Tax Reform and the Valuation of Superstar Firms

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PRELIMINARY DRAFT NOT FOR CITATION

Abstract

In a frictionless model of perfect competition, the increase in value a company receives after a tax cut is offset exactly by an equal decrease due to the entry of new firms. If instead frictions prevent immediate entry, the size of the increase in value upon a tax cut will be higher, the higher the economic profits of a firm. Using data on the U.S. stock market, I show that, among the biggest firms, those with a bigger market capitalization before the tax cut saw a higher return on their stock upon news shocks regarding the passing of the Tax Cuts and Jobs Act. My work complements a growing literature documenting a concentration of market shares in the U.S. economy.

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1 Introduction

The last few decades have seen the rise of incredibly innovative firms, which have managed to quickly gain massive market shares in their respective sectors. Some of these, like Apple, Microsoft, Google, Amazon, Facebook, and Walmart, have become some of the most valued companies on the planet. The rise of these companies has sparked a debate, both in public opinion and the academic literature, regarding the nature of these companies' profits. What are the benefits of innovation? To what extent are these profits attributable to more efficient business practices, and to what extent are they attributable to positions of rent?

Some papers, such as Autor et al. [2017] and Dorn et al. [2017] have argued that the rise of "superstar", capital-intensive firms has contributed to the surprising fall in the labor share over the last few years. In their work, they show that most of the fall in labor's share of GDP is attributable to production shifting *within* industry, with a few very productive firms hoarding much of the market share – and concurrently, of the labor employed. Others, like De Loecker and Eeckhout [2017] have documented a sharp increase in markups over marginal cost. They also find that this increase in driven by a few high-markup firms, and argue that this might be linked to the fall in labor share and a slowdown in output growth, among other things.

Ever since Schumpeter [1942], economists have known that innovation entails some degree of market power. More recent work, such as Boldrin and Levine [2008], has highlighted how innovation can be a source of rents even in a perfectly competitive environment. They also point out how, in many cases, innovating firms can leverage this initial position of dominance to impose artificial barriers to competitors, thus extending this initial position of rent indefinitely.

This paper sets out to analyze the consequences of a recent cut in U.S. corporate tax rates on stock market prices, with the purpose of answering the question of where investors believe the value of these companies to come from, and whether that confirms or denies the findings in the literature mentioned above. The consequences of a tax cut depend sharply on whether a firm is facing a mass of potential entrants, or whether they are accruing economic profits. To illustrate this, suppose that the after-tax rate of return to capital is set exogenously by world markets, at some value ρ. Firms in the U.S. face a corporate tax rate of τ, so that the aggregate capital stock $K(\tau)$ will satisfy the no-arbitrage condition

$$(1-\tau)F'(K(\tau)) = \rho, \tag{1}$$

where $F(K)$ is the aggregate production function. Further suppose that firms draw value from two separate sources: the capital they own, k, and the economic profit they control, π. The value of a company, then, can be expresses as:

$$V(k) = (1-\tau)(F'(K(\tau))k + \pi). \tag{2}$$

What are the consequences, in this model, of a change in τ? We can quickly obtain the answer by differentiating equation 2:

$$\frac{\partial V}{\partial \tau} = -(F'(K(\tau))) - \pi + (1-\tau)F''(K(\tau))\frac{\partial K}{\partial \tau}.$$

As we can see, the effect of a change in tax rate on the value of the firm will depend on how quickly the aggregate capital stock responds to the change in tax rate. Differentiating equation 1 with respect to τ on both sides, we can find this effect explicitly:

$$\frac{\partial K}{\partial \tau} = \frac{F'(K(\tau))}{(1-\tau)F''(K(\tau))}.$$

Therefore, we can combine the last two equations to see that

$$\frac{\partial V}{\partial \tau} = -\pi$$

In other words, the value of a company with no rents ($\pi = 0$), will not change upon a change in the tax rate. This implies that we can study the extent to which an individual company's profits are derived from rents by looking at how their stock market prices reacted to the tax cut.

It should be noted that the model I just outlined ignores many facts that are relevant in determining a company's stock market valuation. For example, the presence of adjustment costs, which would slow down the change of the aggregate capital stock, would at least partially invalidate the argument that I laid out: even in the absence of rents, firm values would still benefit from the period of adjustment. The paper develops a dynamic model that is able to take these considerations into account, and more formally describe the effect of a change in tax rate.

Having established some theoretical predictions, I then use financial data on companies as well as news shocks on the Tax Cuts and Jobs Act of 2017, which reduced corporate income tax rates, to test whether indeed the firms that experienced the largest gains from the the tax cut were also the ones earning more profits before the tax change. I find that among the largest companies in terms of market capitalization, the ones with bigger expected future profits before the tax change where also the ones to experience the biggest gains upon news shocks of the tax cut.

The rest of the paper proceeds as follows. Section 2 gives some background on the present state of the literature, contextualizing the contribution of this paper. Section 3 lays out a dynamic model that formalizes the arguments laid out in the introduction by modeling explicitly the decisions of the firm and the entry of new capital. Section 4 contains my empirical analysis. Section 5 concludes and lays out a path for how to expand and improve the paper.

2 Background

Most literature in public economics is concerned with studying the effects of government policy, and thus it treats policy as exogenous and either permanent or unfolding in a manner that is common knowledge. But studying the effects of policy on the stock market and more generally on economic behavior must mean recognizing that most agents in the economy most likely do not see policy in this way, but rather hold some beliefs implying a distribution of possible future policies.

The late 1980's and 1990's saw a spur of interest in such questions. Auerbach and Kotlikoff [1987], Auerbach and Hines [1988], Cutler [1988], Poterba [1989], Rodrik [1991], and Slemrod and Greimel [1999] are all concerned with how changes in expectations regarding future tax policy affect current decision making, both by firms and individuals, both in financial markets and in the real economy. A more recent strand of literature, starting with Bloom [2009] and Baker et al. [2016], has concerned itself with understanding the effects of policy uncertainty itself, and showing that it has an impact in real economic behavior. This new strand of literature has made significant strides in understanding how changes in both expectations and variances impact economic decisions, but much remains unanswered: measuring expectations is notoriously difficult, and models of dynamic stochastic decision-making get complicated very quickly.

