Corporate Tax Asymmetry and Market Power

Peter Choi

October 13, 2025

Click here for latest version

Abstract

This paper examines how asymmetric corporate taxation interacts with product market power. Since losses are not immediately refunded, firms with higher expected profitability experience lower average tax rates, but marginal tax rates can be ambiguous. In a simple dynamic model featuring firms of varying markups making quantity and investment decisions, lower markup firms are more likely to exit and in certain situations experience more downward pressure on investment relative to a system with immediate offset than high markup firms. This can lead to even higher relative market share for already advantaged firms. Firm financial data from Compustat provide empirical support for both mechanisms of mitigation of the asymmetry penalty, though of modest size. Higher markup firms are more profitable and spend less time in nontaxable status. Holding net present value of pre-tax income fixed, high markup firms still have lower loss exposure.

1 Introduction

All corporate tax systems are based on annual accounting: profits are taxed in the year they are earned, while tax losses are not immediately refunded. Instead, firms must carry forward (or back) their net operating losses against future (past) profits.[1] If carried forward, firms lose value on their delayed refund due to the time value of money or complete expiration. In the United States, carryforwards have an indefinite expiration since the Tax Cuts and Jobs Act of 2017 (TCJA), though they had a 20 year or lower expiry in years prior. Countries such as the UK, France, and Germany similarly have indefinite durations, while countries such as Japan and South Korea have more limited durations of 10 and 15 years.[2]

There are several reasons why governments opt for an asymmetric system. For example, tax asymmetry provides protection against fraud in the form of corporations overreporting losses. The government could instead increase enforcement efforts to combat this, but this would only incur further administrative costs. Additionally, there is a political economy angle. Adopting tax symmetry may be publicly perceived as propping up failing or inefficient firms even if losses are temporary shocks.

This paper argues that asymmetric corporate taxes can indirectly benefit firms with market power. It develops a dynamic model of heterogenous firms of varied markups making output and investment decisions under an asymmetric corporate tax system. The model highlights that the asymmetric penalty on firm value typically shrinks as market power rises due to higher expected profitability. Impacts on marginal behavior, however, can depend strongly on past income realizations. Financial data from Compustat support that the magnitude of this penalty is negatively associated with market power, but the scaling in the sample is modest. Finally, a change in carryforward rules under TCJA is used to test differences in marginal investment incentives between high and low market power firms.

For a given statutory tax rate, all firms have a higher effective average and in most situations marginal tax under an asymmetric system relative to a system with immediate loss offset. Firms with higher market power will be partially shielded from the asymmetry penalty, implying that they have a relative subsidy. This can work in at least two ways. First, higher markup usually implies higher mechanical profitability. Second, firms with higher market power may have a stronger ability to influence timing of profit or tax realizations conditional on a given level of profitability.

A lower average tax does not strictly lead to higher market power, as this can be accomplished by a pure redistribution in rents that does not affect relative market shares. However, a persistent increase in after-tax profits will increase a firm's (continuation) value. A decrease in profits has the reverse effect. Thus, redistributing rents from low to high market power firms increases the likelihood of firm exit for low market power firms. By the same token, it can also block entry into

[1]Prior to the TCJA 2017, firms were also allowed to carry any losses back to two years. TCJA eliminated loss carrybacks; however, the CARES Act in 2020 granted a special 5 year carryback allowance for taxable years beginning in 2018-2020.

[2]Table A1 in the Appendix describes the current net operating loss rules of several different countries.

the market by less productive firms that now need a higher pre-tax value to overcome entry costs.

On the intensive margin, it is not strictly the case that firms with higher market power face a lower marginal tax (relative to immediate offset) compared to low market power firms. For example, a firm that is currently nontaxable, and expects to be nontaxable for the forseeable future, can experience a marginal rate close to zero. Thus, whether or not market power increases or decreases (on a market/sales share basis) in the following depends on current and expected taxability outlays.

In an asymmetric system, the tax benefit of investment can only be experienced in a profitable period. If this profitable period is never reached, this benefit is lost entirely. Even if the profitable period is reached, since loss carryforwards are not adjusted for inflation, the value of the tax benefit is discounted by the number of periods it takes to reach the profitable state. Thus, the disadvantage of tax asymmetry is directly scaled by to the expected duration, i.e., time before usage, of net operating losses.

