increase in domestic capital after 10 years.

Table E.7: Coverage of the Synthetic Sample

	US firms		Capx (Avg 2011-17)		Market Value (Avg 2011-17)	
	N	%	Total (in billions USD)	%	Total (in billions USD)	%
Cleaned Compustat Firms w/o NAICS 52	8,936	100	1,121.7	100	20,002.1	100
Dropping Panels with any missing Year-Capx or Year-Sales	2,359	26	906.0	81	17,063.5	85
Dropping Panels with Less than 4 Non-Missing Year-Xs	2,278	25	905.8	81	16,779.3	84
Close Synthetic Matches	1,486	17	654.7	58	9,921.3	50

Notes: This table shows how the sample declines as we drop firms with key variables missing in order to conduct synthetic matching. In row 2, we drop any firms that are missing any capital expenditure data from 2011-2021 or any sales from 2011-2017 since we estimate the synthetic control weights on these variables. The X's in row 3 include assets, and property, plant, and equipment. Firms that are dropped in row 4 come from NAICS industries with no global firms. For example, these NAICS codes include 4571, 6222, and 6244 which represent gas stations, psychiatric and substance abuse hospitals, and child daycare services. Close synthetic matches refer to the synthetic matches that have an average pre-reform period (2011-2017) capx within 10% of the US firm's average pre-period capx.

Table E.8: Summary Statistics of Matched Firms

Firms:	Closely Matched: US		Closely Matched: Synthetic	
	Mean	Median	Mean	Median
Pre-period Characteristics (2011-17)				
Capx	440.6	47.9	437.5	46.4
	(1,659.6)		(1,698)	
Assets	8,072.7	1466.1	6,744.8	1,260.6
	(30,290)		(19,939)	
PPE	3,284.2	242.6	2,989.0	253.0
	(12,203)		(10,095)	
Sales	5,035.7	1,218.0	3,910.2	869.7
	(17,173)		(13,016)	
Market Value	7,453.8	1,341.0	NA	NA
	(23,998)			
Post-period Characteristics (2018-19)				
Capx	459.2	56.8	386.9	54.1
	(1,527)		(1,320)	
Assets	9,148.7	1,812.9	7,687.1	1,663.2
	(31,253)		(20,882)	
PPE	3,836.5	355.4	3,283.0	338.6
	(13,317)		(10,115)	
Sales	5,243.2	1392.2	4,030.7	1,084.9
	(16,225)		(12,285)	
Market Value	9,105.8	1,399.2	NA	NA
	(26,893)			
Observations	1,486		1,486	

Notes: The table uses data from Compustat North America and Global. All values are in millions of USD and are adjusted for inflation using CPI data from the series https://fred.stlouisfed.org/series/CPIAUCSL#0 indexed to 2019 US dollars. It shows the summary statistics for key variables in the pre-period (2011-17) as well as the post-period (2018-19). The numbers in the brackets show the standard deviation. The first two columns show the closely matched US headquartered firms that are in the synthetically matched sample, and the next 2 columns show their synthetically created global matches.

Table E.9: Investment of US and Synthetic Matched Firms in 2019, by Industry

Industry	US Public Firms	Synthetic Firms	Difference
Utilities	238.7	167.3	71.4
Manufacturing (NAICS 31-33)	216.3	192.5	23.8
Mining, Quarrying, Oil, Gas	70.1	52.2	17.9
Retail Trade (NAICS 44-45)	19.9	13.5	6.4
Transportation, Warehousing	63.2	59.4	3.8
Real Estate, Rental	5.1	3.9	1.2
Accommodation and Food	3.6	2.7	0.9
Admin, Waste Mgmt, Remediation	2.6	1.7	0.9
Wholesale Trade	4.4	3.7	0.7
Professional, Science, Tech	3.9	3.3	0.6
Nonclassifiable	22.4	21.9	0.5
Construction	1.8	1.4	0.4
Agriculture, Fishing	0.2	0.2	0
Education	0	0	0
Other Services	0	0	0
Health Care	1.7	2.0	−0.3
Arts, Entertainment	1.3	1.7	−0.5
Information	32.3	32.9	−0.6

Notes: This table displays total investment by US firms in 2019 in billions of dollars in our Compustat analysis sample, their synthetic counterparts from Global Compustat, and the difference between the two separately for each two-digit NAICS industry.

