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ABSTRACT

Goods producers increase their capital expenditure and employment in response to a cut in marginal corporate income tax rates or an increase in investment tax credits. In contrast, companies in the service sector mostly use any tax windfall to increase dividend payouts. We base our conclusions on a novel measure of U.S. firm-specific tax shocks that combines changes in statutory tax rates faced by each firm with narrative identified legislated U.S. federal tax changes between 1950 and 2006.

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1 Introduction

Changes in corporate taxes are a recurrent feature of electoral manifestos among leading political parties. For instance, President Trump's 2017 Tax Cuts and Jobs Act (TCJA) featured sizable cuts in corporate taxes, partly motivated by the notion that cutting taxes on firms would spur investment and create jobs. On the other hand, some of the post-Covid policy discussion has considered higher corporate taxes as a tool to reduce deficits and fund public expenditure. But despite their popularity, relatively little is known about which group(s) end up winning or loosing from corporate tax changes. Workers? Shareholders?

In this paper, we estimate the effects of changes in U.S. federal corporate income tax rates and the investment tax credit on a range of firm outcomes. Our approach exploits U.S. firm-level data, while also capturing general equilibrium effects that might lead some firms, sectors or groups to benefit more than others indirectly. Our main finding is that corporate tax cuts generate a significant boost in investment and employment for the economy overall, but the benefits are spread unevenly across sectors and groups. In particular, goods producing companies —such as manufacturing firms— expand both capital expenditure and wage bills following a cut in corporate taxes, but do not alter dividend payments. In contrast, firms in the service sector —which are far less capital-intensive— do not increase investment or employment at all but use most of their windfall to pay dividends. In short, we find important differences in the effect on workers vs. shareholders across sectors of the economy.

To isolate plausibly exogenous variation in taxes at the firm-level, while also estimating general equilibrium effects, we develop a method that blends changes in statutory tax rates faced by each firm with the narrative identification of exogenous U.S. federal tax reforms from Romer and Romer (2010). We focus on U.S. firms in Compustat, an extensive panel of U.S. public companies. These data allow us to study a long period of time from 1950-2006, which facilitates the use of time series identification methods combined with firm-level panel data.

We proceed as follows. First, we calculate a firm's taxable income from their income statements by matching each firm in any given year to a marginal tax rate bracket. For a tax reform effective in, say, January 1980, we use a firm's taxable income in 1979 to determine their tax bracket and then construct a 'counterfactual' marginal tax rate from the new Internal Revenue Services (IRS)

tax rate schedule. This 'counterfactual' rate is then compared to the marginal tax rate on the old IRS schedule to compute the *change* in the firm-level marginal tax rate. It is 'counterfactual' because it refers to how the firm's marginal tax rate would have changed assuming no change in taxable income in 1980.

Federal tax reforms may still be endogenous with respect to the macroeconomy. In the second step, we only use firm-level marginal tax rate changes generated by corporate tax reforms that Mertens and Ravn (2013) identify as exogenous based on their disaggregation of the Romer and Romer (2010) narrative dataset. Romer and Romer (2010) classify legislated federal tax changes as exogenous if the motivation for the legislation is "unrelated to current and prospective economic conditions". We follow a similar strategy for Investment Tax Credit (ITC), which is a uniform tax rate independent of a firm's taxable income. As above, we only keep ITC changes stemming from tax reforms that Mertens and Ravn (2013) classify as 'exogenous'. Finally, we use these new measures of firm-level corporate tax shocks in a sequence of local projections to trace out the dynamic causal effects across time and across groups of firms.

It is worth noting that most empirical macro analyses of tax policy share three elements from which we depart. First, "narrative identified" tax changes are typically constructed using projected aggregate tax revenues and refer to the economy as a whole. In contrast, our approach exploits variation in marginal tax rates at the firm-level, and is in the spirit of the tax rates computed for households by Barro and Redlick (2011), Mertens and Montiel Olea (2018) and Zidar (2019). Furthermore, most macroeconomic studies focus on the effects of tax changes on the aggregate economy, and are therefore silent about the more detailed distributional dynamics, which is a main focus of our analysis. Finally, we also examine the effects of specific instruments such as marginal tax rates and investment tax credits, which allows us to explore potentially interesting heterogeneity across different tax policies. Relative to more microeconomic approaches, we exploit time series identification methods to allow for general equilibrium effects and study various federal tax reforms over a long time period.[1]

[1]Interestingly, Hassett and Hubbard (2002), in their review of the literature note that "one should be cautious, however, in moving from the microeconomic evidence to aggregate predictions... little continues to be known about the general-equilibrium effects of major policy changes", a challenge that partly motivates our approach.

Related literature. Our project connects to three stands of the literature. First, there is a sizable literature identifying the macroeconomic effects of tax changes using narrative identification approaches. Romer and Romer (2010) find that U.S. legislated federal tax reforms can have sizable effects on macroeconomic outcomes, including GDP, consumption and investment. Mertens and Ravn (2013) further disaggregate these into corporate and personal income taxes and we build on this approach.[2]

Second, we connect to the macro and micro literature that focuses on the effects of corporate taxes specifically. In the macro literature this includes Mertens and Ravn (2013) (short-run effects of average corporate income tax rate changes), Howes (2019) (who disaggregates the Mertens and Ravn (2013) tax reforms further), Liu and Williams (2019) (state level implications of federal tax changes), Cloyne et al. (2022) (the longer-term effects of corporate taxes via productivity, R&D and innovation), Mertens and Montiel Olea (2018) and Barro and Furman (2018) (macro effects of the TCJA). In public finance various papers estimate the effects of corporate tax reforms on firm level outcomes including investment, but using cross sectional variation for identification. Cummins et al. (1994), Cummins et al. (1996), Goolsbee (1997), Desai and Goolsbee (2004), Edgerton (2010), for example, examine firm responses to industry level variation in tax-adjusted Tobin's Q. These papers, like us, also use U.S. Compustat data, although we apply narrative time series methods, capture macro general equilibrium effects and focus on distributional issues. Other papers focus on specific policy reforms using cross-sectional variation in treatment.[3]

Third, we connect to work studying the distributional effects of corporate tax changes, and the question of who bears corporate taxes. For example, Suárez Serrato and Zidar (2016) examine the effects of state corporate tax cuts on workers, land owners and firm owners. Nallareddy et al. (2022) show that U.S. state corporate tax cuts raise income equality. Saez et al. (2019) (using Swedish payroll tax changes), Dobridge et al. (2021) and Ohrn (2022) (in the context of the U.S. Domestic Production Activities Deduction) and Kennedy et al. (2022) (focusing on the TCJA) examine the

[2]Other related contributions in this macroeconomics literature using narrative identification include Barro and Redlick (2011), Cloyne (2013), Mertens and Ravn (2012, 2014), Guajardo et al. (2014), Hayo and Uhl (2014), Cloyne and Surico (2017), Gunter et al. (2021), Nguyen et al. (2021), Hussain and Liu (2018) and Cloyne et al. (2021).

[3]This is a sizable literature but examples include House and Shapiro (2008), Zwick and Mahon (2017), Ohrn (2019), Garrett et al. (2020) Curtis et al. (2021) (U.S. "bonus" depreciation policies); Yagan (2015) and Boissel and Matray (2022) (dividend tax reforms); Goodman et al. (2021) (2018 reforms to U.S. Section 199A); Ohrn (2018) and Dobridge et al. (2021) (the U.S. DPAD); Kennedy et al. (2022) (2017 TCJA); Giroud and Rauh (2019) (effects of U.S. state level taxes).

effects on the within-firm earnings distribution. More broadly, Piketty and Saez (2007) document how various tax reforms in the U.S. have changed the progressivity of the tax system over time. We study the differential effects of corporate tax cuts across sectors and groups of firms and capture general equilibrium effects that might attenuated or amplify the direct distributional effects of corporate tax reforms.

