# Dividend Taxes and Corporate "Non-Capital" Investment

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**Abstract**

I present new evidence that the 2003 dividend tax cut prompted a vigorous and lasting increase in equity financing and real expenditures by a large number of US public firms, but—in contrast to the predictions of policymakers and traditional theories—this extra financing was devoted almost entirely to operations and R&D, rather than capital investment. I exploit quasi-experimental variation in equity issuance incentives created by the tax cut, enabling me to estimate both extra equity financing and use of proceeds. I find that firms facing likely cash shortages (encompassing about half of public firms since 2003) sharply increased quarterly equity financing by 48% (±9%) on average, raising roughly \$50-\$90bn in extra cash since 2003, suggesting an elasticity to the net-of-tax rate between 0.6 and 1.2. But these firms were not inclined to capital investment: almost all of the extra cash was devoted to operating expenditures. In short, longstanding assumptions about the productive uses of cash have likely overlooked the most substantial real impacts of dividend taxation on the firms most sensitive to the cost of equity capital.

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# 1 Introduction & Overview

In May 2003, President Bush signed into law the largest shareholder-level tax cut in decades, lowering the top marginal dividend tax rate from 38.6% to 15%. The reform divided economists and policymakers over a central question: whether the dividend tax cut would stimulate business capital investment. Proponents drew support from traditional models of dividend taxation, arguing that dividend taxes create a "wedge" that raises the cost of equity financing, distorts business investment decisions, and thus lowers overall capital investment (Harberger, 1962; Feldstein, 1970; Poterba and Summers, 1985). However, recent evidence has revealed that the tax cut likely prompted zero additional capital investment by US businesses in aggregate (Yagan, 2015). This striking null result is often interpreted as evidence that dividend taxes are better characterized by an alternative class of models known as the "new view," predicting that dividend taxes do not distort investment decisions and thus have minimal real effects (King, 1977; Auerbach, 1979; Bradford, 1981).[1]

But what if the tax cut prompted real expenditures other than capital investment? Research and policy discussions have historically focused almost exclusively on capital investment outcomes,[2] but there are many other productive uses of cash. The availability of financing has substantial effects on expenditures in R&D (Brown, Fazzari, and Petersen, 2009; Czarnitzki and Hottenrott, 2011; Hoberg and Maksimovic, 2015), hiring and employment (Chodorow-Reich, 2014; Benmelech, Bergman, and Seru, 2011), as well as marketing and advertising (Campello, Graham, and Harvey, 2010). Equity is commonly a source of financing for expenditures other than capital investment (Hall, 2010; Carpenter and Petersen, 2002). Moreover, investment cash-flow sensitivity had declined substantially by 2003 (Brown, Fazzari, and Petersen, 2009), suggesting that firms obtaining additional financing after the tax cut would use this cash in ways other than capital investment.[3]

This paper presents new evidence that a large number of firms responded quite vigorously to the 2003 dividend tax cut, but—in contrast to the predictions of policymakers and existing literature—this response materialized in outcomes other than capital investment. To show this, I take a different approach than prior studies. Rather than attempting to directly estimate real outcomes by comparing a pre-determined set of comparison groups, I devote significant effort to first identifying and estimating the equity financing response, as this is the pathway that affects real outcomes as predicted in traditional models. I accomplish this by using a quasi-experimental difference-in-difference (DD) design, exploiting variation in the equity issuance incentives created by the dividend tax cut across firms, which I discuss below. I then use two-stage least squares (2SLS) to estimate how any extra equity proceeds were spent.

[1] See Section 3 for a detailed discussion of the two sets of models.

[2] This focus on capital investment is clear in the seminal work of Modigliani and Miller (1958), the development of models of capital taxation during the 1970s and 1980s, the arguments surrounding the 2003 dividend tax cut, and in more recent empirical work estimating the effects of shareholder-level tax policy changes, discussed below.

[3] Thus, the estimates about capital investment responsiveness to cost of capital that served as the basis for the traditional predictions, such as those summarized in Hassett and Hubbard (2002), were describing firms in a time that were not representative of the likely affected group of firms, as discussed more below.

The investigation is conducted using quarterly data from Compustat North American Fundamentals between 1991 and 2017. I focus on public firms for two critical reasons. First, as discussed below, knowing the form and context of a firm's equity issuance is essential to my empirical strategy. I therefore link the data to quarterly filings (10-Qs and 10-Ks), which offer rich discussions on financing and expenditures. Second, the quarterly frequency of the data enables much more precise tracking of firms' equity and expenditure responses than annual tax return data.

The empirical strategy of the paper proceeds in two steps. First, I identify the firms likely to issue more equity as a result of the tax cut—i.e., firms that would benefit from extra equity financing, but that are constrained by the wedge between the internal and external cost of funds created by the dividend tax cut. To do this, I build a model similar to Chetty and Saez (2010), but that incorporates forecasted cash flows as a diagnostic tool. I validate the accuracy of the model with textual analysis of quarterly filings and by testing predictions on pre-reform data. The predicted group of affected firms are those in a "Cash-Short" state: that is, the firm either (a) has insufficient cash holdings to cover short-term forecasted losses, so that it has pressing cash needs, or (b) has very low sales revenue, so that extra cash is particularly valuable.

Roughly 55% of firms in my sample are in this Cash-Short state at some point, or 25% in any given quarter. Firms in this state tend to be smaller, have low tangible assets and low capital investment, are highly varied in growth rate (from very negative to very positive), and have very high operating and R&D expenses on average relative to revenue. They also rely heavily on external finance, particularly equity financing, and appear generally quite financially constrained.[4]

The second step of the empirical strategy is to identify a comparison group for the DD analysis. This is a challenge because there is no viable "alternate" set of Cash-Short firms that was not affected by the tax cut. What is thus needed is a group with parallel trends in equity issuance, but that was minimally affected by the tax cut.

To overcome this challenge, I exploit an important fact that generates quasi-experimental variation. Most public firms (82%) issue equity every year—even those flush with cash—but this equity is issued in many different forms that were each affected differently by the tax cut. For example, a firm might issue equity in public offerings, private sales of stock, as incentive compensation, upon the exercise of warrants or options, upon the conversion of other securities, or even for mergers and acquisitions (M&A). The dividend tax cut had heterogeneous effects across these forms of issuance. For example, stock sales were incentivized, as predicted by traditional models. Incentives for warrants and options experienced similar effects. But equity issuance for M&A experienced generally offsetting effects: in M&A, stock is issued to acquire the stock of another company, creating price effects that offset the incentives for extra issuance.[5]

[4] As articulated in Fazzari, Hubbard, and Petersen (1987); Kaplan and Zingales (1997), firms are financially constrained when the wedge between their internal and external costs of funds constrains the firm's behavior. By comparison, being Cash-Short is a characteristic determined by the firm's financial condition. The latter is predictive of the former, so there is great overlap between the two, but the concepts are not synonymous. Section 3 offers a more thorough discussion of the relationship between these two concepts.

[5] The effect of the tax cut on equity issuance incentives in M&A is complex, and this statement is an oversimpli-

I utilize this variation in incentives to identify a valid comparison group: "Cash-Rich" firms, defined as firms in a state of very high cash flow and high sales revenue (roughly 28% of firms in the sample at some point, and 15% in any given quarter). These firms generally do not rely on equity issuance as a marginal source of finance, and thus fall outside the scope of affected firms under traditional models. But despite their abundant cash, these firms still issue a substantial amount of equity every year (median $10m per firm). However, they do so overwhelmingly for M&A and other less-incentivized forms of issuance. Therefore, the incentives for equity issuance are minimally affected by the tax cut compared to the Cash-Short firms.

Note that identification in this DD analysis is *not* premised on random assignment or that the two groups are equivalent. It is based on the assumption that equity issuance by the two groups would trend similarly were it not for the tax cut—the assumption that permits me to estimate the extra equity issuance post-reform by Cash-Short firms. Strikingly, the issuance patterns of the two groups are highly procyclical and track one another within a margin of error in 43 of the 48 quarters prior to the dividend tax cut—but then sharply and permanently diverge in the quarter immediately after the tax cut. (See Figure 12).

I estimate that the effect of the dividend tax cut on Cash-Short firms was immediate, large, and lasting. In the year following the tax cut, I find that Cash-Short firms doubled their equity issuance (+107% ± 22%). (See Figure 11). The effect persists through 2017, with average quarterly issuance up overall by 48% (±9%). I estimate Cash-Short firms were able to raise an aggregate of roughly $52bn-$87bn in extra cash since 2003. The results are quite robust, even to substantial changes in the definition and composition of the comparison groups.

Detailed analysis reveals that this extra equity issuance is concentrated among repeat high-issuers, suggesting a strong intensive margin response. The most strongly affected firms have low tangible assets, low sales revenue, and are very unprofitable. The effects are widespread across industries, and with one exception the industry composition of the Cash-Short firms is not strikingly different than that of Cash-Rich firms. That one exception is pharmaceuticals, which have an outsize representation among Cash-Short firms and account for 38% of all of their post-reform equity issuance. Even so, the results are quite similar when excluding pharmaceuticals.

How did Cash-Short firms spend this extra financing? Evidence from 2SLS regressions estimating the use of extra proceeds annually suggests that at most a tiny amount went to capital expenditure. Instead, almost all of the proceeds went to operating expenditures, including R&D. (See Figure 26). I estimate that roughly half was devoted to general selling & administrative expenses, roughly one third to R&D (although this was driven almost entirely by pharmaceutical firms), with most of the rest to cost of goods sold.[6]

These results are economically significant. From the amounts of cash raised, I estimate a fi-

fication. But as discussed in more detail in Section 4, the incentives (albeit complex) substantially offset.

[6]Cost of goods sold reflects production expenditures, such as materials, labor, and overhead, while selling & admin reflects other costs incurred in the generation of income, such as marketing, commissions, rent, and other miscellaneous expenses.

nancing to net-of-tax rate elasticity between 0.6 and 1.2, and a financing to cost-of-capital elasticity between -1.4 and -2.8. Complementary tests on expenditures suggest that these estimates are economically reasonable. And although these estimates are for public firms, the results of Alstadsæter, Jacob, and Michaely (2017) suggest that they should extrapolate to unlisted firms.

This paper contributes to existing literature in three ways. First and foremost, it contributes to the extensive literature on dividend taxes by revealing the importance of real outcomes other than capital investment. After all, dividend taxes are predicted to affect real outcomes through financing impediments, but financing and expenditures are separate decisions.

Second, the paper contributes to recent empirical work on dividend taxes by presenting new evidence that the dividend tax cut did reduce the cost of equity capital for a large number of firms, prompting substantial additional equity financing and real expenditures. This finding challenges implications from Yagan (2015), while still in perfect accordance with his striking null result on capital investment. This paper also reconciles tension in recent empirical literature. The results of Yagan (2015) contrasted with results internationally, where researchers have found evidence of a modest increase in investment by smaller firms with less cash availability (Alstadsæter, Jacob, and Michaely, 2017; Becker, Jacob, and Jacob, 2013). They also contrasted with accounting and finance literature, where researchers found evidence of a reduced cost of capital for financially constrained firms (Dai, Shackelford, Zhang, and Chen, 2013; Dhaliwal, Krull, Li, and Moser, 2005). My results align these findings by revealing that US Cash-Short firms (which are also generally quite financially constrained) do appear to respond with real effects, but just in ways not previously discovered.

Third, this paper offers a richer picture about the set of firms affected by dividend taxes as predicted by traditional models. Prior investigations have looked for aggregate effects across all firms or a reallocation between broadly defined groups of firms. In contrast, by adding cash flow forecasts to my model and by distinguishing between different types of equity issuance, I am able to offer a more tailored identification of the firms likely affected. My findings suggest that many firms are (or have been) in a Cash-Short state that would cause dividend taxes to have substantive effects on both their financing options and real expenditures.

## 2 Background on the Tax Cut

The Jobs and Growth Tax Relief and Reconciliation Act ("JGTRRA") was enacted on May 23, 2003. The concept was first introduced by President Bush on January 7, when he proposed a complete elimination of the double-taxation of distributed corporate profits (at which point he contended that the tax cut would "provide capital" for businesses "to build factories" and "to buy equipment," following the predictions of traditional models for capital investment).[7] The proposal was unanticipated, and the ultimate passage of the law was far from certain even in its modified

[7] President Bush's Remarks to the Economic Club of Chicago in Chicago, Illinois. January 7, 2003. *Public Papers of the Presidents of the United States.*

compromise form, justifying the use of the tax cut as an instrument for the effect of dividend tax cuts in many studies since then.[8]

Prior to JGTRRA, dividends were taxed as ordinary income. JGTRRA changed this by taxing dividends instead at the long-term capital gains rate, which was also reduced by the law (from a top rate of 20% to 15%).[9] The law was retroactive to January 1, 2003. The exact rate reduction thus depended on the tax situation of the recipient. For tax-exempt investors and corporations, there was no effect. For individuals, the rate reduction depended on their taxable income and their state tax regime. For all computations of elasticities, I follow Yagan (2015) in using the rate change estimated by the OECD: a reduction from a top rate of 44.7% to 20.8%.[10]

The shareholder tax rates established in JGTRRA were originally set to expire on January 1, 2008, but they were subsequently extended in 2005 and 2010, and made permanent in 2012.[11] And while JGTRRA represents the most substantial shareholder-level tax reform in decades, it is not the only one. Several other federal tax laws affecting dividend and capital gains rates were enacted during my 26-year investigation period, but all of these were much smaller in magnitude, generally more anticipated, and received much less public attention than the dividend tax cut in JGTRRA.[12]

Other important law changes occurred contemporaneously in 2003. First, JGTRRA also included investment tax incentives targeting small businesses (increasing bonus depreciation and expensing caps), which I consider as a confounding factor that could bias my (already quite low) estimates of capital expenditure upward during the 2003-2008 period.[13] Another important law was the Medicare Prescription Drug, Improvement, and Modernization Act of 2003, enacted in December: it subsidized the pharmaceutical industry with new regulations and through the establishment of Medicare Part D. I perform robustness tests excluding pharmaceutical companies to ensure that my results are robust to any contamination from the law. A more detailed discussion is available in Section 9.

[8] See (Auerbach and Hassett, 2007) for the discussion of the timing and unanticipated nature of the tax cut.

[9] Note that to be taxed at the lower rate, the dividend must be "qualified" dividends. Generally this requires the dividends be paid by US corporations or corporations traded on a US stock market, and that the shareholder meets a 60-day holding period requirement.

[10] See OECD Tax Database Table II.4 (http://www.oecd.org/tax/tax-policy/tax-database.htm).

[11] The rates were extended until January 1, 2011 by the Tax Increase Prevention and Reconciliation Act of 2005, until January 1, 2013 by the Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010, and made permanent by the Middle Class Tax Relief and Job Creation Act of 2012.

[12] The Taxpayer Relief Act, enacted August 5, 1997, reduced the top marginal capital gain rate from 28% to 20%. The Patient Protection and Affordable Care Act, enacted March 23 2010, added a 3.8% surtax to the net investment income of high-income individuals, applying to dividend and capital gain income beginning on January 1, 2013. The American Taxpayer Relief Act of 2012, which primarily raised the ordinary income tax rates on high earners (which received most of the attention leading up to its enactment) raised the long-term capital gain and dividend tax rate on the highest bracket from 15% to 20%.

[13] The bonus depreciation provisions permitted an additional first-year depreciation deduction equal to 50% of the adjusted basis for certain qualified property, generally tangible property and improvements. The business expensing provisions raised the expensing cap from $25,000 to $100,000 for qualifying property (generally tangible property used in the ordinary course of business, as well as computer software). *See* Joint Committee on Taxation, 2003. *General Explanation Of Tax Legislation Enacted In The 107th Congress.*

# 3 Theory

Dividend taxes are predicted to affect real outcomes by distorting firms' cost of financing. But the presence of these distortions depends on firms' marginal source of funds (Auerbach and Hassett, 2003). For firms that issue new equity to raise cash, traditional models predict that dividend taxes create an additional wedge that raises the cost of equity financing, raising the hurdle-rate for investments, and thus distorting both financing and investment decisions (Harberger, 1962; Feldstein, 1970; Poterba and Summers, 1985). For firms that instead use internally-generated funds or debt-financing, "new view" models predict that dividend taxes do not distort investment decisions (King, 1977; Auerbach, 1979; Bradford, 1981).[14]

The goal of this section is to construct a model that achieves two purposes. First, it must capture the heterogeneous predictions of the two views. To do this, the model takes a form analogous to Chetty and Saez (2010), nesting the two sets of predictions in a simple two-period model. Second, the model must also provide guidance for empirically identifying affected and unaffected firms. This second task has been an important challenge in empirical work on dividend taxation, as key concepts in both the traditional and new view models are unmeasureable.[15] I address this obstacle by adding additional structure to my model, incorporating forecasted cash flows as a diagnostic tool to identify firms likely to have high demand for equity financing, and thus likely to be at least weakly constrained by dividend taxes as predicted by traditional models. I later validate this additional structure in Section 6, using close readings of quarterly filings to show that the framework is quite realistic.

***Model Foundation***

I begin at the root of all traditional models: Modigliani and Miller (1958), who describe the mechanical relationship between dividends, equity issuance, investment, and firm valuation in a simplified setting. The following equation serves as the foundation for most models in this literature.[16]

$$V_1 = (1 - \tau_d)D_1 - E_1 + \frac{V_2}{1 + \rho_1} \tag{1}$$

$V_1$ is the aggregate value of outstanding common shares at the start of period 1, $\tau_d$ is the marginal dividend tax rate, $D_1$ is the value of any dividends paid in period 1, $E_1$ is the value of any new equity issued in period 1, and $\rho_1$ is the market after-tax return on capital invested in period 1. In

[14] For a concise review of theory, see Zodrow (1991); Sinn (1991).

[15] The two critical measures are the firm's marginal value of cash and marginal cost of equity financing, both unmeasureable. See Becker *et al.* (2013) and Alstadsæter *et al.* (2017), who address this uncertainty by using quintiles of cash holdings and other measures to broadly group firms as more likely or less likely to be characterized by one view versus the other.

[16] Including King (1974), Auerbach (1979), Poterba and Summers (1983), Poterba and Summers (1985), Fazzari, Hubbard, and Petersen (1987), Sinn (1991), Keen and Schiantarelli (1991), Devereux, Keen, and Schiantarelli (1994), (Auerbach and Hassett, 2003, 2006, 2007), Korinek and Stiglitz (2009), Chetty and Saez (2010), Moon (2019), and Ohrn and Seegert (2019).

short, firm value today and tomorrow can be mechanically related by accounting for distributions and equity issuance in between the two valuations.