In this paper, I study how changes in beliefs about tax reform in the U.S. shaped the valuations of perceived winners and losers from said reform. The Tax Cuts and Jobs Act (TCJA) has been in the making since Donald J. Trump was elected President on November 8, 2016, and has faced a rocky road until its passing on December 22, 2017. Other analyses of the effects of TCJA on the stock market exist. Wagner et al. [2018b], for instance, document how gains from the tax cut differed for companies depending on their effective tax rate and their foreign operations. Wagner et al. [2018a], on the other hand, analyze the effects of the Trump election on the U.S. stock market. Blanchard et al. [2018] use betting data on the tax rate, which I will also make use of, to explore the recent rise in stock market prices. Gaertner et al. [2019], insted, studies the effects on foreign companies. Hanlon et al. [2018] look at the actions and *statements* about actions of companies in the aftermath of TCJA. Sterk and Sterk [2019] simulate the long-run consequences of TCJA, finding that it could lead to a substantial increase in firm entry.

My paper distinguishes itself in its effort to better understand the heterogeneity of the effects of tax reform on domestic companies, and how they can be motivated by differences in economic profits, explained either by exogenously higher productivity or the presence of market power. The most direct predecessor of this paper is Cutler [1988]'s analysis of the 1986 Tax Reform Act's (TRA86) effect on stock market prices. Among other things, Cutler points out the the effect of tax reform on firm value is after all ambiguous, a reality that in his case was further aggravated by the fact that TRA86 drew a distinction between old and new capital via the Investment Tax Credit. I improve upon this work by leveraging the latest tax reform, which uniformly lowered corporate income tax rates, and the availability of new data such as the prices of betting contracts on the tax reform, as well as by being more explicit about the theoretical explanation of the effects of tax rate changes on firm values.

Recent literature has also gone beyond the study of expectations about tax policy, and has gone on to study the effects of policy beliefs more generally. Friedman [2009], who used news on regulations of drug coverage to estimate the incidence of Medicare Part D, is a methodological predecessor to this paper: instead of taking an out-right event-study approach, I use a more continuous approach that allows me to do something closer in spirit to a difference-in-difference estimation. Graziano et al. [2018], Handley and Limão [2017], and Carballo et al. [2018] have studied the effects of changing beliefs regarding trade policy, while Meng [2017] has used prediction market data regarding the passing of an anti-pollution cap-and-trade bill to estimate the marginal abatement cost of proposed policy. More generally, the great potential uses for prediction market data, of which I make some use in this paper, have been advocated for some time in the literature, starting with papers such as Wolfers [2006], Arrow et al. [2008], or Snowberg et al. [2011]. While some authors, such as Manski [2006] have cast some doubt on the use of these data, Wolfers and Zitzewitz [2006] offer some theoretical justification as well as some empirical evidence in support of interpreting betting prices as average beliefs.

3 Dynamic Framework

I begin by developing two distinct models of the decisions of heterogeneously productive firms within an industry, with the purpose of understanding what is the role of monopoly rents in the stock market reaction of firms to a corporate tax cut. In the first model, the number of firms operating in the industry is exogenous and fixed; firms compete à la Cournot, and doing so earn economic profits due to their market power. In the second model, there is a pool of potential entrants who at any time can decide to compete with incumbent firms. Firms with a particularly high productivity will be making positive profits due to their superior technology – in other words, they will be earning Ricardian rents due to their un-reproducible knowledge

– but all firms are price-takers and thus behave competitively. We will see how these two models generate radically different implications for how the stock market price of a firm should behave upon a change in the corporate tax rate: while under free entry the value of the firm is not affected, under monopoly after-tax profits decrease linearly in the tax rate.

After introducing these two models in the first two subsections, I proceed to investigate how two aspects of the model shape my predictions. First, I will discuss what happens if we don't assume, as I do in the initial outlining of the free-entry model, that potential entrants can decide to enter immediately upon news of a tax cut. Second, I will discuss the role of heterogeneous productivity by looking at what happens, in each of the two models, if firms are assumed to be homogeneous. Each different version of the models will generate distinct empirical predictions that will guide empirical analysis.

3.1 Oligopoly

In what follows I focus on the case of duopoly, which is easier to follow along, but all my arguments extend trivially to any fixed number of firms competing on quantities. With this in mind, imagine that there are two firms, $i = 1, 2$ deciding each period how much of a good to produce, $q_{i,t}$, at a constant marginal cost c_i. They face the aggregate inverse demand function $P(Q_t) = 1 - Q_t$, where $Q_t = q_{1t} + q_{2t}$. Each turn, firms earn pre-tax profits:

$$\pi(q_{i,t}, q_{-i,t}) = \Big[(1 - q_{i,t} - q_{-i,t})q_{i,t} - c_i q_{i,t}\Big].$$

Firms are taxed at rate $\tau \in (0, 1)$ on these profits and face an opportunity cost c_f to stay open, so they end up with period payoffs $(1 - \tau)\pi(q_{i,t}, q_{-i,t}) - c_f$. This stage game repeats identically forever, and firms discount their future profits at a common discount factor β.

For the rest of this subsection, I will be dropping time subscripts and focusing on the Nash-Equilibrium of the stage game, since always playing the stage-game equilibrium quantities must also be subgame perfect. Nonetheless, the reader will notice that my argument about the change in the value of the firm upon a tax cut would be still valid as long as firms are in a stationary equilibrium, and as long as the tax rate does not act as the public signal in a coordinated equilibrium.