Structure of the paper. In Section 2, we present the data and the empirical framework. Most importantly, we detail the construction of our novel measure of narrative identified, firm-level tax shocks. In Section 3, we report our main empirical results on investment and employment, both on average in the U.S. economy and across some of its main sectors. In the following section, we focus on wage bills and dividends paid, in an effort to identify the ultimate benefiter of the tax changes between workers and shareholders. Section 5 concludes. In the Appendices, we provide further details on the construction of our tax shock series and an analysis on the heterogeneous responses across sectors based on their capital-intensity.

2 Data and Empirical Strategy

In this section we present the data, describe the strategy we use to compute narrative identified tax shocks at the individual firm-level and present the empirical framework that will be used in the next section to estimate the dynamic effects of changes in corporate income taxes and investment tax credits on investment and employment.

2.1 Data

Our main source is the annual Compustat database on publicly traded C-corporations in the United States.[4] Compustat provides high-quality information on the balance sheet and income statement components of active and inactive companies, which we exploit to construct a taxable income measure that determines firms' statutory rate treatment. We focus on the years between 1950 and 2006, as this is the period over which narrative measures of tax shocks are available from Romer and Romer (2010) and Mertens and Ravn (2013). The full sample consists of 220,575 firm-by-year

[4] Standard & Poor's/Compustat (1950-2006) data are available from Wharton Research Data Services.

observations, covering a total of 17,469 companies. The main outcome variables are investment, defined as capital expenditure of firm j in period t ($capx$) and number of employees (emp). We also look at the dynamic responses of the wage bill, measured by staff expense (xlr), and cash dividends paid (dv).[5] A further advantage of the rich cross-section available in Compustat is that it allows us to explore interesting heterogeneity across firms and industries.

Despite all these attractive features of the data, there are also a few limitations that are worth noting. First, Compustat only provides data on publicly held companies; hence the estimates represent the effects of changes in the corporate tax code on the behavior of publicly-traded C-corporations. Second, Compustat only provides data on financial statements, and therefore neither the gross income nor the amount of tax paid by each company are reported for the purpose of tax compliance. Since taxable income is not observed in the generic financial statements available in Compustat, we rely on balance sheet variables to construct a measure of taxable income.[6] More specifically, for each firm, we compute corporate profits net of any allowable cost deduction. Appendix A provides more detail.

To explore heterogeneity in the responses across firms, below we focus on broad industrial sectors. In the Appendix we map these results to the capital intensity of the firm and sector. We construct a measure of the capital share as capital income over firm-level value added. Capital income is defined as operating income before depreciation ($oibdp$), where $oibdp$ equals sales minus operating expenses including the cost of goods sold, labor cost and other administrative expenses. Value added is the sum of $oibdp$ and staff expenses, xlr.

Table 1 provides summary statistics for the key variables in our sample. These are provided over the full sample, and across both goods producing and private service sectors, which are the two largest groups we will focus on in the next section. Goods producing firms tend to be larger,

[5] As noted by Hartman-Glaser et al. (2019), the measure of staff expenses (xlr) in Compustat is somewhat sparsely populated. To address this, we follow the steps in the imputation procedure proposed by Hartman-Glaser et al. (2019) and Donangelo (2016). First, we group companies into one of the seventeen industries featured in the Fama-French classification. Then, we generate ten size-groups in each industry based on their number of employees. This allows us to obtain 170 industry-size cells. Next, we pin down the average labor cost per employee (xlr/emp) in each industry/size cell for each year using the available staff expenses observations. Finally, we use this ratio to impute labor costs to firms that have missing staff expenses data but have available employment data, namely we multiply the number of employees by the average labor cost per employee in the same industry-size cell during that year. Following Hartman-Glaser et al. (2019), we additionally: (i) winsorize the extended xlr at 5% to exclude outliers from the approximation, and (ii) exclude FIRE companies.

[6] A growing public finance literature has advocated the use of third-party information on business records in developed countries to cross-check the accuracy of tax reports, with Kleven et al. (2016) documenting smaller discrepancies especially for large firms in countries where the tax enforcement through auditing is strong.

as measured by both investment and number of employees in the first two columns (and sales in the final column). Investment ranges from a thousand dollars up to near 428 million dollars, and employment from 10 to 28,000 workers. The average dividend payment varies from 0 to 32 million dollars across groups and is found to be larger in the goods producing sector than among service companies. In terms of the capital share, goods producing firms are characterized by an average capital share around 52%, as opposed to 36% for firms providing private services. As noted above, Appendix B provides supporting evidence on the role of capital intensity in accounting for our findings below.

2.2 A New Measure of Firm-level Tax Shocks

In this section, we describe the construction of our main corporate tax measures: changes in the statutory tax rate and the investment tax credit. First, we discuss the narrative approach to identification, introduce the statutory rate proxy we construct and discuss features of the corporate tax code. Then, we present the investment tax credit proxy and discuss its properties.

Statutory Tax Rates. We construct 'exogenous' statutory corporate tax changes in two steps. First, we focus on tax changes that follow from federal legislated tax reforms and, because we are interested in general equilibrium effects, our regressions will not include time fixed effects. As a result, changes in the federal tax code may well be a function of macroeconomic conditions. To address this, we rely on the narrative approach of Romer and Romer (2010) and Mertens and Ravn (2013), who examine the motivations given by U.S. policymakers for all major pieces of federal tax legislation from 1950 to 2006. Tax reforms that were not implemented in response to changes in current or prospective future economic conditions are regarded as 'exogenous'. Following Mertens and Ravn (2012) and Mertens and Ravn (2013), we also focus on tax changes implemented within one-quarter of the legislation becoming law to avoid anticipation effects. This yields six corporate tax reforms over our sample, with a significant and immediate impact on the statutory tax rates faced by firms.[7]

The narrative "shocks" constructed by Romer and Romer (2010) and Mertens and Ravn (2013)

[7]The resulting exogenous marginal tax rate changes come from the: Revenue Act of 1964, Revenue Act of 1978, Economic Recovery Tax Act of 1981, Deficit Reduction Act of 1984, Tax Reform Act of 1986 and Omnibus Budget Reconciliation Act of 1993.

are aggregate objects and relate to economy-wide average tax rates. We therefore need a way to map these narrative identified episodes to our firm level panel data. In our second step, we therefore use the IRS statutory rate schedules to construct firm-specific measures of statutory rate changes. Following Mertens and Montiel Olea (2018) and Zidar (2019), in equation (1), we compute the statutory change in the marginal tax rate faced by company j, $\Delta mtr_{j,t}$, as the difference between: (i) a counterfactual statutory rate, $\tau_{j,t}(.)$, which is calculated using year $t-1$ firm j's taxable income, $TI_{j,t-1}$, *and* the IRS tax schedule in *year* t, and (ii) the IRS statutory tax rate actually faced by firm j in year $t-1$, $\tau_{j,t-1}(.)$, which is a function of year $t-1$ firm j's taxable income, $TI_{j,t-1}$:[8]

$$\Delta mtr_{j,t} = \tau_t(TI_{j,t-1}) - \tau_{t-1}(TI_{j,t-1}) \tag{1}$$

As the marginal tax rate in each year of equation (1) is computed on the basis of the taxable income in period $t-1$, our measure of marginal tax rate changes, $\Delta mtr_{j,t}$ proxies a change in the statutory rate, net of any possible endogenous response of firm j's income in year t. For estimation we then focus on tax changes that follow from the exogenous legislative reforms identified above.

