Kinky Tax Policy and Abnormal Investment Behavior *

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Abstract

This paper studies tax minimizing investment, in which firms increase capital expenditure (CAPEX) sharply near fiscal year-end to reduce tax payments. During the period of 1984-2013, fiscal Q4 CAPEX is on average 36% higher than the average of the first three fiscal quarters. We exploit the discontinuity around firms' zero taxable income status and the Tax Reform Act of 1986 to establish the causal link between fiscal Q4 investment spikes and tax minimization. The Q4 CAPEX spike represents a higher CAPEX level instead of a mere shifting over time. Firms that are more financially constrained, have higher loss carryforward, and meet or beat earnings forecasts are more inclined to backload investment. Cross-country data shows that tax minimizing investment exists internationally.

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It has been fifty years since Hall and Jorgenson (1967)'s call for empirical work showing tax policy's effect on business investment behavior. With modern empirical methods and much better data, research in recent years has made considerable progress. This work has relied on quasi-experiments based on non-random tax policy changes, leaving some remaining skepticism over the size and robustness of tax effects. This work has also left open more fundamental questions about the right investment model: Which components of the user cost matter most for investment? How important are financial frictions and tax asymmetries for investment? Are tax motives important for aggregate investment behavior?

This paper presents indisputable evidence that tax policy affects business investment. We develop a novel measure of investment behavior, which is simple, transparent, and most importantly, orthogonal to low and medium frequency firm-by-time and policy shocks. Our approach allows us to remove time-varying omitted factors coinciding with the identifying variation we exploit, thus addressing one of the key concerns with existing empirical work. We demonstrate the first order importance of taxes for corporate investment behavior and further illustrate that tax asymmetry—in particular, the immediacy of the incentive to respond—matters critically for fitting the data.

We begin by documenting a robust but hitherto unnoticed stylized fact about investment behavior among public companies in the US. Firms frequently backload their investment near fiscal year-end, leading to quantitatively significant spikes in fiscal Q4 capital expenditures (CAPEX). This pattern is pronounced among firms across the size distribution and present nearly every year of our sample, which spans from 1984 to 2013. Over the full sample period, fiscal Q4 CAPEX is on average 36 percent higher than the average of the first three fiscal quarters. The pattern is robust to non-December fiscal year-end, to changes in fiscal year-end, as well as to within-year seasonality of sales and cash flows. Moreover, fiscal Q4 investment spikes exist internationally. Based on data from 33 countries, we document fiscal Q4 spikes nearly universally during the period between 2004 and 2014. Although the magnitude of spikes varies across countries due to differences in corporate income tax rates and depreciation methods, the general pattern of Q4 spikes remains robust.

We confirm that fiscal Q4 investment spikes do not merely represent reporting behavior by firms using commercial lending data based on the Equipment Leasing and Financing Association's Monthly Leasing and Finance Index (MLFI-25) from 2005 through 2014. These data reveal that the month of December sees significantly higher new business volume than other months. For example, in 2014 new business volume ranged between $6 and 9 billion per month before December and in December increased sharply to $13 billion. Given that most firms use the calendar year as their fiscal year, the December spikes from the lending side validate firms' fiscal year-end investment spikes.

We interpret Q4 investment spikes as primarily reflecting a tax minimization motive. Depreciation allowances are deducted from firms' pre-tax income and hence reduce their tax bill. Because tax positions can be better estimated close to fiscal year-end when most revenues and expenses for the year have been recorded, backloading investment allows firms to maximize the tax benefit of depreciation and allows us to show that these tax motives are in fact driving the observed spike behavior.

We use two methods to identify the link between tax minimization and Q4 investment spikes. The first method exploits a discontinuity around zero taxable income—the famous tax asymmetry kink in the firm's marginal investment budget set—when a firm goes from realizing the tax benefits of new investments immediately to realizing them only in some future period. We combine Q4 CAPEX spike data from Compustat with tax position data from corporate tax returns for the years 1993 through 2010. We follow Zwick and Mahon (2016) and define taxable as an indicator for whether a firm has positive income before depreciation expense and thus an immediate incentive to offset taxable income with additional investment. We show that fiscal Q4 investment spikes display a discontinuous jump when firms move from negative to positive tax position prior to depreciation. Regression estimates show that within-firm, a positive taxable income fiscal year has a spike between 0.05 and 0.1 higher than a negative taxable income fiscal year, which corresponds to 10 to 20% of the sample mean.

In the second method, we exploit tax policy changes under the Tax Reform Act of 1986 in the US and due to corporate tax changes in other countries. Three major parts of the Tax Reform Act of 1986 affected firms' tax minimization incentive and as a result the size of fiscal Q4 investment spikes. First, the Investment Tax Credit (ITC), through which firms could receive reductions in tax liabilities as a percentage of the price of purchased assets, was repealed. The ITC was a dollar-for-dollar reduction from firms' tax liabilities set at 10% prior to 1987. Second, the top corporate income tax rate decreased significantly after 1987: the top rate dropped from 46% in 1984-1986 to 40% in 1987, to 34% in 1988-1992, and then remained at 35% in 1993-2013. Third, the depreciation periods of investment goods were lengthened after 1987, leading to a lower dollar amount of depreciation per year for each new investment. All three major changes lead to lower tax reduction for new corporate investment and hence a lower incentive for firms to backload investment. Regression estimates confirm that after 1987, fiscal Q4 investment spikes are 0.05 (13.8% of sample mean) lower than before. We document parallel and similar sized responses in Q4 spikes in a panel of firms from 33 countries using corporate tax rate changes.

Having established the link between tax minimization and fiscal year-end investment spikes, we turn to study its cumulative impact on the level of investment. We trace the average quarterly CAPEX up to 12 quarters after Q4 and confirm that investment spikes do not get offset subsequently and hence are not a mere shifting over time. In terms of the economic magnitude, firm-years with CAPEX$\frac{Q4}{Ave(Q1-Q3)}$ >2 show CAPEX/PPE level 0.04 higher than the average, which is about 10% of the sample mean. Forward 1 year displays a similar spike in terms of investment level, and the level only starts to reverse 2 years after large spikes. Nevertheless, the reverse does not offset the level increase from the spike year.

We then ask what types of firms are more inclined to employ tax-minimizing investment strategies. Firms relying heavily on internal funds for investment financing are expected to time their investment more strategically to save taxes and retain cash. We test this prediction by studying three different measures of financial constraint: Altman's Z-score, a dividend payer dummy, and a speculative grade bond rating dummy. Regression estimates show that financially constrained firms conduct more tax minimizing investment.

Firms with large amount of loss carryforward are shielded from corporate income taxes, and as a result are less likely to rely on investment depreciation to offset tax liabilities. We do find firms with a greater amount of loss carryforward relative to net income level display lower Q4 CAPEX spikes. In addition, given that depreciation and expensing reduce firms' book earnings, the resulting effect on book earnings would likely provide incentives or disincentives for investment. We find that firms able to beat their analyst earnings forecasts show higher year-end investment spikes, suggesting earnings management and tax-minimizing investment are interconnected decisions. We find only modest evidence that spikes are related to "Use it or Lose it" budgeting incentives thought to characterize internal capital markets.

Our results also suggest a more careful interpretation of investment-cash flow sensitivity as a possible measure of financial constraints (Fazzari, Hubbard and Petersen, 1988; Kaplan and Zingales, 1997). If firms increase their CAPEX to minimize tax payments after experiencing high net incomes (and thus high cash flows), then we would expect investment to respond to cash flow innovations. In this case, the investment-cash flow sensitivity reflects the firm's tax minimization motive instead of the presence of financial constraints. To explore this idea, we decompose the investment-cash flow sensitivity into different fiscal quarters, and show the fourth quarter displays a much larger investment-cash flow sensitivity compared to the first three. Financial constraints alone would have a difficult time explaining the sudden spike in investment-cash flow sensitivity near the fiscal year-end.

The outline of the paper is as follows. Section 1 explains the tax policies related to corporate investment and describes our data. Section 2 describes the fiscal Q4 CAPEX spikes both in the US and other countries and examines the robustness of spikes to various possible confounds. Section 3 establishes the link between tax minimization and fiscal Q4 spikes by exploiting the discontinuity in firm tax position and policy reforms in the US and overseas. Section 4 describes the type of firms that are more inclined to adopt a tax-minimizing investment strategy, and explores the budget story as an alternative explanation. Section 5 concludes.

1 Policy Background and Data

1.1 Policy Background

When making an investment, a firm is permitted a sequence of tax deductions for depreciation over a period of time approximating the investment's useful life. Allowable depreciation deductions offset the firm's taxable income, reducing its tax bill. Since the Tax Reform Act of 1986, the US tax code's schedule of depreciation deductions is specified by the Modified Accelerated Cost Recovery System (MACRS). MACRS specifies a recovery period and a depreciation method for each type of property. The recovery period specifies how many years it takes to completely depreciate the investment, while the depreciation method specifies the speed of depreciation.[1]

Under MACRS, averaging conventions establish when the recovery period begins and ends. The convention determines the number of months for which firms can claim depreciation in the year they place property in service. The most common convention for equipment investment is the half-year convention, where firms treat all property placed in service during a tax year as placed at the midpoint of the year. This means that a half year's worth of depreciation is allowed for the year the property is placed in service. Because the half-year convention applies even to investments made at the end of the year, the code creates an incentive for firms to accelerate the timing of investment purchases at the end of the fiscal year in order to realize the deductions a year earlier.[2] In other words, the schedule creates a nonlinearity (or "kink") in

[1]The common recovery periods for equipment investment are 3-,5-,7-,10-,15-, and 20-year. Structures are typically depreciated over 27.5 or 39 years. The most common depreciation methods for equipment are 200-percent declining balance and 150-percent declining balance, switching to straight-line. For structures, the depreciation method is straight-line. More detail is available in IRS publication 946.

[2]The IRS is aware of the "tax minimization" incentive through expensing at year end and requires firms to use "mid-quarter" convention if the total depreciable property placed in service during the last 3 months of the tax year are more than 40% of the total depreciable property placed in service during the entire year. This convention treats such property as placed into service in the midpoint of the last quarter of the taxable year. Most observations in our sample fall well below this threshold.

the marginal incentive to invest near the end of the fiscal year because of discounting applied to the tax savings from future deductions. Our research design exploits this kink and the sharp behavior it induces to separate investment responses driven by the tax code from other confounding factors.

Our focus is primarily on tax policy that affects the incentive for large firms to invest during our sample period of 1984 to 2013 in the US, though we also study the interaction between investment behavior and tax policy in a sample of developed and developing countries. In addition to the depreciation schedule, other tax policy parameters interact with investment to affect firms' tax liabilities. For example, because the corporate income tax rate affects the tax deduction of depreciation, a higher tax rate will amplify the incentive to use investment to minimize taxes. If investments are financed through equity, then dividend taxes will have similar though more indirect effect.

During the past two recessions, policymakers have introduced additional first-year (or "bonus") depreciation to stimulate investment and have expanded the Section 179 provision, which allows small and medium-sized businesses to fully deduct the cost of eligible purchases during the year of purchase.[3]

Until 1986, our US sample period included an Investment Tax Credit (ITC), which generates reductions in tax liability as a percentage of the purchase price of investments. Different from Section 179 or bonus depreciation, as a credit the ITC reduces tax liabilities dollar-for-dollar. Starting with the Revenue Act of 1962, the ITC went through many rounds of major changes, including being suspended, reinstated, and eventually repealed in 1986. Between 1979 and 1985, the ITC was set at 10 percent for spending on business capital equipment and special purpose structure. Though structured differently, each of these provisions creates a strong incentive for firms to retime investment as a tax planning strategy.

[3]Zwick and Mahon (2016) study these programs in detail.