Firms with higher markups are mechanically advantaged in at least two ways in this type of system, so long as higher markups implies higher profits. First, these firms are more likely to have positive taxable income in a given period, and therefore are less likely to interact with the tax asymmetry. Second, conditional on having net operating losses in a given year, higher markup firms are more likely to be profitable again in following periods. This allows them to use acquired tax loss carryforwards earlier and therefore experience less discounting on these benefits.

Another reason why high market power firms may be advantaged by tax asymmetry is in the ability to smooth profits, either due to intertemporal shifting of profit realization or in choosing projects with more consistent income streams. Conditional on the same present value of pre-tax profits, a firm can mitigate the negative effects of tax asymmetry by reducing the size of losses or reducing the average duration of nontaxability. Regardless of whether this choice is ex ante (project choice) or ex post (shifting), after-tax profits are higher.

These advantages have implications for market structure. The higher average tax rate implies a higher minimum exit productivity. This average tax rate decreasing with market power implies that the lowest markup firms are hit the hardest and are pushed closer to the margin of exit. It also implies that firms must be particularly efficient, or some other manner of profit extraction, if they want to break into the market. As the market shrinks, the highest markup firms in the market can capture an even higher sales share as they benefit the most from the newly available capacity.

These advantages, however, do not strictly translate monotonically to lower (relative) marginal tax rates. The marginal cost of investment weakly increases across the board for all firms due to the potential for discounting on the tax refund on the cost. This increase shrinks as markup increases, due to higher expected profitability. However, marginal benefits follow a somewhat opposite pattern. Return on investment, the additional profits from a productivity increase, is shielded if the firm is in a nontaxable state in the following period(s). Thus, a firm that is more likely to be persistently nontaxable operates similar to if they were untaxed, conditinal on not exiting.

One situation where a market power favoring relationship is more likely to hold occurs when the current stock of carryfowards in very low. In this situation, expected persistent nontaxability is more likely to result in exit rather than a firm staying in the market and operating on a tax-neutral margin. Thus, the relevant comparison is more likely to be between firms who are more likely to switch from nontaxable to taxable versus those who are persistently taxable. In this situation, the latter typically experiences a lower relative tax. As higher markup firms are more likely to be the latter, this situation would lead to higher relative investment and an increase in market share.

The relationships between market power, profitability, and tax losses are then empirically examined using Compustat financial data. Markups are constructed as the product of output elasticity and inverse revenue shares as in De Loecker et al. (2020). Tax loss or status variables are constructed in two manners. First, Compustat features a built in field for tax loss carryforwards. This is adjusted in accordance with the accounting literature to address the standard pitfalls of using this variable directly. As an alternative, measures of taxable status and carryforward stock are constructed using the process developed in Edgerton (2010). This process uses other fields in Compustat and real world tax rules in an attempt to deduce carryforward values.

The data show evidence of higher markup being associated with both increased profitability and in conditional loss exposure. Firms with higher market power have shorter average durations on their carryforwards and nontaxability status. For firms with similar NPV, firms with higher markup have lower present value of losses. All of this implies that these firms face lower time value losses due to asymmetry. While these estimates are relatively modest, implying a modest penalty, it should be noted that this is a highly selected sample of large firms. While there is a dispersion in markups, even lower markup firms in this sample are not lower level players in a market.

As a supplementary analysis, this paper exploits changes in tax asymmetry due to the TCJA. TCJA immediately reduced the value of carryforwards by simultaneously capping yearly usage to 80% of taxable income and reducing the statuory rate from 35% to 21%.[3] Triple difference regressions are set up around the implementation of TCJA, with groupings due to whether the firm had higher pre-TCJA average markup and whether the firm had positive carryforward stock immediately prior to the enactment of TCJA.