An important feature of the U.S. corporate income tax code is that it is a piecewise linear system according to which taxable income is divided into brackets. Marginal tax rates are fixed within these brackets, but vary across the bracket thresholds. In Appendix Table A.1, we provide an overview of the IRS statutory marginal tax rates across different taxable income brackets from 1950 to 2016. This table reveals several unique features of the corporate tax code. First, the corporate tax code has adhered to 11 historically *stable* taxable income brackets ranging from under 25,000 dollars to over 18.333 million dollars.[9] Second, the gradual rate structure has consistently been an important characteristic of the corporate tax code since the late 1960s. Third, changes in corporate statutory taxes are not uniform across brackets; in fact, there is considerable variation in the tax treatment across firms depending on the reform. For example, some acts changed rates for very high income levels, while others were more uniform. As a result, the corporate rate schedule incorporates sizable time-series and cross-sectional variation in statutory rates. That is, the measure of statutory rate

[8] In each year, a firm's taxable income is matched to the relevant tax bracket of that year in nominal terms.

[9] These brackets are \$0 - \$25,000, \$25,000 - \$50,000, \$50,000 - \$75,000, \$75,000 - \$100,000, \$100,000 - \$335,000, \$335,000 - \$1,000,000, \$1,000,000 - \$1,405,000, \$1,405,000 - \$10,000,000, \$10,000,000 - \$15,000,000, \$15,000,000 - \$18,333,000 and over \$18,333,000.

changes in equation 1 captures sizable variation in tax treatment across different income brackets.

The Investment Tax Credit. ITC provisions allow businesses to deduct a certain percentage of their investment in new physical capital as a tax credit. To generate a time-series measure of the changes in the investment tax credits, we use historical data on ITC rates.[10] In Appendix Figure A.1, we plot the level of investment tax credit rates granted by IRS over time. The ITC was introduced under the Revenue Act of 1962 and was in effect through the end of 1985, except for two short periods. Within these years, the ITC was a commonly used tax policy tool. In particular, it was suspended from October 1966 to March 1967, removed in April 1969, reintroduced in August 1971 and increased to 10% with the Tax Reduction Act of 1975. After 1982, the ITC rate was set to 8% on average. Overall, Appendix Figure A.1 shows that corporate tax policy has incorporated generous capital-consumption allowances. In addition, the investment tax credit displays sizable variation until 1986, when it was fully repealed under the 1986 Tax Reform Act. After matching the changes in the ITC to narrative identified dates, we are left with five legislated changes, in the years 1962, 1967, 1971, 1982, and 1987.

2.3 Empirical Framework

In the previous section, we described our strategy that exploits narrative identification of 'exogenous' federal tax liability changes to construct a measure of tax shocks at the firm-level. In this section, we describe the empirical framework that we use in next section to estimate the effects of these tax reforms on firm investment and employment.

Recall, we are interested in identifying the effects of changes in marginal rates and the ITC over time. As a result, the baseline panel regressions estimate the impulse response functions as a sequence of local projections following Jordà (2005):

$$y_{j,t+h} - y_{j,t-1} = \alpha_j^h + \beta^h \, \Delta mtr_{j,t} + \delta^h \, \Delta ITC_t + \sum_{l=1}^{2} \theta_l^h X_{t-l} + \epsilon_{\,j,t+h} \tag{2}$$

where h = 0, 1,..., H. α_j is the fixed effect for firm j. This absorbs permanent differences across firms

[10] The ITC dataset is constructed using Auerbach and Summers (1979), Auerbach (1982), Auerbach et al. (1983), Rosacker, Robert E. and Metcalf (1992), Kern (2000) and IRS resources such as David (1981).

and allows us to exploit within-firm variation. $\Delta mtr_{j,t}$ denotes changes in the firm-level marginal tax rate, and ΔITC_t represents the change in the investment tax credit rate, where both measures refer to changes occurring on the narrative-identified dates. Initially, the dependent variable is either investment or the number of employees. $X_{j,t-1}$ is the vector of control variables that include lags of changes in: the average corporate income tax rate, the average personal income tax rate, log real GDP, log government spending, the marginal tax rate, the ITC rate, the dependent variable, the real taxable income and real assets. Firm-level controls capture the impact of observable differences across firms over time, time-series controls help with the possible correlation of federal tax changes with other lagged aggregate variables as in Mertens and Ravn (2013).[11] As is customary in the local projections literature, the dependent variable is the cumulative difference between period $t-1$, before the shock hits, and period $t+h$. Coefficient estimates are therefore the impulse responses for the dependent variable at each forecast horizon h. The horizon limit is five years and the lag length is set to two years. Note that, because tax policy changes can influence other macroeconomic aggregates such as GDP, investment and the employment rate, which in turn may impact firm-level capital and labor demand, our baseline specification does not control for time fixed effects. Our estimates therefore capture any general equilibrium effects.[12]

At this point, equation 2 can be seen as estimating the dynamic average effects of these exogenous federal legislated tax reforms on U.S. public firms over time. Although this connects to an economy-wide average effect, relative to the wider macro literature, there are now two main parameters of interest (β^h and δ^h) and our average estimates come from exploiting firm-level narrative identified tax shocks. The coefficient β^h captures the effect of a one percentage point increase in the statutory tax rate faced by a firm on a firm-level outcome at horizon h, while δ^h summarizes the impact of an increase in the investment tax credit rate, which is scaled to generate the same tax liability impact so the two coefficients can be easily compared.[13] Standard errors are two-way

[11] Aggregate data come from the replication package of Mertens and Ravn (2013), https://doi.org/10.3886/E112644V1

[12] Our results are also robust to controlling for changes in depreciation allowances that occur within the same piece of federal legislation.

[13] To implement this, we estimate how our two firm-level narrative shocks move overall aggregate tax liabilities. A one percentage point cut in statutory tax rate variable leads to a 0.41% decrease in corporate liabilities overall, while a one percentage point increase in investment tax credits leads to a 0.34% decrease in corporate income liabilities. This implies that, on average, a one percentage point cut in the marginal tax rate is 0.19% more expensive than a one percentage point increase in the investment tax credit. Our impulse responses are normalized such that the two tax instruments generate the same tax liability change.

clustered by firm and year, where serial correlation adjustment is set to 2 years following Driscoll and Kraay (1998). This method adjusts standard errors for the possibility of correlation in the residuals across dates t and horizon h.[14]

After studying the average effects, β^h and δ^h, below we will then consider heterogeneity. To do this, we group firms into bins and interact these bin indicators with all variables in equation 2.[15] We can then estimate a set β^h and δ^h coefficients for different types of firms.

3 Main Results

In this section, we use the local projection specification in equation (2) and our new measure of firm-specific narrative corporate tax shocks to trace out the dynamic effects on capital expenditure (Figure 1) and employment (Figure 2) at the firm-level.

In the left column of Figure 1, we report the responses to a 1% cut in the marginal rates of corporate income tax. The right column shows the dynamic effects of an increase in investment tax credits that causes an equivalent change in federal tax liabilities (to make the two policy experiments comparable). The top row refers to the average effect across all sectors whereas the middle and bottom rows focus on two of the main groups of companies in the U.S. economy, namely firms in the goods producing sector and the private service sector.[16] Solid lines represent point estimates. The shaded grey areas report the 90% confidence regions.

Three main results can be seen in Figure 1. First, changes in both marginal tax rates and investment tax credits trigger a significant average response of investment for U.S. public firms. In particular, the left column shows that a 1% cut in the marginal tax rate stimulates an increase in capital expenditure that peaks at 6% two years after the shock, before reverting to zero in year four. The right column reveals that the dynamic effects of an increase in the investment tax credit (scaled to generate the same effect on tax liabilities), are very similar to those associated with

[14] In terms of sample selection, to prevent our results from being driven by a handful of outliers, in each year we trim 1% of observations at both ends of the full sample, based on the investment ratio. In addition, we trim the top 1% of the debt to asset ratio and the debt issuance ratio as well as restrict the sample to firms whose acquisition ratio does not exceed five. Companies observed for less than five years are dropped because the impulse responses are estimated using at least five years of consecutive observations.

[15] A related approach is used by Cloyne et al. (2023) to study the heterogeneous effects of monetary policy.