1.2 Data

Our primary sample includes Compustat US firms spanning the years from 1984 through 2013. The sample excludes financial firms and utilities, as well as firm-years without quarterly capital expenditure (CAPEX) information. Firms with asset amounts less than $10 million are also excluded from the sample. The full US sample includes 158,859 firm-year observations for 17,527 unique firms.

Firms report year-to-date CAPEX in their quarterly 10-Q filings. To produce our primary measure of investment behavior, we first use this year-to-date data to back out CAPEX in each quarter. For example, in fiscal year 2012, US Airways reports quarterly year-to-date CAPEX as: Q1 $87 million, Q2 $191 million, Q3 $428 million, and Q4 $775 million. Thus CAPEX for each quarter is: Q1 $87 million, Q2 $104 million, Q3 $237 million, and Q4 $347 million. The year-to-date format makes within-year changes in CAPEX less salient, though this example indicates strong bunching of investment in the last quarter of the year. We use the *Q4 spike* as our key measure of tax-driven investment behavior, defined as $CAPEX \frac{Q4}{Ave(Q1-Q3)}$, which equals 2.43 in this case.

Studying the properties of the Q4 spike allows us to demonstrate the importance of tax policy for investment behavior more cleanly and clearly than has been shown before, because omitted variables such as expected profitability, prevailing financial and economic conditions, and product demand are unlikely to display the sharp periodic behavior we observe for CAPEX. Our focus on the pure timing of investment rather than its level is the key departure between our approach and past work on taxes and investment.

Table 1 presents summary statistics for the sample of US and international firms. For the US sample, the average firm-year has $1,250.8 million in assets and $137.3 million in CAPEX. The average Q4 spike is 1.36 (with median 1.19), which indicates that Q4 CAPEX is about 36 percent higher than the average of CAPEX for the first three fiscal quarters. Sales also display some Q4 periodicity due perhaps to the holiday season with a Q4 sales spike yielding a mean value of 1.13. Similar summary statistics are documented for international firms.[4] In Section 2, we demonstrate the robustness of the Q4 CAPEX spike to this seasonality in addition to a host of other potential confounds. Appendix Table A.1 provides detailed definitions for other firm characteristics.

For some analyses, we supplement the Compustat US data with corporate tax returns from the Statistics of Income (SOI) division of the IRS Research, Analysis, and Statistics unit. Each year the SOI produces a stratified sample of approximately 100,000 unaudited corporate tax returns that includes all the largest US firms.[5] We use these data to design sharp tests of whether the Q4 CAPEX spike depends on a firm's tax position as measured using tax accounting data.

We draw international evidence of Q4 CAPEX spikes from the Compustat Global database. Starting from 2004, Compustat Global collects quarterly CAPEX information systematically. We focus on countries with sufficient available quarterly CAPEX information during the period of 2004-2014. In addition, we use OECD and tax agency reports for each country to compile a complete time series of corporate income tax rates for each country. Table 1, Panel (b) presents summary statistics for the sample of international firms.[6] In total, 15,764 firms and 88,067 firm-year observations from 33 countries (excluding the US) are included in our international sample.

We also draw from Compustat Segment data, which provides detailed information on segment structures and financial characteristics of each segment. We use this data to measure corporate or budgetary complexity of firms.[7]

Finally, we draw data on equipment lending from the Equipment Leasing and Finance Association's (ELFA) Monthly Leasing and Finance Index (MLFI-25). The MLFI-25 measures monthly commercial equipment lease and loan activity reported by participating ELFA member

[4]Q4 CAPEX spikes are censored at 5 to make sure outliers are not driving our results.

[5]Please refer to Zwick and Mahon (2016) for a detailed description of the data.

[6]Due to currency difference, variables measuring nominal dollar amount are not meaningful. Only financial ratios are summarized in Panel (b) for international firms.

[7]We only keep segment information for firms whose segment data adds up to more than 80% of the sales and CAPEX at the consolidated level.

companies, which represents a cross section of the equipment finance sector.

2 Investment Spikes in Fiscal Q4

In this section, we document the size and persistence of Q4 CAPEX spikes and assess their robustness to potential measurement and reporting issues. Figure 1 presents the time series of fiscal Q4 investment spikes for US firms in Compustat between 1984 and 2013. We plot the average ratio of quarterly CAPEX to the average CAPEX within a firm's fiscal year. The fourth quarters, indicated by red dots, consistently display higher CAPEX compared to the first three quarters. The fiscal Q4 spikes are relatively lower during the 2001 and the 2008 financial crisis periods but remain above 100 percent. On average, fourth quarter CAPEX is between 110 percent to 130 percent of the average quarterly CAPEX. In contrast, the first fiscal quarter consistently displays the lowest CAPEX within a year.

We conduct a number of simple robustness checks to confirm this behavior is both present and real. First, we show that Q4 investment spikes do not get offset immediately in the next fiscal Q1. In Panel (a) of Appendix Figure B.1, we plot the Q4 investment spikes with red dots being the average of Q4 and next fiscal Q1 to the average CAPEX within a firm's fiscal year. Although the drop in the following fiscal Q1 attenuates the Q4 investment spikes, we still observe spikes persistently above 100%. It appears that Q4 investment spikes are not caused by firms simply shifting next fiscal Q1 investment one quarter forward.

Second, in Panel (b) of Appendix Figure B.1, we focus on firms that change their fiscal year-end to six months later. The y-axis measures the ratio of quarterly CAPEX to average CAPEX in a firm-year. Green bars indicate the fiscal year-end quarter according to the old regime, and red bars indicate the fiscal year-end quarter after switching. Panel (b) shows that CAPEX spikes switch to the new fiscal Q4 afterwards. The consistency of this pattern before and after the fiscal year-end change further validates that CAPEX spikes are indeed related to the fiscal year-end.[8]

Third, instead of plotting the average ratios across sample firms, in Appendix Figure B.1, Panel (a) we plot the fraction of firms with Q4 spike $\geq$ 130%, meaning fourth fiscal quarter CAPEX has to be at least 30 percent higher than the average of the first three quarters. This measure is immune to the concern that outliers are driving the spikes we observe. Over the period between 1984 and 2013 more than 40 percent of firms show spikes over the 30 percent threshold. Even during the years of 2001 and 2008 when the average spikes were of smaller magnitude, more than one third of the sample firms show spikes over the 30 percent threshold.

Third, in Appendix Figure B.2 we show that fiscal year-end investment spikes are robust to non-December fiscal year-ends and are still present in firms that do not display seasonality in cash flows or sales. Appendix Figure B.2, Panel (a) plots the time series of Q4 CAPEX spikes for firm-years with non-December fiscal year-ends. Fiscal Q4 CAPEX spikes still hold for the subsample, alleviating the concern that calendar time patterns drive year-end spikes. Panel (b) plots the time series of sample firms' book depreciation spikes and shows higher book depreciations in the fourth quarters. Q4 book depreciation spikes swing between 110% to 120%, and are smoother and than CAPEX spikes since only a fraction of each dollar of investment is depreciated. Panels (c) and (d) plot Q4 CAPEX spikes among firm-years with smooth cash flows and sales, where fiscal Q4 cash flows and sales are lower than the average of the first three fiscal quarters. Though slightly attenuated, fiscal Q4 investment spikes remain robust after controlling for seasonality in cash flows and sales.

To further confirm that these spikes reflect real activity, we confirm the presence of Q4 spikes from the lending side. Figure 2 plots the monthly overall new business volume based on the Equipment Leasing and Financing Association's Monthly Leasing and Finance Index (MLFI-25). Each year the month of December experiences significantly higher new business volume than previous months. For example, in 2014 new business volume ranged from around \$6 to 9 billion per month before December, and in December 2014 it increased sharply to around

[8] A similar plot can be done for firms that changed their fiscal year-end to three months later or nine months later. Given the concern over sample size, we present the plot for six months, which includes more observations.

$13 billion. Similar December spikes can be seen throughout the whole decade of the sample. Given that the majority of sample firms use December as their fiscal year-end (91,147 out of 158,859 sample US firm-years), December spikes on the lending side confirm the fiscal year-end spikes of investment.

One might be concerned that seasonality on the lending side is driving the spikes in new business volume. If for some reason lending is much cheaper in December compared to previous months, then the December spikes should not come as a surprise even though no tax minimizing motive is responsible. However, Murfin and Petersen (2016), which studies the seasonal variation of syndicated loans, describes a seasonal pattern of high volume and interest rate in December due to "unanticipated non-deferrable" investment needs. Our results show that spikes in interest rate and volume indeed are an unnoticed consequence of the tax system , where clustering of investment near year end for tax minimization leads to higher cost of financing.

Of course, the spike in December lending cannot explain the Q4 CAPEX spikes for firms with non-December fiscal year-ends. In Appendix Table B.1 we show the correspondence between Q4 investment spikes and debt spikes for all sample firms in Panel (a) and for firms with non-December fiscal year-ends in Panel (b). With firm fixed effects and year fixed effects, regression estimates confirm that firms do issue more debt in fiscal Q4 when investment spikes are higher.

Last we move to our international sample to show that fiscal Q4 CAPEX spikes exist nearly universally. For the period from 2004 to 2014, Figure 3 plots the time series of fiscal Q4 investment spikes for countries with at least nine years of data.[9] In each plot, fiscal Q4s are indicated by red dots. Countries are sorted according to their average corporate income tax rate during the period—Switzerland has the lowest average corporate income tax rate (about 8%), while Pakistan has the highest (about 35%). Across the 24 countries listed in Figure 3, we observe fiscal Q4 CAPEX spikes throughout. Countries such as Indonesia, China, and Mexico show the highest spikes, while the United Kingdom, Australia, New Zealand, and France show much

[9] The time series for the other nine sample countries are not plotted as they only have data shorter than 8 years.

lower spikes than average.[10] As a whole, the evidence from international data are remarkably consistent with the pattern prevailing in the US data. This suggests that factors more general than the specific US institutional setting are responsible for the Q4 CAPEX spikes.

3 Investment Spikes and Tax Policy

In this section, we present direct evidence that Q4 CAPEX spikes are driven by a tax minimization motive. We pursue three complementary strategies. First and most direct, we show that firms only spike consistently when they are in the position to use depreciation deductions during the current tax year. Second, we show that the Tax Reform Act of 1986, which considerably reduced the marginal incentive to shift investment, led to a subsequent decline in spike patterns. Third, we use evidence from a panel of firms in other countries to show that tax rate cuts lead to a decline in Q4 spikes outside the US as well.

3.1 Investment Spikes and Tax Position

We combine Q4 CAPEX spike data from Compustat with tax position data from corporate tax returns for the years 1993 through 2010. We follow Zwick and Mahon (2016) and define taxable as an indicator for whether a firm has positive income before depreciation expense and thus an immediate incentive to offset taxable income with additional investment. Zwick and Mahon (2016) show that bonus depreciation and Section 179 only affect investment when firms have positive taxable income before depreciation. In studying bonus depreciation, they focus on the level of investment and exploit cross-industry variation in exposure to changes in the depreciation schedule. By studying Q4 CAPEX spikes, we remove any slow moving, firm-by-time omitted variables that might interfere with their design. As such, our design is closer in spirit to their Section 179 bunching design. We complement their findings by documenting

[10] Australia, New Zealand and France use the effective life for property depreciation. For example, for property placed in service in the last month of a fiscal year, a firm only gets to depreciate 1/12 of the first year depreciation amount for the current tax year. The effective life method significantly reduces the impact on tax payment of fiscal year-end investment.

a strong tax minimization motive among large public firms, who are not affected by Section 179.