Of potential importance for investment behavior is the capped usage. For firms that are more likely to remain in *traditionally* nontaxable states, this policy change may significantly alter the marginal tax on investment. The probability of remaining in nontaxable state is no longer the probability that current carryforwards exceed taxable income, but instead the probability that taxable income falls below 0. Thus, firms whose choices were near this margin, which are firms closer to the lower end of markups, may have faced a sudden increase in their marginal tax on investment.

[3] As stated earlier, TCJA also extended the duration of carryforwards from 20 years to indefinite. While this should work in the opposite direction to increase the value of carryforwards, there are two reasons why this impact is minimal. First, as I later show, very few firms in the sample actually hold carryforwards longer than 10-15 years. Second, after 20 years of discounting, the additional value of years beyond this point have minimal impact on the expected value of a carryforward.

The results imply that investment, controlling for lagged Tobin's q, falls more for low markup firms with carryforwards compared to high markup firms with carryforwards. There is also evidence for increasesd acquision spending and more rapid depletion of carryforwards. Taken at face value, these estimates would support the previous story about an increase in the marginal tax for the lower markup firms.

The effects of corporate tax system asymmetry on firm incentives have been rigorously analyzed since at least Auerbach (1986) and Mayer (1986). This paper combines these models of tax asymmetry with elements of firm decision making and entry/exit decisions in models such as Jovanovic (1982), Hopenhayn (1992), and Ericson and Pakes (1995).[4] As is central in Ericson and Pakes (1995), the model here features both a static quantity game and a dynamic investment game. Firm productivities are stochastically affected by per-period investment decisions by all firms in a given industry.

The discussions in this paper strongly mirror the distinction in Auerbach (1986) about how tax asymmetry need not push average effective tax rate and marginal effective tax rates in the same direction. A separate body of work documents the rise in concentration in the past half century and its aggregate implications. De Loecker et al. (2020) and Gutiérrez and Philippon (2017) document this rise in publicly traded firms covered by Compustat. The prior emphasizes that this increase in market power has been primarily driven by top percentile firms further increasing their markup. The latter connects this increase in concentration with a decrease in investment. This paper provides at least one way to link tax asymmetry to implications about market power, or at the very least, the distributional impacts of tax asymmetry across these firm types.

Past empirical work on tax asymmetry has shown a high fraction of net operating losses are never used or with significant delay, and that this usage can differ substantially across firms and industries (Altshuler and Auerbach, 1990; Cooper and Knittel, 2006, 2010; Edgerton, 2010; Goodman et al., 2023). The ideas here are similar. For example, these papers and common rhetoric often point to younger firms or startups as being particularly punished by tax asymmetry. Younger firms typically have lower market power, though this may not necessarily translate to the lower markup measure used here, as they may need to cover higher initial costs. This raises the importance of interpreting direct results of this paper as conditional on market, rather than explicitly comparing firms across different markets with different demands, fixed costs, and shocks. Some implications are of course transferable to between market comparisons, but still an "all else equal" qualifier is usually required.

Financial statement data from Compustat are widely used but present challenges for measuring tax outcomes. First, there is no direct indicator of taxable status. This paper employs similar or exactly the proxies used by Graham (1996) and Edgerton (2010), which have been shown to perform well relative to using actual tax status from firm returns (Graham and Mills, 2008). An important empirical finding is that a substantial portion of tax loss benefits remain before expiring

[4] Auerbach (1986) conducts simulations in which fixed costs are varied. This can be viewed as a sort of percursor to the more explicit modeling in this paper of market power, as differential fixed costs can be responsible for varying profitability.

(Edgerton, 2010; Cooper and Knittel, 2006). The results of this paper relate this to firm market power, and suggests how if this trend is systematically associated with lower market power firms, then this sustains a relative advantage for high market power firms.

Along the same lines, considerable work has been done in the accounting literature on measurements of tax planning and tax loss. Max et al. (2023) try to directly fix issues in the Compustat measures, while Heitzman and Lester (2021) establish an alternative measure to Compustat's tax loss carryforward variable that improves on the predictive power in the amount of tax benefits firms actually use. Both of these measures are adopted, along with those previously mentioned in Edgerton (2010) in a catch-all approach to measuring tax loss and taxable status.