[16] Goods producing sectors includes manufacturing (SIC 20-39), construction (SIC 15-17), mining (SIC 10-14). Private service sectors include service sectors (SIC 70-89).

marginal tax rates, although with a slightly smaller peak effect of around 4% in year two.

The other two rows, however, reveal that the average effect in the top row masks significant heterogeneity across sectors. In the middle row, goods producing firms are characterized by far larger responses, with the investment expansion peaking at 8% and 5% in year two following a cut in the marginal tax rate and an increase in the investment tax credit. In sharp contrast, private service sector companies in the bottom row display more muted responses, with peak effects no larger than 3% for either type of tax shock.

A similar picture emerges from the estimates in Figure 2, where we focus on employment. Both shocks lead to a significant increase in average employment in the top row, with peaks of around 2% and 1.5% respectively in year two. The remaining rows reveal, however, that the average effect is a tale of two sectors. Among goods producing firms, the dynamic effects on employment average just below 2% within the first two years (between year one and three) after the marginal tax rate (investment tax credit) shock. On the other hand, the response of employment among firms in the private service sector is far more modest, averaging below 1% over the same horizons.[17]

In summary, changes in corporate marginal tax rates, and increases in investment tax credits cause, on average, a significant response of both investment and employment in the U.S. economy. A sectoral analysis, however, reveals that the bulk of the average effect is driven by the large and significant response of goods producing firms. This contrasts with the far smaller and often insignificant changes that we record among companies in the private service sector.

4 Workers versus Capitalists

In the previous section, we showed that both types of corporate tax cut are associated with large and significant effects on capital expenditure and employment among goods producing firms, but the responses of private service sector companies are far smaller and often insignificant. This raises

[17] In Appendix B, we present suggestive evidence that goods producing firms respond more because they are more capital-intensive. More specifically, for each sector of the U.S. economy, we split companies by quartiles of the capital share distribution in that sector and show that: (i) goods producing firms in top quartile of the capital share distribution respond much more than goods producing firms in the bottom quartile (Appendix Figure B.1); (ii) similar heterogeneity across quartiles also emerges in all other sectors (Appendix Figures B.2a and B.2b), but the absolute magnitude of the effects in each quartile tend to be smaller than for goods producing firms, consistent with the notion that the latter are the most capital-intensive firms in the U.S. economy. This chimes with the results in Kennedy et al. (2022) who find that the 2017 TCJA led to increases in investment and employment, and this is driven by firms in capital-intensive industries.

the important question of who benefits from these tax reductions across sectors. And, if service sector companies do not raise investment or employment, who else benefits?

To shed light on this issue, Figure 3 reports the response of wage bills (Panel A) and dividends (Panel B) for both goods producing firms (top row in each panel) and private service sector firms (bottom row). In keeping with the other figures, solid lines are the point estimates, shaded areas are the 90% confidence intervals.

Our main finding is that goods producing firms mainly increase investment, employment and, therefore, wage bills in the top row of Panel (A). In contrast, the responses of dividend payouts in the top row of Panel (B) are small and insignificant. This set of findings, however, is completely reversed in the private services sector, which tends to be far less capital-intensive. More specifically, following a 1% cut in marginal tax rates, service sector firms increase dividend payouts significantly and by up to 5% (in the bottom left corner of Panel B) but do not adjust wage bills at all (in the bottom left corner of Panel A). On the other hand, following an increase in the investment tax credit, private service sector firms do not see an increase in either wage bills or dividend payments. These findings seem consistent with the less capital-intensive nature of their businesses. In summary, while the benefits of a cut in corporate income taxes accrues to workers among goods producing firms, they accrue only to shareholders among private service sector companies.

5 Conclusions

This paper uses changes in statutory corporate income tax rates in the United States, coupled with the narrative identification methods from Romer and Romer (2010) and Mertens and Ravn (2013) to construct novel firm-level measures of shocks to marginal tax rates and investment tax credits. Our main finding is that goods producing firms adjust their capital expenditure and employment significantly following a change in marginal corporate income tax rates and investment tax credits. In sharp contrast, businesses in the service sector, which tend to be relatively less capital-intensive, use most of the tax windfall to pay dividends, and do not modify their investment or wage bills at all after a cut in marginal tax rates.

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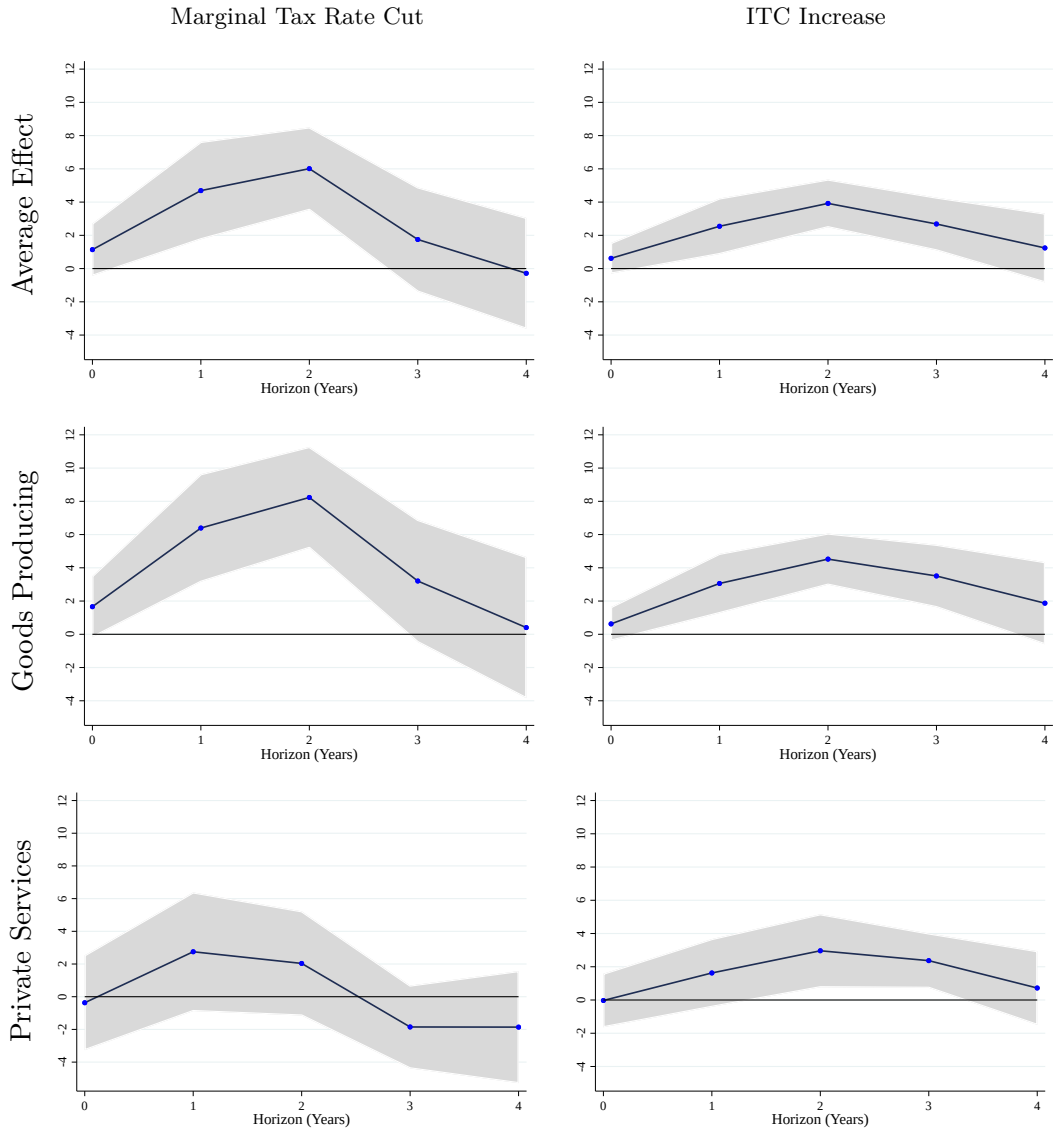
Table 1: Descriptive Statistics