Figure 4 plots the relationship between Q4 spikes and firm tax position. We divide firms into $1,000 bins based on their taxable income before depreciation expense is taken into account and plot for each bin the average Q4 CAPEX spike. The results starkly confirm the hypothesis that immediate tax position is a first order driver of the Q4 spikes. To the right of zero, the average Q4 spike is approximately 1.2 and considerably above 1 for all bins. Just to the left of zero, the average spikes are centered around 1 with no clear pattern above or below. We are not aware of a clearer illustration that tax policy influences the investment behavior of large firms.

Table 2 presents firm-level regressions designed to measure the size and robustness of the tax position result. All regressions include firm and year fixed effects. Thus the regressions measure spike responsiveness while only exploiting variation in a firm's tax position over time. Unlike regressions with the level of investment on the left hand side, these are considerably less subject to the concern that tax position and investment are jointly correlated with growth opportunities. Column (1) shows that positive tax position leads firms to exhibit a spike that is 0.10 higher than for nontaxable firms, which is large compared to the average within-sample mean of 1.31. Column (2) adds the following controls: ln(assets), Market-to-Book, Cash/Assets, CAPEX/PPE, and Sales Q4/Ave(Q1-Q3). Even controlling for the level of investment does not materially alter the coefficient on tax position. Columns (4) through (7) show that the results are very similar in the pre-2000 and post-2000 samples.

In column (3) we add a measure of cash flow (EBITDA/Assets) as an additional control, which reduces the coefficient to 0.052. As cash flows may serve as a measure of the intensity of a firm's tax position, this regression likely "overcontrols" for confounding factors, causing a downard bias in the tax position coefficient. We include the regression because it suggests an alternative interpretation of the sensitivity between investment and cash flows, which has been used in countless studies going back to Fazzari, Hubbard and Petersen (1988) to measure financial constraints. Such a sensitivity may instead reflect a tax minimization motive. We return to this issue in Section 4.

3.2 Investment Spikes and the Tax Reform Act of 1986

The US passed the Tax Reform Act of 1986 (TRA86, enacted October 22, 1986) to simplify the income tax code and broaden the tax base. Three key changes affected corporate incentives regarding CAPEX spending.

First, TRA86 abolished the Investment Tax Credit (ITC). Between 1979 and 1985, the ITC was set at 10 percent for spending on business capital equipment and special purpose structures. The ITC is not refundable, and thus is valuable for a firm only if there is a tax liability.[11] As with depreciation deductions, under the ITC regime, a firm has a greater incentive to wait to fiscal year-end to make tax-minimizing investments, as its tax liability can be better estimated near year's end. As a 10 percent credit, the ITC was considerably more generous than first-year deductions for most investments. Thus removal of the ITC predicts lower Q4 investment spikes after 1987.

Second, the corporate income tax rate for the top bracket decreased significantly after 1987: the top rate dropped from 46% in 1984-1986 to 40% in 1987, to 34% in 1988-1992, and then remained at 35% in 1993-2013.[12] The decrease in the corporate income tax rate further reduced the tax minimization incentive of CAPEX spending, as for a given amount of CAPEX, the reduction in tax liability is lower when the tax rate is lower.

Third, the depreciation period of property was lengthened after TRA86. Before 1987, the depreciation schedule was conducted according to the Accelerated Cost Recovery System (ACRS).[13] After 1987, property was depreciated according to the Modified Accelerated Cost Recovery System (MACRS). In general, MACRS lengthens the recovery periods for property.

[11] The safe-harbor leasing provision in the Economic Recovery Tax Act of 1981 allowed the sale of unused tax credits to firms with current tax liabilities, but it was eliminated at the end of 1983.

[12] Please refer to Appendix Table A.3 for details of corporate income tax changes during the period of 1984-2013.

[13] IRS publication 534. ACRS set up a series of useful lives based on 3 years for technical equipment, 5 years for non-technical office equipment, 10 years for industrial equipment, and 15 years for real property.

For example, automobiles and trucks had a depreciation schedule of 3 years under ACRS, but 5 years under MACRS; non-technical office equipment had a depreciation schedule of 5 years under ACRS, but 7 years under MACRS.[14] The lengthening of depreciation period further reduced the incentive for tax-minimizing investment, as a same amount of investment leads to less depreciation and hence less taxes saved after TRA86.

Each major change listed above leads to a smaller tax saving for a given amount of investment. The tax minimization hypothesis thus predicts a weaker incentive to wait until fiscal year end to invest and lower fiscal year-end spikes as a consequence. We formally test this prediction in regression form and present estimates in Table 3. The coefficients of interest are on dummy variables D(1984-1986) and D(1987), which indicate the corresponding years for the pre-TRA86 period in our sample and the phase-in year for the rate changes and ITC phase-out, respectively. Firm fixed effects are included in order to control for time invariant firm characteristics. We also include firm financial characteristics such as the level of CAPEX/PPE, Sales$\frac{Q4}{Ave(Q1-Q3)}$, EBITDA/Assets, ln(assets), Market-to-Book, and Cash/Assets to control for the effect of contemporaneous non-tax shocks.

We run regressions for different time periods for robustness. Columns (1) and (2) show regression estimates for the period of 1984-1992, as the corporate income tax rates after 1993 are slightly higher. Columns (3) and (4) show regression estimates for the period of 1984-2000, as after 2000 bonus depreciation policy significantly changes the tax benefits of investment. Columns (5) and (6) present regression estimates for the whole period of 1984-2013. In all six specifications, D(1984-1987) shows significantly higher fiscal Q4 spikes. On average, Q4 spikes drop by between 0.04 and 0.05 after TRA86, representing 11.1%-13.8% of the sample mean of Q4 spike.

In general, analysis of tax regimes and investment suffer endogeneity issues, as tax reforms are likely to be in response to some macroeconomic factors that could also affect investment. However, endogeneity concerns are primarily expressed with respect to the level of investment.

[14] MACRS lengthens the lives of property further for taxpayers covered by the alternative minimum tax (AMT).

Since we focus on the timing of investment within the same fiscal year, rather than investment levels, it is quite unlikely that shocks affecting the level of investment would also systematically shift investment toward a particular part of the fiscal year.

3.3 Investment Spikes and Taxes around the World

Over the previous decade, many countries around the world implemented major changes in their tax systems, with a general downward trend for corporate tax rates. For example, Germany decreased its top corporate income tax rate from 26.375% to 15.825% in 2008. Thailand reduced its top corporate income tax rate from 30% to 23% in 2012, and then to 20% in 2013. Among the 33 countries in our sample, 24 went through corporate tax rate changes during the period of 2004-2014. This provides a setting for examining the relationship between tax minimization and fiscal year-end investment spikes at the international level.

Table 4 presents firm-level regressions of Q4 spikes on the top corporate income tax rate for the 33 countries in our sample. The regression sample includes 15,764 firms and 88,067 firm-year observations across 33 countries during the period of 2004-2014. Notice that a simple cross-country relationship might suffer the endogeneity concerns, as omitted variables can drive both corporate income tax rate changes and fiscal year-end investment spikes. To address this concern, we exploit time series variation within country (columns (1) and (3)) and within firm (columns (2) and (4)). We also include our standard firm financial characteristics in the regressions.

Table 4 shows when a country increases its corporate income tax rate, firms' fiscal Q4 CAPEX spikes increase correspondingly. The coefficients are statistically significant across all specifications. In terms of economic magnitude, after controlling for firm fixed effects and time-varying firm characteristics, a one standard deviation increase in corporate income tax rate raises fiscal Q4 CAPEX spikes by about 0.4, which is about 11.1% of the average level for our international sample, and consistent with the magnitudes estimated in the US and using the tax position split sample analysis.

3.4 The Cumulative Effect of Investment Spikes

After establishing the effects of tax minimization on the timing of investment, next we turn to study its cumulative impact on the level of investment. First we plot the ratio of average quarterly CAPEX to CAPEX$\frac{Q2+Q3}{2}$ in the base year, in Figure 5. The dotted lines are the 95% confidence intervals. We trace the average quarterly CAPEX up to 12 quarters after Q4. Figure 5 shows that the ratio is reversed slightly by the decrease in the next fiscal Q1 CAPEX; nevertheless, it remains persistently above 1 even after 12 quarters. The plot confirms that the Q4 CAPEX spike represents a higher CAPEX level instead of a mere shifting over time.[15]

Table 5 presents firm-level regression estimates examining the level of CAPEX around firm-years with large Q4 CAPEX spikes. All regressions include firm fixed effects and year fixed effects, thus the regressions compare within-firm investment level around large spikes. We examine investment level from one year before to two years after large spikes, where large spikes are defines as CAPEX$_{\frac{Q4}{Ave(Q1-Q3)}}$ >2 in Columns (1) and (2), and CAPEX$_{\frac{Q4}{Ave(Q1-Q3)}}$ >3 in Columns (3) and (4). Columns (2) and (4) adds ln(assets), Market-to-Book, Cash/Assets, and EBITDA/Assets as additional controls in order to absorb the impact of time-varying firm characteristics on investment level.

Table 5 shows that firm-years with large Q4 CAPEX spikes experience higher investment level as well. More importantly, the spikes in investment level is persistent and do not get reversed even after 2 years. In terms of the economic magnitude, firm-years with CAPEX$_{\frac{Q4}{Ave(Q1-Q3)}}$ >2 show CAPEX/PPE level 0.04 higher than the average, which is about 10% of the sample mean. Forward 1 year displays a similar spike in terms of investment level, and the level only starts to reverse 2 years after large spikes. The reverse does not offset the level increase from the event year. Adding additional firm controls does not change the conclusion of the tests.

[15] Appendix Figure B.4 presents a similar plot using the average quarterly CAPEX in the base year as the benchmark, which can be underestimating the impact on investment level. It delivers the same message as using CAPEX$\frac{Q2+Q3}{2}$ as the benchmark.

4 Cross-Sectional Implications of Tax-Minimizing Investment

In this section, we study the types of firms most likely to employ a tax minimization strategy of retiming investment, and explore implications of tax-minimizing investment for other patterns of corporate behavior.

4.1 Investment Spikes and Financial Constraints

Firms relying heavily on internal funds for investment financing should time their investment more rigorously for tax minimization, as they value taxes saved with higher effective discount rates (Zwick and Mahon, 2016). We follow past literature and test this prediction by studying three financial constraint measures: Altman's Z-Score, a dividend payer dummy, and a speculative grade dummy. Table 6 presents tests conducted both at the cross-sectional level (columns (1)-(3)) and time-series level (columns (4)-(6)). Columns (1)-(3) show that firms which are more financially distressed (lower Z-Score), non-dividend payers, and firms with speculative grade bond ratings all display higher fiscal Q4 CAPEX spikes. A one standard deviation decrease in Altman's Z-Score raises the fiscal Q4 CAPEX spikes by 0.05 (13.8% of sample mean). Non-dividend payers, on average, display fiscal Q4 CAPEX spikes 0.04 (11.1% of sample mean) higher than dividend payers.

A cross-sectional test of the correlation between financial constraint measures and fiscal Q4 CAPEX spikes might be confounded by omitted variables. To better assess the relationship between financial constraints and firms' Q4 spikes, we interact financial constraint measures with time series variation in spike incentives. In Section 3, we show that TRA86 decreases firms' tax-minimizing investment and leads to a drop in Q4 spikes after 1987. This drop should be more significant for financially constrained firms. Table 6 columns (4)-(6) confirms this prediction: firms that are more financially distressed, do not pay dividends, and are rated speculative grade, each experience a larger drop in their Q4 spikes after 1987.

Another implication of the tax minimization incentive of firms' CAPEX spending for the study of financial constraints concerns the investment-cash flow sensitivity. A large literature in macroeconomics and finance studies how firm investment responds to changes in cash flow. The idea is that if firms rely more on internal funding for investment (and hence are more financially constrained), their investment should display larger sensitivities to cash flow. Our paper provides an alternative explanation for investment-cash flow sensitivities—firms experience larger incoming cash flows, which tend to correspond to higher taxable incomes, might invest more due to tax minimization. This is especially true in the case of one time or low persistence shocks to cash flows and would hold even if cash flow shocks were uncorrelated with other drivers of investment, as long as those shocks came in before tax terms.