In the stage game, each firm simultaneously picks q_i taking q_{-i} as given. In equilibrium:

$$q_i^{NE} = \frac{1 + c_{-i} - 2c_i}{3}.$$

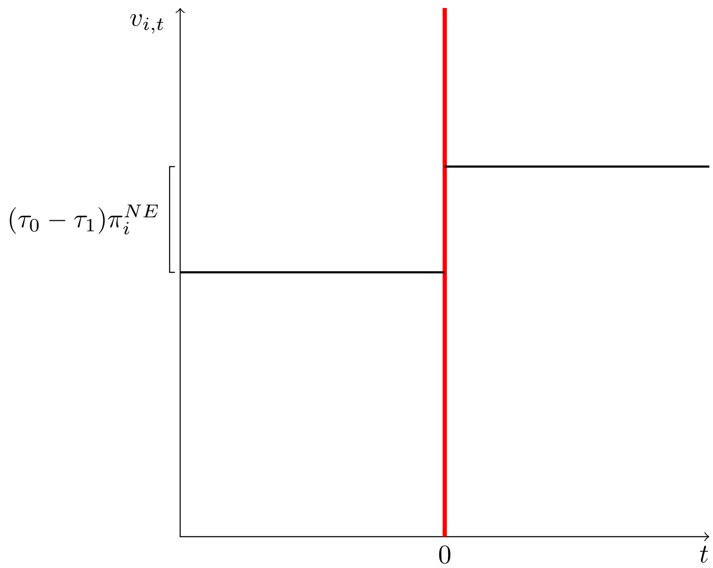

Figure (1) At time $t = 0$, the there is an unanticipated change in τ from τ_0 to τ_1, $\tau_0 > \tau_1$. The picture depicts the change in the value of a firm operating in oligopoly.

Assuming that this implies positive quantities for both firms, and as long as fixed costs are low enough that both firms operate,[1] this equilibrium will not be influenced by the corporate tax rate τ. Thus, the value of firm i will simply be given by:

$$\begin{aligned} v_{i,t} &= \sum_{s=0}^{\infty} \beta^s \Big[(1-\tau)\pi(q_{i,t+s}, q_{-i,t+s}) - c_f \Big] \\ &= (1-\tau)\frac{\pi_i^{NE}}{1-\beta} - \frac{c_f}{1-\beta}, \end{aligned}$$

where $\pi_i^{NE} = \pi(q_i^{NE}, q_{-i}^{N}E)$ are the profit firm i earns in the stage-game equilibrium. As we can see, v_{it} is linear in τ, so upon a surprise decrease in τ the value of the firm will simply increase proportionally to its current profits. Figure 1 shows an example of this effect: firm value immediately and permanently jumps to a new, higher value.

3.2 Free Entry

Let us now turn to the case in which anyone can enter the market. Let me also note that the model described in this section is a simple extension of a special case of a more general model developed in Hopenhayn [1992a]. Each firm is born with an idiosyncratic productivity $\phi \sim U(0,1)$. Every period, firms

[1] For $c_f = 0$, this will require that $0 < c_i < \frac{c_{-i}+1}{2} < 1$, $\forall i = 1, 2$

that are open for business decide how much capital to rent in order to maximize period-by-period profits:

$$\pi(p_t, \phi, \tau) = \max_{k \geq 0}(1-\tau)[p_t\phi k^\alpha - k] - c_f.$$

The rental rate of capital is assumed to be one, $\alpha \in (0,1)$, and firms face an opportunity cost c_f for every turn in which they are open. Finally, corporate profits $[p\phi k^\alpha - k]$ are taxed at a constant and exogenous rate, τ.

Besides its input choice, an incumbent firm faces the decision of whether to stay open, and earn profits $\pi(\phi, p, \tau)$, or to shut down, and earn zero profits. The Bellman equation for an incumbent firm, thus, is:

$$v(p_t, \phi, \tau) = \max\left(0, \frac{\pi(p_t, \phi, \tau)}{1-\beta}\right).$$

An entrant firm is ex-ante uncertain about its own productivity draw, and faces a sunk entry costs c_e. The Bellman equation for an entrant, therefore, is:

$$v^e(p_t, \tau) = \int_0^1 v(p_t, \phi, \tau)d\phi - c_e.$$

While every potential entrant faces the same entry decision, not everyone will decide to stay open for business once they enter. In particular, firms will face a cut-off exit rule, deciding to exit if they draw a productivity below a certain ϕ^*, and to stay otherwise. The distribution of firms who do not decide to exit is summarized by the measure μ_t, with total mass $M_t = \mu_t(0,1)$, which gives us the size of the industry in each period. Aggregate supply, then, is given by

$$Q(p, \mu_t) = \int_{\phi \geq \phi^*} \phi k^*(p, \phi)^\alpha \mu_t(d\phi),$$

where $k^*(p, \phi)$ is the profit-maximizing choice of capital for a firm with productivity ϕ facing a price p. Finally, aggregate demand is given by the strictly decreasing inverse demand function $D(Q(p_t, \mu_t))$.

A stationary equilibrium is defined as follows:

Definition 1. *Given a tax rate τ, a stationary equilibrium is a triplet (p^*, ϕ^*, M^*) such that:*

1. *Potential entrants are indifferent to enter or stay out of the industry: $v^e(p^*, \tau) = 0$*
2. *Marginal exiters are indifferent to stay in the industry or exit: $v(p^*, \phi^*, \tau) = 0$*
3. *The product market clears: $p^* = D(Q(p^*, \mu))$, where μ has total mass M^* and distribution given by the conditional of $U(0,1)$ on $[\phi^*, 1)$.*

Assuming that c_f and c_e are of appropriate magnitudes such that a meaningful equilibrium (i.e., one where $p^*, M^* > 0$ and $\phi^* \in (0,1)$) is possible under the tax rates we will consider, this model satisfies assumptions A.1 – A.4 in Hopenhayn [1992b] and thus we are also guaranteed that this equilibrium is unique.

Let us consider two tax rates $\tau_0 > \tau_1$ and the equilibria they each induce, respectively (p_0^*, ϕ_0^*, M_0^*) and (p_1^*, ϕ_1^*, M_1^*). Assume that the change in tax rate is unanticipated and announced at the beginning of the period, so that new entrants can take it into account when they make their decision, and the industry will seamlessly transition from the first to the second equilibrium. Then, the change in value for an incumbent firm with productivity ϕ will be:

$$\begin{aligned}\Delta V(\phi) &\equiv (v(p_1^*, \phi, \tau_1) - v(p_0^*, \phi, \tau_0) \\ &= A(1-\beta)^{-1}\phi^{\frac{1}{1-\alpha}}\left((1-\tau_0)(p_0^*)^{\frac{1}{1-\alpha}} - (1-\tau_1)(p_1^*)^{\frac{1}{1-\alpha}}\right),\end{aligned}$$

where $A = \alpha^{\frac{1}{1-\alpha}}(\alpha^{-1} - 1)$ is a positive constant.