Total Sample	Investment ($m, real)	Number of Employees Thousands	Staff Expense ($m, real)	Dividends ($m, real)	Capital Share	Sales ($m, real)
Count	187365	181215	147822	198780	179034	198730
p5	0.03	0.01	0.71	0.00	0.09	1.29
p50	5.86	0.93	41.68	0.12	0.43	137.14
Mean	107.09	7.07	339.34	32.29	0.52	1235.38
p95	428.50	30.00	1465.04	126.61	1.00	4881.50
St. Dev.	623.04	30.34	1443.85	217.60	0.33	6098.94
Goods Producing						
Count	109637	105170	76568	114274	102821	114261
p5	0.03	0.01	0.52	0.00	0.10	1.00
p50	4.92	0.80	42.80	0.06	0.44	112.29
Mean	83.41	6.16	359.32	27.07	0.56	1169.12
p95	293.47	28.00	1608.97	89.06	1.00	4507.87
St. Dev.	552.61	23.96	1408.94	189.11	0.35	6401.05
Private Services						
Count	26450	24631	24713	27318	23252	27311
p5	0.01	0.01	0.81	0.00	0.04	0.78
p50	2.11	0.40	15.53	0.00	0.27	49.70
Mean	46.48	5.39	225.50	10.48	0.36	481.44
p95	134.47	19.10	789.26	18.69	1.00	1556.47
St. Dev.	367.09	29.22	1301.57	268.28	0.28	3222.85

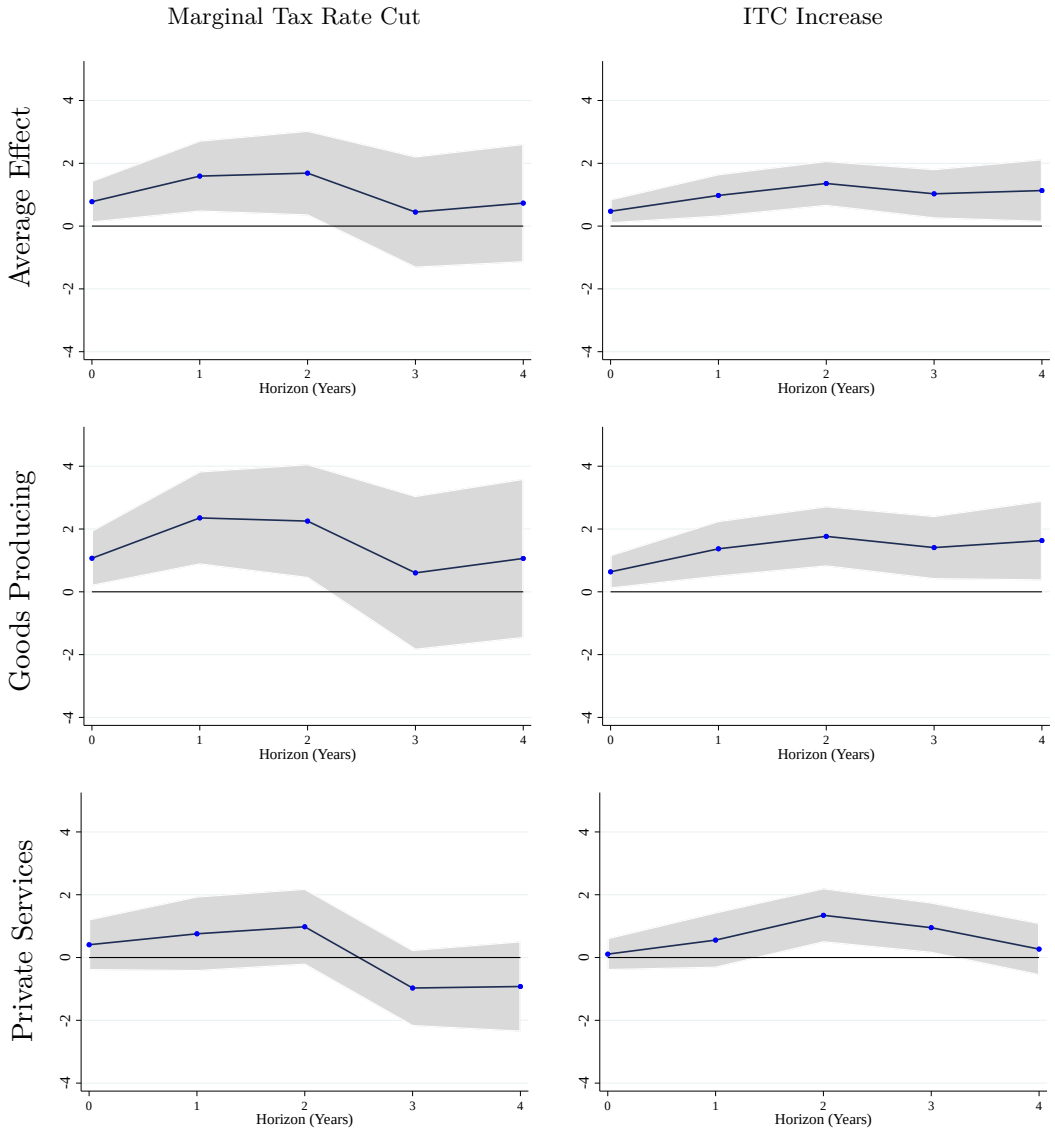
Note: The table presents summary statistics of key variables of interest in the data covering the period 1950-2006. The summary statistics are provided across the full sample, goods producing sectors and private service sectors. The number of employees is expressed in thousands. Investment, staff expense, dividends and sales are expressed in real millions of dollars.

Figure 1: Impulse responses of investment, sample 1950-2006.