To show the importance of this idea, we decompose the conventional investment-cash flow sensitivity into different fiscal quarters and present the results in Table 7. To enable comparison to past work, in column (1) we replicate the annual investment-cash flow sensitivity analysis by showing a firm's CAPEX is positively related to its cash flow after controlling for Tobin's Q. As is standard, both firm fixed effects and year fixed effects are included to show the within-firm sensitivity. In columns (2) and (3), we decompose annual CAPEX into four quarters and run the same regressions but with cash flow interacted with dummy variables indicating different fiscal quarters. Column (2) interacts a fiscal Q4 dummy with Cash Flow/Assets. Column (3) interacts dummies for each fiscal quarter with Cash Flow/Assets. While investment-cash flow sensitivity remains positive with a smaller magnitude, the fourth fiscal quarter displays sensitivities twice as large as that of the first three quarters.

There might exist some concerns due to within-year seasonality in firm cash flows. If cash flow itself also tends to concentrate in the fourth quarter, then the larger sensitivity displayed in the fourth quarter might simply reflect the seasonality of cash flows. We rerun the regression in Column (4) and (5) within a subsample where Q4 cash flows are lower or equal to the average of the first three quarters. Q4 spikes in investment-cash flow sensitivity remain robust for firms with stable cash flows. A financial constraint hypothesis alone would have a difficult time explaining the sudden spike in sensitivity—is the fourth quarter more financially constrained than the first three? The tax minimization hypothesis has no trouble explaining this pattern.

4.2 Loss Carryforward, Sales Volatility and Earnings Management

We continue to explore other firm characteristics that might affect a firm's tax minimizing investment decision. In particular, we examine loss carryforward, sales volatility and earnings reporting and present the results in Figure 6 and Table 8.

When filing for tax returns, firms can deduct the net operating loss(NOL) carryforward if applicable.[16] Large stock of NOL carryforward shields a firm from income tax payment and reduces the incentive of backloading investment for tax reduction. We examine this prediction by first plotting firms' Q4 CAPEX spikes and corresponding NOL carryforward, calculated as available NOL carryforward divided by net income before depreciation. As shown in Figure 6 Panel (a), higher stock of NOL carryforward is associated with lower fiscal Q4 CAPEX spikes. The evidence is consistent with higher NOL stocks substituting for backloading investment as a tax shield.

Investment spikes cluster in fiscal Q4 because tax positions can be better estimated close to fiscal year-end when most revenues and expenses for the year have been recorded. Firms with more volatile sales are more likely to wait until the fiscal year-end for investment planning as their taxable incomes are more difficult to predict. Figure 6 Panel (b) shows a binned scatterplot of sales volatility, measured by the standard deviation of a firm's sales normalized by the average sales, against Q4 CAPEX spikes. Firms with higher sales volatility show much higher Q4 spikes. In terms of economic magnitude, an one-standard-deviation increase in sales volatility corresponds to a 3% increase in Q4 CAPEX spikes, representing 8.3% of the sample mean.

Given that expensing and depreciation affect book earnings, the resulting effect on book earnings would likely provide incentives or disincentives for corporate investment. Figure 6

[16] IRS publication 536: IRS allows firms to carry forward NOL for up to 20 years after the NOL year (the carryforward period).

Panel (c) presents a binned scatterplot of firm Q4 CAPEX spikes against Q4 earnings surprises. The red line with earnings surprise equal to zero indicates that firms exactly meet the median analyst forecast.[17] Firms clearly tend to precisely beat the analyst earnings forecasts, and firms that meet or beat the median analyst forecasts conduct more tax-minimizing investment.

To formally test the positive correlation, we regress firm Q4 spikes against their Q4 earnings surprises. Firm fixed effects and year fixed effects are included to establish the within-firm correlation. Regression estimates in Table 8 confirm the positive correlation. In years when a firm manages to beat or meet the analyst forecasts, be it the annual or Q4 earnings forecast, Q4 spikes are higher. The coefficient on the beat or meet earnings forecast dummy is 0.05, representing 13.8% of the sample mean. Results suggest that earnings management and tax minimizing investment are indeed connected decisions. The results further confirm the presence of an active trade-off margin between tax minimization and earnings management, which has proved elusive in the tax accounting literature.

4.3 Investment Spikes and Internal Capital Markets

An alternative explanation for the Q4 CAPEX spikes is related to firm budget cycles. Many firms have budgets expiring at the end of fiscal years, where accounts will be set lower subsequently if the budget amounts are not exhausted. Those firms face a "Use it or lose it" dilemma. Moreover, in some firms, evaluation of employee or manager performance might also be linked to budget spending, where more spending can be interpreted as better performance. These factors create an incentive for firms to rush to spend budgets near fiscal year end. Similar year-end "rush to spend" behavior has been observed in other forms of organizations. For example, Liebman and Mahoney (2013) study spikes in year-end procurement spending for the US federal government and show that expiring budgets lead to wasteful year-end spending, while an agency that has the ability to rollover the unfinished budget does not exhibit year-end spending spikes.

Due to the lack of firms' budget data, a direct test of the budget hypothesis is not viable. As

[17] Using the mean or median analyst forecasts does not generate any difference.

an alternative, we study different measures of budgetary complexity and the quality of internal governance. If the rush in fiscal year-end CAPEX spending is valid, then we would expect it to be more pronounced in firms with more complex budgetary structure where budgets across different divisions cannot be uniformly managed. Also we expect firms with worse internal governance to display a larger year-end spending rush. We test this idea and present the results in Table 9.

We use 2 different measures to capture the complexity of a firm's budgetary structure: the number of segments and the number of two digit SIC codes in the corporate segment. We use the Entrenchment index of Bebchuk, Cohen and Ferrell (2009) and the G index of Gompers P. Ishii and Metrick (2003) to capture the quality of internal governance. The variation explored in Table 9 is mainly cross-sectional and all measures are standardized for easy interpretation.

Table 9 shows that firms with more complex budgetary structures indeed display higher Q4 spikes—a one standard deviation increase in complexity measures leads to a 0.03 increase in fiscal Q4 CAPEX spikes. Firms with worse internal governance measures also display higher fiscal Q4 CAPEX spikes—a one standard deviation increase in internal governance measure leads to around 0.02 increase in fiscal Q4 CAPEX spikes, which is about 5% of sample mean. Although the sign of coefficients are as predicted and the effects are statistically significant, the economic magnitude of the effects shown in Table 9 are quite small relative to the impact of tax policy.

5 Conclusions

In this paper, we study a new channel through which taxes affect firms' investment behavior. In order to reduce tax payments by depreciating the new investment, firms constantly wait until fiscal year-end, when they can estimate the tax positions, to decide CAPEX spending. Tax minimizing investment leads to robust and quantitatively significant spikes in fiscal Q4 CAPEX. Similar behaviors can be observed for firms across different countries.

This paper focuses on the timing of investment at a relatively high frequency, and emphasizes the asymmetry of corporate tax in respect to taxable status. This micro-level finding helps to explain the ineffectiveness of investment stimulus on loss firms. The findings also highlight the important effect of depreciation allowance on investment. For instance, in countries like Australia, France, and New Zealand, where firms can only depreciate according to the effective time property has been in place during the first year, tax minimizing investment is significantly lower. A better understanding in terms of how depreciation and tax status affects the timing of investment, and ultimately the aggregate level of investment, can help to precisely guide tax policy decisions.

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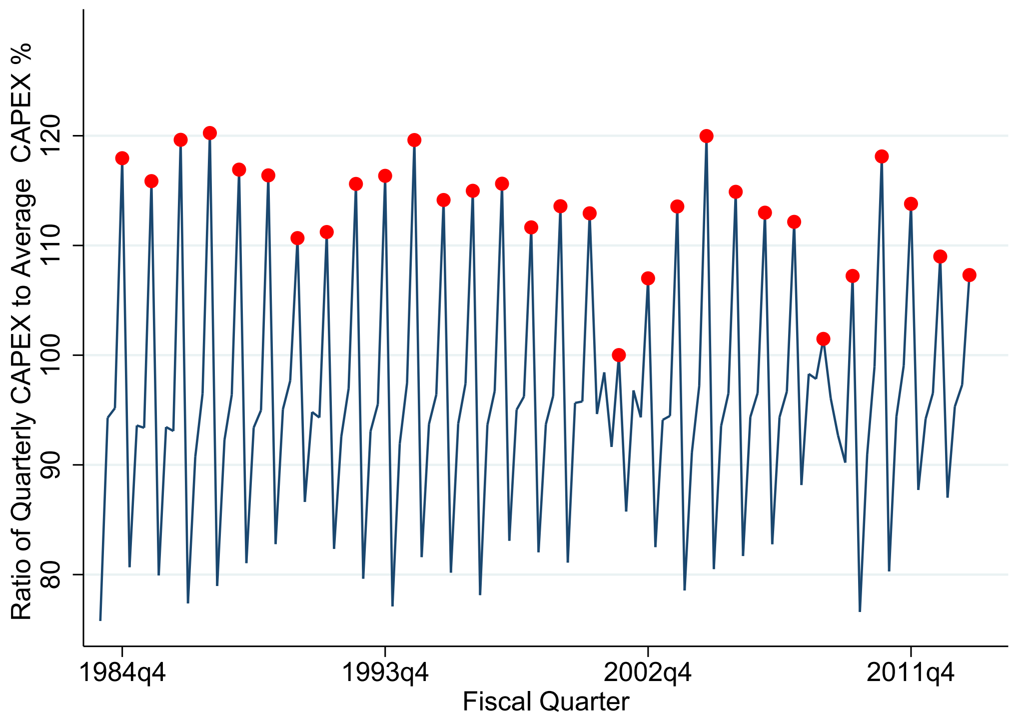
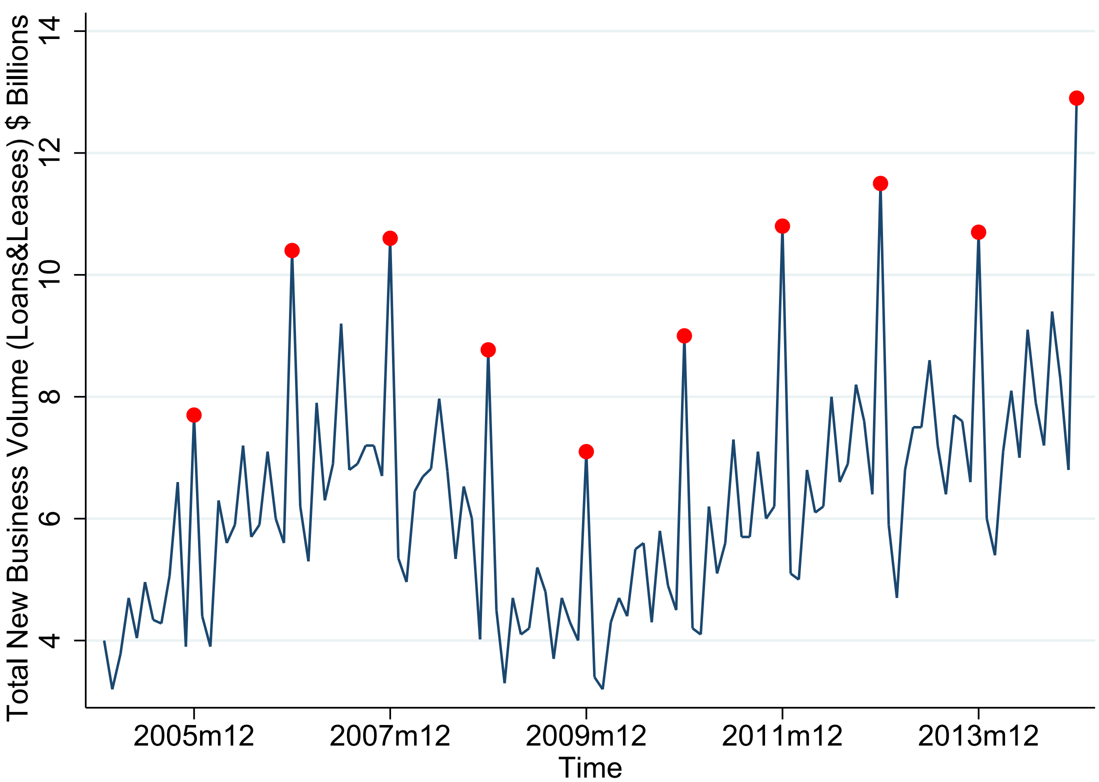
Figure 1: Time Series of Fiscal Q4 CAPEX Spikes