From Equation 1 I construct a two-period model of firm valuation, where one should conceptualize period 1 as the "short run" and period 2 as the "long run."[17] The firm operates in the short and long run, but then shuts down at the conclusion of the long run, having distributed all its profits as dividends, thus:

$$V_1 = (1 - t_d)D_1 - E_1 + \frac{(1 - \tau_d)\Pi_2 + C_1}{1 + \rho_1} \tag{2}$$

Here, $V_2$ from Equation 1 is decomposed into its constituent parts: accumulated after-tax profits $\Pi_2$ (which are distributed as dividends) and any untaxed return of capital $C_1$.[18]

***Full Model: Incorporating Forecasted Cash Flow***

The model operates on three premises: (1) the firm owner-manager knows forecasted cash flow for the short run;[19] (2) the owner-manager must decide at the start of period 1 whether to sell stock to raise additional cash;[20] and (3) if the firm does not raise sufficient cash to finance any shortfalls in short-term cash flow, the long-term profitability of the firm will be diminished (e.g. the firm must generally reduce expenses, cut operations, or sell assets to cover the shortfall and avoid insolvency).[21] With these premises in mind, we now have the full model:

$$V_1 = (1 - t_d)D_1 - E_1 + \frac{(1 - \tau_d) \cdot \Pi_2(ProjCash_1, X) + C_1}{1 + \rho_1} \tag{3}$$

[17] I use a two-period model for simplicity, but note that if one iterates Equation 1 forward, the value of the firm can be written as a stream of dividend payments through some termination date $T$:

$$V_1 = \sum_{t=1}^{t=T} \frac{(1 - \tau_d)D_t}{1 + \rho_t} + C_{T-1}$$

But this iteration is not necessary to convey the most important conclusions of the model. As a result, the two-period model suffices without loss of generality.

[18] As defined in IRC §316, only distributions from a firm's current or accumulated earnings and profits constitute taxable dividends.

[19] I use the term owner-manager to reflect the assumption that the relevant decision-maker has the same interests as the shareholders. This may not be the case, given agency costs. See Chetty and Saez (2010) for an application of the agency theory in Jensen and Meckling (1976) to dividend taxes, and Alstadsæter *et al.* (2017) for an empirical test of this theory.

[20] Note that for simplicity this model ignores debt financing, but including it does not alter the conclusions for equity issuance. A simple way to incorporate debt is to first subtract $\tilde{i}_1 B_1$ in the short run (where $B_1$ represents the face value of the debt and $i_1$ the effective after-tax interest rate, with $\tilde{i}_1 B_1$ representing specifically any interest payments that must be made in the short run), and second to recognize that the future profit $\Pi_2$ will be decreased by any remaining interest payments to be made in the long run $(i_1 - \tilde{i}_1)B_1$, but may be increased by the additional capital raised through debt issuance. There may be nuanced interactions between debt and equity that could be captured by making debt a function of equity issuance (e.g., capturing that the extra capital raised through equity issuance may make the firm more creditworthy). But while these add some realism and texture, they do not change the core predictions.

[21] For example, firms having difficulty obtaining external financing during the Great Recession often sold assets to raise cash (Campello *et al.*, 2010).

where:

$$ProjCash_1 = \underbrace{Cash_0 + ProjCashFlow_1}_{\text{Pre-Financing Forecast}} + ExtFinance_1 \tag{4}$$

The only difference between Equation 2 and Equation 3 is that an argument of the future profits function $\Pi_2$ is now specified: $ProjCash_1$ is the projected cash available at the end of period 1, while $X$ is a vector of all other unspecified inputs. $ProjCash_1$ is defined in Equation 4 as the sum of cash holdings carried over from the previous period ($Cash_0$), plus the projected internal cash flow in period 1 (which may be positive or negative), plus any external financing in period 1. Finally, the "Pre-Financing Forecast" is the projected cash available at the end of period 1 *in the absence of* any external financing.

Consistent with the third premise above, I make one assumption about the functional form of $\Pi_2$: that $\frac{\partial \Pi_2}{\partial ProjCash_1}$ is high when $ProjCash_1 < 0$.

***Optimization***

The owner-manager desires to maximize $V_1$, the value of the stock in the hands of current shareholders. Will the firm issue new shares? The objective function and first order condition (obtained by differentiating with respect to $E_1$) are:

$$\max_{E_1} V_1 = (1 - t_d)D_1 - E_1 + \frac{(1 - \tau_d) \cdot \Pi_2(E_1) + C_1}{1 + \rho_1} \tag{5}$$

$$\text{FOC:} \quad (1 - \tau_d)\frac{\partial \Pi_2}{\partial E_1} = \rho_1 \tag{6}$$

And because $E_1$ is just the cash value of equity sold, which is added to the firm's cash holdings at the start of the short run, the FOC can be rewritten:

$$\text{FOC:} \quad (1 - \tau_d)\frac{\partial \Pi_2}{\partial Cash_0} = \rho_1 \tag{7}$$

This first order condition is consistent with all traditional models in the literature. In short, the owner-manager will issue stock until the marginal increase in after-tax profits from the extra cash raised is no greater than the market return on capital. The intuition behind this conclusion is straightforward. Assuming elastic demand for the firm's equity in a competitive capital market, investors will always bid up or down the expected return on stock sales so that they receive $\rho_1$ in expectation. Therefore the firm will bear any extra costs on equity financing (like the dividend tax, or financing frictions), but will also capture any extra profits. The firm will thus continue to raise additional cash until the return no longer surpasses the opportunity cost of $\rho_1$.

The result above applies to all firms, but the implications for firms' cost of capital and for the incentives created by a dividend tax cut depend on whether the firm is rich in cash (and thus

unlikely to benefit from equity financing) or short on cash (and thus more likely to benefit).

***Case 1: New View***

Consider firms with sufficient cash (or cash flows) that $\frac{\partial \Pi_2}{\partial Cash_0} \leq \rho_1$. It follows that this firm will not issue equity, which can be shown in two steps by contradiction. First, recognize that no firm will optimize with both $E_1 > 0$ and $D_1 > 0$, as the firm will do strictly better by setting one to 0. Second, assuming then that $D_1 = 0$, we have:

$$(1 - \tau_d)\frac{\partial \Pi_2}{\partial E_1} - \rho_1 < 0 \quad \forall\, E_1 > 0 \tag{8}$$

Thus $E_1^* = 0$ for Cash-Rich firms.

The only decision left is whether to pay out now via $D_1$, or reinvest any $Cash_0$ and pay out later through $\Pi_2$. Assuming a return on investment of $r_1 = \frac{\Pi_2}{Cash_0}$, the hurdle-rate for $r_1$ reflecting the cost of capital is given by:

$$r_1 = \rho_1 \tag{9}$$

That is, the firm will reinvest $Cash_0$ as long as $r_1 > \rho_1$, and will pay out dividends $D_1$ whenever $r_1 < \rho_1$. Thus neither the payout-vs-investment decision nor the cost of capital is distorted by $\tau_d$, and so a dividend tax cut is expected to not change these firms' optimization condition:

$$\frac{\partial r_1}{\partial \tau_d} = 0 \tag{10}$$

***Case 2: Cash-Short Firms, Traditional View***

Now consider firms I refer to as "Cash-Short:" firms with sufficiently low cash (or cash flows) so that $\frac{\partial \Pi_2}{\partial Cash_0} > \rho_1$. The firm will optimally set $D_1 = 0$, since the cash can be used more productively within the firm than outside (where it achieves a return of $\rho_1$).[22] The decision of whether to issue $E_1 > 0$ will depend on whether return on investment exceeds the cost of capital. In this case, the hurdle-rate for $r_1$ (reflecting the cost of capital) is given by:

$$r_1 = \frac{\rho_1}{1 - \tau_d} \tag{11}$$

That is, firms will issue $E_1 > 0$ so long as the return exceeds this hurdle-rate, which corresponds exactly to the first order condition in Equation 5. Unlike the new view firms, however, the cost of capital is thus distorted by $\tau_d$: higher dividend taxes raise the cost of capital and require higher hurdle rates. Thus, a dividend tax cut should reduce the cost of capital for these firms and induce more equity issuance.

[22] Similar to the new view case, assume the alternative, that $E_1 = 0$. Taking the FOC with respect to $D_1$ reveals that the firm will only pay $D_1 > 0$ if $\frac{\partial \Pi_2}{\partial Cash_0} \leq \rho_1$, which is a contradiction.

The predicted effect of the dividend tax cut on real activity plays out through a multi-step channel. First, investors realize the opportunity for higher after-tax cash flows and bid up the market equilibrium share price (a prediction I test below). Second, with the higher share price, firm owner-managers are able to raise additional cash with less share dilution. Thus, the cost of equity capital (and thus the hurdle-rate for expenditures) has fallen.

Using the Pre-Financing Forecast in Equation 4, we can break the Cash-Short group down into two subgroups. The first are firms with Pre-Financing Forecasts $< 0$. These firms will be very likely to satisfy the hurdle-rate in Equation 11, and thus the first order condition in Equation 5, since the pressing short-term cash needs create a high demand for external finance. The second group are firms with Pre-Financing Forecasts $\geq 0$, but that still fit into this traditional view framework due to the high productive value of cash. Although these firms don't have pressing short-term cash needs, some still will issue equity (for instance if their revenue is insufficient to finance desired expansions or other activities).

***A Note on Financing Constraints***

A rich literature exists on financing frictions and constraints, which are relevant here. In the broadest sense, a firm is financially constrained when there is a wedge between the cost of internal and external funds, and this affects the firm's activities (Fazzari, Hubbard, and Petersen, 1987; Kaplan and Zingales, 1997). While even small transaction costs might accomplish this, more substantial frictions exist, particularly in the context equity financing. These include agency costs (Jensen and Meckling, 1976), asymmetric information (Myers and Majluf, 1984), and others.[23]

As shown in the model above and in Fazzari *et al.* (1987), dividend taxes create such a wedge. Cash-Short firms, who would benefit from additional cash, bear the cost of this wedge when seeking equity financing. Thus, the simplest articulation of the relationship between being Cash-Short and financially constrained is that the former is a status that is predictive of the later, an outcome. Therefore, one expects Cash-Short firms to generally be financially constrained as well, as articulated in Prediction 3 below and confirmed later.

Note also that financing frictions beyond dividend taxes can easily be incorporated into the model. One simply replaces $\Pi_2$ with $[\Pi_2 - f_2(E_1)]$, where $-f_2(E_1)$ captures the negative effects of frictions. This approach is analogous to Kaplan and Zingales (1997). However, this addition is functionally superfluous, as the predictions regarding the dividend tax cut do not change.

***Empirical Predictions***

The analysis above yields five testable predictions. The first four can be used to validate the model, while the fifth offers the core prediction of the paper.

**Prediction 1**: Firms with projected short-run cash shortfalls in their Pre-Fincancing

[23] See Hoberg and Maksimovic (2015) for a discussion of the literature.

Forecasts will be very likely to seek external financing (specifically equity financing).

*Prediction 1 is tested in Figure 1 and Figure 2, discussed in more detail in Section 6.*

**Prediction 2**: Some firms with positive Pre-Financing Forecasts, but nevertheless for whom extra cash is particularly valuable, will still seek equity financing.

*Prediction 2 is tested in Figure 4 discussed in more detail in Section 6.*

**Prediction 3**: Firms predicted to seek equity financing under Predictions 1 and 2—i.e., Cash-Short firms—will generally be financially constrained.

*Prediction 3 is tested in Figure 3, discussed in more detail in Section 6.*

**Prediction 4**: Firms predicted to be affected by the dividend tax cut should experience an increase in their share price (compared to the counterfactual state without a tax cut).

*Prediction 4 is tested in Figure 9 and in Section 8.*

And finally, the primary test in the paper:

**Prediction 5**: There will be more equity financing after the dividend tax cut for the Cash-Short firms.

*Prediction 5 is tested in Section 9.*

# 4 Empirical Strategy

The key challenge in this paper is identifying the effect of the tax cut on Cash-Short firms. The tax cut did not apply randomly, and likewise there is no "alternate" set of unaffected Cash-Short firms as a natural comparison group.[24] What is needed is thus a group of firms with parallel trends in equity issuance, but whose issuance incentives were minimally affected by the tax cut.

This requirement may seem paradoxical at first, but in fact most public firms (82%) issue equity every year, in a variety of different forms. Stock sales are just one such form; there are also issuances for the exercise of warrants and options, conversion of securities, incentive compensation,

[24]The reform applied to all C-corporations, so that there is no viable *de jure* comparison group for this study. The comparison group used in Yagan (2015) is S-Corporations, which are passthrough entities whose distributions are not subject to dividend taxation. But this is not a viable control group here because of legal restrictions on ownership. S-corporations can only issue one class of stock, and can have no more than 100 shareholders, who must all be individuals who are U.S. citizens or residents. 26 U.S.C. §1361(b)(1).

and for M&A, among others. A key insight used in this paper is that the dividend tax cut created different issuance incentives depending upon the form of equity issuance. Therefore, by finding a group of "new view" cash-rich firms that issue equity in parallel trends with the Cash-Short firms, but in forms that are minimally incentivized by the tax cut, it is possible to identify the effects of the tax cut on Cash-Short firms.

***Heterogeneous Incentives for Equity Issuance***

In essence, equity issuance is a transfer of one asset (stock) in exchange for another item of value (typically cash, property, or services). While the discussion of the model in Section 3 reflects a simple stock sale for cash, other exchanges are commonplace. The incentives created by the tax cut depend on the items exchanged, as well as the terms of the transaction and the tax rules to which it is subject. In short, the tax cut generally: (1) incentivized sales of stock, warrants, and options, (2) had offsetting effects for M&A, and (3) had more muddled and complex effects for a number forms of issuance less consequential to this investigation.

The form of issuance most directly incentivized by the tax cut is issuance for cash, as shown in the model in Section 3. This category includes not only public offerings, but also private placements, stock sales to other firms, and sales through equity financing facilities. It also includes issuance of stock in lieu of cash.[25] Warrants and options are incentivized similarly to sales: using the model of Black and Scholes (1973), warrant and option prices should increase after the dividend tax cut, permitting the firm to raise additional cash (or compensate additional services) with less dilution.[26] That said, the incentives may be dulled somewhat by certain technical aspects of warrants or options, such as the interplay between the recognition of ordinary income by the investor and the offsetting deduction available to the firm.[27]

[25] Such as compensation for services, either by employees or third parties.

[26] By warrants, I refer to securities sold by the firm (or tacked on to another transaction as a sweetener) that endow the holder with a right to purchase common shares at a pre-defined exercise price before an expiration date. Options are assumed to have similar terms, but are often awarded as executive compensation rather than sold to investors.

Note that warrants/options can be modeled in Equation 3 by replacing $E_1$ with an $E_1'$ that reflects the present value of the expectation of equity to be issued upon exercise of the security. For warrants, the profit function $\Pi_2$ takes as an argument the expected cash raised, which diverges from the market value of the equity issued. For options, the positive effect on $\Pi_2$ is predominantly through labor.

The price of an option can be modeled in a simplified way following Black and Scholes (1973):

$$C = S \cdot N(d_1) - Xe^{-r \cdot t} \cdot N(d_2) \quad \text{where} \quad d_1 = \frac{\ln(S/X) + t \cdot (r + \sigma^2/2)}{\sigma\sqrt{t}} \quad \text{and} \quad d_2 = d_1 - \sigma\sqrt{t}$$

where $C$ is the market value of the call option, $S$ is the price of the underlying security, $X$ is the exercise price, $t$ is the time to expiration, $r$ is the risk-free rate, $\sigma^2$ is the variance of the rate of return on the underlying security, and $N(d_1)$ is the cumulative normal density function evaluated at $d_1$.

The variance of the rate of return on the stock will increase after the dividend tax cut because only distributions from earnings and profits are taxed as dividends. Thus, the distribution is wider in profitable states but unchanged in unprofitable states. Thus the market price of the option rises and enables the firm to sell the warrant for a higher price, raising more capital.

[27] In a state where the warrants are exercised in the money, the firm enjoys an influx of capital equal to the exercise price while the investor recognizes ordinary income on the spread. The firm may also take a deduction for the amount of ordinary income recognized by the investor, which may not be of value if the firm is unprofitable. (Note that the

On the other side of the spectrum, equity issuance for M&A generally experiences offsetting incentives from the tax cut. While "stock-for-stock" acquisitions may take one of several forms, in all cases the Acquiror is effectively issuing its stock to obtain the stock owned by Target shareholders.[28] To the extent the two companies are equally affected by the dividend tax cut, the extra "purchasing power" of the Acquiror shares is perfectly offset by the higher price of the Target shares. The dividend tax cut thus provides no incentive for extra issuance, *ceteris paribus*.[29]

This analysis is of course highly simplified, and there are several effects that vary idiosyncratically with the Acquiror and Target. On the one hand, to the extent the share prices of both firms rise, there will be a mechanical increase in the value of equity issued. On the other hand, this mechanical increase is offset to the extent that likely Acquirors benefit less from the tax cut than potential Targets. I confirm these offsetting phenomena empirically, as discussed in Section 8 and demonstrated in Figure 9. That is, I show that the stock prices of likely Acquirors responded more modestly on average to the dividend tax cut, in accordance with the findings of prior literature (Auerbach and Hassett, 2007; Dhaliwal *et al.*, 2005).[30]

Beyond the forms of issuance dicussed above (i.e., sales, warrants, options, and M&A), there are a number of other forms that experience more muddled and muted effects. These predominantly include conversions of debt and preferred stock securities.[31] However, these forms of issuance constitute only a tiny portion of the equity issuance for Cash-Short and Cash-Rich firms (see Section 8), and are thus of much smaller consequence in this investigation..

tradeoffs are different for qualified options, but these constitute the minority of options.) Thus the warrant represents a trade-off: on the one hand, this is less cash value to the firm upon exercise than if the firm had sold new stock at that time, but on the other hand the firm received some capital sooner.

[28] Typically in statutory mergers, the outstanding shares of the Target are automatically converted into the right to receive shares of the Acquiror at an agreed upon "exchange ratio." In non-merger acquisitions, the Target shareholders typically surrender their shares in exchange for shares of the Acquiror.

[29] The acquisition is intended to increase future profits $\Pi_2$. The dividend tax cut both raises the share price of the Acquiror, which raises $\frac{\partial \Pi_2}{\partial E_1}$, and raises the price of the Target, which lowers $\frac{\partial \Pi_2}{\partial E_1}$, with offsetting effects.

[30] There are also complex effects from a tax-free versus taxable transaction. A stock-for-stock M&A deal may be structured as either a taxable or tax-free transaction, and past research shows that shareholder taxes are quite significant in encouraging or discouraging transactions of certain forms (*see* Ayers, Lefanowicz, and Robinson (2004)). If the Acquiror is likely to issue dividends in the future, tax-free transactions are encouraged by the tax cut. On the other hand, the elimination of the gap between the dividend tax rate and the capital gains rate will discourage taxable stock-for-stock transactions (*see* Ohrn and Seegert (2019)). However, this is only a portion of the totality of stock-for-stock M&A, since one of the most important reasons to use stock as merger consideration is to qualify for tax-free treatment, rendering much of this complexity analysis moot.