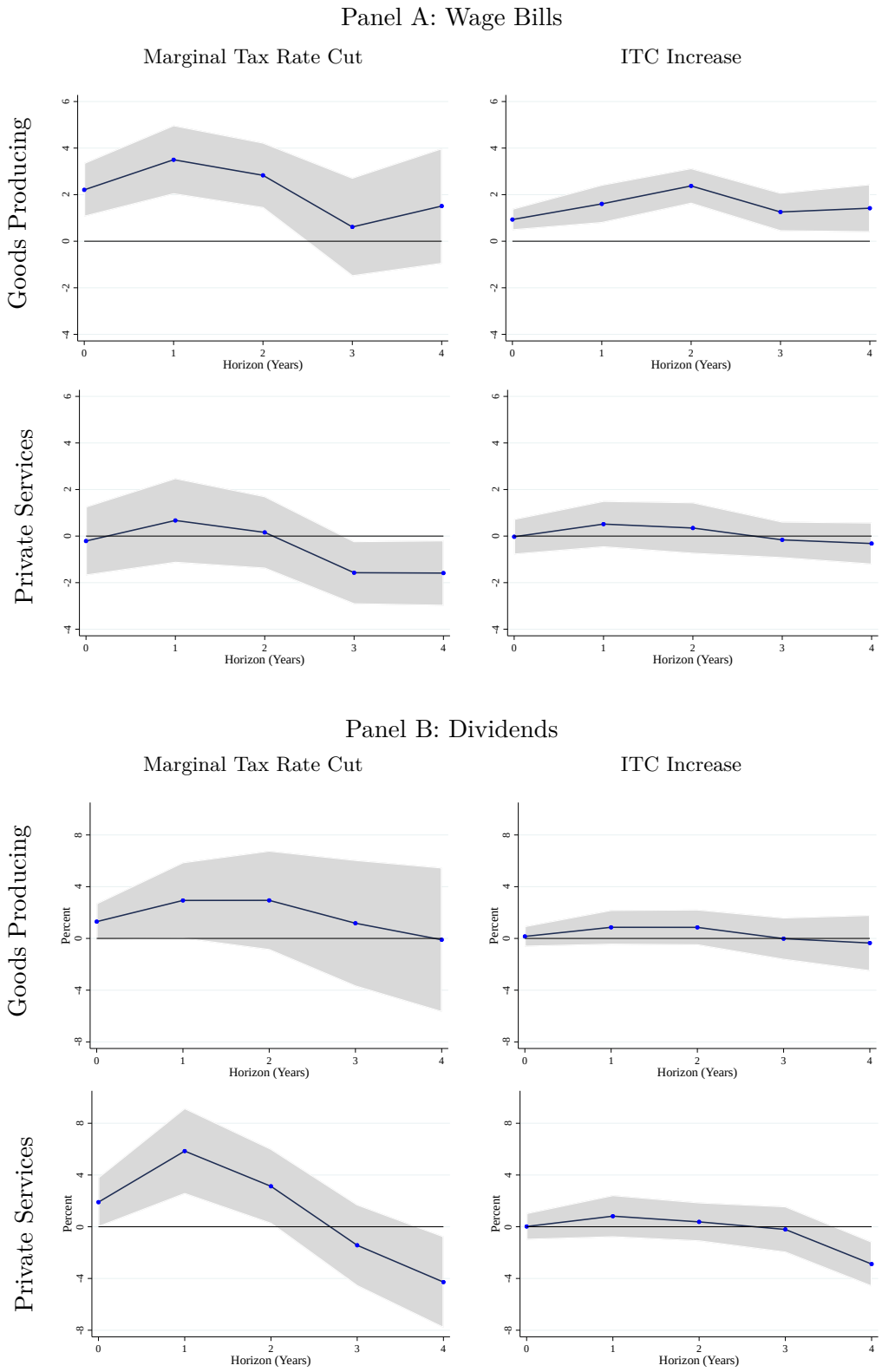
Note: This figure shows the percentage response of investment (capital expenditure) to changes in the marginal corporate income tax rate and the investment tax credit. Left column shows the effect of 1% marginal tax rate cut. Right column shows the effect of an ITC increase with equal liability impact. Shaded areas show 90% confidence intervals. Control variables include lags of change in average corporate income tax rate, lags of change in average personal income tax rate, lags of change in log real GDP, lags of change in log government spending, lags of marginal tax rate, lags of ITC, lags of change in marginal tax rate, lags of the dependent variable, lags of real taxable income and lags of log real assets.

Figure 2: Impulse responses of employment, sample 1950-2006.



Note: This figure shows the percentage response of employment to changes in the marginal corporate income tax rate and the investment tax credit. Left column shows the effect of 1% marginal tax rate cut. Right column shows the effect of an ITC increase with equal liability impact. Shaded areas show 90% confidence intervals. Control variables include lags of change in average corporate income tax rate, lags of change in average personal income tax rate, lags of change in log real GDP, lags of change in log government spending, lags of marginal tax rate, lags of ITC, lags of change in marginal tax rate, lags of the dependent variable, lags of real taxable income and lags of log real assets.

Figure 3: Impulse responses of wage bills and dividends.



Note: This figure shows the percentage response of wage bills and dividends to changes in the marginal corporate income tax rate and the investment tax credit. Left column shows the effect of 1% marginal tax rate cut. Right column shows the effect of an ITC increase with equal liability impact. Shaded areas show 90% confidence intervals. Control variables are the same as in earlier figures.

Appendices

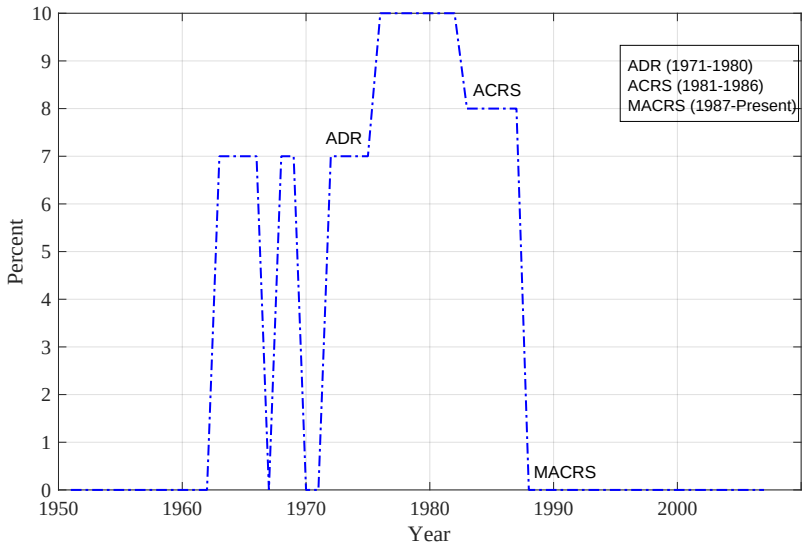
A Taxable income and corporate income tax rate schedules

Taxable income is calculated as follows:

$$\text{Taxable Income} = \text{EBIT} + \text{interest on leases} - \text{timing differences estimated using deferred tax expense} \quad (3)$$

where EBIT is earnings before interest and taxes (*ebit* + *nopi*, CRSP & Compustat annual item), interest on leases is interest income *(tii)* and deferred taxes is *txdc*.[18] Following Blouin et al. (2010) and Shevlin (1990), the timing differences are captured using deferred tax expense grossed up using the top statutory tax rate (*txdc*/max statutory rate).

Figure A.1: Investment Tax Credit (ITC) Rate in the U.S. (1950-2006)



Note: ITC dataset is constructed using Auerbach and Summers (1979), Auerbach (1982), Auerbach et al. (1983), Rosacker, Robert E. and Metcalf (1992), Kern (2000) and IRS resources such as David (1981). The ITC was introduced under the Revenue Act of 1962 (January 1, 1962) and was in effect through the end of 1985, except for two short periods. In particular, ITC was suspended from October 10, 1966 to March 9, 1967, removed in April 19, 1969, reintroduced in August 15, 1971 and increased to 10 percent with the Tax Reduction Act of 1975. After 1982 (under Accelerated Cost Recovery System), the ITC rate was set to 8 percent on average. When the exact rates varied depending on the asset's life, like in 1982 Accelerated Cost Recovery System, we take an average of investment tax credits provided for assets of different useful lives. The ITC was fully repealed under 1986 Tax Reform Act. After matching the changes in ITC to narratively identified dates, we focus on ITC changes legislated in years 1962, 1967, 1971, 1982 and 1987.

[18] The taxable income series includes ebit and nopi (nonoperating income) that is reported separately in Compustat.

Table A.1: IRS Corporate Income Tax Rates and Brackets (1950-2016)

1950	
First $25,000	23.00
Over - $25,000	42.00
1951	
First $25,000	28.75
Over - $25,000	50.75
1952-1963	
First $25,000	30.00
Over - $25,000	52.00
1964	
First $25,000	22.00
Over - $25,000	50.00
1965-67	
First $25,000	22.00
Over - $25,000	48.00
1968-69	
First $25,000	24.20
Over - $25,000	52.80
1970	
First $25,000	22.55
Over - $25,000	49.20
1971-1974	
First $25,000	22.00
Over - $25,000	48.00
1975-1978	
First $25,000	20.00
$25,000 - $50,000	22.00
Over - $50,000	48.00
1979-1981	
First $25,000	17.00
$25,000-$50,000	20.00
$50,000-$75,000	30.00
$75,000-$100,000	40.00
Over -$100,000	46.00
1982	
First $25,000	16.00
$25,000-$50,000	19.00
$50,000-$75,000	30.00
$75,000-$100,000	40.00
Over -$100,000	46.00
1983	
First $25,000	15.00
$25,000-$50,000	18.00
$50,000-$75,000	30.00
$75,000-$100,000	40.00
Over -$100,000	46.00
1984-1986	
First $25,000	15.00
$25,000-$50,000	18.00
$50,000-$75,000	30.00
$75,000-$100,000	40.00
$100,000-$1,000,000	46.00
$1,000,000-$1,405,000	51.00
Over $1,405,000	46.00
1987	
First $25,000	15.00
$25,000-$50,000	16.50
$50,000-$75,000	27.50
$75,000-$100,000	37.00
$100,000-$335,000	42.50
$335,000-$1,000,000	40.00
$1,000,000-$1,405,000	42.50
Over $1,405,000	40.00
1988-1992	
First $50,000	15.00
$50,000-$75,000	25.00
$75,000-$100,000	34.00
$100,000-$335,000	39.00
Over $335,000	34.00
1993-2016	
First $50,000	15.00
$50,000-$75,000	25.00
$75,000-$100,000	34.00
$100,000-$335,000	39.00
$335,000-$10,000,000	34.00
$10,000,000-$15,000,000	35.00
$15,000,000-$18,333,333	38.00
Over $18,333,333	35.00

Note: See the full historical data on U.S. Corporation Income Tax Brackets and Rates at IRS Table 24.