Using condition (2) in definition 1 to substitute for p^* in condition (1) of definition 1, one can confirm that ϕ^* does not depend on τ, i.e. $\phi_0^* = \phi_1^*$. Using again condition (2) to substitute for p_0^* and p_1^*, one can easily confirm that $(1-\tau_1)(p_1^*)^{\frac{1}{1-\alpha}} = (1-\tau_0)(p_0^*)^{\frac{1}{1-\alpha}}$, and thus that $\Delta V(\phi) = 0$ for all ϕ. In other words, the composition of firms that stay in the industry does not change (ϕ^* is constant); but the scale of the industry increases, $M_1^* > M_0^*$, to the point where the price decreases enough so that incumbent firms are indifferent between the two tax rates. This is in stark contrast to what happened in the case of oligopoly, where firm values saw an immediate and permanent increase in their valuations. Figure 2 gives a graphical depiction of the value of a firm upon a change in the tax rate. Next, we turn to discuss what happens when entrants cannot immediately react to the change in tax rate, and what role heterogeneity plays.

3.3 Delayed Entry

In the case of oligopoly there is no entry, so here we only focus on the case of free entry. A simple way to model the idea that potential entrants might be unable to immediately enter, is to slightly change our thought-experiment so that the unanticipated announcement of the tax cut is made *after* firms have made their entry and exit decisions, but *before* they have made their input decisions or realized their profits. In such a case, M^* and phi^* are fixed are their initial levels, but the price p is free to move to clear the market. However, since firms' input decisions do not depend on τ, they will each be producing exactly as much as before the tax change, and so nothing will change in market-clearing condition (3) in definition 1, meaning

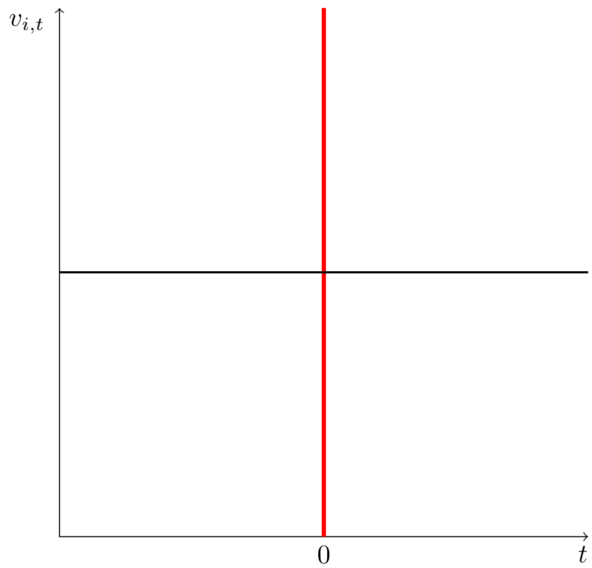

Figure (2) At time $t = 0$, the there is an unanticipated change in τ from τ_0 to τ_1, $\tau_0 > \tau_1$. The picture depicts the change in the value of a firm operating under free and immediate entry.

that the price will also not change. In the period of the announcement incumbent firms will earn identical pre-tax profits as they did before, but will get to keep a larger fraction of it. After the announcement period is over, the economy will again transition to the new steady state that makes all incumbents indifferent between the two tax rates. Thus, we have:

$$\begin{aligned} \Delta V(\phi) &= \pi(p_0^*, \phi, \tau_1) - \pi(p_0^*, \phi, \tau_0) + \beta((v(p_1^*, \phi, \tau_1) - v(p_0^*, \phi, \tau_0)) \\ &= (\tau_0 - \tau_1)[p_0^* \phi k^*(p_0^*, \phi)^\alpha - k^*(p_0^*, \phi)]. \end{aligned} \tag{3}$$

Thus, upon the tax change the value of the firm will immediately increase proportionally to its pre-tax profits. Assuming these profits are not simply held by the company in cash, the following period the value of the firm will return to pre-tax change levels. Figure 3 shows what happens to the value of a firm when there is free but delayed entry.

3.4 The Role of Heterogeneity

In the case of oligopoly, we have allowed for firms to vary in their marginal cost, but things aren't much different if we simply assume that $c_1 = c_2 = c$. The case of free entry, instead, warrants some thought. If all firms have the same productivity draw, say $\bar{\phi}$, the only possible equilibrium is one in mixed strategies, in which all firms earn exactly enough profits to offset entry costs, and exactly enough of them decide to indifferently enter to clear the product market. As in the model sketched in the introduction, firm valuations