Table E.10: The Effect on Global Investment of U.S. Public Firms (Leave One Out Synthetic Control)

Dropped Regions/Industries	(1)	(2)	(3)	(4)
Baseline	0.167***	0.159***	0.167***	0.159***
	(0.027)	(0.007)	(0.006)	(0.007)
N	13,203	12,177	13,203	12,177
China	0.180 ***	0.178***	0.180***	0.178***
	(0.027)	(0.007)	(0.006)	(0.007)
N	13,367	12,341	13,367	12,341
Japan	0.161***	0.151***	0.161***	0.151***
	(0.027)	(0.007)	(0.007)	(0.007)
N	13,161	12,108	13,161	12,108
India	0.169***	0.163***	0.169***	0.163***
	(0.027)	(0.007)	(0.007)	(0.007)
N	13,267	12,232	13,267	12,232
Europe	0.158***	0.148***	0.158***	0.148***
	(0.031)	(0.007)	(0.007)	(0.007)
N	12,801	11,703	12,801	11,703
North America (Non-US)	0.147***	0.126***	0.147***	0.126***
	(0.028)	(0.007)	(0.007)	(0.007)
N	12,919	11,902	12,919	11,902
South America	0.152***	0.141***	0.152***	0.141***
	(0.028)	(0.007)	(0.006)	(0.007)
N	13,196	12,152	13,196	12,152
Oil/Gas	0.141***	0.124***	0.141***	0.124***
	(0.028)	(0.006)	(0.006)	(0.006)
N	12,395	11,396	12,395	11,396
Controls	No	Yes	No	Yes
NAICS 4-digit FEs	No	No	Yes	Yes

Notes: We conduct leave one out analyses by dropping control firms from the specified regions/industries before creating our synthetic matches. Standard errors in parentheses are clustered at the firm level. The outcome variable is log(CAPX of treated firms) - log(CAPX of synthetic firms). The controls include trade shocks and the mean pre-period (2011-17) values of CAPX, assets, sales and property, plant and equipment (PPENT) of treated firms. All regressions are weighted by the mean pre-period CAPX of treated firms. The post-period is defined as 2018-2019. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table E.11: The Effect on Global Investment of U.S. Public Firms (Backdated Synthetic Control)

	(1)	(2)	(3)	(4)
Post	0.160***	0.141***	0.160***	0.141***
	(0.036)	(0.009)	(0.008)	(0.008)
Observations	11,339	10,376	11,339	10,376
Controls	No	Yes	No	Yes
NAICS 4-digit FEs	No	No	Yes	Yes

Notes: Standard errors in parentheses are clustered at the firm level. The outcome variable is log(CAPX of treated firms) - log(CAPX of synthetic firms). The controls include trade shocks and the mean pre-period (2011-14) values of CAPX, assets, sales and property, plant and equipment (PPE) of treated firms. For the backdated matched sample, the firms are synthetically matched based on the values of firm characteristics between 2011 and 2014. All regressions are weighted by mean pre-period CAPX of treated firms. The post period is defined as 2018-2019.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table E.12: Tax Change Statistics

	Means		Standard Deviations	
Variable	Pre	Post	Pre	Post
Γ	0.229	0.151	0.082	0.054
$\hat{\Gamma}$	0.177	0.191	0.000	0.039
τ	0.273	0.175	0.090	0.059
$\frac{1-\Gamma}{1-\tau}$	1.065	1.030	0.060	0.035

Notes: This table provides the means and standard deviations in our analysis sample of 9305 firms of the three tax variables, as well as the tax term before and after the TCJA.