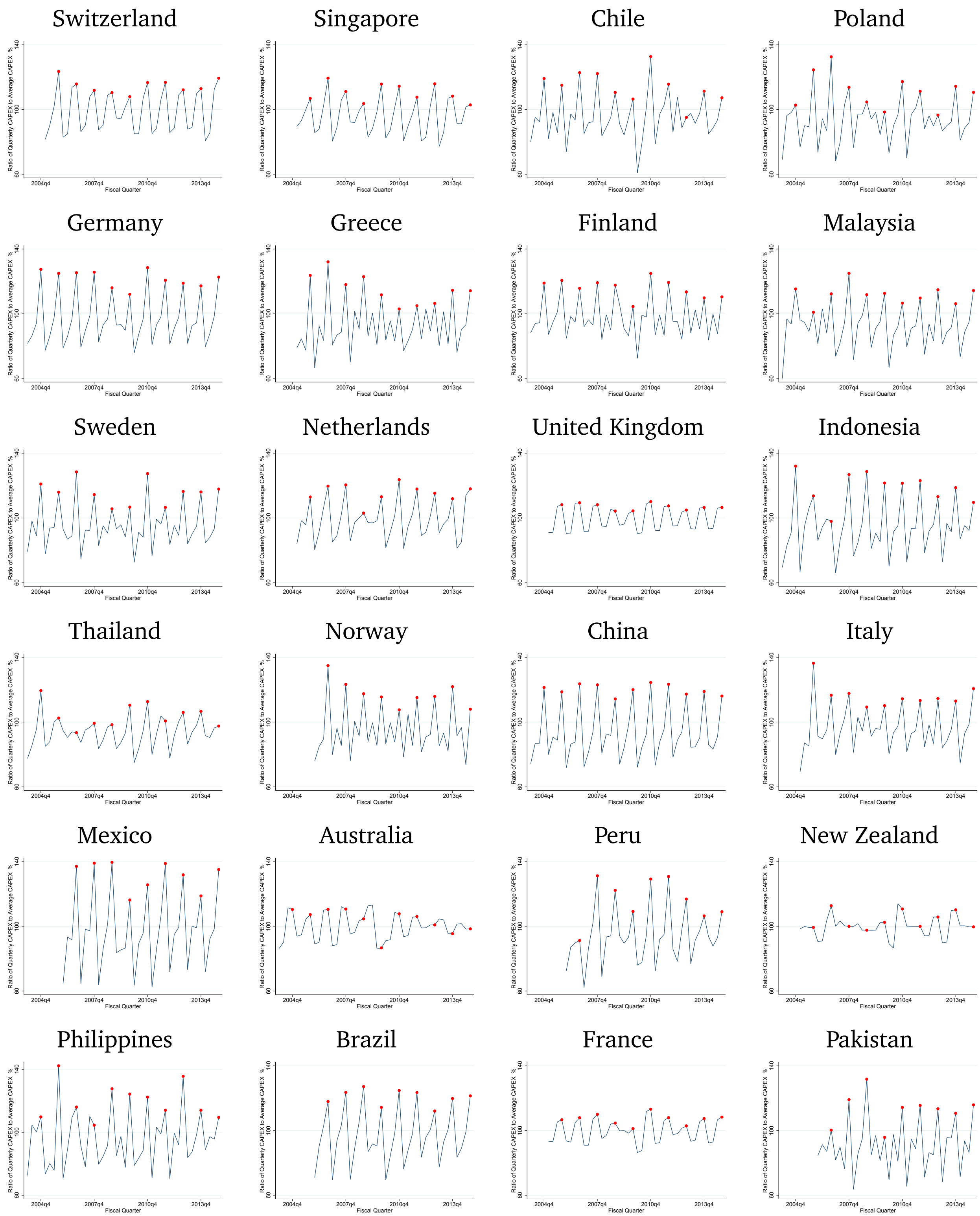
Notes: This figure shows fourth quarter capital expenditure (CAPEX) spikes for US firms in Compustat between 1984 and 2013. We plot the median ratio of quarterly CAPEX to the average CAPEX within a firm's fiscal year. Red dots indicate the fourth fiscal quarter.

Figure 2: Spikes in New Business Volume



Notes: This figure plots monthly overall new business volume from the Equipment Leasing and Finance Association's (ELFA) Monthly Leasing and Finance Index (MLFI-25). The MLFI-25 measures monthly commercial equipment lease and loan activity reported by participating ELFA member companies, which represent a cross section of the equipment finance sector. Source: `http://www.elfaonline.org/data/MLFI`

Figure 3: International Evidence of Fiscal Q4 CAPEX Spikes

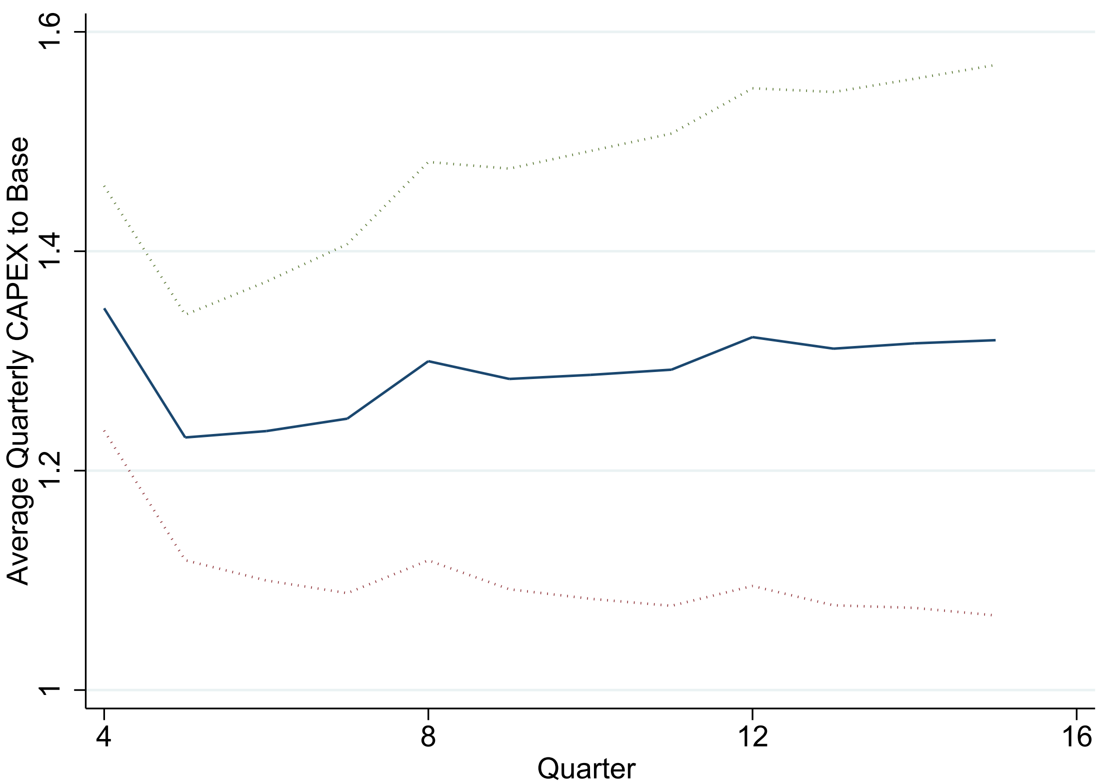


Notes: This figure shows fourth quarter CAPEX spikes across country. Countries are sorted according to their average corporate income tax rate during the sample period: Switzerland has the lowest average corporate income tax rate (about 8%) while Pakistan has the highest (about 35%).

Figure 4: Q4 CAPEX Spikes and Tax Status

Notes: This figure shows the relationship between fourth quarter capital expenditure (CAPEX) spikes and firm tax position by combining CAPEX spike data from Compustat with tax position data from corporate tax returns for the years 1993 through 2010. We divide firms into $1,000 bins based on their taxable income before depreciation expense is taken into account and plot for each bin the average ratio of fourth fiscal quarter CAPEX to the average CAPEX of the first three fiscal quarters.

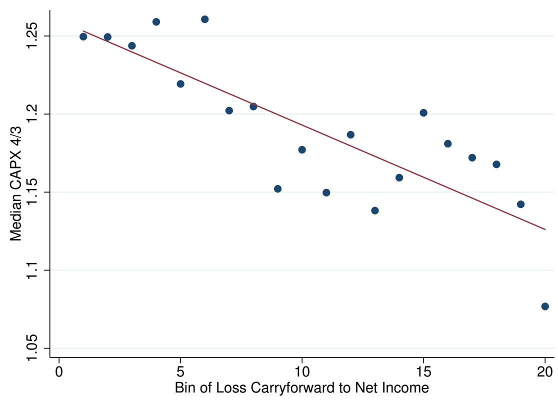
Figure 5: Cumulative Effect of Q4 CAPEX Spikes



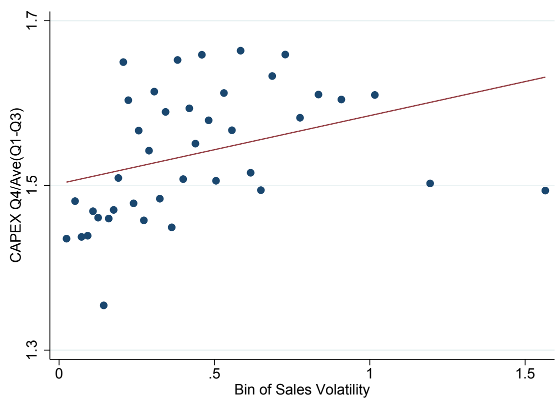
Notes: This figure presents the cumulative effects of CAPEX Q4 Spikes by plotting the ratio of average quarterly CAPEX to CAPEX$\frac{Q2+Q3}{2}$ in the base year. The numerator is calculated as the average quarterly CAPEX starting from Q4 of the base year: for Quarter 4 the numerator is CAPEX Q4, for Quarter 5 the numerator is CAPEX$\frac{Q4+Q5}{2}$, and for Quarter 6 the numerator is CAPEX$\frac{Q4+Q5+Q6}{3}$, etc.. The dotted lines are the 95% confidence intervals.