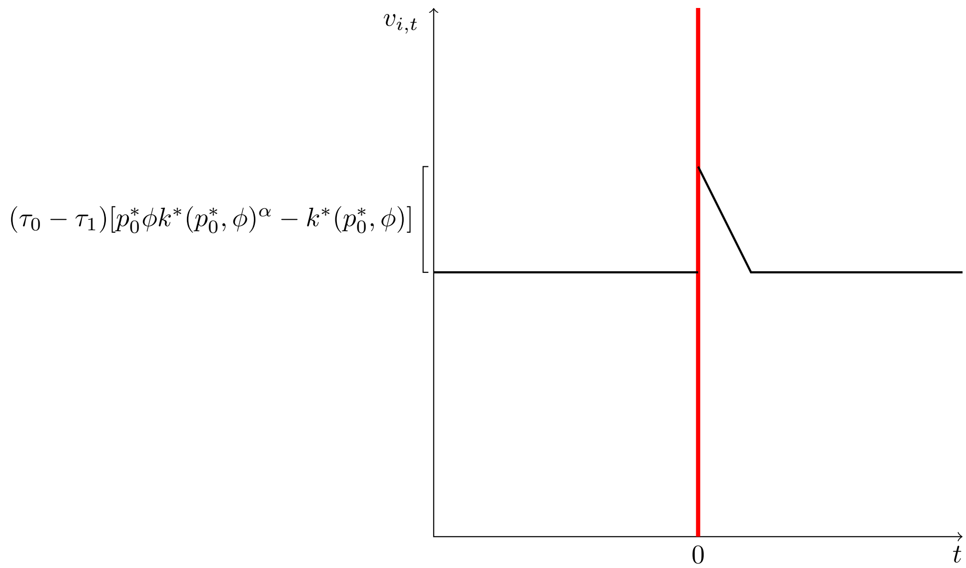

Figure (3) At time $t = 0$, the there is an unanticipated change in τ from τ_0 to τ_1, $\tau_0 > \tau_1$. The picture depicts the change in the value of a firm operating in free but delayed entry.

do not change upon a change in the tax rate if firms are earning no rents.

To formally investigate what would happen upon a surprise reduction in the tax rate, imagine again two stationary equilibria induced by two tax rates $\tau_0 > \tau_1$. In the case of homogeneous productivity there is no meaningful ϕ^*, so these two equilibria will be defined by the pairs (p_0^*, M_0^*) and (p_1^*, M_1^*). Because potential entrants now face no uncertainty in their productivity, and because profits must be equal to entry costs, we have that in both equilibria,

$$v(p_0^*, \bar{\phi}, \tau_0) = v(p_1^*, \bar{\phi}, \tau_1) = c_e.$$

And so, just like in the case of heterogeneous entry, $\Delta V = 0$ for all incumbents. Just like before, in the case of delayed entry, in which incumbent firms get one period at the old price with the new tax rate, then they will see a temporary increase in value followed by a return to pre-tax change levels. Thus, everything we have learned so far in this section is still true in the case of homogeneous productivity.

What changes in the case of homogeneous productivity is that all firms will be earning the same profits; since both in the case of oligopoly and in the case of free both delayed entry the increase in firm value (permanent or not) is proportional to pre-tax profits, then all firms should see an identical increase in their valuation. This stands in contrast to the case of heterogeneous productivity: since pre-tax profits are strictly increasing in productivity (or in the case of oligopoly, strictly decreasing in marginal cost), a bigger increase in value upon the tax cut is indicative of higher productivity – as can be seen in figures 1 and 3.

3.5 Discussion

The various predictions of the models in this section suggest several empirical tests. First, one can look at which companies had the biggest gains upon news of the tax bill. If these gains vary across companies, that will be evidence of heterogeneous productivity. If these gains are permanent, that will be evidence that firms have market power. If instead these gains are transitory, the speed of their return to pre-TCJA levels will tell us about how fast potential entrants can react to the tax cut.

Naturally, these simple models also leave many other important aspects out of the picture. For one thing, TCJA implemented many changes in the U.S. tax system other than changing the corporate tax rate. Controlling for how these changes affected company valuations will be crucial for the credibility of my results. Further, the models I presented in this section simply assume that firms rent capital every period, so the value of the firm is simply given by its discounted sum of expected future profits. This leaves an open question as to how to treat empirically other ways in which investors can hold claim to a company's stream of profits, such as the value of a company's debt or share buybacks. For the moment, the empirical analysis that follows is based solely on the value of a firm's equity.

4 Empirical Analysis

4.1 Data

The data used in this study can be binned in two broad categories. First, I use merged data from the Center for Research in Security Prices (CRSP) and Compustat to obtain data on the daily holding returns of various stocks in the New York Stock Exchange (NYSE) and the companies to which they are tied. In particular, I use firm accounting data on items such as revenue, profits both domestic and foreign, and tax liabilities, as well as financial data such as holding returns, share prices, and shares outstanding.

Second, I use data that give me news shocks regarding the tax bill. On one hand, I use six dates identified in Gaertner et al. [2019] as particularly relevant for the development of tax reform in 2017.[2] In their paper, they document spikes in Google searches regarding "tax reform" on these dates, and argue that this is due to the fact that these were surprising events at the time, which attracted the public's attention on the tax bill. In their paper, they also use these dates to perform event studies on the stock returns of foreign companies.

In addition to these dates, I use data from several bets undertaken on the web platform PredictIt.org, which organizes bets among users around the world. Betting on PredictIt is entirely user-based; any registered

[2]These dates are: September 27, 2017 (United Framework for Tax Reform unveiled - Member retreat), November 2, 2017 (TCJA introduced in the House), November 16, 2017 (House passes TCJA), December 2, 2017 (Senate passes TCJA), December 15, 2017 (Bill reported by the joint conference committee), December 20, 2017 (Final version agreed to by the Senate).

individual can post a "Buy" or a "Sell" contract for each possible outcome, which in the case of our bets of interest is always binary ("Yes" or "No"). Contracts pay out $1 in the case that the user gave the correct answer, and the price is simply the share of that dollar paid in by each of two users taking part in the bet. No user can wager more than a total of $850 on a single bet, and PredictIt makes money by charging a 10% fee for all winnings in excess of money invested, plus a 5% withdrawal fee. As a result, users will want to buy "Yes" contracts that have a price lower than their subjective probability of a "Yes", and sell contracts with a price higher.

As Graziano et al. [2018] point out, one need not interpret these implied probabilities as the true belief of all agents in the economy, as long as we are willing to suppose that the price of these contracts is strongly correlated with individual beliefs, and as long as no agents systematically change belief in direction opposite to that of the change in odds.[3] I will be looking at innovations in the prices of these betting contracts, as I'm interested in showing how financial markets react to shocks in policy expectations.