Table E.13: Tax Changes by Industry, Full Sample

Industry (NAICS)	Code	Γ			τ			Tax Term $(1-\Gamma)/(1-\tau)$			N
		Pre	Post	% Change	Pre	Post	% Change	Pre	Post	% Change	
Agriculture, Forestry, Fishing and Hunting	11	0.24	0.16	-32.4%	0.27	0.18	-34.3%	1.05	1.02	-2.6%	152
Mining, Oil, and Gas	21	0.19	0.13	-31.7%	0.21	0.14	-34.6%	1.03	1.01	-1.8%	224
Utilities	22	0.18	0.13	-30.9%	0.23	0.15	-36.4%	1.07	1.02	-3.9%	141
Construction	23	0.25	0.17	-33.7%	0.30	0.19	-35.0%	1.06	1.03	-2.9%	343
Manufacturing	31	0.25	0.16	-34.0%	0.29	0.19	-36.6%	1.07	1.03	-3.7%	434
Manufacturing	32	0.23	0.15	-33.8%	0.27	0.17	-36.6%	1.05	1.02	-3.1%	1002
Manufacturing	33	0.23	0.15	-35.0%	0.26	0.16	-37.7%	1.05	1.02	-3.0%	1944
Wholesale Trade	42	0.25	0.17	-34.9%	0.30	0.19	-36.2%	1.07	1.03	-3.4%	1207
Retail Trade	44	0.25	0.17	-34.3%	0.31	0.20	-35.5%	1.08	1.04	-3.7%	476
Retail Trade	45	0.23	0.15	-32.6%	0.27	0.18	-34.4%	1.06	1.03	-3.0%	115
Transport and Warehousing	48	0.24	0.16	-33.0%	0.27	0.17	-35.7%	1.04	1.02	-2.7%	261
Transport and Warehousing	49	0.24	0.16	-31.6%	0.30	0.20	-33.6%	1.08	1.04	-3.8%	33
Information	51	0.21	0.14	-33.0%	0.24	0.15	-36.2%	1.04	1.01	-2.5%	628
Real Estate	53	0.20	0.14	-32.4%	0.25	0.16	-34.2%	1.06	1.03	-3.0%	190
Professional, Scientific, and Technical Services	54	0.22	0.14	-35.3%	0.25	0.16	-37.2%	1.04	1.02	-2.4%	439
Management of Companies	55	0.23	0.15	-34.7%	0.31	0.21	-34.2%	1.13	1.07	-4.8%	884
Admin., Support, and Waste Mgmt.	56	0.24	0.16	-34.0%	0.28	0.18	-36.1%	1.05	1.02	-2.9%	187
Educational Services	61	0.21	0.14	-34.2%	0.26	0.17	-35.8%	1.07	1.04	-3.4%	52
Health Care	62	0.18	0.12	-34.7%	0.23	0.15	-36.0%	1.06	1.03	-2.8%	167
Arts, Entertainment, and Recreation	71	0.17	0.12	-29.9%	0.23	0.16	-32.1%	1.08	1.04	-3.6%	131
Accommodation and Food	72	0.18	0.12	-35.9%	0.25	0.16	-37.3%	1.09	1.05	-4.1%	214
Other Services (except Public Admin.)	81	0.20	0.13	-33.6%	0.25	0.16	-34.1%	1.07	1.04	-3.0%	78

Notes: This table summarizes tax change statistics by industry for the full sample in our analysis. For each industry (as reported in columns 1-2), columns 3-5 summarize the average value of Γ before and after the TCJA, as well as the percent change. Columns 6-8 and 9-11 report the same for τ and the tax term (respectively). Column 12 summarizes the number of firms in that industry in the full sample.

Table E.14: Tax Changes by Industry, Domestic Sample

Industry (NAICS)	Code	Γ			τ			Tax Term $(1-\Gamma)/(1-\tau)$			N
		Pre	Post	% Change	Pre	Post	% Change	Pre	Post	% Change	
Agriculture, Forestry, Fishing and Hunting	11	0.23	0.16	-32.4%	0.27	0.18	-34.2%	1.05	1.02	-2.6%	144
Mining, Oil, and Gas	21	0.19	0.13	-32.5%	0.21	0.14	-35.3%	1.03	1.01	-1.8%	175
Utilities	22	0.19	0.13	-30.7%	0.23	0.15	-36.2%	1.07	1.03	-4.0%	129
Construction	23	0.26	0.17	-33.6%	0.30	0.20	-34.8%	1.06	1.03	-2.9%	320
Manufacturing	31	0.24	0.16	-33.6%	0.29	0.19	-35.8%	1.07	1.03	-3.5%	329
Manufacturing	32	0.24	0.16	-33.6%	0.27	0.17	-35.9%	1.05	1.02	-2.9%	673
Manufacturing	33	0.23	0.15	-34.6%	0.27	0.17	-36.4%	1.05	1.02	-2.7%	1133
Wholesale Trade	42	0.26	0.17	-34.8%	0.31	0.20	-35.9%	1.07	1.04	-3.4%	964
Retail Trade	44	0.25	0.17	-34.3%	0.31	0.20	-35.3%	1.08	1.04	-3.6%	431
Retail Trade	45	0.23	0.16	-33.5%	0.28	0.18	-35.1%	1.06	1.03	-3.0%	87
Transport and Warehousing	48	0.24	0.16	-32.8%	0.27	0.18	-35.5%	1.05	1.02	-2.7%	217
Transport and Warehousing	49	0.24	0.17	-31.8%	0.30	0.20	-33.7%	1.08	1.04	-3.8%	30
Information	51	0.24	0.16	-32.0%	0.27	0.17	-35.0%	1.04	1.02	-2.7%	383
Real Estate	53	0.20	0.14	-31.8%	0.25	0.17	-33.5%	1.07	1.03	-3.0%	156
Professional, Scientific, and Technical Services	54	0.22	0.14	-34.7%	0.25	0.16	-36.2%	1.04	1.02	-2.2%	290
Management of Companies	55	0.23	0.15	-34.7%	0.31	0.21	-34.2%	1.13	1.07	-4.8%	881
Admin., Support, and Waste Mgmt.	56	0.24	0.16	-33.4%	0.28	0.18	-34.9%	1.06	1.03	-2.8%	122
Educational Services	61	0.21	0.14	-35.0%	0.26	0.17	-36.2%	1.08	1.04	-3.5%	43
Health Care	62	0.18	0.12	-34.5%	0.22	0.14	-35.8%	1.06	1.03	-2.7%	156
Arts, Entertainment, and Recreation	71	0.17	0.12	-30.4%	0.23	0.15	-32.5%	1.08	1.04	-3.5%	122
Accommodation and Food	72	0.18	0.12	-35.9%	0.24	0.15	-37.1%	1.09	1.05	-4.0%	190
Other Services (except Public Admin.)	81	0.19	0.13	-33.2%	0.25	0.16	-33.4%	1.07	1.04	-2.8%	71