B Role of Capital Share by Sector

To explore why the goods and services sectors may respond differently, this appendix examines the role of capital intensity. To do this we conduct two further exercises and show: (i) within the goods producing sector —which is more capital intensive— the most capital intensive firms respond even more strongly; (ii) more capital intensive firms respond more strongly to corporate tax cuts in all sectors.

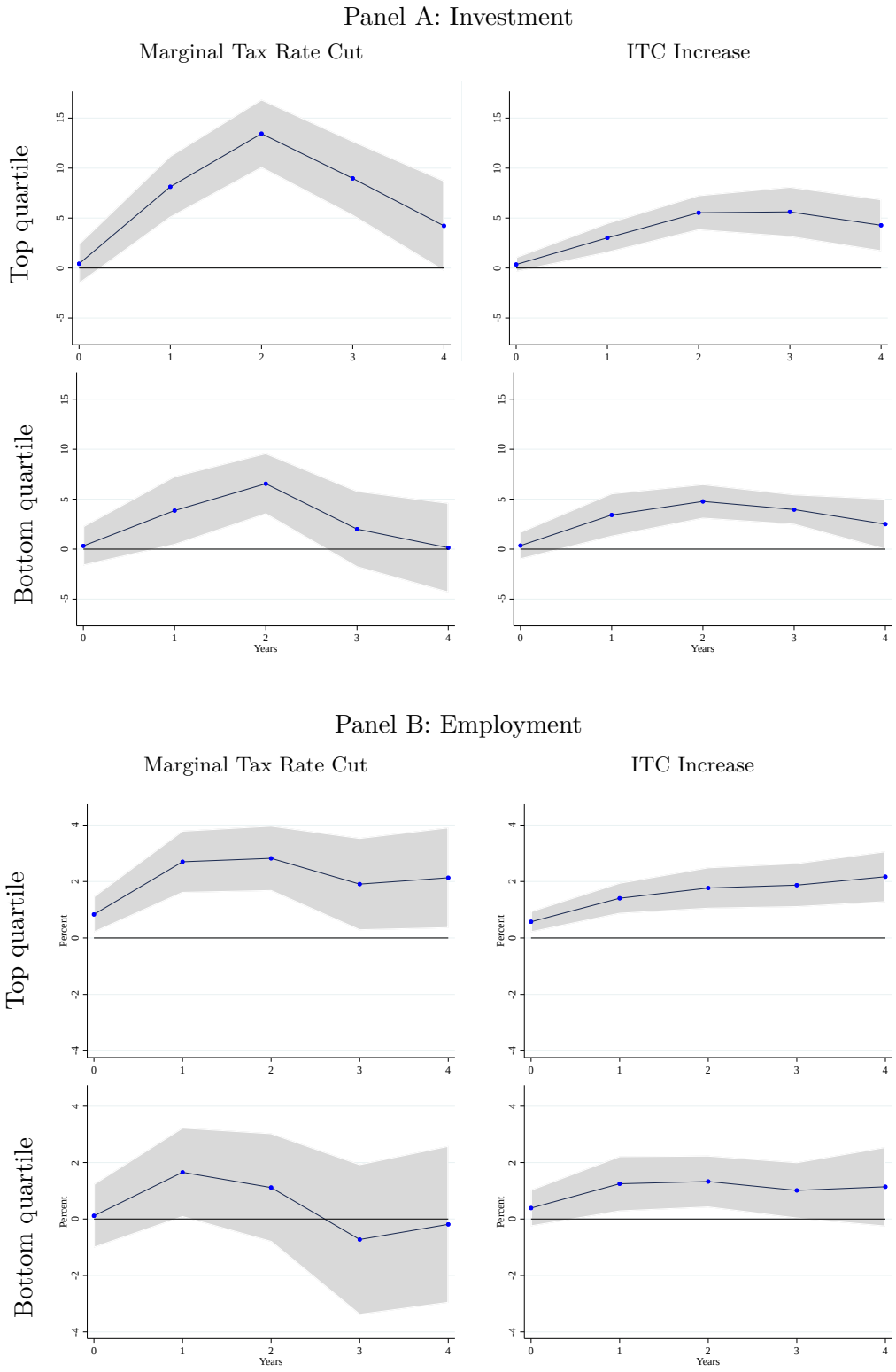
As noted in the main text, capital share is measured as firm capital income over firm value added. Capital income is defined as operating income before depreciation (*oibdp*), where *oibdp* equals sales minus operating expenses including the cost of goods sold, labor cost and other administrative expenses. Value added is the sum of *oibdp* and *xlr*, which records staff expenses.

In each year and for each sector, companies are grouped into quartiles of the capital share distribution. For sake of brevity and exposition, Figure B.1 reports estimates of the dynamic effects of a cut in the marginal tax rate on corporate income (left column) and an increase in the investment tax credit of the same size (right column) for only the top quartile (top row in each panel) and the bottom quartile (bottom row of each panel) in the goods producing sector. Solid lines refer to the point estimates and shaded areas represent 90% confidence intervals. Similarly, Figures B.2a and B.2b report top quartile, bottom quartile and the middle 50% of the capital share distribution in the other sectors.

There are three main results from this exercise. First, the responses of investment and employment for goods producing firms in the top quartile of the capital share distribution are significantly larger than companies in the bottom quartile within the same sector (Figure B.1). Second, the larger effects on firms with relatively higher capital-intensity (as measured by the top and bottom quartiles) within each sector is also broadly confirmed for Services, Transportation & Utilities, and to a far lesser extent for Wholesale & Retail (Figure B.2a and Figure B.2b). Third, the heterogeneity in the goods producing sector, which is the most capital-intensive, is more pronounced than for any other (relatively less capital-intensive) sector.