Gaertner et al. [2019] are quite critical of these data in their work, and point out that the biggest spikes do not seem to match up with neither the Google trends data they use nor conventional wisdom about the developments of the tax bill. While these very betting odds have been used in other literature, such as in Blanchard et al. [2018], the fact that they do not seem to line up very well with conventional wisdom is worrying. This is probably driven by the fact that this specific betting market was not as thick as in other bets on the same website – e.g., betting odds on the election of Donald Trump are more widely used and acknowledged as a good proxy for the public's beliefs – so a few outliers could disproportionately move the price on any given day. For example, readers can see in figure 4 that not all events match up with changes in odds as we would expect, and that the largest spike in the price occurs on August 9, 2017, which does not seem to match up with any event of note. A simple explanation for this random spike is that a) limits on the amount that each user can wager on a single bet mean that some mispricing might not get arbitraged away, and b) this is particularly true on days were very few people are betting; , it is not surprising to find out that on August 9, 2017, only two users were exchanging contracts on this bet. As a result, I use these data notwithstanding, but I urge the reader to take them with a grain of salt. In particular, they will be particularly useful to establish the cardinality of my results ex-post. Other bets of interest to this study include an analogous bet on whether there would be a corporate tax cut by March 31, 2018, which started on October 23, 2017, and closed when TCJA was signed into law; and whether the Senate would pass TCJA, which started on November 3, 2017, and closed when the Senate finally approved the final version of the bill on December 2, 2017. Figures 5 and 6 give details on these further bets.

[3] This could technically happen, for instance, if agents with radically different priors interpreted the same signals in systematically opposite ways.

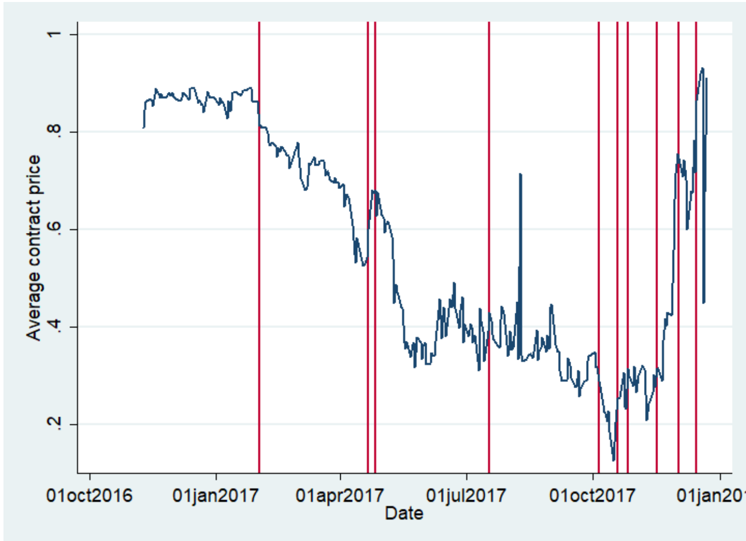

Figure (4) Average price for a "Buy Yes" contract. Each red line represents one of these political developments, in chronological order: **Feb 1, 2017**: retailers formally launched a coalition against the border adjustment tax proposal called Americans for Affordable Products (AAP); **Apr 21, 2017**: Trump administration announces it will release a "tax plan"; **Apr 26, 2017**: Tax plan released; **Jul 18, 2017**: reconciliation resolution (H.Con.Res.71) announced; **Oct 5, 2017**: TCJA passes House of Representatives; **Oct 19, 2017**: TCJA passes Senate; **Oct 26, 2017**: reconciliation resolution agreed to without objection; **Nov 16, 2017**: TCJA passes House of Representatives; **Dec 2, 2017**: TCJA passes Senate; **Dec 15, 2017**: TCJA reported by joint conference committee. The bet starts Nov 9, 2016 and ends Dec 22, 2017. The dip in odds on Dec 21, 2017, reflects doubts that President Trump would sign the bill by year end over a showdown with congressional Republicans, and as one can see in figure 5 it does not appear when the bet asks about tax cuts by Mar 31, 2018.

4.2 Methodology

My research design is based on so-called difference-in-difference designs. Instead of the classic, pre-post and treated-control distinction, I plan to take a more continuous route. The final objective is to compare how different firms' stock market valuations react to changes in the probability of a tax cut.

To do this, I plan to first estimate a model of the stock market in the spirit of Fama and French [1993] on a period *preceding* the election of president Trump, to get a sense of how each company's stock moves with the rest of the financial market. In their three-factor model the stock market returns of company i in day t, $R_{i,t}$, depends on the risk-free rate of return, R_t^f, the returns to a market portfolio, R_t^m, the persistent effects of book-to-market equity, a High-Minus-Low portfolio (HML_t), and the persistent effects of firm size as measured by its market capitalization, a Small-Minus-Big portfolio (SMB_t):[4]

$$R_{i,t} - R_t^f = \beta_i^m (R_t^m - R_t^f) + \beta_i^{HML} HML_t + \beta_i^{SMB} SMB_t + u_{i,t}.$$

The estimates $(\hat{\beta}_i^m, \hat{\beta}_i^{HML}, \hat{\beta}_i^{SMB})$ will allow us to construct expected returns during our sample period of interest, namely the months leading up to the passing of TCJA. I will use these expected returns to construct

[4]These last three values, R_t^m, HML_t, and SMB_t, are taken directly from Kenneth French's website.

"abnormal returns" for each company in every period, $AR_{i,t}$:

$$AR_{i,t} \equiv (R_{i,t} - R^f_t) - \hat{\beta}^m_i(R^m_t - R^f_t) - \hat{\beta}^{HML}_i HML_t - \hat{\beta}^{SMB}_i SMB_t.$$

Once we have abnormal returns for every company in the sample, I plan to study how news shocks regarding the tax bill affected returns relative to what we would have expected. More specifically, in the vein of the model laid out in section 3, I plan study whether firms that we might deem more productive ex-ante also saw the biggest increase in returns upon news of the tax cut.