Figure 6: Loss Carryforward, Sales Volatility and Earnings Surprise

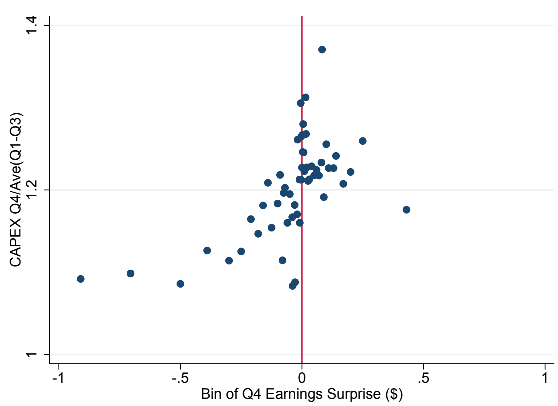
(a) NOL Carryforward



(b) Sales Volatility



(c) Earnings Surprise



Notes: This figure presents binned scatterplots of sample firm Q4 CAPEX spikes against their loss carryforward, sales volatility and Q4 earnings surprises. In Panel (a), loss carryforward is calculated as available NOL carryforward divided by net income before depreciation. In Panel (b), sales volatility is calculated as the standard deviation of a firm's sales, normalized by the average sales. In Panel (c), the red line with earnings surprise equal to zero indicates that firms exactly meet the median analyst forecasts.

Table 1: Summary Statistics

(a) US Sample

	N	Mean	Median	SD	P10	P90
Assets (Mils)	104,470	2,703.14	209.52	15,962.44	27.08	3,783.26
Depreciation (Mils)	104,292	125.93	8.63	712.87	0.74	174.00
CAPEX (Mils)	104,457	172.31	10.55	1,087.18	0.75	229.00
PPE(Mils)	104,412	936.49	47.77	5,518.96	3.28	1,299.68
Sales (Mils)	104,463	2,303.76	202.52	12,152.49	16.02	3,553.89
M/B	100,230	1.90	1.43	1.42	0.88	3.45
Cash Flow/Assets	101,358	0.05	0.09	0.23	-0.14	0.23
Cash/Assets	104,405	0.17	0.09	0.21	0.01	0.50
EBITDA/Assets	104,254	0.09	0.12	0.16	-0.09	0.24
CAPEX/PPE	102,872	0.41	0.23	0.59	0.07	0.84
CAPEX Q4/Ave(Q1-Q3)	104,470	1.36	1.19	0.85	0.47	2.48
Sales Q4/Ave(Q1-Q3)	101,171	1.11	1.07	0.28	0.85	1.43

(b) International Sample

	N	Mean	Median	SD	P10	P90
M/B	52,788	1.89	1.29	2.08	0.75	3.28
Cash Flow/Assets	79,310	0.04	0.07	0.21	-0.12	0.20
Cash/Assets	80,303	0.18	0.12	0.18	0.02	0.42
EBITDA/Assets	79,812	0.06	0.09	0.22	-0.10	0.23
CAPEX/PPE	79,556	0.46	0.19	1.12	0.04	0.81
CAPEX Q4/Ave(Q1-Q3)	80,303	1.35	1.15	0.90	0.40	2.57
Sales Q4/Ave(Q1-Q3)	77,281	1.13	1.06	0.38	0.80	1.52

Notes: Panel (a) presents summary statistics for sample US firms. There are 17,527 firms with 158,859 firm-years during the period 1984-2013. Financial firms and utility firms are excluded from the sample. Panel (b) presents summary statistics for sample international firms from 33 countries during the period of 2004-2013. 15,764 unique firms and 88,067 firm-years are included in the international sample. CAPEX Q4/Ave(Q1-Q3) and Sales Q4/Ave(Q1-Q3) are winsorized at the top and bottom 3% level. Other financial ratios are winsorized at the top and bottom 1% level.

Table 2: Fiscal Q4 CAPEX Spikes and Tax Status

	LHS Variable is $CAPEX\,\frac{Q4}{Ave(Q1-Q3)}$						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
D(taxable)	0.10***	0.08***	0.05***	0.11***	0.08***	0.08***	0.07***
	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)
$\frac{CAPEX}{PPE}$		0.04***	0.04***		0.04**		0.04***
		(0.01)	(0.01)		(0.02)		(0.01)
$\frac{EBITDA}{Asset}$			0.26***				
			(0.03)				
Observations	49737	48540	48049	19183	18670	30554	29870
Adj R-Squared	0.11	0.13	0.13	0.11	0.12	0.13	0.14
Controls	No	1	2	No	1	No	1
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Period				Pre-2000	Pre-2000	Post-2000	Post-2000

Notes: This table presents regression estimates of firm Q4 CAPEX spikes on firm tax position by combining CAPEX spike data from Compustat with tax position data from corporate tax returns for the years 1993 through 2010. We follow Zwick and Mahon (2016) and define taxable as an indicator for whether a firm has positive income before depreciation expense and thus an immediate incentive to offset taxable income with additional investment. All columns include firm and year fixed effects. Columns (2), (5), and (7) include the following controls: ln(assets), Market-to-Book, Cash/Assets, CAPEX/PPE, and Sales Q4/Ave(Q1-Q3). Column (3) adds EBITDA/Assets as an additional control. Columns (4) and (5) are run using just the years 1993 through 2000 and columns (6) and (7) use the years from 2001 to 2010. Standard errors are clustered at the firm level.

Table 3: Fiscal Q4 CAPEX Spikes and the Tax Reform Act of 1986

	LHS Variable is $CAPEX\frac{Q4}{Ave(Q1-Q3)}$					
	(1)	(2)	(3)	(4)	(5)	(6)
D(1984-1987)	0.10***	0.04**	0.10***	0.05***	0.10***	0.05***
	(0.02)	(0.02)	(0.01)	(0.02)	(0.01)	(0.01)
Observations	25596	23731	54654	50801	104470	96006
Adj R-Squared	0.0956	0.101	0.0835	0.0999	0.0760	0.0919
Controls	No	Yes	No	Yes	No	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Period	1984-1993	1984-1993	1984-2000	1984-2000	1984-2013	1984-2013

Notes: This table presents regression estimates of firm Q4 CAPEX spikes around the Tax Reform Act of 1986. The top corporate tax rate was 46% in 1984-1986, 40% in 1987, 34% in 1988-1992 and 35% in 1993-present. The Tax Reform Act of 1986 repealed the Investment Tax Credit, and lengthened the depreciation period for property. D(84-87) is a dummy variable equal to 1 for years 1984-1987. Columns (1) and (2) include the period from 1984 to 1992, columns (3) and (4) include the period from 1984 to 2000, and columns (5) and (6) include the period from 1984 to 2013. Columns (1), (3), and (5) only include firm fixed effects, while columns (2), (4), and (6) include the following controls: ln(assets), Market-to-Book, Cash/Assets, CAPEX/PPE, EBITDA/Assets, and SALES$\frac{Q4}{Ave(Q1-Q3)}$. Standard errors are clustered at the firm level.

Table 4: International Evidence of Q4 CAPEX Spikes

	LHS Variable is $CAPEX\frac{Q4}{Ave(Q1-Q3)}$			
	(1)	(2)	(3)	(4)
Corp Tax Rate	0.05***	0.04***	0.04***	0.04***
	(0.01)	(0.01)	(0.01)	(0.01)
Observations	79354	79354	49739	49739
Adj R-Squared	0.0283	0.0879	0.0316	0.109
Controls	No	No	Yes	Yes
Firm FE	No	Yes	No	Yes
Country FE	Yes	No	Yes	No

Notes: This table presents international evidence of the relation between Q4 CAPEX spikes and corporate tax rates across 33 non-US countries for the period of 2004-2014. In total, 15,764 firms and 88,067 firm-year observations are included. Columns (1) and (2) do not include firm controls, while columns (3) and (4) include firm controls. Columns (1) and (3) include country fixed effects and columns (2) and (4) include firm fixed effects. Control variables include ln(assets), Market-to-Book, Cash/Assets, CAPEX/PPE, EBITDA/Assets, and SALES$\frac{Q4}{Ave(Q1-Q3)}$. Standard errors are clustered at the firm level.

Table 5: Cumulative Effect of Q4 CAPEX Spikes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
D(Lagged 1Y)	-0.03***	-0.03***			-0.10***	-0.10***		
	(0.00)	(0.00)			(0.01)	(0.01)		
D(Spike≥2)	0.06***	0.04***			0.25***	0.24***		
	(0.01)	(0.01)			(0.01)	(0.01)		
D(Forward 1Y)	0.03***	0.04***			0.32***	0.31***		
	(0.00)	(0.00)			(0.01)	(0.01)		
D(Forward 2Y)	-0.05***	-0.04***			-0.10***	-0.10***		
	(0.00)	(0.00)			(0.01)	(0.01)		
M/B		0.09***		0.09***		0.11***		0.11***
		(0.00)		(0.00)		(0.01)		(0.01)
$\frac{EBITDA}{Asset}$		0.14***		0.14***		0.72***		0.74***
		(0.03)		(0.03)		(0.05)		(0.05)
Log(Assets)		0.02***		0.02***		0.04***		0.04***
		(0.01)		(0.01)		(0.01)		(0.01)
$\frac{CashHoldings}{Asset}$		0.37***		0.38***		0.21***		0.23***
		(0.03)		(0.03)		(0.05)		(0.05)
D(Lagged 1Y)			-0.03***	-0.03***			-0.10***	-0.09***
			(0.01)	(0.01)			(0.02)	(0.02)
D(Spike≥3)			0.08***	0.06***			0.33***	0.32***
			(0.01)	(0.01)			(0.02)	(0.02)
D(Forward 1Y)			0.04***	0.05***			0.31***	0.32***
			(0.01)	(0.01)			(0.02)	(0.02)
D(Forward 2Y)			-0.05***	-0.04***			-0.09***	-0.08***
			(0.01)	(0.01)			(0.02)	(0.02)
Observations	117581	112860	117581	112860	94709	91277	94709	91277
Adj R-Squared	0.373	0.403	0.372	0.402	0.110	0.129	0.0951	0.115
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table examines the level of CAPEX around firm-years with large Q4 CAPEX spikes. Dummy variables indicate time period from one year before to two years after large spikes. Large Q4 spike (CAPEX$\frac{Q4}{Ave(Q1-Q3)}$) threshold is 2 in Columns (1) and (2), and 3 in Columns (3) and (4). Columns (2) and (4) include ln(assets), Market-to-Book, Cash/Assets, EBITDA/Assets, and SALES$\frac{Q4}{Ave(Q1-Q3)}$ as controls. Firm fixed effects and year fixed effects are included. Standard errors are clustered at the firm level.

Table 6: Investment Spikes and Financial Constraints

	LHS Variable is $CAPEX\,\frac{Q4}{Ave(Q1-Q3)}$					
	(1)	(2)	(3)	(4)	(5)	(6)
Altman Z-Score	-0.05***			-0.02***		
	(0.01)			(0.01)		
Dividend Payers		-0.04***			-0.02	
		(0.01)			(0.02)	
Speculative Grade			0.02			0.05**
			(0.01)			(0.02)
D(1984-1987)*zscore				-0.03*		
				(0.02)		
D(1984-1987)*paydiv					-0.08**	
					(0.04)	
D(1984-1987)*junkrating						0.16**
						(0.06)
D(84-87)				0.18***	0.15***	-0.03
				(0.04)	(0.03)	(0.03)
Observations	113554	117559	28308	113554	117559	28308
Adj R-Squared	0.0264	0.0256	0.0289	0.117	0.116	0.152
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	No	No	No
Firm FE	No	No	No	Yes	Yes	Yes

Notes: This table presents regression estimates relating the magnitude of firm Q4 investment spikes to various proxies for financial constraints used in prior work. Columns (1) through (3) present cross-sectional regressions, while columns (4) through (6) interact financial constraint proxies with tax policy changes around the Tax Reform Act of 1986. Control variables include ln(Assets), Market-to-Book, Cash/Assets, CAPEX/PPE, EBITDA/Assets, and SALES$\frac{Q4}{Ave(Q1-Q3)}$. Year fixed effects are included for columns (1) through (3) and firm fixed effects are included in columns (4) through (6). Standard errors are clustered at the firm level. Altman's Z is standardized for ease of interpretation.