[31] For convertible debt, a substantial portion of the value is driven by the debt aspects of the security, which mitigates the effects of the tax cut. For convertible preferred stock, there are likely strong clientele effects that cause the holders less sensitive to dividend taxes. More precisely, corporations are able to take advantage of the dividends-received deduction (which is not available to individuals), making the securities a welcome substitute for debt, and likely pricing most individual investors out of the market (Alderson and Fraser, 1993; Erickson and Maydew, 1998; Dunbar and Veliotis, 2005; Plesko, 2005).

# 5 Data

**Quarterly Data**. I use Compustat North America Fundamentals Quarterly data, which has two features essential in the investigation. First, the data can be linked to quarterly 10-Q and 10-K filings, which offer detailed accounts of firm financing and expenditure activities. This qualitative discussion is necessary to determine the motivations for equity issuance, and thus to establish the comparison groups in the study. Second, the quarterly frequency of the data permits precise tracking of the timing of equity issuance and use of any proceeds. This precision, particularly in the timing of issuance, is important in understanding how firms act exactly while their financial status qualifies them as Cash-Short or Cash-Rich. Annual administrative data, although rich in other respects, lacks these critical features and so is not ideal for this study.

**Sample**. Using the Compustat data, I am able to estimate results over a 26-year range. I begin the investigation at the earliest possible date, 1991:Q3,[32] and stop in 2017:Q2 to avoid any contamination by the 2017 Tax Cuts and Jobs Act. Over this range, there are 13,148 firms and 447,057 firm-quarters included in this range with sufficient data to compute the firms group status and equity issuance response.

**Winsorizing**. Unless otherwise specified, all statistics in the paper are calculated using data winsorized (top- and bottom-coded) at the 2.5% and 97.5% level. Results are strong and highly significant at other levels. That said, because equity issuance is highly concentrated near the tails, both 95% and 99% thresholds produce noiser results. I thus choose the 2.5%/97.5% threshold as a reasonable medium between the two.

**Equity Issuance**. To measure firms' quarterly common equity issuance, I use the preferred measure of Fama and French (2005),[33] which deduces total common equity issuance during a given period from changes in the firms' split-adjusted (SA) share price and shares outstanding:[34]

$$TotEqIssue_q = (Shares_q^{SA} - Shares_{q-1}^{SA}) \times \frac{1}{2}(Price_q^{SA} + Price_{q-1}^{SA}) \tag{12}$$

To make the equity issuance measure comparable across firms of different sizes, I scale issuance by the average of the firm's previous two years' annual sales (where lagged annual sales are bottom-

[32] Quarterly cash flow data is only appreciably available beginning in 1988. The forecast model requires three years of lags, and thus 1991 is the earliest year I can investigate.

[33] Other measures include a book value computation of issuance (change in stockholder equity net of change in retained earnings) and an approximation of issuance from reported stock sale proceeds. The former undercounts mergers and employee stock issuances, while the latter ignores M&A altogether, and thus are not viable measures for this study.

[34] All share and price data are split-adjusted. To avoid contamination from net repurchases (which will bias results upward), I bottom-code the measure at 0.

coded at \$100k):[35]

$$ScaledEqIssue_q = \frac{EqIssue_q}{\frac{1}{2} \times \sum_{t=q-8}^{t=q-1} Sales_t} \tag{13}$$

Sales is the best scaling factor for this investigation because it is the least endogenous to equity issuance. Compare to lagged assets: a firm that raises cash from equity financing will have more assets, which will bias down the effect in future quarters. However, as shown below in the robustness discussion, scaling by lagged assets gives similar results.

# 6 Empirically Identifying Cash-Short Firms

Predictions 1 and 2 in Section 3 identify two groups of firms likely to be affected by the dividend tax cut and thus prompted to issue more equity: (1) firms facing short-run cash flow shortfalls, and (2) firms with adequate cash for the short run but for whom extra cash is nevertheless particularly valuable. These two sets of firms together make up the group of Cash-Short firms. The goal of this section is to implement the model, first empirically validating it (testing Predictions 1 and 2) and then identifying these Cash-Short firms.

***Forecasted Cash-Flow Shortfalls: Evidence from Quarterly Filings***

To identify the first group of Cash-Short firms, I ask: How do firms think about short-run versus long-run cash flows in practice? To answer this question, I sample 100 random quarterly filings (10-Qs and 10-Ks) of firms in my final dataset, and intensively read the Management Discussion & Analysis section. Specifically, I look for explicit statements of a firm's outlook for cash needs, usually in the "Liquidity and Capital Resources" section.

My key findings align remarkably well with the cash-flow framework I construct in the model in Section 3, and also offer clear practical measures to implement it empirically. First, a one-year-ahead timeframe appears to correspond nicely to the "short run" concept in the model. I find that among firms offering an explicit horizon for their forecasted cash needs, the vast majority (86%) use a one-year-ahead forecast. Second, the concept of the "Pre-Financing Forecast" in the model (Equation 4) appears to realistically reflect how management weighs external financing in practice. I find that when firms forecast their cash needs, the vast majority cite a combination of cash holdings and forecasted operating cash flows to determine whether or not they will need to obtain external financing.[36] Most indicative of all, I find that 100% of the firms that conclude

[35] Bottom-coding is necessary because a nontrivial portion of firms have negative sales. Results are robust to wide ranges of bottom-coding, but magnitudes do fall as the threshold rises. Again, this result is not concerning, as it fits exactly with the detailed analysis in Section 9 finding that firms with lower sales tended to respond more vigorously to the tax cut.

[36] Specifically, 70% explicitly cite current cash holdings, 86% cite forecasted operating cash flow, and 73% specifically cite the availability (or lack thereof) of external financing to cover any shortfalls. 91% cite a combination of these three. Only 27% explicitly cite another factor when making a projection about future cash needs.

their cash holdings are insufficient for the year ahead are also explicit they are seeking external financing.

A few representative examples demonstrate how accurately the Pre-Financing Forecast reflects the stated decision-making metrics on external financing:

> **Example 1**: Pre-Financing Forecast $\geq 0 \implies$ no external financing
>
> "We believe that our cash flow from operations and our cash and cash equivalents are sufficient to fund our . . . requirements for at least the next 12 months."
>
> — *Guidance Software, Inc., March 2015 10-Q*

> **Example 2**: Pre-Financing Forecast $< 0 \implies$ external financing
>
> "Current cash reserves and net cash flow from operations expected during the near future are inadequate when measured against present and anticipated future needs. . . . [M]anagement is currently negotiating with several financing sources . . . ."
>
> — *Magnitude Information Systems, 2005 10-K*

***Implementing the Model Empirically***

Guided by the observations from the sample of quarterly filings above, I implement the model as:

$$\widehat{Pre\text{-}Financing}\ Forecast_q = \widehat{Cash}_{q-1} + \widehat{OperatingCashFlowForecast}_q \tag{14}$$

where the hats indicate estimated parameters, $q$ are quarters, $\widehat{Cash}_{q-1}$ is the firm's cash & cash equivalents as reported at the end of the prior quarter, and $\widehat{OperatingCashFlowForecast}_q$ is the four-quarter-ahead operating cash flow forecast.

To generate the four-quarter-ahead operating cash-flow forecast, I use cross-sectional regression techniques from Lorek (2014) and Francis and Eason (2012).[37] The model uses lagged operating cash flow and balance sheet accrual items as predictors, a technique that both studies find outperforms other regression models. In short, the forecasting method I adopt as the baseline for the rest of the paper has a 13% median forecast error and 96% correlation with actual year-ahead operating cash flows. Most importantly, however, the results of the paper are not sensitive to the choice of forecast method: they hold even with naive forecasts. Appendix B offers a thorough discussion of the forecasting methodology.

***Testing Prediction 1***

I test Prediction 1 on pre-reform data to validate the model. Prediction 1 is of particular importance because it speaks to the accuracy of the Pre-Financing Forecast measure: that firms with

[37] Another approach I attempted was to use I/B/E/S analyst forecasts. However, it was not feasible because there were no forecasts available for many small firms, which are an integral part of the Cash-Short group.

Pre-Financing Forecasts $< 0$ should have more external financing (particularly equity issuance) than firms with Pre-Financing Forecasts $\geq 0$. Figure 1 and Figure 2 depict a test of Prediction 1, suggesting its accuracy: there is a very large break exactly around 0, as predicted.

***Other Cash-Short Firms, Testing Prediction 2***

The second group of Cash-Short firms, described in Prediction 2, is more difficult to identify precisely. These are firms that, despite having ample cash so that the Pre-Financing Forecast $\geq 0$, still satisfy the first-order condition in Equation 5 and thus still sell stock for cash. It turns out, however, that this is the case for many firms with positive Pre-Financing Forecasts.

To identify these firms, I review the quarterly filings of 100 random firms with positive Pre-Financing Forecasts that issued large amounts of equity prior to the reform in 2003.[38] Of these 100 large issuances, 40 were stock sales for cash.[39] The majority of these are firms with low operating revenue that rely heavily on external financing, but just happened to have a relatively high cash balance at the time of the issuance.[40] As a result, I find that a simple metric identifies these firms with decent accuracy: low lagged sales revenue.

Figure 4 plots these 100 random large equity issuances by lagged sales and log Pre-Financing Forecast. Simply isolating the bottom 20% of firms by lagged sales (i.e. the average of the previous two years of sales revenue) captures the majority of stock sales for cash with minimal contamination from less-incentivized forms of issuance. And to the extent there are other types of equity issuances captured, they're types that tend to be more aligned with the incentives of the model, as discussed in Section 4. For the 48 firms falling below this threshold, 82% of the equity issued (by scaled value) reflects equity-for-cash or transactions with similar incentives including warrant or option exercises (62% stock for cash, 20% warrants and options). Another 11% reflects equity-for-cash transactions mixed with some M&A (e.g., an offering followed by a cash acquisition that uses part of the proceeds). Only 8% of the total issuance reflects conversions or straight M&A.

While there's no doubt that future researchers will be able to develop more precise methods of isolating firms issuing stock for reasons that are incentivized by the tax cut, perfection shouldn't be the enemy of the good in this case. Imprecision in my grouping will generally attenuate my results, not bias them upwards. Most importantly, the results are remarkably robust to even large changes in the delineation of comparison groups. See Figure 16 and Section 9.

[38] It's important to use a pre-reform sample to avoid contamination from the effects of the tax cut. A "large equity issuance" is an issuance in a single quarter (using the definition in Section 5) for which the dollar value is greater than 50% of the average of the firms average annual sales for the prior 2 years.

[39] Public offerings, follow-on offerings, and private placements for the most part.

[40] It is often the case that the firm relies on external financing, and thus accumulates cash in spurts. Some firms will have substantial cash on their books, but still issue equity to raise more if the market conditions are right, knowing that they will need the cash in the future. This group aligns with the market timing hypothesis of equity issuance. See Baker and Wurgler (2002).

***Financing Constraints, Prediction 3***

Figure 3 depicts a test of Prediction 3, suggesting its accuracy as well. The Y-axis here reflects the "equity financing constraint" score from Hoberg and Maksimovic (2015), which the authors calculated using text analysis of 10-Ks to determine whether firms appeared likely to delay investments on account of inability to obtain equity financing. As well, I estimate that Cash-Short firms are significantly more constrained in the pre-reform period (+0.09 ±.03 standard deviations) than other firms, after controlling for firm and industry-by-quarter fixed effects. The results clearly suggest that the Cash-Short group is quite constrained relative to other firms, as predicted.

***Empirical Definition of the Cash-Short Group***

Following the above methodology, the Cash-Short group is thus comprised of two sub-groups: (1) firms with Pre-Financing Forecasts less than zero and (2) firms that fall in the bottom 20% of all firm-quarters in terms of average sales over the previous two years. Note that this definition describes a "state" of a firm that is not stable over time—a firm can move into and out of the Cash-Short group in any given quarter. This is intentional, as the equity issuance response is a reaction to a financial state, not an underlying quality inherent in the firm.

# 7 Identifying Cash-Rich Firms

With the Cash-Short group defined above, the next step is to define a comparison group. Note that it will not suffice to simply compare the Cash-Short group to all other firms—the Cash-Short group issues large amounts of equity in a pro-cyclical pattern, while most firms don't. The ideal is thus to find a group of firms with parallel trends in equity issuance, but that are not affected by the dividend tax cut.

It turns out that a simple metric accomplishes this task. Figure 6 presents a heatmap of equity issuance by lagged sales (Y-axis) and forecasted cash flow divided by lagged operating expenses (X-axis). There is a clear U-shaped pattern to the equity issuance. Firms with low cash flows and low sales (the left and bottom of the U) roughly correspond to the Cash-Short firms. The upper right is a new group: firms with high cash flows relative to their expenses as well as high sales revenue. These firms are the farthest from the group of predicted equity issuers, but yet still issue a large amount of equity.

Figure 7 rearranges the 100 firms sampled from Figure 4 so that the axes map to the heatmap in Figure 5. The upper right group is clearly issuing equity predominantly for M&A. Using this method, I thus define the baseline group of "Cash-Rich" firms as firms that fall in the top right-hand corner of Figure 5 (and thus as outlined by the green box in Figure 6). More precisely, these firms score both in the top 25% of all firm-quarters in terms of forecasted operating cash flow scaled by lagged operating expenses and in the top 60% of all firms by lagged sales revenue. Most importantly, as shown in Section 9, the results are highly robust to changes in this demarcation.

***A Note on Trends in M&A***

An important concern with this Cash-Rich group is that its equity issuance may be sensitive to trends in M&A, which could confound my results (for instance, if M&A activity declined remarkably after 2003). But this does not appear to be the case. M&A activity is highly pro-cyclical, and since the early 1980s has been highly correlated with market performance. There was no fall in deal volume or total value after 2003 that would appear to bias my estimates upward. (See Figure 8). To the contrary, the mid-2000s is considered to constitute a merger wave, and after a downturn during the Great Recession M&A activity was strong once again in the 2010s. Moreover, there were no contemporaneous legal developments that substantively discouraged stock-for-stock M&A. If anything, the dividend tax cut would encourage stock-for-stock M&A, as found by Ayers, Lefanowicz, and Robinson (2004).

# 8 Validating and Describing the Groups

***Validation of the Groups***

The above analysis predicts that Cash-Short firms are issuing equity to raise cash, while Cash-Rich firms are issuing equity predominantly for M&A. I review 100 random pre-reform filings of high-equity issuers within each group to validate this prediction.[41] Among Cash-Short firms, 81% of the scaled equity issued is for cash, options, or warrants, while only 8% is for M&A. For Cash-Rich firms, 88% is for M&A while only 6% is for cash, options, or warrants.

Another important check relates to share prices. A central premise in the model for Cash-Short firms is that share prices will rise to reflect the higher after-tax cash flow to shareholders, as stated in Prediction 4. Similarly, and as discussed in Section 7, for Cash-Rich firms to be a good comparison group, they should see more modest price increases than other firms.

I test these premises by following the event study approach of Auerbach and Hassett (2007). I estimate abnormal returns of Cash-Short and Cash-Rich firms during narrow windows around important news events leading up to the passage of the dividend tax cut. The results in Table 1 exactly reflect the premises above: Cash-Short firms enjoyed a high abnormal return while Cash-Rich firms suffered a slightly lower (but still positive) return. Figure 9 depicts a heatmap of returns over these windows after controlling for market trends and industry fixed effects, revealing how well the price movements correlate with the premises of my approach. See Appendix C for a thorough discussion of the abnormal return analysis.

Ultimately, the pre-trends of equity issuance by Cash-Rich firm closely parallel Cash-Short firms. Figure 10 presents the raw trends without any controls, but after weighting to adjust for composition changes as discussed below. The noise is substantially absorbed by firm and industry-

[41] By high-equity, I look only at issuances with value at least 10% of the firm's annual sales and at least $200,000. This captures the vast majority of issuance activity (99% of Cash-Short scaled issuance, and 82% of Cash-Rich scaled issuance).

by-quarter controls, as discussed in Section 9 and seen in Figure 12, where in 43 of the 48 quarters leading up the tax cut equity issuance between the two groups was within a margin of error.

***Description of the Groups***

Table 2 and Table 3 present descriptive statistics by group for the pre-reform and post-reform periods, respectively. When viewing these statistics it is important to remember that the groups are not static over time, and that firms may move into and out of each group depending on their current financial condition.

Across the 26-year period, 55% of firms at some point in their lives are Cash-Short, while 28% are Cash-Rich at some point. Only 6% are in both groups at some point. By definition, the groups are strikingly different: the Cash-Short groups are smaller ( median $6.7m annual sales, $11.6m total assets in the pre-reform period) and unprofitable (-16% profit margin), while the Cash-Rich firms are very large (median $458m annual sales, $640m total assets) and very profitable (23% profit margin). Cash-Short firms also tend to have very low tangible assets. They have much higher average growth, equity issuance, operating expenditures, and R&D, but these are driven by the upper end of the distribution. In contrast, Cash-Short firms tend to have lower capital expenditures.

Despite these substantial differences, the industry composition of the groups is not strikingly different, as shown in Table 4. There is only one exception: a substantial portion of the Cash-Short group is comprised of pharmaceutical companies, particularly post-reform. Given pharmaceutical firms rely heavily on equity finance, as a robustness check I exclude the industry to ensure my results hold without these firms.

Equity issuance by Cash-Short firms is very concentrated near the top of the distribution. Moerover, the vast majority is issued by repeat issuers: 84% of the total dollar value of pre-reform equity issuance by Cash-Short firms was issued by firms making at least five large issuances (each greater than 10% of sales).

***Weighting to Address Composition Changes***

An important observation is that the composition of the groups changes over time, seen by comparing Table 2 and Table 3: Cash-Short firms are getting smaller and less profitable on average, while Cash-Rich firms are getting larger and more profitable. This composition change, assuming that it is not driven by the dividend tax cut, can bias the results if not addressed.

To mitigate any effects from these trends, I create nonparametric weights to ensure that the distribution of firms post-reform remains similar to the pre-reform distribution. I construct a "grid" of 600 bins into which all firm-quarter observations are sorted: 30 industry "columns" by 20 "rows" for every 5th percentile of lagged sales revenue. I reweight all post-reform observations by year so that the weight across the 600 bins replicates the distribution of firms across this grid in the two years immediately prior to the tax cut. Thus, the effects of the weighted regression will not

simply be the result of sales revenue widening between the groups. Note that such weighting is a conservative approach, because the dividend tax could very well have composition effects on Cash-Short firms by enabling them to finance increasingly unprofitable situations.