My main specification of interest is:

$$AR_{i,t} = \beta_0 + \beta_1 MarketCap_i + \beta_2 MarketCap_i TCJADates_t + \zeta_t + \xi_{s(i)} + \gamma' \mathbf{X_{i,t}} + \varepsilon_{i,t}, \tag{4}$$

where $MarketCap_i$ is firm i's market capitalization at the end of fiscal year 2015; $TCJADates_t$ is a dummy equal to one if day t is one of the six dates identified by Gaertner et al. [2019]; ζ_t are a set of time fixed-effects; ξ_s are a set of sector fixed effects;[5] and $\mathbf{X_{i,t}}$ is a vector of controls, including what fraction of a company's profits came from abroad in previous years, and the average tax rate that they face abroad (both are assumed to be zero if a firm only operates domestically). This is quite important because TCJA changed many provisions regarding the treatment of corporations' foreign income, which likely affected future profits differently depending on how many profits a company was earning abroad, and depending on the locations of these operations – and the tax rates faced therein. As a result, I also include the interaction between these two variables and $TCJADates_t$.

The resulting estimate of β_2 will indicate how firms with a larger market capitalization where differently impacted by the news of the tax bill, by measuring at how their stock market returns differed, on average, during our six dates of interest. According to the theory developed in section 3, we should observe that companies with the biggest market capitalization before the tax change, which presumably had the largest expected future profits, will also see the biggest increase in after-tax profits after the tax change. Companies that, instead, earned little or no economic profits, instead, should see their gain in after-tax profits mostly or wholly undone by the increase in entry.

4.3 Results

I run specification 4 on different segments of companies quoted on the NYSE. I start by estimating it on all firms, and then restrict the sample to bigger and bigger firms in terms of market capitalization. Results

[5] Industry here is defined as the first three digits of a company's NAICS code.

are reported in table 1. As we can see, the coefficient on $market\ cap \times TCJA\ dates$ tends to be positive, but is statistically indistinguishable from zero. Once I restrict the sample to only look at companies in the top quartile or the top decile of market capitalization, however, we can see that companies with a bigger market capitalization before TCJA were the ones with the highest returns on days in which news shocks made the reduction in tax rate more likely to the eyes of the public.

An enticing explanation for these results is that the U.S. economy of 2017 was dominated by a few firms that, through either higher productivity or stronger market power claim the lion's share of economic profits. This would be consistent with the findings on the literature on the fall of labor share as well as the literature documenting a rise in mark-ups.

In order to further investigate this result, I run a similar specification as in equation 4, but instead of using the dates identified in Gaertner et al. [2019] to proxy for news shocks, I instead use the innovation in contract price from PredictIt:

$$AR_{i,t} = \beta_0 + \beta_1 MarketCap_i + \beta_2 \Delta P_t + \beta_2 MarketCap_i \Delta P_t + \gamma' \mathbf{X_{i,t}} + \varepsilon_{i,t},$$

where $\Delta P_t = P_t - P_{t-1}$ is the innovation in the odds of a corporate tax rate decrease. Using these odds for the entire year might be problematic because substantially different proposals were being considered by the Trump administration in late 2016 and early 2017. In order to alleviate these concerns, I restrict attention to the period after July 18, 2017, which is when reconciliation bill H.Con.Res.71 was announced,[6] making tax reform the signature issue of the sitting Republican majority for fiscal year 2017, and starting the process of drafting what eventually became the final bill.

Results are reported in appendix table 2. While all of the estimates of β_2 are positive, which confirms our former results, none of them are statistically significant. This might be a combination of both the fact that sample size was cut by almost two thirds, as well as the fact that the betting odds might be an imprecise proxy for news shocks.

5 Conclusion

This paper sets out to study the reaction of a firm's stock market valuation to a surprise change in corporate income tax rates. I develop a model of firm value, and show how predictions vary depending on the nature of entry and the heterogeneity of firms. When firms are in oligopoly, firms experience a permanent increase in value. When there is free entry, firm values do not change before or after the tax change – unless

[6]Under the Byrd rule, reconciliation resolution is a procedure through which a sitting legislature can bypass filibuster in the Senate.

	Dependent Variable: Abnormal Returns				
	All Firms	Top 75%	Top 50%	Top 25%	Top 10%
$prop.\ foreign$	-0.00145	-0.00221*	-0.00137	-0.00138	-0.000850
	(0.000816)	(0.00100)	(0.000991)	(0.00108)	(0.00189)
$prop.\ foreign \times TCJA\ dates$	-0.00636	0.0137*	0.0107*	0.0108	-0.00312
	(0.00688)	(0.00595)	(0.00338)	(0.00722)	(0.0271)
$\bar{\tau}_i^{FOR}$	-0.00127	-0.00112	-0.00305	-0.00524	-0.00148
	(0.00163)	(0.00170)	(0.00187)	(0.00483)	(0.00644)
$\bar{\tau}_i^{FOR} \times TCJA\ dates$	0.0183	0.0252	0.0141	0.0265	0.0177
	(0.0155)	(0.0136)	(0.0138)	(0.0306)	(0.0512)
$market\ cap$	-0.000243*	-0.0000474	-0.0000198	-0.0000459	0.0000506
	(0.0000857)	(0.0000636)	(0.0000601)	(0.0000693)	(0.0000713)
$market\ cap \times TCJA\ dates$	-0.000222	0.000461	0.000809	0.00106*	0.000906*
	(0.000720)	(0.000537)	(0.000503)	(0.000536)	(0.000421)
N	1,394,692	1,072,245	725,324	366,125	148,393
Industry FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes

* $p < 0.05$

Table (1) Continuous diff-in-diff regressions of abnormal returns. Standard errors, in parentheses, are clustered by day.

entry takes time, in which case incumbent firms will experience a temporary increase in value. Generally speaking, if firms do experience increases in values, these increases will be larger for more productive firms.

I bring these theoretical observations to the data by studying how firms with bigger market caps were also the ones who experienced the biggest returns upon the passing of the Tax Cuts and Jobs Act, which lowered the rate of the corporate income tax from 35% to 21%. , I find that among the largest companies, the ones who started out with the biggest expected future profits where the one who reaped the largest rewards of the tax bill.

Although some main results are established, there are still many open venues for further investigation. On the theoretical side, future work will be focused on developing a more unified framework. As things stand, the treatment of the case of oligopoly and the case of free entry might feel somewhat disjointed. Future versions of this paper will try to build a more cohesive narrative in its dynamic theory.