Table 7: Decomposing the Investment-Cash Flow Sensitivity

	LHS Variable is CAPEX/Asset				
	(1)	(2)	(3)	(4)	(5)
$\frac{CashFlow}{Asset}$	0.083***	0.014***	0.009***	0.008***	0.010***
	(0.004)	(0.001)	(0.001)	(0.001)	(0.001)
$\frac{CashFlow}{Asset} * Q2$			0.005***	0.003***	
			(0.000)	(0.001)	
$\frac{CashFlow}{Asset} * Q3$			0.010***	0.004***	
			(0.001)	(0.001)	
$\frac{CashFlow}{Asset} * Q4$		0.016***	0.021***	0.011***	0.008***
		(0.001)	(0.001)	(0.001)	(0.001)
Tobin's Q	0.017***	0.004***	0.004***	0.004***	0.004***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	139049	468766	468766	214560	214560
Adj R-Squared	0.550	0.471	0.471	0.475	0.475
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes				
Year-Quarter FE		Yes	Yes	Yes	Yes

Notes: This table presents regression estimates of investment-cash flow sensitivity using either annual or quarterly investment measures. To enable comparison to past work, column (1) presents estimates at an annual frequency with CAPEX/Assets as the left hand side variable and annual Cash Flow/Assets and Tobin's Q as key right hand side variables, and includes firm and year fixed effects. Columns (2) through (5) use quarterly CAPEX/Assets as the left hand side variable and include firm and year-by-quarter fixed effects. Column (2) interacts a fiscal Q4 dummy with Cash Flow/Assets. Column (3) interacts dummies for each fiscal quarter with Cash Flow/Assets. Columns (4) and (5) restrict the sample to firm-year observations where Q4 cash flow is less than or equal to the average of the first three quarters. Standard errors are clustered at the firm level.

Table 8: Loss Carryforward, Sales Volatility and Earnings Forecasts

	(1)	(2)	(3)
Sales Volatility	0.03**		
	(0.01)		
Beat or Meet Q4 Earnings Forecast		0.05***	
		(0.01)	
Beat or Meet Annual Earnings Forecast			0.05***
			(0.01)
Constant	1.37***	1.45***	1.47***
	(0.01)	(0.03)	(0.03)
Observations	12780	56517	72756
Adj R-Squared	0.00185	0.0972	0.0972
Firm FE		Yes	Yes
Year FE	Yes	Yes	Yes

Notes: This table presents regression estimates relating the magnitude of firm Q4 investment spikes to financial performance relative to earnings forecasts. We define a dummy variable equal to 1 if a firm beats or meets the median analyst earnings forecast. Column (1) presents results with the Q4 earnings forecast, while column (2) presents results with annual earnings forecast. Firm and year fixed effects are included. Standard errors are clustered at the firm level.

Table 9: Investment Spikes and Complicated Firms: Use it or Lose it?

	LHS Variable is $CAPEX\frac{Q4}{Ave(Q1-Q3)}$			
	(1)	(2)	(3)	(4)
# Segments	0.03***			
	(0.00)			
# SIC2		0.03***		
		(0.00)		
G Index			0.03***	
			(0.01)	
E Index				0.02***
				(0.01)
Observations	100708	100689	19694	18337
Adj R-Squared	0.0278	0.0277	0.0168	0.0164
Controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Notes: This table presents regression estimates relating firm Q4 investment spikes to measures of corporate or budgetary complexity and internal governance of firms. These measures include: (1) the number of segments; (2) the number of two digit SIC codes in the corporate segments; (3) the G-index of Gompers, Ishii, and Metrick (2001); and (4) the Entrenchment-index of Bebchuk, Cohen, and Farrell (2002). The G-index and Entrenchment-index regressions only include the time period of 1990-2007 due to data availability. Control variables include ln(Assets), Market-to-Book, Cash/Assets, CAPEX/PPE, EBITDA/Assets, and SALES$\frac{Q4}{Ave(Q1-Q3)}$. The non-dummy right hand side variables are standardized for ease of interpretation. Year fixed effects are included. Standard errors are clustered at the firm level.

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A Institutional Background

Table A.1: Variable Definition

Altman Z-score	3.3×(EBIT/Assets)+sales/Assets+1.4×(Retained Earnings/Assets)+1.2×(Working Capital/Assets)
CAPEX/ PPE	Capital Expenditures/ Property, Plant and Equipment
Cash/Assets	Cash and Short-term Investment/L.Assets
Cash Flow/Assets	(Income Before Extraordinary Items+Depreciation and Amortization)/L.Assets
Dividend Payers	A dummy variable =1 if a firm pays dividend in a given year
EBITDA/Assets	Earnings before interest, tax, depreciation and amortization/L.Assets
Market-to-Book	(Asset − Common Equity + Common Shares Outstanding × Closing Price (Fiscial Year))/Assets
Speculative Grade	A dummy variable =1 if a firm receives an S&P long term issuer credit rating below or equal to BB+ in a given year
Tobin's Q	(Total Asset + Common Shares Outstanding × Closing Price (Fiscal Year) − Common Equity − Deferred Taxes)/Asset

Table A.2: Section 179 and Bonus Depreciation Policy Changes

Year	S179 Max Value	S179 Phase-out Region	Bonus
1982-86	$5,000		
1987-92	$10,000	$200,000-$210,000	
1993-96	$17,500	$200,000-$217,500	
1997	$18,000	$200,000-$218,000	
1998	$18,500	$200,000-$218,500	
1999	$19,000	$200,000-$219,000	
2000	$20,000	$200,000-$220,000	
2001-02	$24,000	$200,000-$224,000	30% Tax years ending after 9/10/01
2003	$100,000	$400,000-$500,000	50% Tax years ending after 5/3/03
2004	$102,000	$410,000-$512,000	50%
2005	$105,000	$420,000-$525,000	
2006	$108,000	$430,000-$538,000	
2007	$125,000	$500,000-$625,000	
2008-09	$250,000	$800,000-$1,050,000	50% Tax years ending after 12/31/07
2010-11	$500,000	$2,000,000-$2,500,000	100% Tax years ending after 9/8/10
2012-13	$500,000	$2,000,000-$2,500,000	50%

a. 2008 was retroactive.

Table A.3: Historical U.S. Corporate Income Tax Rate

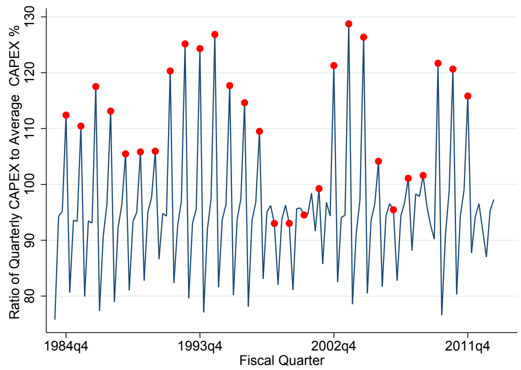
Year	Income Bracket	Tax Rate (%)
1984-1986	First $25,000	15
	$25,000 to $50,000	18
	$50,000 to $75,000	30
	$75,000 to $100,000	40
	$100,000 to $1,000,000	46
	$1,000,000 to $1,405,000	51(a)
	Over $1,405,000	46
1987	First $25,000	15
	$25,000 to $50,000	16.5
	$50,000 to $75,000	27.5
	$75,000 to $100,000	37
	$100,000 to $335,000	42.5
	$335,000 to $1,000,000	40
	$1,000,000 to $1,405,000	42.5
	Over $1,405,000	46
1988-1992	First $50,000	15
	$50,000 to $75,000	25
	$75,000 to $100,000	34
	$100,000 to $335,000	39 (b)
	Over $335,000	34
1993-2013	First $50,000	15
	$50,000 to $75,000	25
	$75,000 to $100,000	34
	$100,000 to $335,000	39(c)
	$335,000 to $10,000,000	34
	$10,000,000 to $15,000,000	35
	$15,000,000 to $18,333,333	38(d)
	Over $18,333,333	35

Notes:
(a) The Deficit Reduction Act of 1984 placed an additional 5 percent to the tax rate in order to phase out the benefit of the lower graduated rates for corporations with taxable income between $1,000,000 and 1,405,000. Corporations with taxable income above $1,405,000, in effect, pay a flat marginal rate of 46 percent.
(b) Rates shown effective for tax years beginning on or after July 1, 1987. Taxable income before July 1, 1987 was subject to a two tax rate schedule or a blended tax rate.
(c) An additional 5 percent tax, not exceeding $11,750, is imposed on taxable income between $100,000 and $335,000 in order to phase out the benefits of the lower graduated rates.
(d) An additional 3 percent tax, not exceeding $100,000, is imposed on taxable income between $15,000,000 and $18,333,333 in order to phase out the benefits of the lower graduated rates.
Source: IRS