# 9 Effects on Equity Issuance

***DD Empirical Test***

To test the effect of the tax cut on equity issuance, I run the following DD regression:

$$E_{fq} = \alpha + \sum_{\mathcal{T}=-11}^{\mathcal{T}=14} \beta_{\mathcal{T}} Short_{fq} \times \mathbb{1}\{year = \mathcal{T}\} + \theta Constrained_{fq} + \delta_f + \gamma_{nq} + \varepsilon_{fq} \tag{15}$$

In short, this regression produces annual estimates for the percentage of extra quarterly equity issuance by Cash-Short firms. Years before and after the reform are given by $year$. $E_{fq}$ is $ScaledEqIssue_{fq}$ defined in Section 5, re-scaled within each group by its pre-reform group mean. $Short_{fq}$ is a dummy for Cash-Short, which is interacted with year dummies that reflect years before or after the tax cut. The regression includes firm fixed effects ($\delta_f$) and industry-by-quarter fixed effects ($\gamma_{nq}$), using Fama French 30 industry groups. So $\beta_{\mathcal{T}}$ can be interpreted as the average percent extra quarterly equity issuance by Cash-Short firms in year $\mathcal{T}$, relative to the group's pre-reform mean.

***Main Results***

Figure 11 presents the main results from Equation 15. For the 12 years leading up to the dividend tax cut, the Cash-Short and Cash-Rich firms exhibit extremely similar patterns in quarterly common equity issuance. Immediately after the tax cut, the Cash-Short firms nearly triple their equity issuance (+198% ± 41%) compared to the Cash-Rich group relative to their pre-reform mean. Since equity issuance was much higher after the reform generally, this translates to a doubling of the equity issuance by Cash-Short firms on average of what the issuance would have been otherwise that year (+107% ± 22%). The effect is largely persistent through 2017 with only minimal deviations, 14 years after the tax cut.

Figure 12 depicts the same test, but with quarterly rather than year dummies. The most striking result is the stability of the pre-trends combined with the sudden and permanent break in the very first quarter after the enactment of the tax cut. For 43 of the 48 quarters leading up to the tax cut the estimate is within the error bad. In contrast, beginning with the very first quarter after the reform, 46 of the 56 quarters have point estimates significantly different from zero.

To estimate the average effect of the tax cut across the entire post-reform period, I run a standard DD regression:

$$E_{fq} = \alpha + \beta Post_q \times Short_{fq} + \theta Short_{fq} + \delta_f + \gamma_{nq} + \varepsilon_{fq} \tag{16}$$

Where $Post_q$ is a dummy for the post-reform period, and $\beta$ gives the average percent extra quarterly equity issuance by Cash-Short firms after the reform. With this approach, I estimate that the tax cut prompted Cash-Short firms to issue, on average, +136% (±25%) more equity each quarter relative to the pre-reform mean. This translates to an increase of 48% (± 9%) over what equity issuance would have been without the tax cut. Regression results are reported in Table 5.

Estimating the aggregate effect is somewhat challenging because of the heavy concentration of equity issuance by high issuers with low sales (see decomposition analysis below). Using the estimates above yields a total extra equity issuance of $87bn (± $16bn) over the post-reform period.[42] But this estimate may be high, since it assumes a homogeneous average affect across firms of different sizes. To address this issue, I break down the Cash-Short group into 22 subgroups by sales revenue, estimating the effect in separate regressions for each.[43] I then sum the statistically significant estimates in a "Riemann sum" approach to estimating the total issuance. This yields a more conservative estimate of $52bn.[44]

***Robustness***

The results above are robust to numerous checks, presented in Table 5 and Table 6. First, they are robust to the inclusion of numerous firm-level controls, including quadratic terms of lagged sales growth, profitability, sales-to-assets ratio, and book leverage (Figure 13, column 2 in Table 5).[45] Second, a balanced panel specification produces nearly identical results (Figure 14).[46] Third, I scale equity issuance by lagged assets rather than sales.(Figure 15).[47] Fourth, the results are largely unchanged by the exclusion of pharmaceuticals, which represent a tremendous 38% of Cash-Short post-reform equity issuance. Fifth, the results are robust to different winsorization thresholds. As well, the results are extremely robust to changes in the demarcations of the Cash-Short and Cash-Rich groups: even when expanding or narrowing the groups by 50% or more, the findings are still clearly apparent (Figure 16 and Table 6). In short, these checks confirm that the results are not an anomaly, but rather reflect a strong and pervasive phenomenon.

***Decomposing the Effects***

Certain Cash-Short firms responded more vigorously than others. To add texture, I decompose

[42] A 48% increase post-reform suggests that $87bn of the $268bn total post-reform equity issuance by Cash-Short firms is extra, prompted by the tax cut.

[43] The 22 regressions include 11 each for firms with positive and negative Pre-Financing Forecasts: one for the firms with bottom-coded sales, and the remaining 10 for the deciles above the bottom-coding.

[44] The estimate is not particularly sensitive to the number of subgroups. Using quintiles rather than deciles (i.e., 12 groups rather than 22), yields an aggregate estimate of $59bn.

[45] See the notes on Figure 13 for details on these variables. I do not include these controls in the main specification because of the 26-year timeframe, which spans multiple business cycles. Also note that inclusion of certain controls highly correlated with (or even collinear with) the definitions of Cash-Short and Cash-Rich (such as lagged sales or lagged total assets) predictably begins to muddle the results.

[46] Note that for a balanced panel, the window must be narrowed significantly due to attrition.

[47] As explained in Section 5, assets are endogenous to equity issuance, biasing the estimates down. This is because equity financing raises cash, which raises assets, which dilutes subsequent equity issuances.

the Cash-Short group into quartiles of various measures, and then re-run the main regression in Equation 16 focusing on one subgroup at a time. In all cases I focus exclusively on the six-year window 2000:Q3-2006:Q2 to mitigate any potential confounding trends across subgroups.[48]

The largest responses are among firms with low sales (Figure 17), low tangible assets (Figure 18), and that are unprofitable (Figure 19). The weakened effects among firms with higher sales is also seen in sales-weighted regressions, where the results get stronger as Cash-Short firms with higher sales are excluded (see Table 7). There are less clear trends for total assets and book leverage. I also find that the response is overwhelmingly concentrated along the intensive margin: the top quartile of recent equity issuers represents 88% of the total equity issuance by all Cash-Short firms in the three-year period after the tax cut (Figure 20). While there appear to be extensive margin effects as well (the share of Cash-Short firms issuing equity in any given year increased from 73% pre-reform to 84% post-reform, after controlling for composition changes), these are not driving the results.

Industry decompositions are presented in Figure 22, where I run separate DD regressions within each industry.[49] Results suggest fairly widespread effects across a number of industries, including both health and "tech" industries (pharmaceuticals, computers, medical equipment) as well as a number of "non-tech" industries (business services, entertainment, oil & gas, machinery).

The one standout is pharmaceuticals, which have an outsize representation among Cash-Short firms: not only is the estimated response powerful (+170% ± 36%), but pharmaceutical companies constitute 23% of Cash-Short firms in the post-reform period and represent 38% of the total post-reform equity issued by all Cash-Short firms. In many ways these facts make perfect sense, as pharmaceuticals are the quintessential industry to react to the tax cut: they have high expenditures, low sales, low assets, and rely on equity financing until a drug becomes marketable. To ensure that the main findings are not driven by the pharmaceutical industry, I re-run the main regression excluding pharmaceutical firms. The results are quite robust to this concern (see Table 5). This also assuages potential concerns of confounding effects from the passage of the Medicare Prescription Drug, Improvement, and Modernization Act of 2003, which subsidized pharmaceutical companies through new regulations and Medicare Part D.[50]

[48] Ideally, I split the sample into quartiles using the same thresholds across Cash-Short and Cash-Rich firms, then run the main regression within each quartile. This is possible for some measures that are scaled, including lagged equity issuance, sales growth, and book leverage. But for other variables it is not possible, as the two groups do not overlap, by definition. These include lagged sales, tangible assets, total assets, and profit margin. For these variables I instead isolate the Cash-Short group one quartile at a time, running it against the full Cash-Rich group.

[49] To avoid small-sample effects, I exclude any industry that has fewer than 20 firms in either group (Cash-Short and Cash-Rich) in either the pre- or post-reform window. Note that each firm has multiple observations, and I use firm fixed effects with standard errors clustered at the firm level.

[50] The Medicare Prescription Drug, Improvement, and Modernization Act was enacted in December 2003, providing a subsidy to the pharmaceutical industry notably by preventing the government from negotiating drug prices and encouraging private insurance plans to cover prescription drugs. Medicare Part D (which subsidizes purchases of prescription drugs for seniors on Medicare) was also created in this legislation, coming into force in 2006. While the industry-by-quarter fixed effects that I use in every regression should substantially control for the effects of this law, the fact that the complete removal of the pharmaceutical industry from the analysis does not substantively affect the results is perhaps the most reassuring robustness test.

## 10 Effects on Expenditure & Investment

How did the Cash-Short firms use the cash raised by extra equity financing? Evidence from two approaches makes it clear that extra cash was spent almost entirely on operating expenditures, particularly general administrative and selling expenses and R&D, and not on capital investment. The first approach is to use DD plots for expenditures, analogous to the equity plots, to show how these expenditures follow equity issuance patterns. Second, I use 2SLS to estimate the approximate allocation of extra cash by expenditure category.

***Background on Cash Flow Accounting***

The premise of this section is that the extra cash inflow from equity financing must go somewhere: either spent or held as cash & cash equivalents. The cash flow statement breaks down the aggregate inflow and outflow over a given period (quarterly in this case) into three major categories: operating cash flow, investment cash flow, and financing cash flow.[51] These three categories, which may each be positive or negative, sum to equal the change in the firm's cash holdings.[52] The equation must balance: extra inflow results in extra cash holdings, extra outflow draws down cash holdings. I use these relationships to identify extra expenditures financed by the extra equity issuance.

***Results***

I begin by creating DD plots for key areas of expenditure to determine how well they track the equity financing response. I use Equation 16, but with scaled expenditures as the dependent variable, rather than equity issuance.

The results for capital expenditure (scaled by tangible assets) are presented in Figure 23. Although there is a small bump in the 2000s, this extra investment is tiny relative to the amount of capital raised through equity issuance. As well, evidence from the public finance literature suggests this bump may be best attributable to unrelated but contemporaneous investment tax incentives targeting small businesses (Zwick and Mahon, 2017).[53] Thus, the main takeaway is that the equity financing does not appear to be directed toward capital investment.

In stark contrast, the results for operating expenditures in Figure 24 are much larger and reflect both the pattern and magnitudes seen in the equity issuance estimates.[54] The right panel shows the net operating cash-flow, which almost exactly mirrors operating expenses. This juxtaposition reveals that the extra expenditures were not financed by profits, but by other sources, in an amount

[51] Operating cash flow generally includes operating revenues (e.g. sales revenue), net of expenses like salaries, rents, production costs, and R&D. Investment cash flow generally includes income from sales of tangible assets or securities net the firm's investments in capital expenditures, securities, or acquisitions. Financing cash flow generally includes proceeds from sales of equity or debt net of repurchases and payouts to investors.

[52] There are of course other adjustments, such as for exchange rates in the case of multinational businesses.

[53] Also in the JGTRRA were various investment incentives inlcuding increased small business deductions for tangible property investment and bonus depreciation. Zwick and Mahon investigated the responses to these incentives and found that small businesses exhibited a 95% larger response than larger businesses.

[54] Note that the operating expenditure variable is from the income statement. Data on specific cash outflows is not available for operating cash flows.

very similar to the estimated equity issuance and following a similar pattern.

I next conduct 2SLS analysis to better estimate the allocation of extra equity financing across expenditure categories. Figure 26 presents these approximations, adding texture to the DD plots. To estimate these effects, I run the following 2SLS regressions:

$$
\begin{aligned}
E_{fq}^{year \in Y^h} &= \alpha + \phi Post_q^h \times Constrained_{fq} + \theta Constrained_{fq} + \delta_f + \gamma_{nq} + \varepsilon_{fq} \\
Z_{fq}^{year \in Y^h} &= \alpha + \beta \widehat{E}_{fq}^{year \in Y^h} + \theta Constrained_{fq} + \delta_f + \gamma_{nq} + \varepsilon_{fq} \qquad (17) \\
\text{where } Y^h &= \{-11, -10, \ldots, -1, 0, h\}, \text{ where } h \in H = \{1, 2, ..., 14\}
\end{aligned}
$$

In short, for every expenditure variable the 2SLS is run 14 times, where each iteration treats a single post-reform year as the "post" period to estimate the relationship between extra financing and expenditure in that year (i.e., years $h = 1, 2, ..., 14$). $Z_{fq}$ is the the expenditure variable, scaled by the within-group pre-reform mean (analogously to the equity variable $E_{fq}$). The coefficient $\beta$ thus gives the percent extra expenditure in that category for every percentage point increase in equity financing estimated in the first stage. From these estimates, it is possible to calculate the share of the equity financing in that year devoted to each category of expenditure.[55]

The results in Figure 26 show that the vast majority of the extra cash is estimated to be spent on operations. Compustat breaks down this category further into cost of goods sold, general selling & admin expenses, and R&D.[56] A combination of R&D and other selling & admin expenses constitute the bulk of the operating expenditures, although costs of goods sold are substantial as well. Very little is estimated to be spent on investment in any given year, even during the 2000s. Table 8 includes estimates for the full post-reform period, rather than year-by-year, and tell the same story. Across the full period, the estimated effect on capital expenditures is essentially zero, exactly in accordance with the results of Yagan (2015).

One important detail is that the majority of the R&D expenditure is driven by the pharmaceutical industry, as seen in Figure 25. However, other results are substantively the same when excluding pharmaceutical firms.

A final interesting result is seen in net debt reduction in Table 8. Cash-Short firms increased their debt after the reform rather than reducing it, suggesting that these firms took advantage of the improved balance sheet to issue additional debt. A thorough investigation on capital structure is beyond the scope of this investigation, but the result nevertheless presents a relationship between debt and equity financing among Cash-Short firms that warrants more attention.

[55] I assume that cash is fungible, so that the equity financing is split proportionally across the extra expenditures. If the estimate for a category is negative in a particular year, I exclude it.

[56] Costs of goods sold include costs incurred in production, such as materials, overhead and labor. Selling & admin expenses include advertising and marketing, commissions, pensions, rents, and other general expenses in the regular course of business. R&D is generally a sub-component of selling and admin, but is netted out for purposes here. Unfortunately many specific types of expenses, such as wages, will be split between these categories, and cannot be disentangled.

## 11 Economic Implications

***Elasticity of Response***

Based on the results above, I estimate an elasticity of equity financing to dividend net-of-tax rate for Cash-Short firms between 0.6 and 1.2. In other words, a 20% dividend tax cut should prompt Cash-Short firms to raise between 12% to 24% extra equity financing. To calculate this result, I follow Yagan (2015), using the OECD measure of average combined top statutory dividend tax rates, which fell from 42.27% to 19.65% after the tax cut.[57]

This estimate appears reasonable. Although I am not aware of any directly comparable estimates in literature, expenditure estimates offer a helpful comparison. For example, based on longstanding estimates of investment elasticities in literature, Yagan (2015) indicates that theory would predict an elasticity of investment to the net-of-tax rate of 0.21 to 0.42. I likewise calculate an estimate for operating expenditures, arriving at an elasticity between 0.22 to 0.40.

I also estimate the elasticity of equity financing with respect to the cost of capital. Following literature back to Poterba and Summers (1983), the corporate cost of equity capital can be written:

$$Cost\ of\ Capital\ = \frac{\rho}{(1-\tau_{corp})\left[\phi(1-\tau_{div})+(1-\phi)(1-\tau_{cap})\right]}$$

The three tax rates are the corporate income tax rate, the dividend tax rate, and the long-term capital gains tax rate, respectively, and $\phi$ reflects the share of future profits paid out as dividends.[58] Parameterizing the model following Yagan (2015) and Desai and Goolsbee (2004), I estimate an elasticity for equity financing to cost-of-capital between -1.4 to -2.8.[59] This time, a reasonableness check can be done using R&D expenditure to cost-of-capital elasticities, on which there is a vast literature. I estimate an R&D to cost-of-capital elasticity between -1.0 to -1.9 for Cash-Short firms, squarely within the range of past findings. (Wilson, 2009; Agrawal, Rosell, and Simcoe, 2014; Hall, 1993; Hines Jr, Hubbard, and Slemrod, 1993; Bloom, Griffith, and Van Reenen, 2002; Ladinska, Non, Straathof *et al.*, 2015).

Note that these elasticity estimates are embedded with influential choices and assumptions. First note that these estimates are specifically for Cash-Short firms, and will become higher or lower as the group is narrowed or expanded. Second, the cost-of-capital parameterization assumes that investors are sensitive to payout tax rates. Tax-exempt institutional investors and foreign investors are non-trivial stockholders in US public firms (Blouin, Bushee, and Sikes, 2017). That said, the Cash-Short firms are predominantly small firms, and most equity sales are private placements to investors rather than public offerings. But if one assumes that only 50% of investors

[57] Note that the overwhelming majority of dividend income is received by top-bracket taxpayers.

[58] Note that this is analogous to Equation 11, but includes additional parameters to provide a more accurate estimate.

[59] This assumes a corporate income tax rate of 35%, a dividend tax rate reduction from 42.27% to 19.65%, a capital gains rate reduction from 24.65% to 19.65%, and a payout ratio of 0.5, where $\rho$ is assumed to be the contemporaneous 1-year treasury rate of 1.01%.

are sensitive to payout taxes, the above elasticity estimates roughly double. A third decision is about the payout ratio $\phi$; while an even split between dividends and capital gains appears safe, the choice significantly impacts the elasticity range. Taking all of these points into consideration, an extremely conservative range might be between -0.7 to -5.0.

***Extensions to Private Firms***

An important question that this paper cannot answer is whether these results apply to private firms? Public capital markets offer an efficient way for firms to access a deep and broad reservoir of equity financing, and it's unclear whether the results may be extended. The best evidence comes from Alstadsæter *et al.* (2017), who evaluate responses of unlisted firms to a dividend tax change in Sweden, and find that there is a strong response by low-cash firms. As well, most of the stock sales are in the form of private placements, warrants, and options, which do not make use of public markets. These observations, together with my estimated elasticities above, suggest that the response may well have been quite strong for unlisted firms as well.