On the empirical side, the existence of betting markets specifically on the corporate tax reform gives us the opportunity to assign cardinality to these news shocks, which in turn can give us a better interpretation of the results. After all, what the empirical work is trying to measure is not really the reaction of a firm's value to a change in tax rate, but rather the reaction to a change in *expectations* about future tax rates. If we replace τ_1 in equation 3 with a new expected tax rate $\bar{\tau}(P) = P\tau_1 + (1-P)\tau_0$, where $P \in [0,1]$ is the probability of a change in tax rate, then observing the a change in P allows us to back out the change in after-tax profits. Letting $V(\phi, P)$ be the value of a firm with productivity ϕ when the probability of a tax change is P, and $\Delta V(\phi)$ be redefined as the difference in values under two distinct probabilities P and P'. Then:

$$\begin{aligned}\Delta V(\phi) &= (\bar{\tau}(P') - \bar{\tau}(P))[p_0^* \phi k^*(p_0^*, \phi)^\alpha - k^*(p_0^*, \phi)] \\ &= (P' - P)(\tau_0 - \tau_1)[p_0^* \phi k^*(p_0^*, \phi)^\alpha - k^*(p_0^*, \phi)].\end{aligned}$$

And so, if we can observe some $\Delta P = P' - P$,

$$\frac{\Delta V(\phi)}{\Delta P} = (\tau_0 - \tau_1)[p_0^* \phi k^*(p_0^*, \phi)^\alpha - k^*(p_0^*, \phi)]$$

gives us the change in after-tax profits for a company of productivity ϕ.

Future work will also attempt to expand on how persistent these changes in value are, which would further inform my theoretical observations – albeit it might prove to be an arduous task to do so. Finally, future empirical work will be focused on assessing the robustness of the results, including by trying to see how reactions to the tax change varied with other measures of firm productivity.

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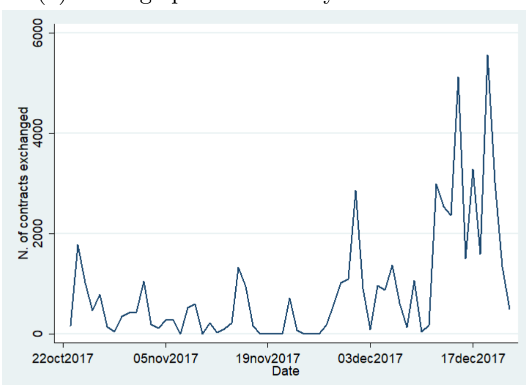
APPENDIX

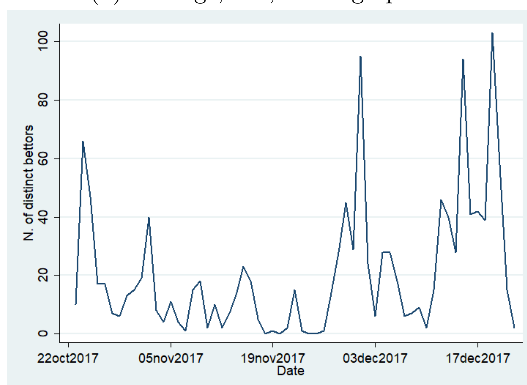
A Figures and Tables

(a) Average price of a “Buy Yes” contract.

(b) Average, low, and high prices.



(c) Number of contracts exchanged.

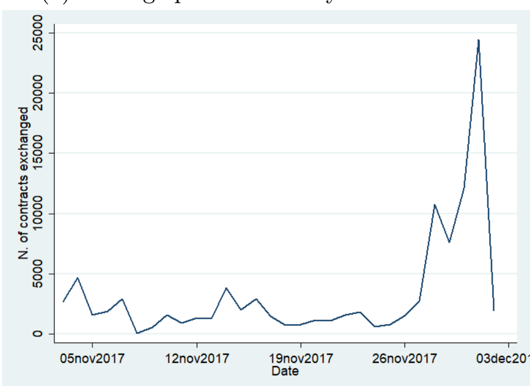


(d) Number of individual bettors.

Figure (5) Data on the bet asking “Will the corporate tax rate be cut by March 31, 2018?”

(a) Average price of a "Buy Yes" contract

(b) Average, low, and high prices



(c) Number of contracts exchanged.

(d) Number of individual bettors.

Figure (6) Data on the bet asking "Will the Senate pass Tax Cuts and Jobs Act in 2017?"

	Dependent Variable: Abnormal Returns				
	All Firms	Top 75%	Top 50%	Top 25%	Top 10%
$prop.\ foreign$	-0.000931	-0.00230	-0.00195	-0.00148	0.000457
	(0.00115)	(0.00156)	(0.00148)	(0.00166)	(0.00310)
$prop.\ foreign \times \Delta P_t$	-0.00449	-0.00444	0.00468	0.000523	-0.0137
	(0.0119)	(0.0186)	(0.0120)	(0.0158)	(0.0336)
$\bar{\tau}_i^{FOR}$	0.00117	0.00105	-0.000382	0.00180	-0.000429
	(0.00273)	(0.00287)	(0.00316)	(0.00796)	(0.0108)
$\bar{\tau}_i^{FOR} \times \Delta P_t$	0.0769*	0.0688*	0.0506*	0.0370	-0.00889
	(0.0263)	(0.0303)	(0.0254)	(0.0926)	(0.112)
$market\ cap$	-0.000271*	-0.000128	-0.0000672	-0.0000467	0.000110
	(0.000117)	(0.0000924)	(0.0000833)	(0.000105)	(0.000117)
$market\ cap \times \Delta P_t$	0.00209	0.000897	0.00102	0.000657	0.000832
	(0.00154)	(0.000926)	(0.000824)	(0.000938)	(0.000771)
N	541,430	417,730	282,892	143,257	58,191
Industry FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes

* $p < 0.05$

Table (2) Continuous diff-in-diff regressions of abnormal returns, where news shocks regarding TCJA are measure by betting odds on whether there would be a corporate tax rate cut in 2017. Standard errors, in parentheses, are clustered by day.