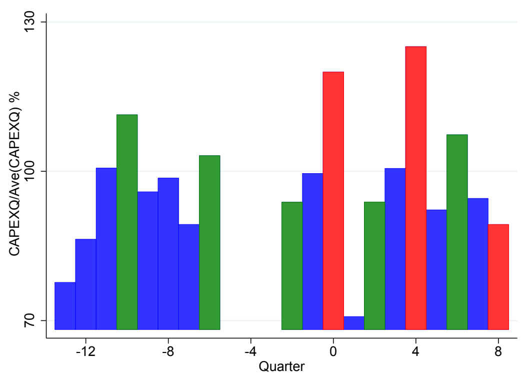
B Additional Robustness

Figure B.1: Robustness of Q4 Investment Spikes

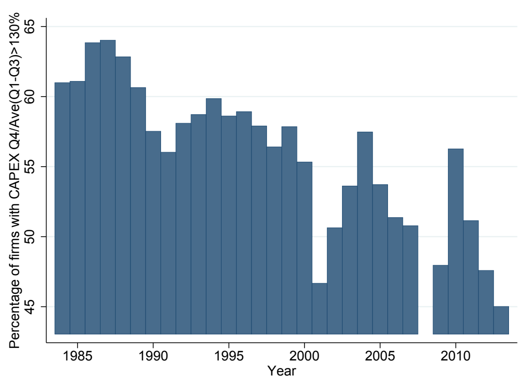
(a) Fiscal Q1 Drop



(b) Fiscal Year-end Change

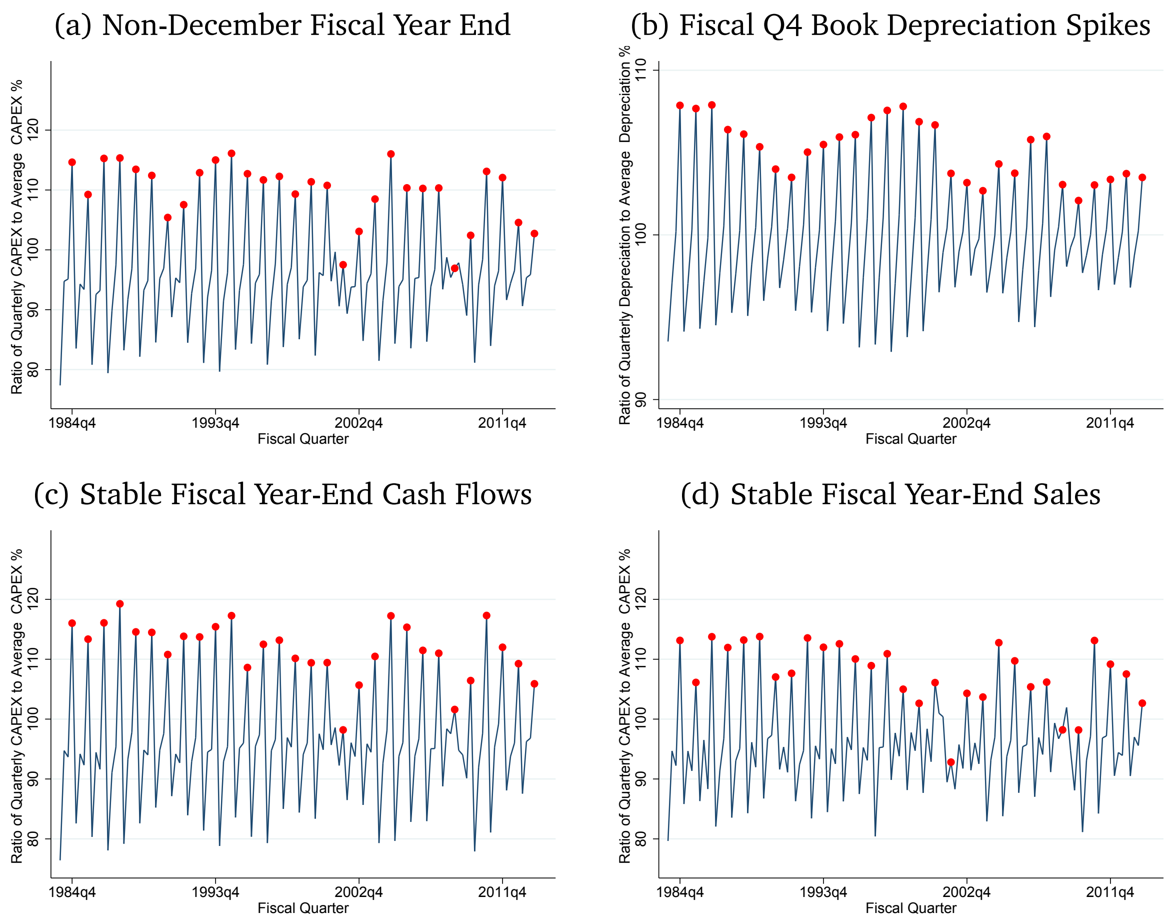


(a) Fraction of Firms with Large Q4 Investment Spikes



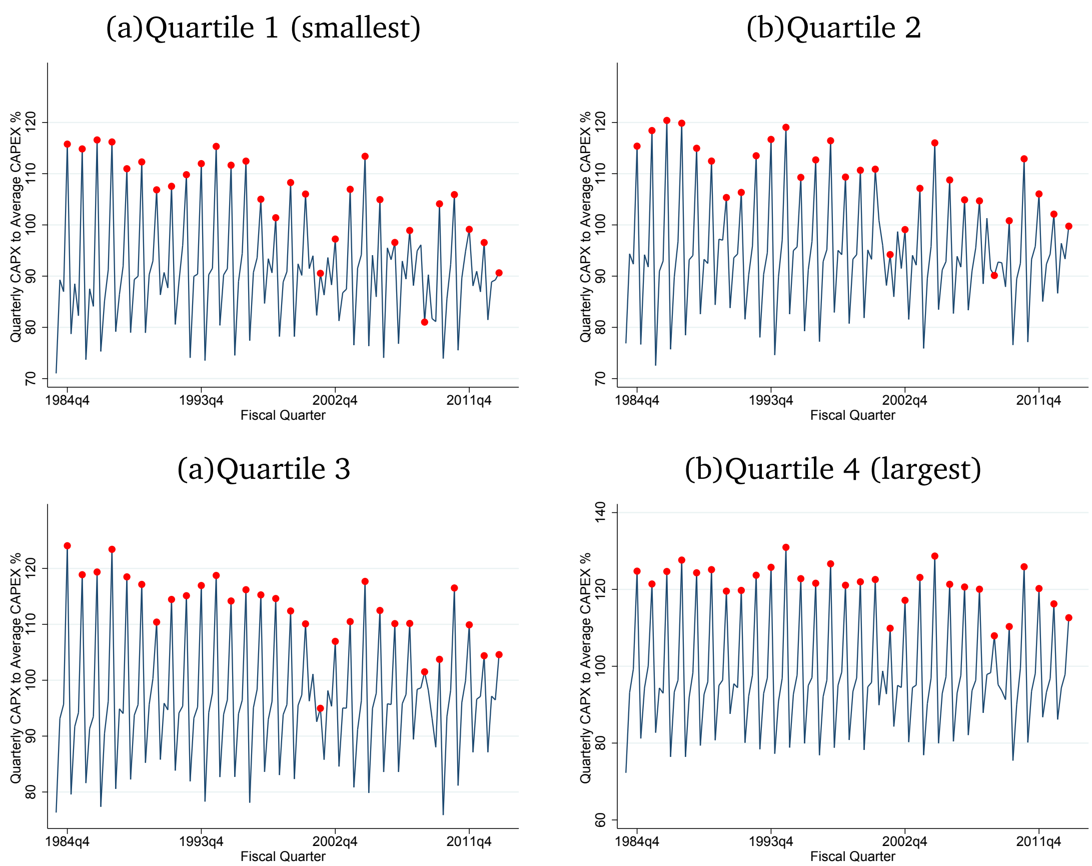
Notes: This figure illustrates the robustness of fiscal Q4 investment spikes. Panel (a) plots the Q4 investment spikes with red dots being the average of Q4 and next fiscal Q1 to the average CAPEX within a firm's fiscal year. Panel (b) plots the time series of CAPEX for 49 sample firms that switched their fiscal year ends to six months later. The Y axis measures the ratio of quarterly CAPEX to average CAPEX in a firm-year. Quarter 0 indicates the new fiscal year-end quarter upon switching. Green bars indicate the fiscal year-end quarter according to the old regime, and red bars indicate the new fiscal year-end quarter after the change. Two quarterly reports are missing on Compustat due to the fiscal year-end changes. Panel (c) plots the fraction of firms with $CAPEX_{\frac{Q4}{Ave(Q1-Q3)}} \geq 130\%$.

Figure B.2: Robustness of Q4 CAPX Spikes over Time



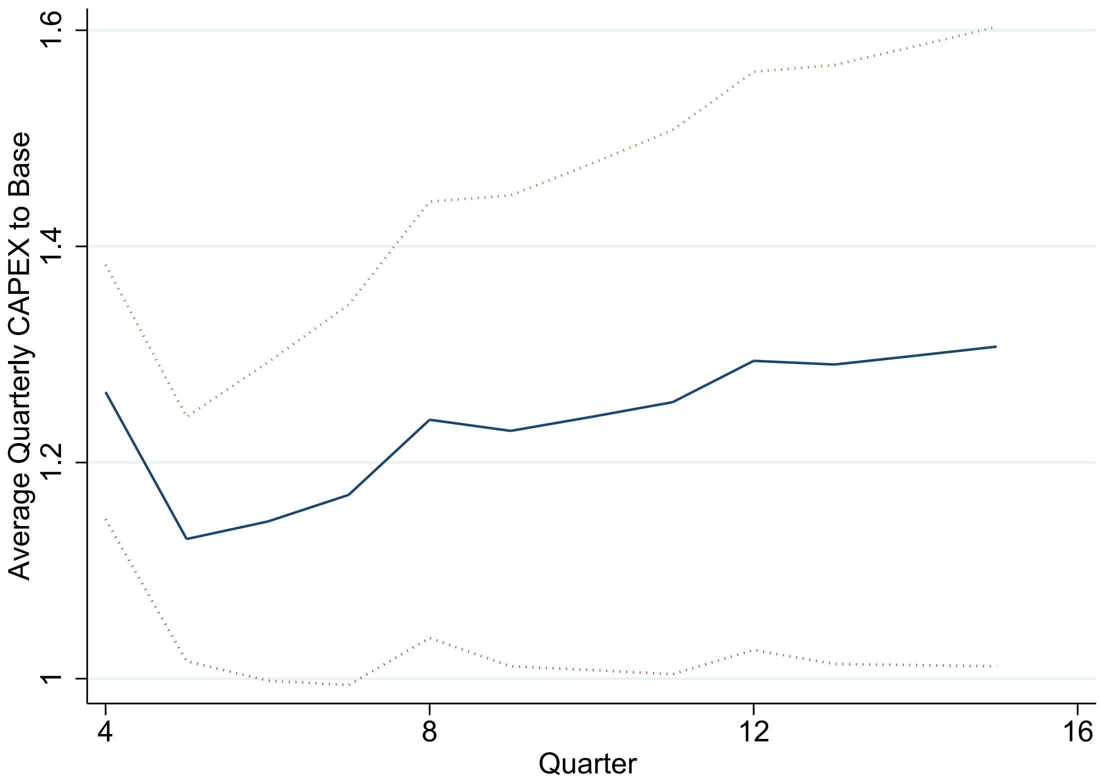
Notes: This figure illustrates the robustness of fiscal Q4 CAPEX spikes. Panel (a) plots the time series pattern of Q4 CAPEX spikes for firms with non-December fiscal year-end. Panel (b) plots the median ratio of quarterly book depreciation to the average book depreciation within a firm's fiscal year. Panels (c) and (d) plot the time series of Q4 CAPEX spikes for firms with stable fiscal year-end cash flows and sales, respectively. Stable cash flows and sales are defined as firm-years for which fiscal Q4 cash flows and sales are lower than the average of the first three fiscal quarters.

Figure B.3: Q4 Investment Spikes across Asset Size Distribution



Notes: This figure illustrates the robustness of fiscal Q4 investment spikes across asset size distribution. The Y axis measures the ratio of quarterly CAPEX to average CAPEX in a firm-year.

Figure B.4: Cumulative Effect of Q4 CAPEX Spikes



Notes: This figure presents the cumulative effects of CAPEX Q4 Spikes by plotting the ratio of average quarterly CAPEX to the base quarterly CAPEX, which is CAPEX$\frac{Q1+Q2+Q3+Q4}{4}$ in the base year. The numerator is calculated as the average quarterly CAPEX starting from Q4 of the base year: for Quarter 4 the numerator is CAPEX Q4, for Quarter 5 the numerator is CAPEX$\frac{Q4+Q5}{2}$, and for Quarter 6 the numerator is CAPEX$\frac{Q4+Q5+Q6}{3}$, etc.. The dotted lines are the 95% confidence intervals.

Table B.1: Investment Spikes and Debt Spikes

(a) Debt Spikes for all Sample firms

	(1) Debt Issues $\frac{Q4}{Ave(Q1-Q3)}$	(2) Long-term Debt $\frac{Q4}{Ave(Q1-Q3)}$	(3) Current Debt $\frac{Q4}{Ave(Q1-Q3)}$	(4) Total Debt $\frac{Q4}{Ave(Q1-Q3)}$
CAPEX $\frac{Q4}{Ave(Q1-Q3)}$	0.08***	0.03***	0.01**	0.02***
	(0.01)	(0.00)	(0.01)	(0.00)
Observations	51169	94559	88142	94502
Adj R-Squared	0.0668	0.0649	0.0446	0.0985
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes

(b) Debt Spikes for firms with non-December Fiscal Year End

	(1) Debt Issues $\frac{Q4}{Ave(Q1-Q3)}$	(2) Long-term Debt $\frac{Q4}{Ave(Q1-Q3)}$	(3) Current Debt $\frac{Q4}{Ave(Q1-Q3)}$	(4) Total Debt $\frac{Q4}{Ave(Q1-Q3)}$
CAPEX $\frac{Q4}{Ave(Q1-Q3)}$	0.06***	0.02***	0.01	0.02***
	(0.01)	(0.00)	(0.01)	(0.00)
Observations	17779	34300	32659	34219
Adj R-Squared	0.0727	0.0619	0.0611	0.116
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes

Notes: This table presents regression estimates relating the magnitude of firm Q4 investment spikes to Q4 debt spikes. Firm and year fixed effects are included. Firm Q4 investment spikes are standardized for ease of interpretation. Standard errors are clustered at the firm level.