Notes: This table summarizes tax change statistics by industry for the domestic sample in our analysis. For each industry (as reported in columns 1-2), columns 3-5 summarize the average value of Γ before and after the TCJA, as well as the percent change. Columns 6-8 and 9-11 report the same for τ and the tax term (respectively). Column 12 summarizes the number of firms in that industry in the domestic sample.

Table E.15: Tax Changes by Industry, Foreign Sample

Industry (NAICS)	Code	Γ			τ			Tax Term $(1-\Gamma)/(1-\tau)$			N
		Pre	Post	% Change	Pre	Post	% Change	Pre	Post	% Change	
Mining, Oil, and Gas	21	0.18	0.13	-28.5%	0.20	0.14	-32.2%	1.03	1.01	-1.9%	49
Utilities	22	0.15	0.10	-33.3%	0.18	0.11	-39.7%	1.04	1.01	-2.9%	12
Construction	23	0.22	0.15	-34.9%	0.26	0.16	-37.9%	1.04	1.02	-2.8%	23
Manufacturing	31	0.26	0.17	-35.0%	0.31	0.19	-38.8%	1.07	1.03	-4.5%	105
Manufacturing	32	0.23	0.15	-34.3%	0.27	0.17	-38.0%	1.06	1.02	-3.5%	329
Manufacturing	33	0.22	0.14	-35.7%	0.25	0.15	-39.5%	1.05	1.02	-3.3%	811
Wholesale Trade	42	0.25	0.16	-35.1%	0.29	0.18	-37.5%	1.07	1.03	-3.8%	243
Retail Trade	44	0.25	0.16	-34.8%	0.31	0.19	-37.4%	1.10	1.04	-5.0%	45
Retail Trade	45	0.20	0.14	-29.5%	0.25	0.17	-31.8%	1.07	1.03	-3.0%	28
Transport and Warehousing	48	0.23	0.15	-33.7%	0.25	0.16	-36.6%	1.04	1.01	-2.6%	44
Information	51	0.18	0.12	-35.1%	0.20	0.13	-38.7%	1.03	1.01	-2.3%	245
Real Estate	53	0.21	0.13	-34.9%	0.24	0.15	-37.9%	1.05	1.02	-2.9%	34
Professional, Scientific, and Technical Services	54	0.23	0.14	-36.3%	0.26	0.16	-39.1%	1.04	1.02	-2.8%	149
Admin., Support, and Waste Mgmt.	56	0.25	0.16	-35.0%	0.28	0.17	-38.4%	1.05	1.01	-3.0%	65
Health Care	62	0.24	0.16	-35.9%	0.30	0.19	-37.7%	1.08	1.04	-4.1%	11
Accommodation and Food	72	0.20	0.13	-36.2%	0.27	0.17	-39.0%	1.09	1.04	-4.8%	24

Notes: This table summarizes tax change statistics by industry for the foreign sample in our analysis. For each industry (as reported in columns 1-2), columns 3-5 summarize the average value of Γ before and after the TCJA, as well as the percent change. Columns 6-8 and 9-11 report the same for τ and the tax term (respectively). Column 12 summarizes the number of firms in that industry in the foreign sample.

F Narrative History of Key TCJA Events

F.1 Notes

Sources for this section are drawn primarily from an analysis of all tax reform-related news in the Wall Street Journal between the 2016 election and TCJA passage (articles linked in-text), along with Google Trends data and analysis of other news sources and scholarly papers used to confirm some event dates that were not initially clear. Our event selection is largely consistent with the prior literature on asset pricing effects of TCJA: our dates include all of the "milestone days" during the legislative sessions leading up to TCJA passage listed in Wagner, Zeckhauser, and Zeigler (2018), the five event dates identified in Overesch and Pflitsch (2021), and all but one of the six "major events" listed in Gaertner, Hoopes, and Williams (2020). Each of our events is also included in the more expansive list of Kalcheva et al. (2020), with the same expected effects on probability of passage.