Finally, measurements of investment has also been a tricky endeavor. Traditionally, measurements of capital has often only included data on property, plant, and equipment (PP&E). However, over the last several decades, the share of intagible capital has been increasing and not included in these physical assets. Tobin's Q, the ratio of market value of assets to relacement costs, has been the standard proxy for investment opportunities. This paper uses the modification of Peters and Taylor (2017) Tobin's Q to better capture intagible investments.

The paper proceeds as follows. Section 2 develops and discusses a model of heterogenous firms under an asymmetric corporate tax system. Section 3 provides a short treatment of the profit smoothing mechanism. Section 4 discusses the financial data and empirical findings. Section 5 concludes.

2 A Model of Tax System Asymmetry

Consider a set of risk-neutral firms indexed by i, at a point in time t, of varying degrees of markup $\mu_t^i \equiv p_t^i(X^t) - c(\phi_t^i)$ in equilibrium, where p_t^i is product price, $c_t^i \equiv c(\phi_t^i)$ are the (constant) marginal costs of production, X_t is aggregate demand, and ϕ_t^i is a productivity parameter.

Each period firm i produces output x_t^i and invests I_t^i to stochastically affect their markups in the following period by altering marginal costs. The firm incurs fixed cost F and realizes an idiosyncratic profit shock ε_t^i prior to tax remittance.[5] Therefore, the firm obtain pre-tax profits

$$\Pi_t^{i,P} = \mu_t^i x_t^i - I_t^i - F + \varepsilon_t^i \tag{1}$$

and the evolution of productivity, which will implicitly determine the evolution of markups, is guided by

$$\phi_{t+1}^i = G(\phi_t^i, I_t^i, \xi_{t+1}^i) \tag{2}$$

where G is increasing in ϕ_t^i and I_t^i, and $c(G(\cdot))$ is concave decreasing in I.[6] ξ_{t+1}^i represents investment uncertainty or a productivity shock. The shock is realized at the start of period $t+1$. The

[5] Fixed costs can equivalently be modeled as time varying if ε_t^i is shifted by the difference between F and F_t, where F_t is this time varying version of fixed costs.

[6] This last condition is to ensure that investment has decreasing marginal returns. Increasing investment increases productivity, but productivity has decreasing returns in reducing marginal cost.

model ignores interest rates related to debt based financing (which can otherwise be included by multiplying I_t by 1 + the user cost of capital). Both shocks, ε_t^i and ξ_{t+1}^i, are assumed to be drawn from continuous distributions.

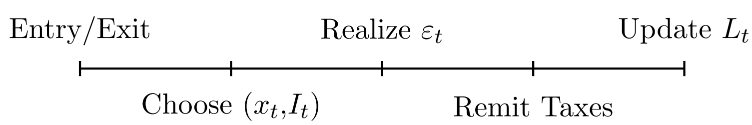
Profits are subject to a corporate tax rate τ. All non-capital production costs are assumed deductible, while a share $\theta \in [0, 1]$ of investment expenditures is deductible. Losses, however, are not immediately taxed (refunded). Instead, firms may carry forward these net operating losses and use them against profits in future years. Let L_t^i represent a firm's stock of tax loss carryforwards (TLCF) at the beginning of period t.[7] Each period, the firm can (1) build upon TLCF if they have losses, (2) reduce the amount of TLCF is profits are less than current TLCF stock, or (3) completely exhaust available TLCF. This can be summarized as follows:

$$L_{t+1}^i = \max\left(0, -B_t^i\right) \tag{3}$$

where $B_t^i = \Pi_t^{i,P} - L_t^i + (1-\theta)I_t^i$ is the virtual tax base. If $B_t^i > 0$, this is the actual taxable income. If B_t^i is negative, this is a net operating loss, and the firm is untaxed. After-tax profits are given by

$$\Pi_t^{i,A} = \Pi_t^{i,P} - \tau \max\left(B_t^i, 0\right) \tag{4}$$

A firm that newly enters a market at time t will have L_t^i set to zero. In summary, the timing in each period follows the timeline below:



2.1 Value Function and States

The productivity and carryforward tuple $\omega_t^i \equiv (\phi_t^i, L_t^i) \in \Omega$ define the private state of a firm. Let the market state be $\omega_t \in \{\omega_t^1, ..., \omega_t^N \mid \omega_t^i \in \Omega, N < \overline{N}\}$. The value function of a firm at time t is

$$\begin{aligned} V(\omega_t^i, \omega_t^{-i}) &= \max\{\mathbb{E}_t\left[\Pi_t^A + \beta V(\omega_{t+1}^i, \omega_{t+1}^{-i}) \mid \omega_t^i, \omega_t^{-i}, x_t^i, I_t^i\right], V_{Exit}\} \\ \text{s.t.} \quad \phi_{t+1}^i &= G(\phi_t^i, I_t^i, \xi_{t+1}^i) \\ L_{t+1} &= \max\left(0, -B_t\right) \end{aligned} \tag{5}$$

where β represents the firm's discount factor, which is assumed to be the same for all firms, and the expectation is taken over the distribution of ε_t and ξ_{t+1}. Though not explicitly written out each time, the value of V is bounded below by the exit (scrap) value which is assumed independent of the tax system. For simplicity, this will be assumed to be constant for all firms at a value $\overline{V}$. This outside option provides an important distinction between economic and accounting profits. As economic profits are weakly lower than accounting profits, it should be that firms must generally

[7] While many countries have (limited) tax loss carryback systems, including the United States prior to 2018, a brief discussion of carrybacks is relegated to the Appendix.

expect positive accounting profits to remain in the market. Additionally, carryfowards are only incurred when *accounting profits* are negative.

2.2 Symmetric System Benchmark

As a point of comparison, consider an alternative symmetric corporate tax system with the same tax rate τ. In this system, tax losses are immediately refunded, and thus there is no carryforward system. After tax profits are given by

$$\Pi_t^{i,A} = \Pi_t^{i,P} - \tau \left[\Pi_t^{i,P} + (1-\theta) I_t^i \right] = (1-\tau)\Pi_t^{i,P} - \tau(1-\theta) I_t^i \tag{6}$$

The value function can be written as

$$\begin{aligned} V^i(\omega_t^i, \omega_t^{-i}) &= \max_{x_t, I_t} E_t \left[(1-\tau)\Pi_t^{i,P} - \tau(1-\theta) I_t^i + \beta V_{t+1}(\omega_t) \right] \\ \text{s.t.} \quad \phi_{t+1}^i &= G(\phi_t^i, I_t^i, \xi_{t+1}^i) \end{aligned} \tag{7}$$

If investment were also fully deductible, then the retention rate $(1-\tau)$ can be factored out of the value function. Firm behavior in both output and investment would be equivalent to behavior absent a corporate income tax, and the only difference would be that value of the firm would be scaled by the retention rate.

This paper will make two types of comparisons: (1) "zero start" comparisons, and (2) general equal markup comparisons. The thought experiment for (1) is to compare firms that starts with 0 TLCF, whether because the market just started or all firms had been fully taxable in the previous period. While idealized, this is a completely neutral starting point as already obtaining carryforwards would grant the asymmetric system an advantage moving forward.

The second type of comparison is for firms that currently have a stock of carryforwards. The issue in trying to compare a "like" firm in this scenario is that the symmetric system does not have carryforwards. So even if the markup matches in both systems, the firm in the asymmetric system with TLCF stock is advantaged *conditional on the history already being realized.* In other words, the firm in the symmetric system has already realized any potential benefits in the past, while the firm in the asymmetric is actively holding onto these potential benefits. Still, this type of comparison has important implications for relative firm behavior moving forward.

2.3 Entry and Exit

Firms will exit the market when their continuation value falls below the outside option $\overline{V}$.