## 12 Conclusion

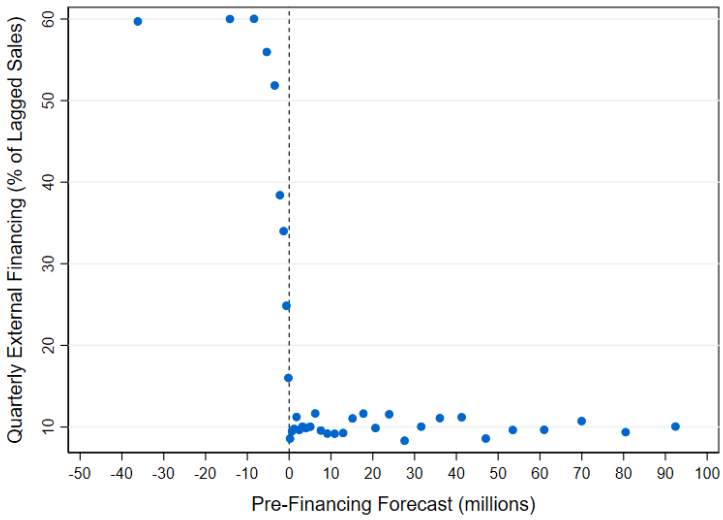
Ever since the seminal work of Modigliani and Miller (1958), research on the real effects of dividend taxation has focused overwhelmingly on capital investment responses. I show in this paper that this focus has likely overlooked substantial real effects in other outcomes. Not only does this finding suggest that prior investigations have underestimated the breadth of the real effects of dividend taxes, but it also helps reconcile competing findings in empirical literature.

I estimate the effects of the 2003 dividend tax cut on the financing and expenditures of US public firms, taking a different approach than prior empirical work in this area. Rather than estimating real outcomes directly, I first focus on identifying the equity financing response, as this is the predicted pathway in traditional models of dividend taxation. I accomplish this with a quasi-experimental DD design, exploiting variation across firms in equity financing incentives created by the dividend tax cut. I then use 2SLS to estimate the use of these proceeds.

My findings suggest that the effects of the dividend tax cut were large, immediate, and lasting. I estimate that Cash-Short firms (generally unprofitable or low-sales firms facing cash shortages, encompassing roughly 47% of public firms since 2003) increased quarterly equity financing on average by 48% ($\pm$9%), raising roughly \$50-\$90bn in extra cash since 2003. I estimate an elasticity to the net-of-tax rate between 0.6 and 1.2, which is large but economically reasonable. Most surprisingly, I find that almost all of the extra cash was devoted to operating expenditures, and not capital investment. These results new light on which firms respond to dividend tax changes and how, suggesting that the most substantial real effects likely occur through "non-capital" pathways.

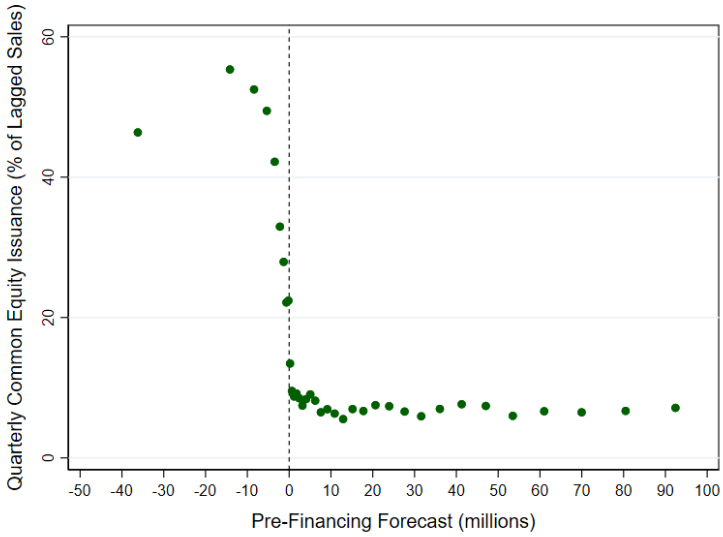
# A Figures & Tables

Figure 1: Binscatter of External Financing by Pre-Financing Forecast



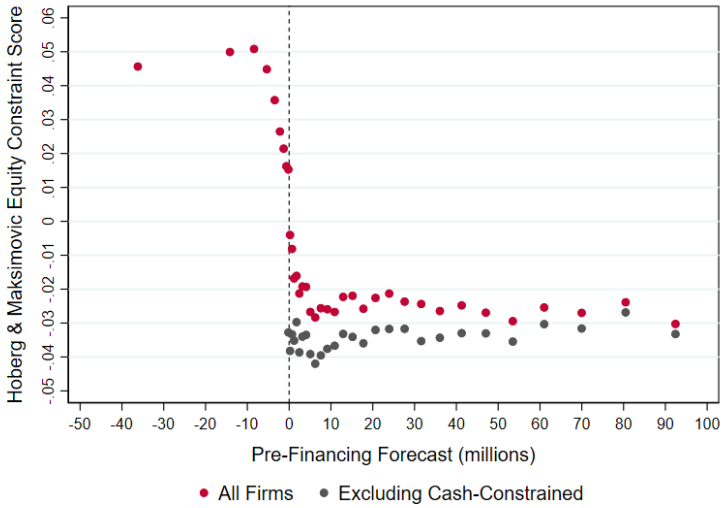

Notes: External financing is defined as the sum of debt issuance (DLTIS+DLCC) and proceeds from the sale of stock (SSTK), scaled by average sales revenue for previous two years. Pre-Financing Forecast, discussed in Section 3 and Section 6, represents the year-ahead cash forecast for the firm, summing current cash holdings plus the year-ahead forecasted operating cash flow. Negative values suggest that the firm does not have enough cash to cover negative forecasted cash flows, while positive values suggest it is forecasted to have a positive cash balance a year ahead without external financing.

Figure 2: Binscatter of Equity Issuance by Pre-Financing Forecast



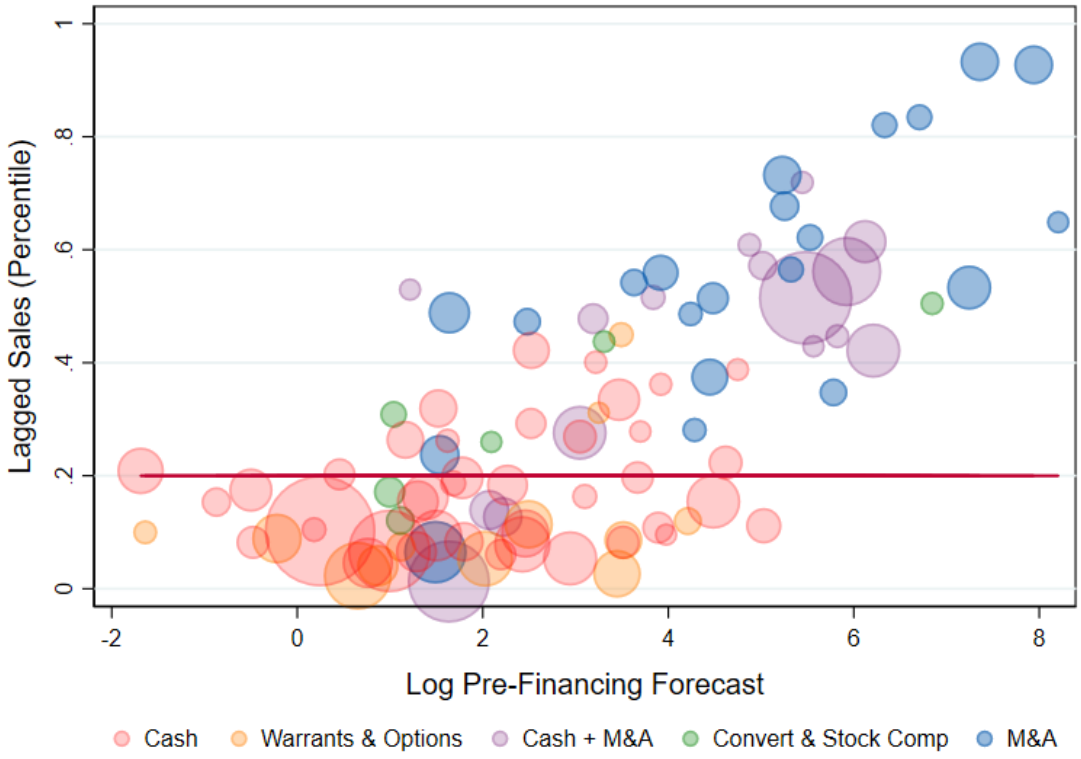

Notes: Scaled quarterly common equity issuance is computed as defined in Section 5. Other details are the same as Figure 1.

Figure 3: Binscatter of Equity Financing Constraints by Pre-Financing Forecast



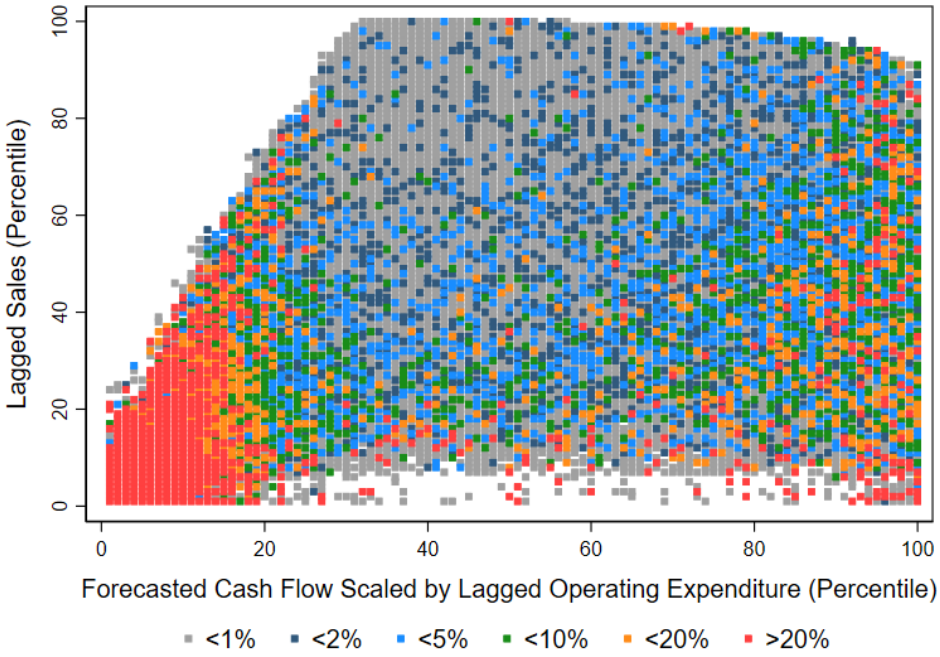

Notes: Equity constraints data are from Hoberg and Maksimovic (2015). The constraints score is a relative metric reflecting how likely the firm is to unwillingly delay investment opportunities on account of inability to obtain equity financing for the project. Higher scores imply more likely to be constrained.

Figure 4: Weighted Scatter of Equity Issuance from 100-Random Quarterly Filings



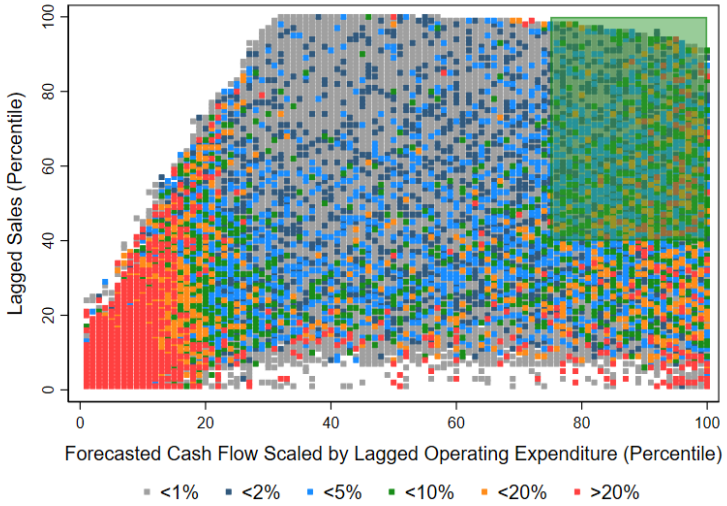

Notes: Red line denotes upper bound for the baseline Cash-Short group. Bubble size represents amount of scaled equity issuance (as defined in Section 5), weighted by lagged sales. Data collected from a sample of 100 random quarterly filings of firms with positive Pre-Financing Forecasts (as defined in Section 6) in the pre-reform period where the firm issued a large amount of equity for its size, at least 50% of sales (these large equity issuances account for the vast majority of scaled equity issuances and drive the movement of trends). The types of equity issuance were determined by the researcher, reading these quarterly filings in detail. "Cash" includes any type of equity issuance either to raise cash or as payment in lieu of cash. "Warrants & Options" includes equity issued upon exercise of these securities. "Cash + M&A" includes all filings where equity was issued to raise cash, but a substantial portion of that cash was used to finance an acquisition. "Convert & Stock Comp" includes equity issued upon conversion of debt-like securities or issued directly to employees as incentive compensation (but not as stock options). "M&A" includes stock issued to Target shareholders as merger consideration. Firms with multiple forms of issuance were categorized into the group that best reflected the principal driver of the high equity issuance for that quarter.

Figure 5: Heatmap of Equity Issuance as a Share of Sales, Pre-Reform



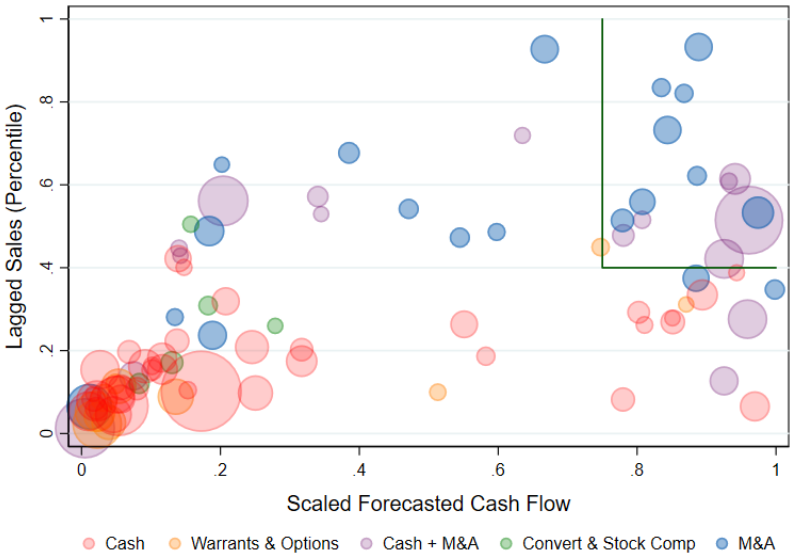

Notes: All firm-quarter observations are sorted into 1,000 cells, where each bin represents a percentile of lagged sales or forecasted cash flow scaled by lagged operating expenditures. Firms to the upper right have high cash flow relative to expenditures and high sales. Firms to the bottom left have low cash flow relative to expenditures and low sales. Average scaled equity issuance (as defined in Section 5) are calculated for each cell.

Figure 6: Cash-Rich Group



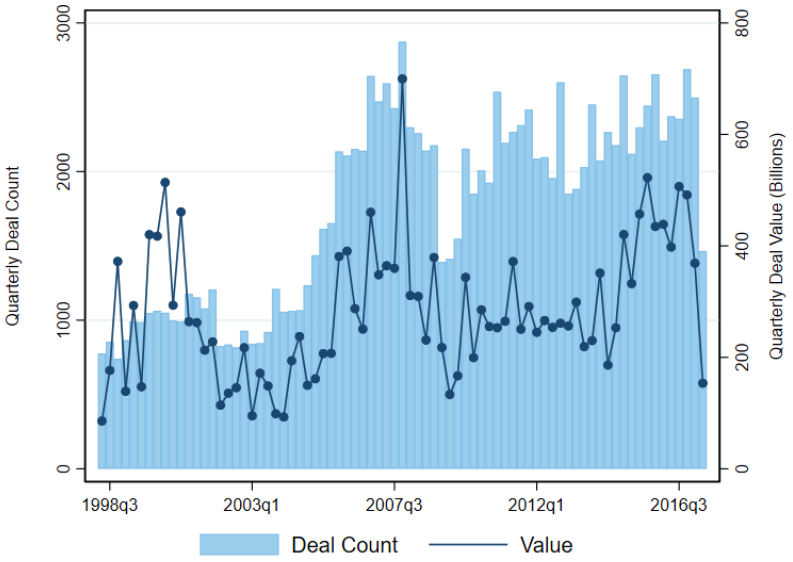

Notes: Green box represents the baseline Cash-Rich firms. Other details are the same as Figure 5.

Figure 7: Cash-Rich Equity Issuance



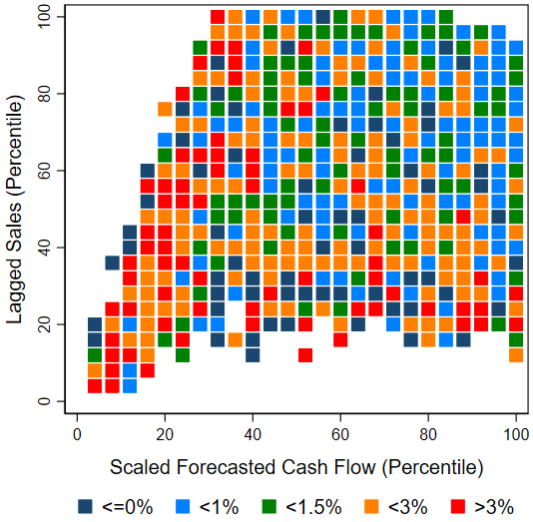

Notes: Details are the same as Figure 4. Axes map to Figure 5 and Figure 6.

Figure 8: Public M&A Deal Volume by Count and Value




Notes: Data from Capital IQ. Includes all deals with public acquirors.

Figure 9: Heatmap of Stock Returns Around Tax Cut News Events




Notes: Colors represent the average returns of firms in each cell across the 8 five-day event windows used in Auerbach and Hassett (2007) (see Appendix C), after controlling for the return on the value-weighted index of CRSP returns and Fama French 30 Industry groupings.

Table 1: Abnormal Returns Around Tax Cut News Events

| Dependent Variable : | Cumulative Return |
|---|---|
| *Specification:* | *Market Model* |
| | (1) |
| **Constant** | **1.63** |
| | (0.04) |
| **Cash-Constrained** | **0.91** |
| | (0.16) |
| **Cash-Rich** | **-0.61** |
| | (0.10) |
| Industry Fixed Effects | Yes |
| Observations | 26,161 |
| Clusters (Industries) | 27 |
| R-squared | 0.021 |

Notes: Coefficients on the Cash-Short and Cash-Rich dummies reflect the average percentage point abnormal returns over the eight 5-day event windows, after controlling for the returns on a market index. See Appendix C for details.