However, our event identification strategy also adds to the existing literature in two ways. First, we use a combination of Google Trends analysis, news prior to event dates, and publications by tax services (particularly KPMG) to more accurately identify when information about passage likelihood hit markets. For example, the passage of TCJA through the Senate on December 2, 2017 was actually the culmination of at least 5 days of intense negotiations, news about which emerged as early as November 27. The bill was almost completely certain to pass the Senate as early as November 30, after John McCain announced his support, and analyses focused on asset pricing effects using December 2 as an event date thus miss the most important relative shifts in pricing for more and less exposed firms around this event. This is borne out in our empirical findings, where the majority of the relative change in returns for more- and less-exposed firms occurs before the end of November.

F.2 Election Day

Date: Between Nov 8 and 9, 2016. *Trump's election was surprising and not fully priced in until the following trading day. Positive expected effects on firms with exposure to foreign and domestic components of the reform.*

Donald Trump's victory in the 2016 election came almost completely unexpected by mainstream pundits, and resulted in a significant and immediate increase in the probability of tax reform that would benefit corporations with exposure to domestic tax cuts or to cash repatriation provisions. While on the campaign trail, Trump had made tax reform one of his top economic policy priorities, regularly promising significant corporate tax cuts and later pledging in a major public statement that overseas cash would be repatriated with a tax rate as low as 10%.

Trump's election victory became clear only late on the night of November 8, after trading had closed for the day. As of 8:35 PM on Nov 8, the WSJ was still reporting that "investors had confidence in a victory for Hillary Clinton." But by 11:30 PM, the Clinton campaign was widely reported to be "in trouble". By 1:22 AM on Nov 9, it was clear that Republicans had won the Senate, and at 2:29 AM on Nov 9, the AP had called the presidential race.

All of these developments would hit markets the trading day of November 9, which we code as the event date.

F.3 Release of Initial Outline of Tax Reform Priorities

Date: Apr 24-26, 2017. *An important event for confirming the shape of tax reform and the White House's commitment to passing a bill. Positive expected effects on firms with exposure to domestic and foreign components of the reform over at least three days.*

In the immediate aftermath of the election, tax reform was mentioned occasionally in speeches and public conferences, but no concrete details emerged until the White House released its outline of 'tax reform priorities' on April 26, 2017. This event was preceded by two others. First, on April 20, then-Treasury Secretary Mnuchin and NEC director Cohn went on the record to say that a reform proposal would be released "very soon" and that the proposal would include both individual and corporate reform, but gave no details on the shape of that reform. Second, and more important for asset pricing effects, on April 24 news emerged that Trump had demanded White House staff include a CIT rate of 15% in their proposal. This latter detail is likely to have some important impacts on pricing for domestically exposed firms. Because of this, we set the beginning of this event at April 24, but do not expect effects to be fully priced in until after April 26.

The plan that was ultimately released was not a detailed policy document, but a one-page sheet of bullet points, which concerned many analysts who had expected a more robust proposal. However, its main points were positive for firms expecting a tax cut. The plan not only promised a 15% base corporate tax rate, as suggested in news on the 24th, but also confirmed the presence of a foreign cash repatriation provision and only loosely gestured at "eliminat[ing] tax breaks for special interests" without highlighting any specific corporate deductions or exemptions that would be eliminated (unlike in the individual provision, where many of these were enumerated.) Banks, accounting firms, hedge funds, and companies with large foreign operations appeared to benefit the most from the plan as it stood upon release, largely because of their significant overseas cash holdings for which repatriation was now on the table. But due to the lower than expected baseline CIT rate, firms with domestic exposure likely benefited to some degree as well.

We code this event as occurring on the trading day of April 24th, with continued effects expected through April 26th, and would expect ambiguous effects on probability of passage but significant positive effects on firms with larger foreign exposure, along with potential positive effects on firms with domestic exposure as well.