Lemma 1. *Let*

$$\mathcal{C}_t^R(\omega_t^i, \omega_t^{-i}) \equiv \mathbb{E}_t[\Pi_t^A + \beta V(\omega_{t+1}, \omega_{t+1}^{-i})] \tag{8}$$

be the continuation value under regime $R \in \{A, S\}$ (asymmetric or symmetric), and define the exit *cutoff productivity for firm i as*

$$\phi^{*,R}(L_t^i) \equiv \inf\{\phi_t^i : \mathcal{C}_t^R(\omega_t^i, \omega_t^{-i}) \geq \overline{V}\}. \tag{9}$$

Assume (i) for each fixed L_t^i, $\mathcal{C}_t^R(\omega_t^i, \omega_t^{-i})$ is continuous and strictly increasing in ϕ; and (ii) for each fixed ϕ_t^i, $\partial\mathcal{C}_t^A(\omega_t^i, \omega_t^{-i})/\partial L_t^i \geq 0$, i.e., increased productivity increases firm value, and carryforwards are weakly beneficial. Then

$$\phi^{*,A}(0) \geq \phi^{*,S}(0), \tag{10}$$

and, for the asymmetric regime,

$$\frac{d\phi^{*,A}(L)}{dL} \leq 0. \tag{11}$$

Lemma 1 makes perhaps obvious two points. First, the exit threshold is higher under the asymmetric system. This is a simple consequence of the present value of tax remittance being higher for any stream of profits in a symmetric system. Second, conditional on a loss being realized, having TLCFs is weakly value increasing. For given firm characteristics, increasing the amount of carryforwards the firm has makes it more likely that they stay in the market so that they can actually extract these benefits.

This latter behavior can thus keep competition higher for more periods than in a counterfactually symmetric system. If current carryforwards are high enough, then a firm that would otherwise exit (perhaps due to downward shifted expectations on future profit shocks) may instead remain in the market.

For the same reason that makes exit at $L = 0$ more likely, asymmetry also deters entry. For any given productivity, tax asymmetry reduces the expected net present value conditional on entry. These conditions relate to past work that has discussed how asymmetry can be harmful to new firms. The point here goes further. Not only are new firms that are already in the market hit harder (provided that they start at low markup), tax asymmetry also deters these types of firms from entering the market in the first place. Thus, corporate tax asymmetry acts as a built-in barrier to entry.

2.4 No Investment

Suppose first that there are no investment opportunities, and firms simply play the output game each period. Consider the "zero start" setting where there is a distribution of firms with various productivities, and all firms have zero carryfowards. The symmetric first order condition is just a pure profit tax and thus implies the same output choice as in an untaxed setting. The FOC for the asymmetric case is

$$(1 - \tau\beta P(B_t < 0))(p'(X_t)x_t^i + p(X_t) - c^i) + \beta P(B_t < 0)\rho_{t+1}(p'(X_t)x_t^i + p(X_t) - c^i) = 0 \tag{12}$$

where ρ_{t+1} is the expected time usage of the incremental loss (equals 1 if the firm knew for certain it would be taxable in the following period). The first order condition combines the concurrent expected payoffs with the value of tax loss carryfoward created in the case where the firm experiences losses. Again, the untaxed first order condition can be factored out, implying the firm chooses the untaxed optimal quantity. Under full deductibility of costs, the quantity that maximizes firm value in the profit state is equal to the one that maximizes value in the loss state. The firm experiences either an undistortive profit tax or no tax at all on the marginal income created in the current period.

The above implies that market power, at least as defined by markups or market share, is exactly the same in the symmetric and asymmetric systems if there is no exit. What is not the same, however, is the distribution of after-tax profits. The value of a firm under the symmetric system is

$$NPV_0 = (1-\tau)\mathbb{E}_{\mathfrak{t}}\left[\Pi_0^P + \beta v\right] \tag{13}$$

where v is the untaxed value function (equal to the expected sum of pre-tax profits). The value of a firm under an asymmetric system is

$$NPV_0 = \mathbb{E}_{\mathfrak{t}}\left[\Pi_0^P - \tau\mathbb{1}[\Pi_0^P > 0]\Pi_0^P - \tau\beta\rho_{t+1}\mathbb{1}[\Pi_0^P < 0]\Pi_0^P + \beta V_{t+1}\right] \tag{14}$$