Table 2: Descriptive Statistics by Group, Pre-Reform

| | Cash-Constrained | | | | Cash-Rich | | | | Neither | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | Median | 10th | 90th | Mean | Median | 10th | 90th | Mean | Median | 10th | 90th |
| **Characteristics (Annual)** | | | | | | | | | | | | |
| Lagged Sales | 18.8 | 2.1 | 0.0 | 34.0 | 2178 | 790 | 149 | 6234 | 2926 | 383 | 31 | 6718 |
| Lagged Revenue | 21.4 | 2.5 | 0.0 | 38.7 | 2467 | 900 | 170 | 7046 | 3305 | 433 | 35 | 7584 |
| Lagged Assets | 36.8 | 8.4 | 0.3 | 96.4 | 3804 | 1264 | 211 | 10400 | 2653 | 364 | 31 | 6122 |
| Lagged Tangible Assets | 18.1 | 1.8 | 0.0 | 43.3 | 3288 | 1054 | 101 | 9306 | 2865 | 283 | 12 | 6500 |
| Lagged Profit Margin | -1977% | -91% | -3968% | 4% | 27% | 23% | 14% | 44% | 4% | 8% | -9% | 17% |
| Lagged Sales Growth* | 51% | 0% | -49% | 135% | 12% | 8% | -8% | 39% | 8% | 4% | -19% | 38% |
| Lagged Leverage | 150% | 15% | 0% | 285% | 28% | 24% | 0% | 63% | 23% | 17% | 0% | 55% |
| **Outcomes (Annualized)** | | | | | | | | | | | | |
| Total Equity Issuance | 9.8 | 0.2 | 0.0 | 23.8 | 61.6 | 3.9 | 0.0 | 154.0 | 25.2 | 0.9 | 0.0 | 56.8 |
| Equity Issuance/Sales | 2114% | 4.8% | 0.0% | 3752% | 6.8% | 0.7% | 0.0% | 16.6% | 6.6% | 0.3% | 0.0% | 13.5% |
| Total CapEx | 1.5 | 0.1 | 0.0 | 3.8 | 344 | 79 | 7 | 935 | 145 | 15 | 1 | 337 |
| CapEx/Tangible Assets | 24.2% | 3.0% | 0.0% | 62.8% | 18.3% | 12.9% | 3.8% | 40.3% | 14.0% | 9.1% | 2.2% | 31.4% |
| Total Oper. Expenditure | 29.6 | 8.6 | 0.5 | 70.8 | 1674 | 620 | 117 | 4792 | 2464 | 364 | 33 | 6235 |
| Oper. Expenditure/Sales | 2550% | 241% | 73% | 6938% | 81% | 81% | 54% | 106% | 102% | 95% | 71% | 137% |
| Total R&D | 7.7 | 1.5 | 0.0 | 25.3 | 158.6 | 40.6 | 0.0 | 439.3 | 51.5 | 7.6 | 0.0 | 118.0 |
| R&D/Sales | 1856% | 37% | 0% | 4715% | 9% | 7% | 0% | 23% | 13% | 3% | 0% | 30% |
| Dividends/Sales | 0.0% | 0.0% | 0.0% | 0.0% | 4% | 0% | 0% | 11% | 1% | 0% | 0% | 3% |
| Repurchases/Sales | 0.2% | 0.0% | 0.0% | 0.0% | 7% | 0% | 0% | 25% | 2% | 0% | 0% | 6% |
| Firm Quarters | 56,446 | | | *Overlap* | 46,015 | | | | 122,804 | | | |
| Number of Firms | 3,991 | | | 413 | 2,593 | | | | 2,285 | | | |

Notes: All non-percentage values are in millions of dollars. All variables are winsorized within group at the 2.5% and 97.5% thresholds. Lagged sales and revenue are averages of the prior two years. Lagged assets, tangible assets, profit margin, and leverage are averages over the prior 8 quarters. Profit margin is 1 minus the ratio of operating expenditures to sales revenue. Lagged sales growth is percent increase of the prior year's sales over the year before that. The outcomes are quarterly, annualized by multiplying by 4. Because the definitions of the groups are not stable across time, there is overlap between the number of firms in the Cash-Short and Cash-Rich (firms that are both at different times). The number of firms in "Neither" reflects the count of firms that are in neither of the two groups at any point during the period summarized.

* Sales growth has many 0% observations for Cash-Short firms because all firms are bottom-coded to $100k sales when calculating growth to avoid misleading negative effects.

Table 3: Descriptive Statistics by Group, Post-Reform

| | Cash-Constrained | | | | Cash-Rich | | | | Neither | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | Median | 10th | 90th | Mean | Median | 10th | 90th | Mean | Median | 10th | 90th |
| **Characteristics (Annual)** | | | | | | | | | | | | |
| Lagged Sales | 18.8 | 2.1 | 0.0 | 34.0 | 2178 | 790 | 149 | 6234 | 2926 | 383 | 31 | 6718 |
| Lagged Revenue | 21.4 | 2.5 | 0.0 | 38.7 | 2467 | 900 | 170 | 7046 | 3305 | 433 | 35 | 7584 |
| Lagged Assets | 36.8 | 8.4 | 0.3 | 96.4 | 3804 | 1264 | 211 | 10400 | 2653 | 364 | 31 | 6122 |
| Lagged Tangible Assets | 18.1 | 1.8 | 0.0 | 43.3 | 3288 | 1054 | 101 | 9306 | 2865 | 283 | 12 | 6500 |
| Lagged Profit Margin | -1977% | -91% | -3968% | 4% | 27% | 23% | 14% | 44% | 4% | 8% | -9% | 17% |
| Lagged Sales Growth* | 51% | 0% | -49% | 135% | 12% | 8% | -8% | 39% | 8% | 4% | -19% | 38% |
| Lagged Leverage | 150% | 15% | 0% | 285% | 28% | 24% | 0% | 63% | 23% | 17% | 0% | 55% |
| **Outcomes (Annualized)** | | | | | | | | | | | | |
| Total Equity Issuance | 9.8 | 0.2 | 0.0 | 23.8 | 61.6 | 3.9 | 0.0 | 154.0 | 25.2 | 0.9 | 0.0 | 56.8 |
| Equity Issuance/Sales | 2114% | 4.8% | 0.0% | 3752% | 6.8% | 0.7% | 0.0% | 16.6% | 6.6% | 0.3% | 0.0% | 13.5% |
| Total CapEx | 1.5 | 0.1 | 0.0 | 3.8 | 344 | 79 | 7 | 935 | 145 | 15 | 1 | 337 |
| CapEx/Tangible Assets | 24.2% | 3.0% | 0.0% | 62.8% | 18.3% | 12.9% | 3.8% | 40.3% | 14.0% | 9.1% | 2.2% | 31.4% |
| Total Oper. Expenditure | 29.6 | 8.6 | 0.5 | 70.8 | 1674 | 620 | 117 | 4792 | 2464 | 364 | 33 | 6235 |
| Oper. Expenditure/Sales | 2550% | 241% | 73% | 6938% | 81% | 81% | 54% | 106% | 102% | 95% | 71% | 137% |
| Total R&D | 7.7 | 1.5 | 0.0 | 25.3 | 158.6 | 40.6 | 0.0 | 439.3 | 51.5 | 7.6 | 0.0 | 118.0 |
| R&D/Sales | 1856% | 37% | 0% | 4715% | 9% | 7% | 0% | 23% | 13% | 3% | 0% | 30% |
| Dividends/Sales | 0.0% | 0.0% | 0.0% | 0.0% | 4% | 0% | 0% | 11% | 1% | 0% | 0% | 3% |
| Repurchases/Sales | 0.2% | 0.0% | 0.0% | 0.0% | 7% | 0% | 0% | 25% | 2% | 0% | 0% | 6% |
| Firm Quarters | | 56,446 | | *Overlap* | | 46,015 | | | | 122,804 | | |
| Number of Firms | | 3,991 | | 413 | | 2,593 | | | | 2,285 | | |

Notes: All non-percentage values are in millions of dollars. All variables are winsorized within group at the 2.5% and 97.5% thresholds. Lagged sales and revenue are averages of the prior two years. Lagged assets, tangible assets, profit margin, and leverage are averages over the prior 8 quarters. Profit margin is 1 minus the ratio of operating expenditures to sales revenue. Lagged sales growth is percent increase of the prior year's sales over the year before that. The outcomes are quarterly, annualized by multiplying by 4. Because the definitions of the groups are not stable across time, there is overlap between the number of firms in the Cash-Short and Cash-Rich (firms that are both at different times). The number of firms in "Neither" reflects the count of firms that are in neither of the two groups at any point during the period summarized.

* Sales growth has many 0% observations for Cash-Short firms because all firms are bottom-coded to $100k sales when calculating growth to avoid misleading negative effects.

Table 4: Top 10 Largest Industries by Group

**Pre-Reform**
1992:Q3 - 2003:Q2

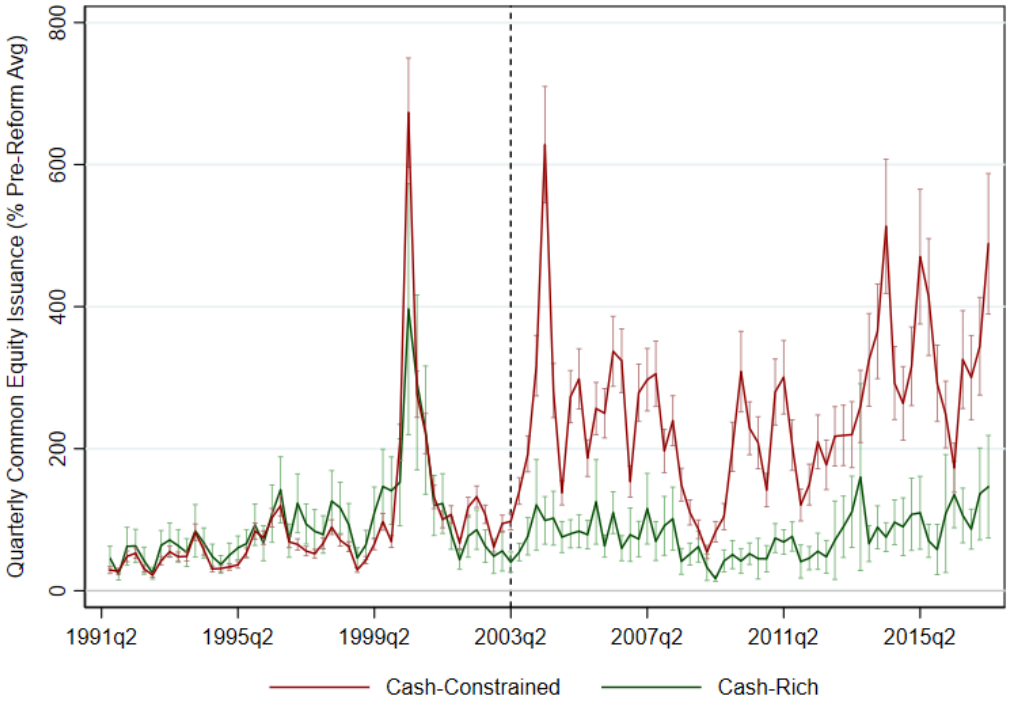
| **Cash-Constrained** | | **Cash-Rich** | | **Neither** | |
|---|---|---|---|---|---|
| Industry | Share | Industry | Share | Industry | Share |
| Business Services | 15% | Business Services | 13% | Business Services | 10% |
| Pharmaceuticals | 12% | Telecom | 12% | Retail | 7% |
| Med Equipment | 7% | Oil & Gas | 8% | Elec Components | 6% |
| Computers | 7% | Elec Components | 8% | Wholesale | 6% |
| Oil & Gas | 6% | Transport | 7% | Computers | 5% |
| Elec Components | 6% | Entertainment | 5% | Machinery | 5% |
| Wholesale | 4% | Chemicals | 3% | Oil & Gas | 5% |
| Retail | 3% | Computers | 3% | Constr Materials | 3% |
| Lab Equipment | 3% | Hotel & Dining | 3% | Consumer Goods | 3% |
| Machinery | 3% | Publishing | 3% | Transport | 3% |

**Post-Reform**
2003:Q3 - 2017:Q2

| **Cash-Constrained** | | **Cash-Rich** | | **Neither** | |
|---|---|---|---|---|---|
| Industry | Share | Industry | Share | Industry | Share |
| Pharmaceuticals | 23% | Business Services | 18% | Business Services | 14% |
| Business Services | 15% | Oil & Gas | 10% | Retail | 8% |
| Med Equipment | 7% | Telecom | 8% | Pharmaceuticals | 7% |
| Oil & Gas | 6% | Elec Components | 7% | Elec Components | 7% |
| Elec Components | 6% | Pharmaceuticals | 5% | Wholesale | 5% |
| Computers | 4% | Transport | 5% | Oil & Gas | 4% |
| Wholesale | 3% | Med Equipment | 4% | Computers | 4% |
| Lab Equipment | 2% | Computers | 4% | Machinery | 4% |
| Machinery | 2% | Entertainment | 4% | Med Equipment | 4% |
| Electrical | 2% | Machinery | 3% | Transport | 3% |

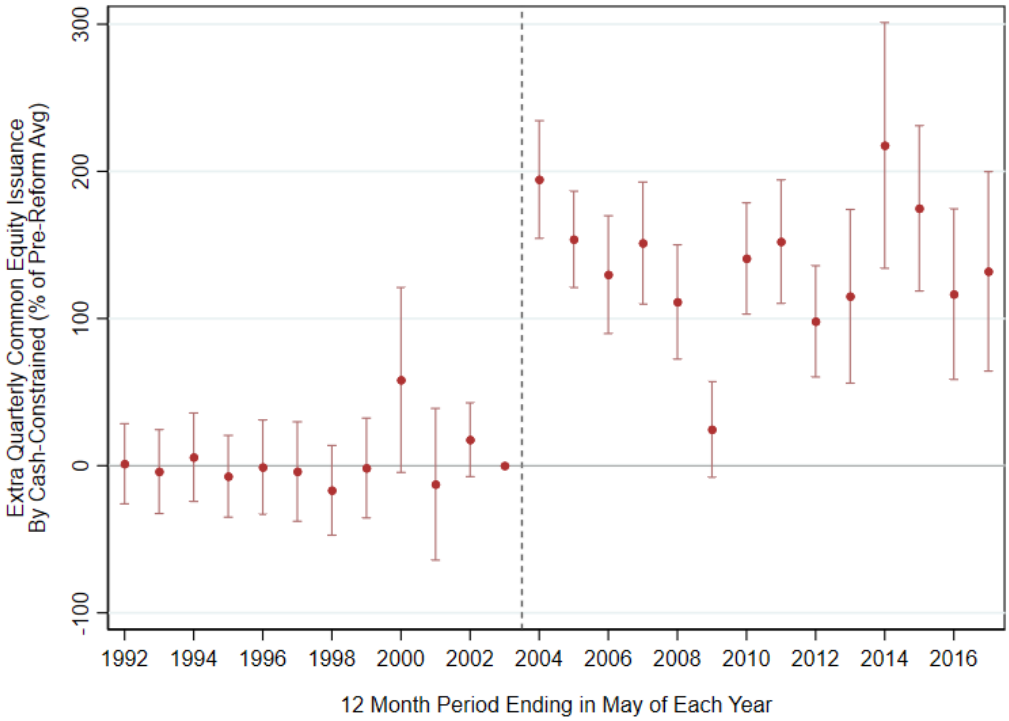
Notes: Shares represent percentage of firm-quarter observations in each industry.

Figure 10: Time Series of Common Equity Issuance



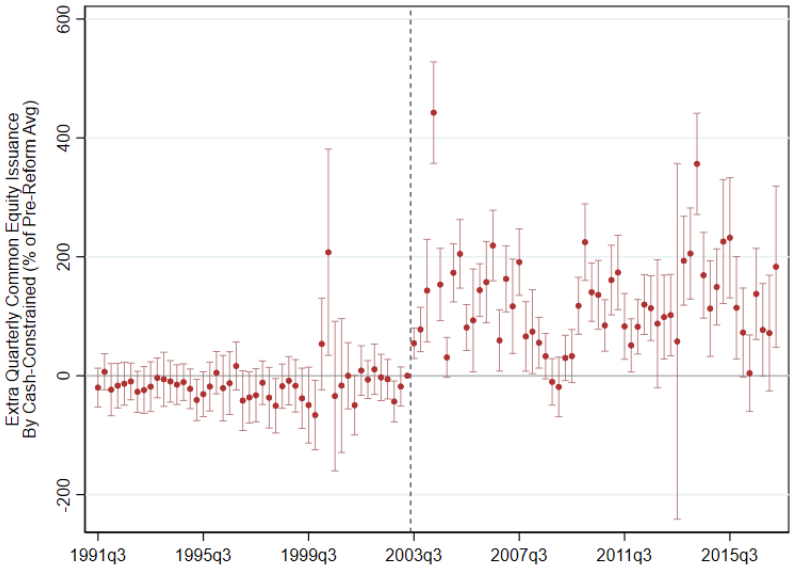

Notes: Error bands are 95% confidence intervals. Firms in post-reform years are noparametrically weighted across 600 bins to match the distribution of firms in the 2 years prior to the tax cut in terms of sales and industry composition.

Figure 11: Main DD Plot of Extra Equity Issuance by Cash-Short Firms



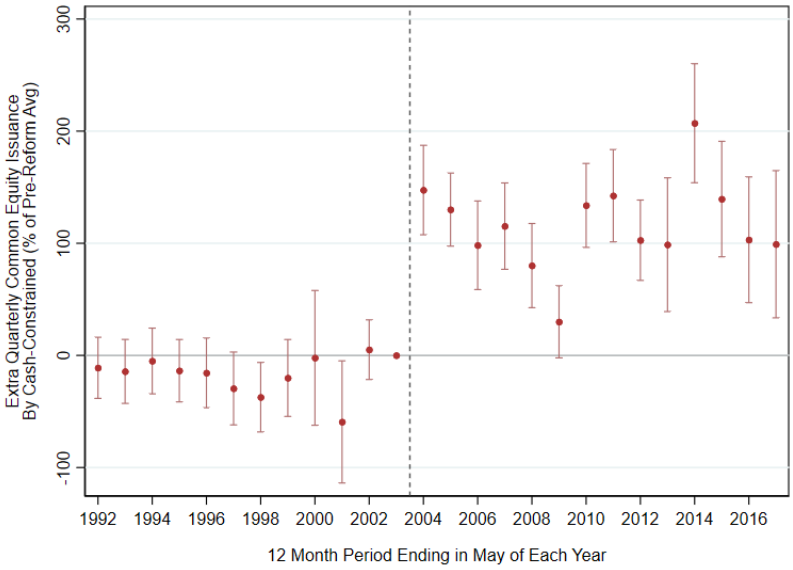

Notes: Includes firm and industry-by-quarter fixed effects. Regression is given in Equation 16. Error bands are 95% confidence intervals with clustered standard errors (by firm). Each point estimate is the coefficient on a dummy variable for Cash-Short interacted with the year (not calendar year, but 12-month periods before and after reform). Firms in post-reform years are noparametrically weighted across 600 bins to match the distribution of firms in the 2 years prior to the tax cut in terms of sales and industry composition. Equity issuance is winsorized at 2.5/97.5 threshold. Coefficients should be interpreted as the extra average quarterly equity issuance by the Cash-Short firms over the Cash-Rich firms, relative to the pre-reform Cash-Short mean. For example, a coefficient of 100 means extra equity issuance by Cash-Short firms equal to 100% of their pre-reform mean.