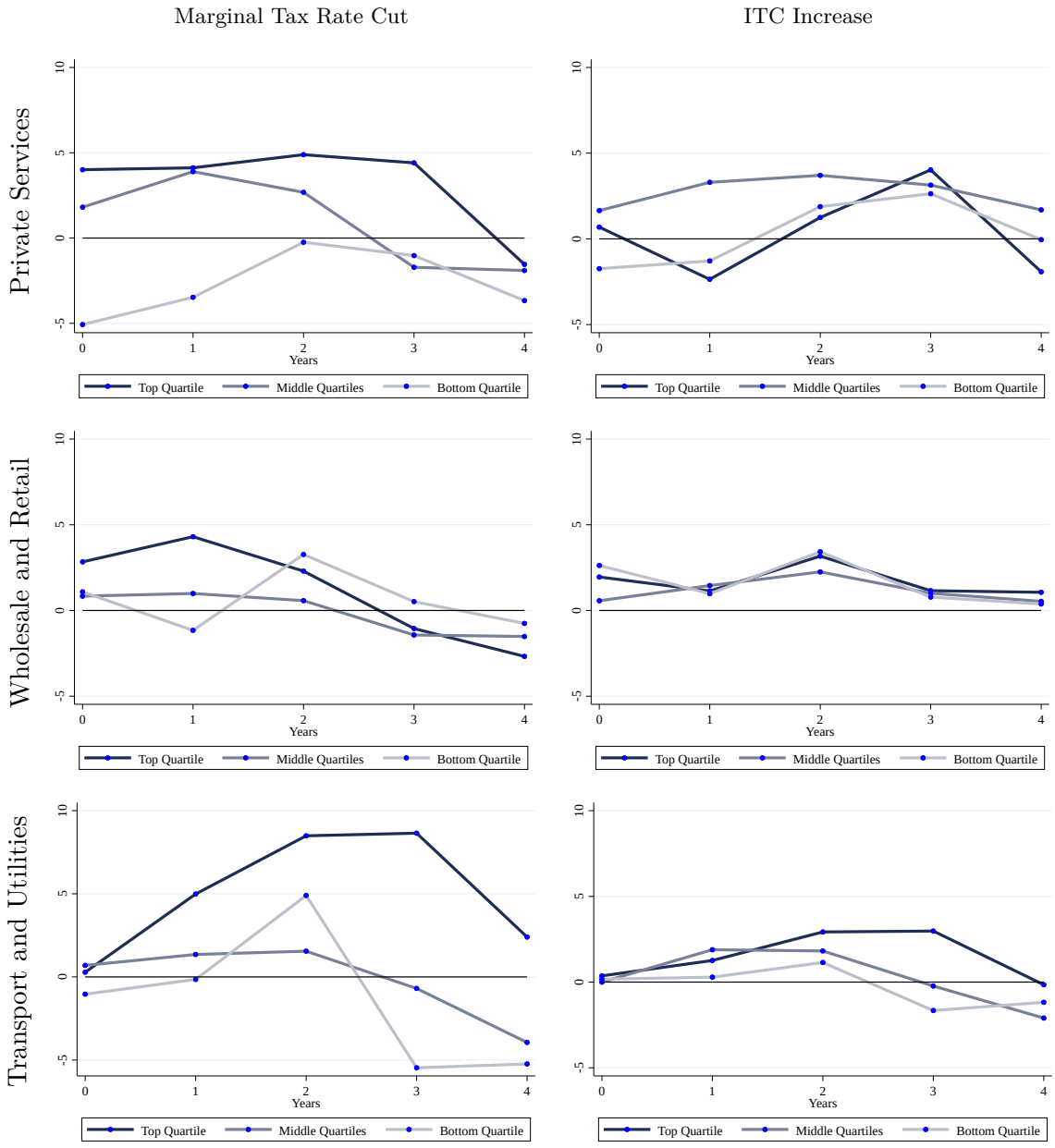
We interpret these findings as suggestive evidence that goods producing firms may respond more to corporate tax changes because they are relatively more capital-intensive.

Figure B.1: Role of Capital Share in Goods Sector



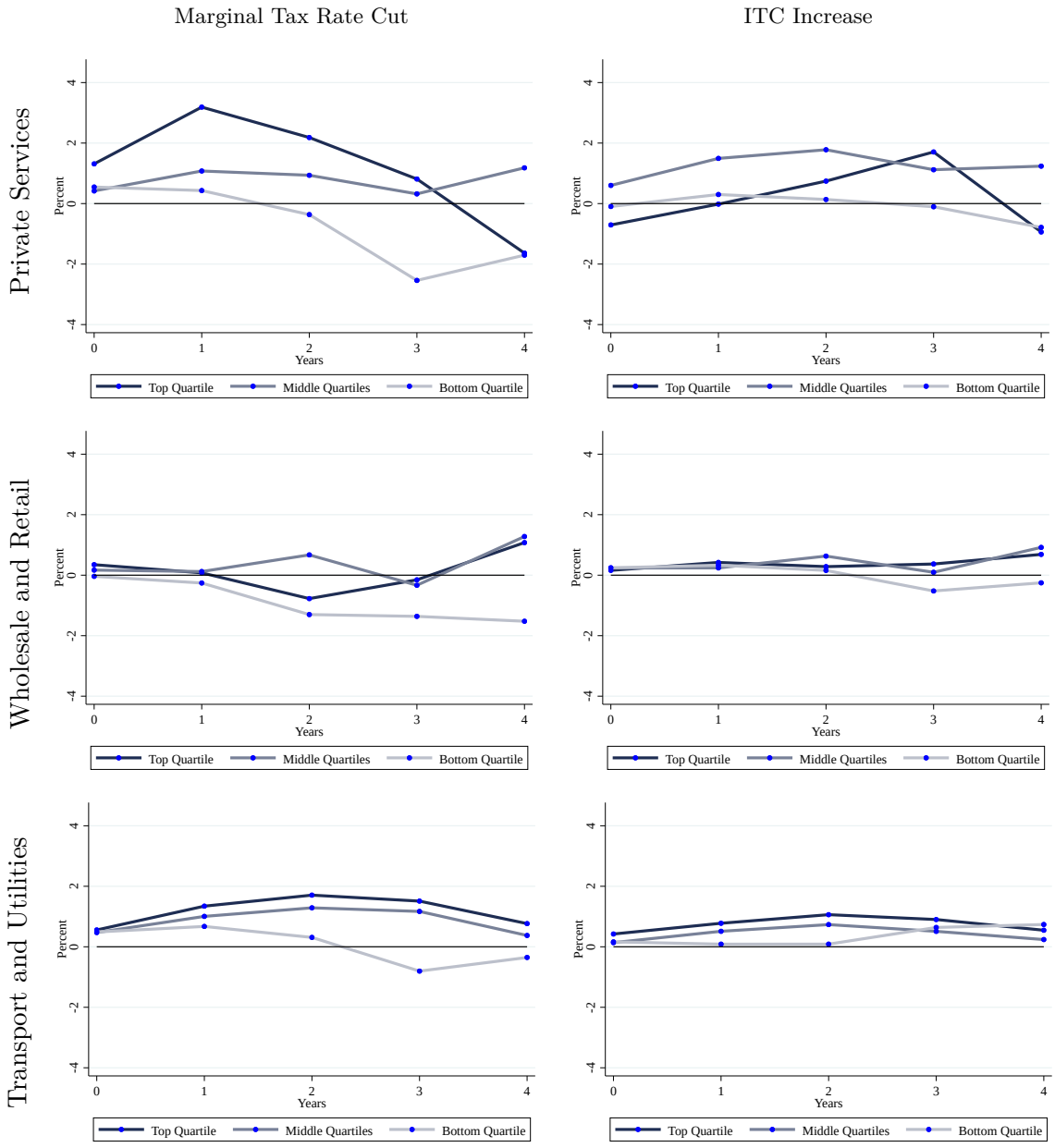
Note: This figure shows the percentage response of investment and employment for firms in the Goods Producing sector. The results are shown for firms in the top and bottom quartiles of the within-sector capital share distribution. Left column shows the effect of 1% marginal tax rate cut. Right column shows the effect of an ITC increase with equal liability impact. Shaded areas show 90% confidence intervals. Control variables are the same as in earlier figures.

Figure B.2a: Heterogeneous effects on investment by capital share.



Note: This figure shows the percentage response of investment for firms in three different sectors: Private Services, Wholesale and Retail, and Transport and Utilities. Each panel shows results for quartiles of the within-sector capital share distribution. Left column shows the effect of 1% marginal tax rate cut. Right column shows the effect of an ITC increase with equal liability impact. Control variables are the same as in earlier figures.

Figure B.2b: Heterogeneous effects on employment by capital share



Note: This figure shows the percentage response of employment for firms in three different sectors: Private Services, Wholesale and Retail, and Transport and Utilities. Each panel shows results for quartiles of the within-sector capital share distribution. Left column shows the effect of 1% marginal tax rate cut. Right column shows the effect of an ITC increase with equal liability impact. Control variables are the same as in earlier figures.