F.4 Release of the Unified Framework for Tax Reform (UFTR)

Date: Sep 26-27, 2017. *A major event that laid out the concrete shape of tax reform for the first time. Positive expected effects on probability of passage and firms with both foreign and domestic exposure. Some information related to foreign provisions and an increase in the headline CIT rate leaked to press the day before, so pricing effects are expected on both September 26 and 27.*

By late September, observers knew that more detail on a framework for tax reform would be released soon, but it wasn't until September 26 that key details of the plan began to emerge. By early that morning, news about the tentative plan had leaked to the press, and the WSJ and numerous other outlets were reporting on the 20% CIT rate, both the one-time tax on repatriated income and the fact that it would be "low," and key elements of what would become GILTI ("a new tax system for American companies' overseas operations, with lower taxes on future offshore earnings.") This news should have been unambiguously positive for firms with significant foreign exposure, especially those that would be able to get the benefits of repatriation without facing significant costs from the new overseas operations tax, although given the chaotic nature of news releases from the Trump White House it may not have been fully priced in until the UFTR report was released the following day. The effects of this news on domestically exposed firms were more ambiguous—it signaled greater seriousness about a concrete tax reform proposal than previous events had, but did raise the expected final CIT rate.

However, when the final UFTR report was released on September 27, a number of provisions were included that were likely to have significant positive effects on firms with domestic exposure as well. Foremost among them was the first clear statement that the reform was intended to include 100% bonus depreciation for all non-structures for 5 years: this had not been previously confirmed, and was first mentioned in this summary article on the 27th. It's possible that the provision was partially priced in, as full expensing was a priority of the business community who were actively involved in shaping the reform, but likely not fully so until the trading day of the 27th.

Some details remained completely unresolved in UFTR. Most important among them included the design of the tax on U.S. companies' foreign profits, including information on the planned tax rates, along with specificity on industry-specific tax breaks and deductions and detail on the planned limits on interest deductions. However, the concreteness and specificity of this plan was overall significantly greater than any previous moves towards reform.

Thus, we code this event date as Sep 26. The event increased the probability of passage significantly, as it presented a concrete plan with input from the business community and key Republican politicians. We would expect positive effects for firms with foreign exposure on the 26th and 27th, and positive effects for firms with domestic exposure expected on Sep 27 after the release of the final report including the bonus depreciation provision.

F.5 Senate budget plan passage

Date: Oct 18-20, 2017. *This event cleared the last remaining procedural hurdle before the bill could be introduced, making budgetary space for tax reform and illustrating broad agreement among Republican senators. Positive expected effects on probability of passage; no clear effects on domestic or international provisions.*

On Oct 20, the Senate passed a "budget blueprint" (51-49, mostly on party lines) that was seen by commentators as a "critical hurdle" in the road to tax reform, and described by senators as mattering "only [as] preparation for tax reform." This blueprint allowed the tax bill to lower projected revenue by up to $1.5 trillion over a decade, clearing the road for some of the major corporate and individual tax cuts in the plan. Until at least Oct 19th, there were significant doubts about what the blueprint would contain and whether it would retain full support from moderate Republicans while keeping $1.5 trillion in space, along with questions about the Republican senator Thad Cochran, who was sick and not present for earlier votes. While this was largely a procedural step on the road to reform, it was an important one that may have had some effects on asset pricing.

Negotiations went on in earnest on October 18-19, as discussed in prior sources, and the plan was passed on the night of October 19 (after the close of trading on the 19th). Asset pricing effects would thus be expected to occur across those three trading days. However, public-facing analysts appeared to be slightly bearish on the asset pricing outcomes of tax reform after the budget blueprint passage, noting that while passage might affect stock prices and especially small U.S. firms, a broad rally of more than 3% in the S&P 500 wasn't necessarily expected.

Thus, we would expect to see some movement on asset prices on October 18-20, but not necessarily major swings for firms with domestic or foreign exposure, as the event increased probability of passage but did not alter any major provisions of the expected reform.

F.6 TCJA introduced in House

Date: Nov 2, 2017. *The House bill included more detail on the specifics of various corporate provisions that had been only outlined previously, which emerged gradually over the week from October 25 to November 2. These provisions were almost universally as generous or more generous than previously assumed, and should have a positive effect on firms with greater domestic or foreign exposure.*

The House bill included the first detailed descriptions of a number of important provisions that had been referenced, but not finalized, in previous events. Those included the 20% CIT rate, which was made permanent in this bill instead of expiring as previously suggested; specific limits on corporate interest deductions, which were capped at 30% of earnings before interest, taxes, depreciation and amortization with real-estate firms and small businesses exempt from the limit; details on the one-time overseas profits tax, with headline numbers in the bill of a 12% tax on cash holdings and 5% on illiquid holdings; and details on the tax on U.S. companies with operations abroad, including a 10% tax on 'high-profit foreign subsidiaries,' but no other taxes on active overseas profits. These were important changes that were at least as generous as previously speculated, and would be expected to have significant positive effects on firms with both foreign and domestic exposure, particularly banking and insurance firms along with domestic manufacturing.