Figure 12: Quarterly DD Plot of Extra Equity Issuance by Cash-Short Firms



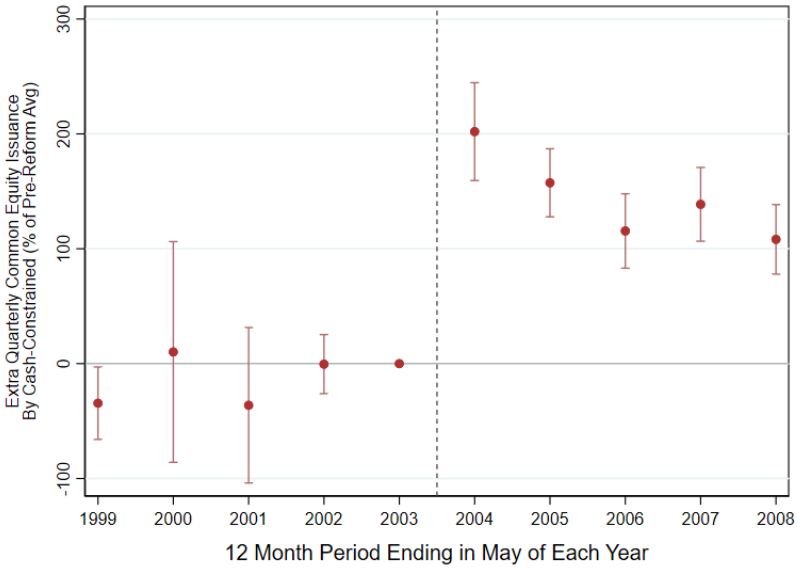

Notes: Regression is is quarterly version (rather than annual) of Equation 15. All other details are the same as Figure 11.

Figure 13: DD Plot of Extra Equity Issuance by Cash-Short Firms with Controls



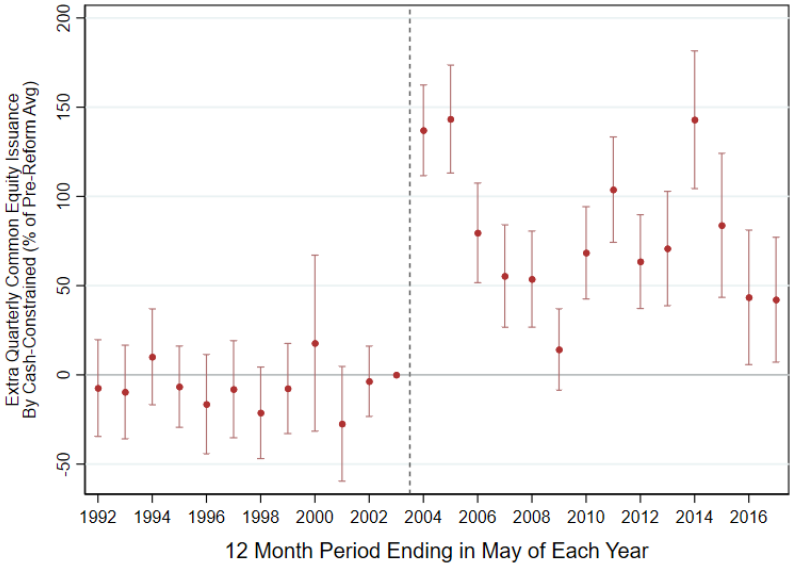

Notes: Details are the same as Figure 11, but with additional controls. These include quadratics of lagged sales growth, profit margin, sales-to-assets ratio, and book leverage. Lagged sales growth is the percent increase of the prior year's sales over the year before that. Lagged profit margin is the average of 1 minus the ratio of operating expenditures to sales revenue over the past two years. Lagged sales-to-assets ratio is over the previous two years. Lagged book leverage is total book value of debt over book value of assets from the previous quarter.

Figure 14: Balanced Panel DD Plot of Extra Equity Issuance by Cash-Short Firms




Notes: Unlike the unbalanced panel regressions, firms are fixed in their group assignment based on their status in the quarter before the reform. Otherwise details are the same as Figure 11.

Figure 15: Asset-Scaled DD Plot of Extra Equity Issuance by Cash-Short Firms



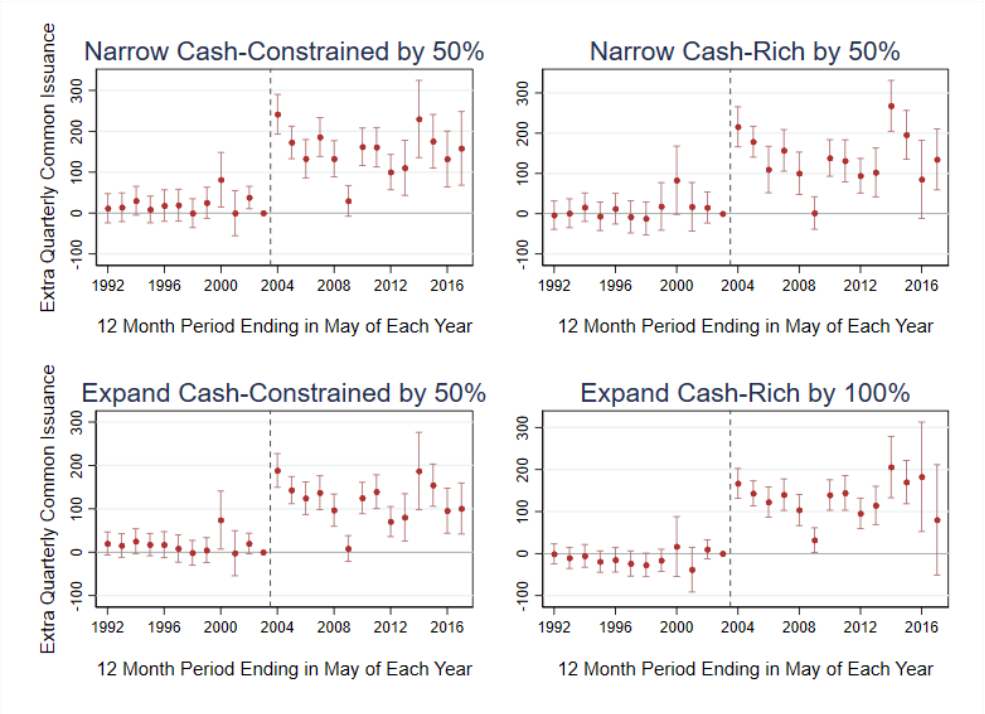

Notes: Details are the same as Figure 11, but with equity issuance scaled by assets rather than sales and with the non-parametric weighting to consider assets rather than sales.

Table 5: Main Regression and Robustness Tests

| Dependent Variable : | Quarterly Common Equity Issuance (Scaled) | | | | | | |
|---|---|---|---|---|---|---|---|
| *Specification:* | *Main* | *Controls* | *Balanced* | *Assets* | *Excl. Pharma* | *Winsor 5/95* | *Winsor 1/99* |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| **Cash-Constrained x Post** | **135.8** | **132.8** | **157.3** | **95.0** | **124.7** | **131.3** | **107.3** |
| | (12.4) | (12.2) | (17.0) | (8.9) | (14.1) | (10.2) | (13.7) |
| Firm Fixed Effects? | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry × Quarter Fixed Effects? | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 172,923 | 144,566 | 51,854 | 161,619 | 149,201 | 172,923 | 172,923 |
| Clusters (Firms) | 9,217 | 8,218 | 1,559 | 8,725 | 8,286 | 9,217 | 9,217 |
| R-squared | 0.288 | 0.265 | 0.233 | 0.266 | 0.286 | 0.333 | 0.236 |

Notes: Clustered standard errors (by firm) reported in parentheses. All regressions are variations on the main specification from Equation 16. Coefficients should be interpreted as the extra average quarterly equity issuance by the Cash-Short firms over the Cash-Rich firms, relative to the pre-reform Cash-Short mean. For example, a coefficient of 100 means extra equity issuance by Cash-Short firms equal to 100% of their pre-reform mean. Column (1) represents the main specification scaled by sales, corresponding to Figure 11. Column (2) is the regression with extra controls, corresponding to Figure 13. Column (3) is the balanced panel regression, corresponding to Figure 14. Column (4) is the assets-scaled equity variable, and corresponds to Figure 15. Column (5) excludes pharmaceutical firms. Columns (6) and (7) are variants of (1) with different winsorization.

Figure 16: Robustness: Changing the Boundaries of the Groups




Notes: All regressions are of the form from Figure 11, with the only change being the delineation of the Cash-Short and Cash-Rich groups. In the top left panel, I drop all Cash-Short firms with positive Pre-Financing Forecasts, almost exactly half of the group. In the bottom left panel, I include all firms with sales less than \$80m in the Cash-Short group, expanding it by 50%. In the top right panel, I narrow the thresholds for the Cash-Rich group on both forecasted cash flow and sales. In the bottom right panel, I do the opposite to expand the Cash-Rich group.

Table 6: Robustness: Changing the Boundaries of the Groups

| Dependent Variable : | Quarterly Common Equity Issuance (Scaled) | | | | |
|---|---|---|---|---|---|
| *Specification:* | *Main* | *Narrow Cash-Constrained* | *Expand Cash-Constrained* | *Narrow Cash-Rich* | *Expand Cash-Rich* |
| | (1) | (2) | (3) | (4) | (5) |
| **Cash-Constrained x Post** | **135.8** | **174.3** | **139.2** | **169.3** | **173.1** |
| | (12.4) | (15.4) | (13.2) | (15.3) | (14.1) |
| Firm Fixed Effects? | Yes | Yes | Yes | Yes | Yes |
| Industry × Quarter Fixed Effects | Yes | Yes | Yes | Yes | Yes |
| Observations | 172,923 | 134,076 | 237,689 | 141,061 | 247,787 |
| Clusters (Firms) | 9,217 | 8,297 | 10,283 | 8,059 | 10,796 |
| R-squared | 0.288 | 0.343 | 0.375 | 0.393 | 0.269 |

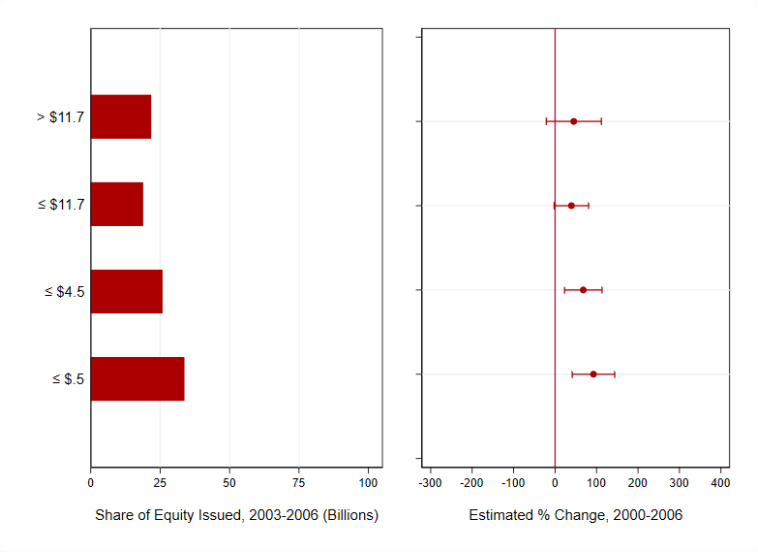
Notes: Clustered standard errors (by firm) reported in parentheses. All regressions use the main specification from Equation 16. Coefficients should be interpreted as the extra average quarterly equity issuance by the Cash-Short firms over the Cash-Rich firms, relative to the pre-reform Cash-Short mean. For example, a coefficient of 100 means extra equity issuance by Cash-Short firms equal to 100% of their pre-reform mean. Column (1) corresponds to Figure 11. Columns (2) through (5) correspond to the regressions in Figure 16.

Table 7: Sales-Weighted Regressions

| Dependent Variable : | Quarterly Common Equity Issuance (Scaled) | | |
|---|---|---|---|
| *Specification:* | *Sales-Weighted (Full Cash-Constrained)* | *Sales-Weighted (Exclude top 25% Sales of Cash-Constrained)* | *Sales-Weighted (Exclude top 50% Sales of Cash-Constrained)* |
| | (1) | (2) | (3) |
| **Cash-Constrained x Post** | **43.5** | **109.4** | **151.7** |
| | (19.4) | (19.9) | (20.9) |
| Firm Fixed Effects? | Yes | Yes | Yes |
| Industry × Quarter Fixed Effects | Yes | Yes | Yes |
| Observations | 176,519 | 148,526 | 120,741 |
| Clusters (Firms) | 9,293 | 7,674 | 6,364 |
| R-squared | 0.166 | 0.153 | 0.153 |

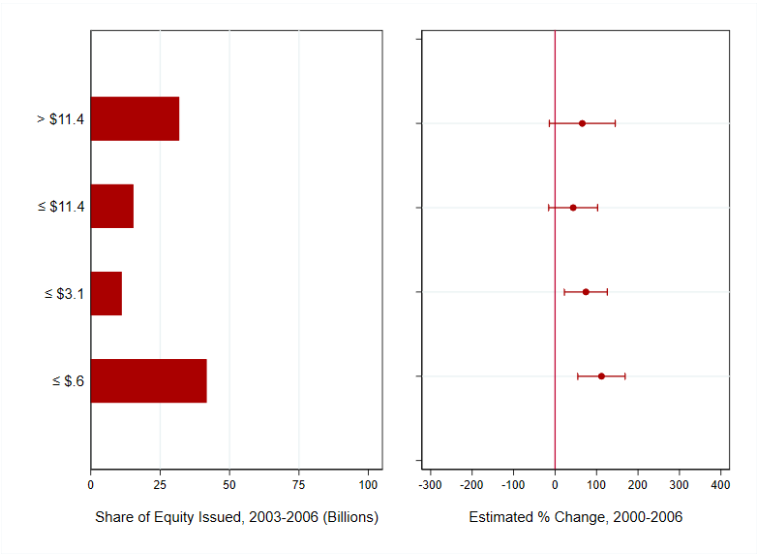
Notes: Clustered standard errors (by firm) reported in parentheses. All regressions use the main specification from Equation 16, but are weighted by sales rather than by the nonparametric scheme. Coefficients are interpreted in the same way as prior regressions. Column (2) excludes the firms with the top 25% of lagged sales revenue among Cash-Short firms, stratified by the a positive or negative Pre-Financing Forecast (i.e., excludes to 25% of each subgroup). Otherwise, only firms with a negative Pre-Financing Forecast would be excluded. Column (3) excludes the top 50% in the same way.

Figure 17: Cash-Short Response by Sales Quartile



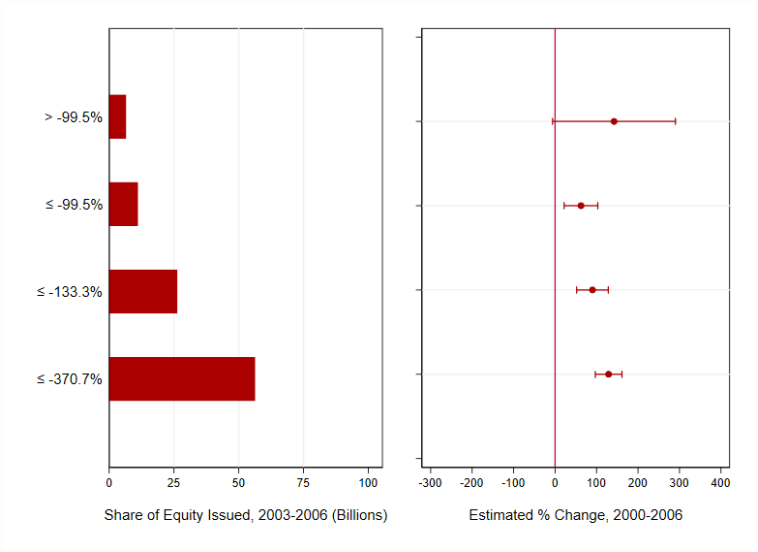

Notes: Quartiles are of lagged sales (average over previous two years). Left figure shows the sum dollar value of equity issuance (not scaled), by quartile in the three years after the reform. Right figure shows an estimated DD response for each quartile of the Cash-Short group, estimated in separate regressions. For all the red decompositions (as opposed to blue), the quartiles would not viably divide the Cash-Rich group, so the four regressions are of each Cash-Short quartile against the full Cash-Rich group. Coefficients should be interpreted as the percent response by that quartile over its pre-reform mean beyond the response of the Cash-Rich group.

Figure 18: Cash-Short Response by Tangible Assets Quartile



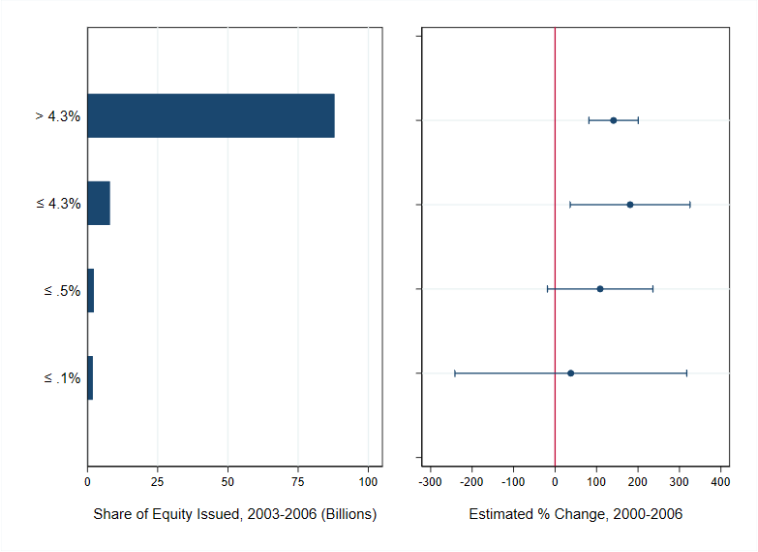

Notes: Details are the same as Figure 17, but by lagged book value of tangible assets (average of previous two years).