While there is not extensive reporting on any of the corporate tax provisions before the bill was passed, details of the internal debates over its contents and provisions from other sections of the bill were known to insiders by October 25 (and perhaps even earlier). On that date, a Politico article was released describing the internal Republican conflicts over the House bill and Kevin Brady's role in attempting to smooth them over, detailing multiple instances of specific policies that required the bill be 'retooled twice in 48 hours.' On the same day, a Minnesota Public Radio report described internal Republican tensions over potential changes to 401(k) plans in both the House and Senate; by October 30, Sen. Susan Collins publicly released a series of demands for the tax bill based on information about the work in progress in the House, while details about homeowner tax credits and the mortgage interest deduction were sufficiently public that the National Association of Home Builders began opposing the bill.

Each of these pieces of news, and the many others like them, had implications for potentially exposed firms: even changes to individual taxation made or restricted room within the $1.5 trillion cap for corporate changes. These articles also suggest more broadly that many of the "behind-the-scenes" conversations about the contents of the bill were somewhat public, and that they would have begun to be priced in.

Given the above, we view this event as occurring over the week from October 25 to November 2, with positive expected effects on more exposed firms.

F.7 Senate bill released

Date: Nov 8-9, 2017. *The Senate bill had meaningfully less generous corporate tax provisions than the House version, and early debates over its framing suggested that those provisions might grow even less generous as popular individual provisions with negative revenue effects were kept. Significant negative expected effect on firms with greater foreign exposure, and possibly some negative effect on firms with domestic exposure.*

The Senate released their initial tax plan on November 9, and it differed significantly from the House bill on a number of key elements. Of particular importance for corporate taxation were the changes to the corporate rate cut timing (the Senate bill scheduled it to take effect in 2019 instead of 2018) and different rules on international rates, including a 12.5% tax on most foreign profits produced from intangible assets, whether those assets were in the U.S. or abroad. Most provisions in the bill were not reported on until its release on November 9, but the possible delay of the CIT rate cut saw some coverage on November 8 and may have been at least partially priced in beforehand.

Along with these concrete declines in the expected value of the reform, the general sentiment about the Senate bill in the business press was more negative than around prior events. One global investment strategist wrote on the record that "one thing seems clear: there isn't enough money to pay for everything that each house wants... Something has to give – most likely corporate tax relief, which may not be as generous as proponents expected a few weeks ago." If this sentiment was shared by investors, we would expect meaningful declines in the relative performance of more-exposed firms over this event period, with effects beginning on November 8 (particularly for firms with primarily domestic exposure) and larger jumps on November 9.

F.8 TCJA passes in House; through Senate Finance Committee

Date: Nov 16, 2017. *This event gave greater certainty to observers that TCJA would be passed by the end of the year, as the wider-than-expected margin in the House and unanimity among Republicans on the Senate Finance Committee left more room for internal dissent while retaining a majority. It would be expected to have a significant positive impact on probability of passage, but ambiguous impacts on exposure measures as no key corporate provisions were changed.*

After the release of the Senate bill, major Republican figures including Treasury Secretary Mnuchin called the differences between the bills "small" and was "highly confident" a bill would be passed by Christmas. But in truth, the differences were fairly significant (for example, see a comparison as of Nov. 9 here), and pointed to potential losses for corporations relative to prior events as the Senate appeared ready to steer more of the benefits of the plan to middle class taxpayers. Open questions also remained about how quickly the bill would pass and which of its corporate provisions would make it through negotiations.

However, November 16 gave significantly more clarity on the bill's probability of passage, albeit while maintaining expectations about the relative lack of generosity of corporate provisions in the Senate bill. The bill passed the House with wide support despite some concerns about the SALT repeal, suggesting an easier path to reconciliation with the Senate version as Republicans could afford to lose a number of potential 'no' votes while retaining a majority. The Senate Finance Committee passage was also relatively smooth: the only change to the bill during that process was a minor tweak to the treatment of carried interest, and every Republican on the committee voted yes. This was a particularly positive shock to expected probability of bill passage after some public dissent among Republican senators about the contents of the bill the day prior.

We would expect this event to meaningfully increase the probability of bill passage, although its effects on specific exposure groups are unclear as neither the House negotiations nor the Senate committee hearings changed any of the most important corporate provisions. For a final accounting of the provisions and their sunset dates (when applicable) as of Nov 16, see this article, released the day after the event.

F.9 TCJA passes Senate with important changes

Date: Nov 27-Dec 1, 2017. *TCJA faced a difficult path in the Senate, with both budget hawks and moderates skeptical of some of the most generous corporate tax provisions. Over the course of the week of negotiations, Republican leadership were forced to make major concessions that significantly reduced the expected generosity of the bill. We would expect significant negative effects on firms with greater domestic or foreign exposure as expectations for the gains from reform diminished.*

The Senate was always expected to be the biggest hurdle for tax reform passage, and it lived up to those expectations in the days before a new version of the bill was finally passed. November 27 kicked off what was described as a "frenzied week of negotiations," with significant differences between the expectations of various camps of Senators detailed in this article. Hawkish senators including Bob Corker, Jeff Flake, and James Lankford were voicing concerns about deficits, while a group including senators Rob Johnson and Steve Daines wanted even deeper tax cuts for pass-throughs and individuals. Meanwhile, the moderates Susan Collins and John McCain were the most resistant to a number of provisions (especially plans to kill the ACA individual mandate) and were expected to be the hardest votes to get to 'yes.' This event was characterized by compromises between Republican leadership and each of these groups, which ultimately resulted in significantly less generous corporate tax provisions than in previous bills.

Among the most important changes made to get the bill to 50 votes in the Senate were retaining the corporate AMT, which was planned to be repealed in the House bill; increased repatriation tax rates to 14.5 percent for liquid assets and 7.5 percent for illiquid holdings, up from 10 percent and 5 percent; and perhaps most important, a gradual phase-out of 100%

expensing, which technically increased the generosity of the bill over the following 10 years but also made it far less likely that 100% expensing would be extended indefinitely. Each of these provisions cut back on a previously generous corporate component of the bill, often in order to allow for more generosity for individual provisions while staying below the $1.5 trillion cap. They would be expected to have major negative effects on valuation for more exposed firms.

On November 30, after some of these changes were announced, John McCain publicly announced his support for the bill, all but ensuring that it would pass in some form (although leaving open the fate of a number of possible amendments detailed in the article.) On December 1, after winning the gradual phase-out of 100% expensing, Jeff Flake announced the same, officially giving Republicans 50 votes. Thus, we code this event as beginning on November 27, with expected asset pricing effects through December 1. While Republicans did ultimately secure a majority and increase the probability that tax reform would pass within the year, firms with greater exposure to tax reform lost a significant share of their previously expected benefits, and we would expect declines in their relative valuation over the course of this event.

F.10 Harmonized version of bill out of Conference Committee

Date: Dec 12-13, 2017. *The creation of a harmonized bill at the House-Senate Conference Committee was the last major step before largely procedural votes in the House and Senate put the bill on President Trump's desk to be signed. Details of the final bill were known to the press in full by December 13, and were slightly better than expected for firms with domestic exposure and slightly worse than expected for firms with foreign exposure. Because of the near-certainty of passage after this event, we would expect positive effects for domestically exposed firms and ambiguous effects on firms with foreign exposure.*

As early as December 4, and likely by the time the Senate bill was passed, the key issues that would be hashed out in the conference committee had become clear. The most important issues for corporate tax were whether the final CIT rate would be 20, 21, or 22%; whether the change to CIT rates would take effect in 2018 or 2019; the design and rates of the international tax provisions; the repeal or preservation of the corporate AMT; and the restrictiveness of the limit on interest deductions. On each of these issues, the House bill was generally more generous than the Senate, and expectations were that the final bill would look closer to the Senate version as Republicans had a much smaller margin in that chamber.

On December 6, it was reported that the corporate AMT would likely be removed in the final conference bill; other small news items may have leaked in a similar way throughout the week. However, other main provisions in the final deal were not covered in the press until December 13, and with some limited exceptions should have been absorbed by markets around that date. The compromises reached, detailed in this Wall Street Journal article, included a 21% final rate (note that the rate remained uncertain until at least Dec. 12) and more details on the international provisions (including the final, higher rates of the repatriation tax). The behind-the-scenes negotiations were likely mostly wrapped up by Dec 12: EY's tax director, for example, claimed on television that the deal was more or less 'reconciliation ready' on the 12th. Thus, while the final reconciliation bill was not released until December 15, details of each of its major corporate provisions were known by the 13th at the latest.

Because of this, we select December 12-13 as the timing for this event. We would expect to see positive returns to more domestically exposed firms over this period as passage became almost certain and the domestic provisions were relatively generous, while returns to firms with foreign exposure are more ambiguous given the higher repatriation rate and the fact that some of the firms seemingly the most positively exposed to the repatriation provisions also stood to lose from the longer-term international tax provisions. However, the increased certainty of passage may have offset these effects.

By the time the details of the reconciliation bill were hammered out, passage through the House and Senate was fairly certain.