Figure 19: Cash-Short Response by Lagged Profit Margin Quartile



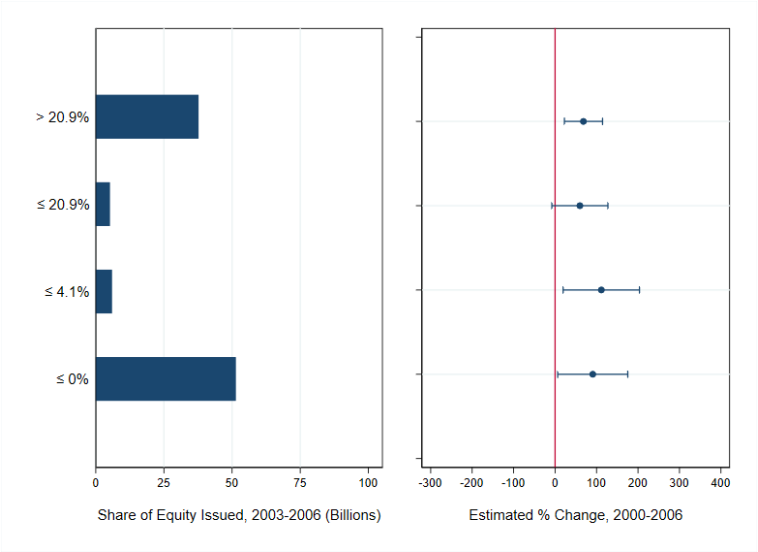

Notes: Profit margin is 1 minus the ratio of operating expenditures to sales revenue. Quartiles are of lagged profit margin (average of previous two years). Other details are the same as Figure 17.

Figure 20: Cash-Short Response by Lagged Equity Issuance



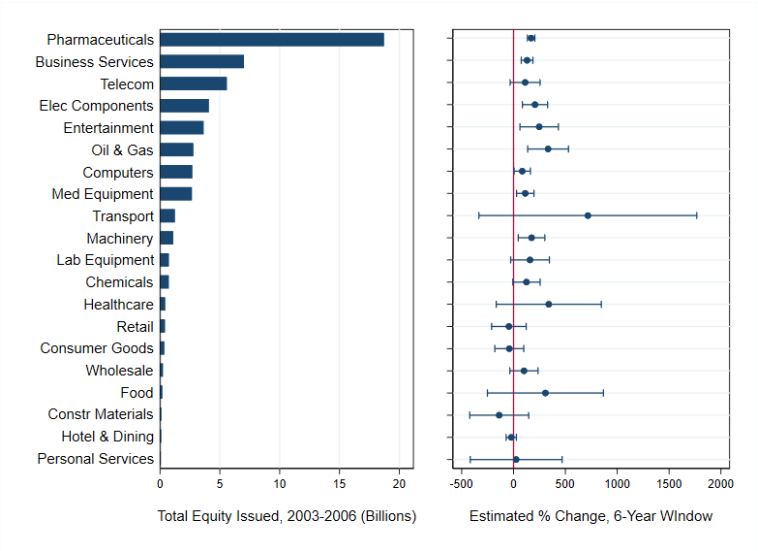

Notes: Quartiles are of lagged scaled equity issuance, as given in Section 5 (average of previous two years). For the variables in the blue decompositions, unlike the red, it is possible to break the Cash-Short and Cash-Rich firms into overlapping quartiles. Each quartile is a separate regression, running Equation 16 but solely with the firms in that quartile. Other details are the same as Figure 17.

Figure 21: Cash-Short Response by Lagged Sales Growth Quartile



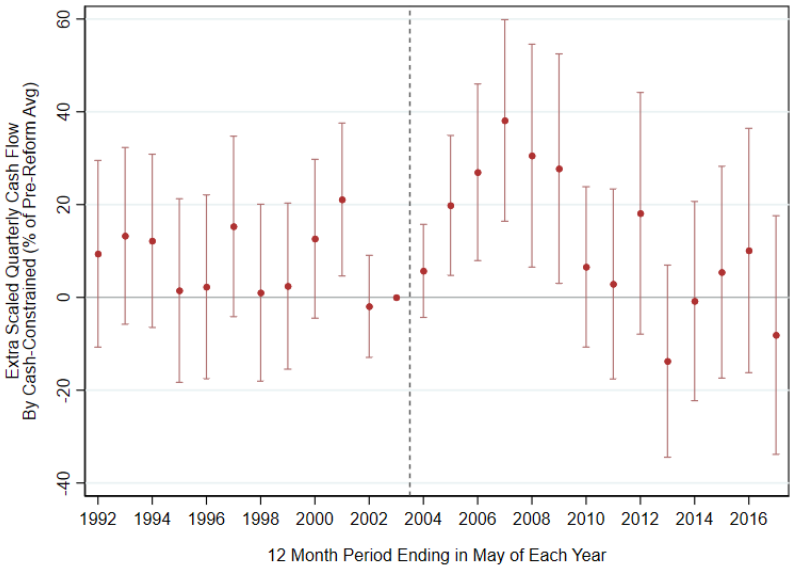

Notes: Sales growth is percent increase of the prior year's sales over the year before that. Firms who were bottom-coded at $100k sales and stayed below $100k sales are excluded, but do not change the results if included (as low sales growth firms). Details are the same as Figure 20, but by lagged sales growth (average of previous two years).

Figure 22: Cash-Short Response by Industry



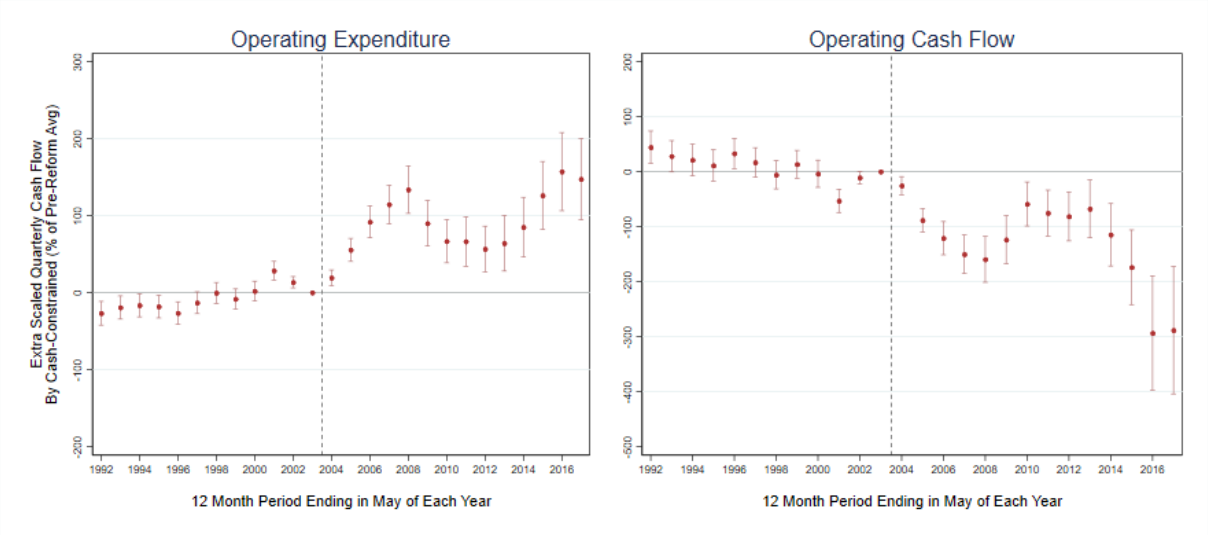

Notes: Industries are Fama French 48 industries. Left figure shows total equity issuance by Cash-Short firms in that industry in the three years after the reform. Right figure shows an estimated DD response using only firms in that industry. Industries with fewer than 20 firms in the pre- or post-reform periods in either the Cash-Short or Cash-Rich groups are excluded. Coefficients should be interpreted as the percent response by Cash-Short firms in that industry over Cash-Rich firms in that industry.

Figure 23: DD Plot of Extra Capital Expenditure by Cash-Short Firms



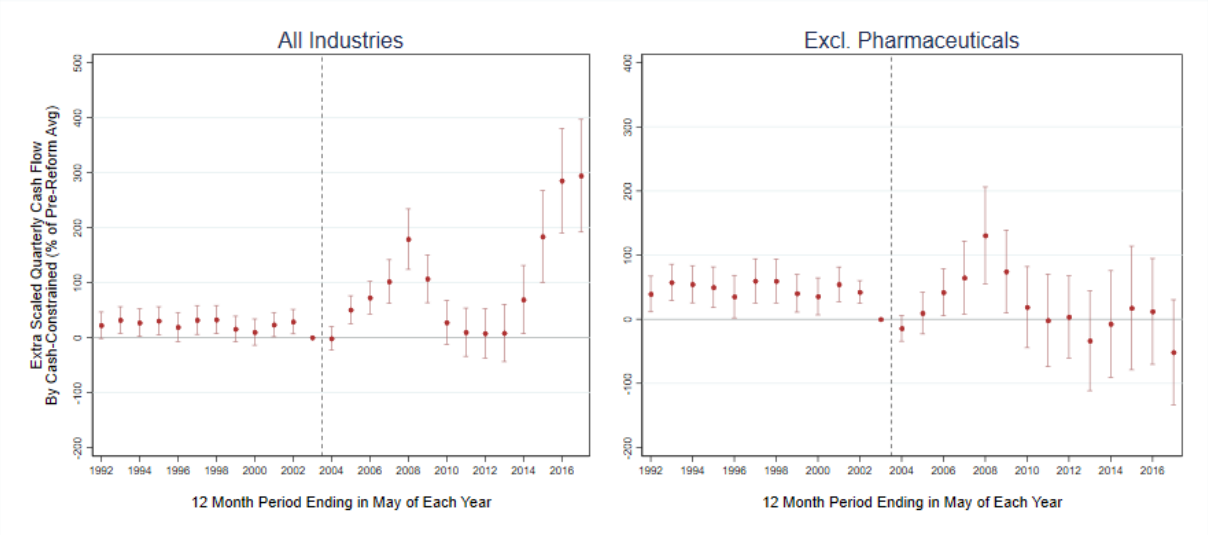

Notes: Regression is given in Equation 16, but with the dependent variable being capital expenditure scaled by the previous two years lagged tangible assets. Coefficients should be interpreted as the extra percentage of capital expenditure by the Cash-Short firms relative to their pre-reform mean over Cash-Rich firms. Other details are the same as Figure 11.

Figure 24: DD Plot of Extra Operating Expenditure by Cash-Short Firms



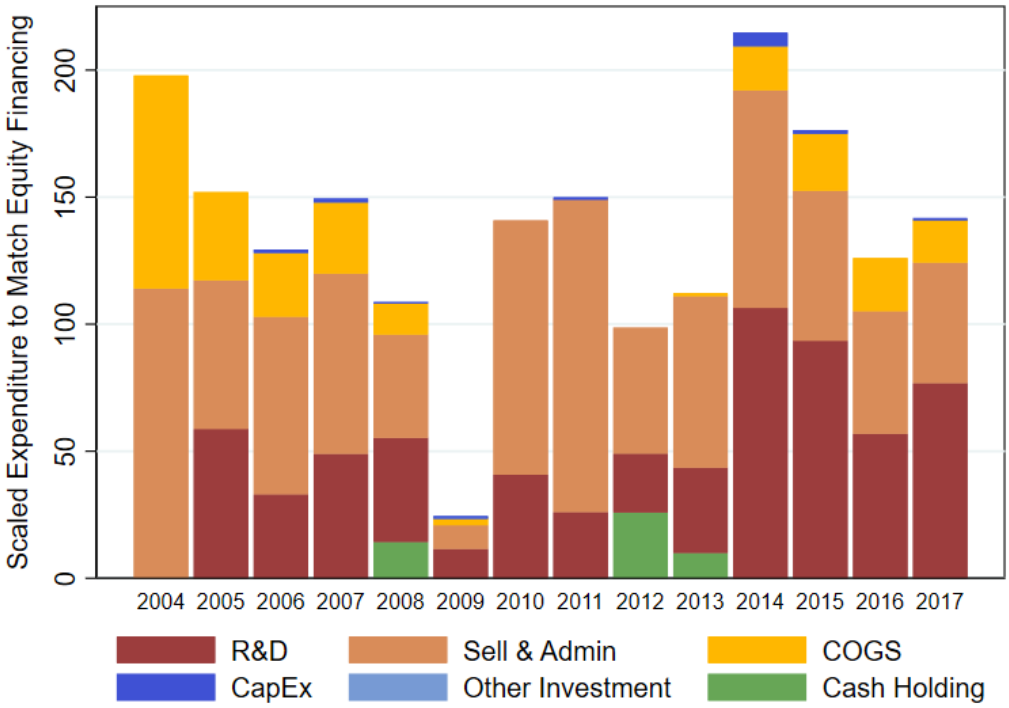

Notes: Operating expenditures and operating cash flow are scaled by two years of lagged annual sales, similar to equity issuance. Other details are the same as Figure 23.

Figure 25: DD Plot of Extra R&D by Cash-Short Firms




Notes: The left panel presents R&D scaled by two years of lagged annual sales. The right panel excludes pharmaceutical firms. Other details are the same as Figure 23.

Figure 26: Where Did the Equity Financing Go? Extra Expenditures by Year




Notes: The heights of the bars are the estimated extra equity issuance by Cash-Short firms by year, from Figure 11. The colors reflect the estimated expenditure of this financing using 2SLS. The table is the result of 84 2SLS regressions: one is run for every expenditure category (dependent variable) in every post-reform year. Regressions take the form specified in Equation 17. The extra estimated expenditure for every category is then divided by the total of the categories to estimate the share, which is re-scaled to fit the equity issuance estimate.

Table 8: Expenditure Responses from 2SLS Regressions

| Item | Share of Extra Expenditure | Estimate |
|---|---|---|
| COGS | 14% | 0.112 |
| | | (0.019) |
| Selling & Admin | 51% | 0.406 |
| | | (0.058) |
| R&D | 35% | 0.279 |
| | | (0.055) |
| CapEx | 0% | -0.007 |
| | | (0.006) |
| Other Invest. | 0% | -0.018 |
| | | (0.008) |
| Debt Reduction | 0% | -0.128 |
| | | (0.020) |
| Payouts | 0% | -0.002 |
| | | (0.001) |
| Δ Cash Holdings | 0% | -0.034 |
| | | (0.081) |

Notes: Percentages represent the estimated share of extra equity financing that was directed to that category of expenditure. Estimates can be interpreted as roughly how many extra dollars were spent in that category for every extra dollar of equity issued (negative means net cash inflow). Clustered standard errors (by firm) reported in parentheses. Regressions are of the form specified in Equation 17, which give percent-changes, which can then be converted into the estimates here. "Selling & Admin" excludes R&D. "Other Investment" includes investment in securities and acquisitions. "Payouts" includes all cash dividends and repurchases of stock. "Cash Holdings" is the change in cash holdings from the previous quarter.

# B Cash Flow Forecasting Methodology

As discussed in Section 6, the vast majority of firms making explicit statements about their future cash needs use a year-ahead horizon, even in 10-Qs. Also, I find that the vast majority look to operating cash flows for these projections. Thus, to implement the model in Section 3 I need to use year-ahead forecasted operating cash flows for the "short-term" horizon.

I follow Lorek (2014) and Francis and Eason (2012) for development of a quarterly year-ahead operating cash flow forecast. Both investigations find that forecasts with accruals outperform other regression model forecasts.

The forecast model I use is the quarterly forecast model in Lorek (2014), adapted for year-ahead projections:

$$\begin{aligned} OpCF_{f,q+4} =& \alpha + \beta_1 OpCF_{fq} + \beta_2 OpInBD_{fq} \\ &+ \beta_3 AccPay_{fq} + \beta_4 AccRec_{fq} + \beta_5 Invent_{fq} + \varepsilon_{fq} \end{aligned} \tag{18}$$

Where, using Compustat data:

$$\begin{aligned} OpCF_{fq} &= \sum_{i=1}^{i=4} OANCF_{f,q-i} \\ OpInBD_{fq} &= \sum_{i=1}^{i=4} OIBD_{f,q-i} \\ AccPay_{fq} &= AP_{f,q-1} \\ AccRec_{fq} &= RECT_{f,q-1} \\ Invent_{fq} &= INVT_{f,q-1} \end{aligned}$$

In words, the model begins with a naive 4-quarter-ahead operating cash flow prediction, using the previous four-quarters as a predictor. Lorek adds lagged operating income, as well balance sheet accruals for the previous quarter for accounts payable, accounts receivable, and inventory.

To obtain the forecast, I run the regression in Equation 18 for every quarter in the 26-year investigation period, using up to 10 years of lagged data for each regression, and doing so separately for every quintile of firms by sales revenue. To prevent contamination from future data, I do not use data in the year before the estimated quarter, as this would incorporate unkowable information at the time of the forecast. To prevent contamination by the tax cut, for all post-reform periods I use only the last 10 years of pre-reform data for the forecast. (However, using post-reform data instead does not change the forecasts in any notable way.) This procedure results in 265 separate regression forecasts.

In addition to the model in Equation 18, I also estimated forecasts for the naive model (using only $OpCF_{fq}$ as a predictor), as well as running all sales quintiles together. I chose the model that performed best for prediction accuracy. The model in Equation 18 had 13% median forecast error

and 96% correlation with actual year-ahead operating cash flows. However, changing the forecast model does not change the results in any substantive way.

# C Abnormal Return Analysis

The analysis of abnormal returns follows the approach of Auerbach and Hassett (2007). The authors identify eight five-day windows around news events indicating the passage of the dividend tax cut became more likely:

| Event Window | Event Description |
|---|---|
| 12/23 - 12/30 | NY Times Article on 12/25/02 |
| 1/3 - 1/9 | Bush announces plan on 1/7/03 |
| 2/27 - 3/5 | Introduced in House and hearing on 2/27 and 3/4 |
| 3/25 - 3/31 | Rep. Thomas floats first plan on 3/27 |
| 4/28 - 5/2 | Rep. Thomas floats second plan on 4/30 |
| 5/6 - 5/12 | Committee passage and House passage on 5/6 and 5/9 |
| 5/13 - 5/19 | Senate passes bill on 5/15 |
| 5/21 - 5/28 | Conference version passes on 5/23 |

I merge the Compustat data with CRSP daily stock data to run the following market model regression:

$$R_{fd} = \alpha + \beta_1 Index_d + \beta_2 CC_{fd} + \beta_3 CR_{fd} + \delta_n + \varepsilon_{fd}$$

where $f$ are firms and $d$ are days, $R_{fd}$ is the return over the 5-day window (excluding dividends), $Index_d$ is a value-weighted index of all firms in the merged Compustat-CRSP dataset, $CC_{fd}$ is a dummy for Cash-Short firms, $CR_{fd}$ is a dummy for Cash-Rich firms, and $\delta_n$ are industry fixed effects, using Fama-French 30 industry definitions. Thus $\beta_2$ and $\beta_3$ represent the abnormal returns Cash-Short and Cash-Rich firms, respectively.

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