The per-period difference in the value of the firm is equal to

$$\tau(1-\beta\rho^{t+1})\mathbb{E}_t[\Pi_t^P \mid \Pi_t^P < 0]P(\Pi_t^P < 0) \tag{15}$$

i.e., the expected asymmetric penalty on any newly accrued carryfowards. Thus, the asymmetric penalty scales with the tax rate, (inversely of) the degree of discounting, the size of the loss, and the expected duration before using these carryforwards. The latter three factors all diminish as markups increase, leading to a shift in the distribution of after-tax profits shares. As the tax collections are now higher (as pre-tax profits are the same, while firms are now remitting more taxes), the government can then adjust the statutory tax downward in the asymmetric system in order to match collections in the symmetric system. Thus, in this setting, asymmetric taxes simply redistributes rents from the lowest markup firms to the highest markup firms and leave the market undistorted.[8]

However, there is a caveat in the interpretation of undistorted. While the intensive margin remains undistorted, in a given period firms experience zero effective marginal tax on production, the extensive margin is not undistorted. The required value of pre-tax profits to stay in the market in higher under asymmetry for all firms, and especially for firms whose penalty is higher. As the penalty increases with declining productivity or markup, firms perviously on the margin can be driven out of the market.

This then *does* have efficiency implications, and it does alter market power and market-shares. As low productivity firms exit the market, there is room for quantity expansion for the remaining

[8] While this paper does not explicitly speak to welfare, this two systems are not necessarily welfare neutral. If, for example, there is positive correlation between firm market power and the income of firm owners, then asymmetry could lead to a regressive redistribution in profits.

firms. As (pre-exit) markup rises, so too does the ability to expand production. All of the preceding arguments summarized in the following proposition.

Proposition 1. *If production costs are fully deductible, then interior output decisions are equivalent under an asymmetric and symmetric system. If no firm is induced to exit by asymmetry, then the distribution of pre-tax profits (and markups and market share) remains the same. The distribution of after-tax profits will be shifted in favor of high markup firms.*

If however, firms are induced to exit, then quantities do change in comparison to the symmetric system. Probability of exit decreases with markup due to the reduced penalty on value. All firms remaining in the market obtain higher markups and market shares.

This impact on exit valuation can have broader implications for firm behavior. For example, this uneven distribution of the penalty can make predatory behavior a more appealing strategy, as it pushes lower end firms closer to the margin of exit. An in-power firm that previously would not find predatory behavior worth it may be induced to do so due to asymmetry. A simple two period, two firm model illustrating this point can be found in the Appendix.

2.5 Investment

Now consider a firm's marginal investment incentives. The first order condition of the value function with respect to current investment is

$$\frac{dV^i}{dI_t^i} = \mathbb{E}_t \left[\underbrace{-1 + \theta\tau \mathbb{1}_{B_t>0}}_{\text{Current Marginal Costs}} + \beta \left(\underbrace{\frac{\partial V^i}{\partial \phi_{t+1}^i} \frac{\partial \phi_{t+1}^i}{\partial I_t^i} + \frac{\partial V^i}{\partial \omega_{t+1}^{-i}} \frac{\partial \omega_{t+1}^{-i}}{\partial I_t^i}}_{\text{Future Markup Value}} + \underbrace{\frac{\partial V^i}{\partial L_{t+1}^i} \frac{\partial L_{t+1}^i}{\partial I_t^i}}_{\text{Future TLCF Value}} \right) \right] = 0 \quad (16)$$

where

$$\frac{\partial \phi_{t+1}^i}{\partial I_t^i} = \frac{\partial G}{\partial I_t^i}, \qquad \frac{\partial L_{t+1}^i}{\partial I_t^i} = \theta \mathbb{1}_{B_t<0} \quad (17)$$

and

$$\mathbb{E}_t \left[\frac{\partial V^i}{\partial L_{t+1}^i} \frac{\partial L_{t+1}^i}{\partial I_t^i} \right] = \mathbb{E}_t \left[\frac{\partial V^i}{\partial L_{t+1}^i} \middle| B_t < 0 \right] P(B_t < 0) \quad (18)$$

Notation will be omitted, but all probabilities are conditional on the market state and choices of investment and output. Continuity of the profit shock term allows the conversion of expectations into a probability function.[9] The combination of current marginal costs and expected (discounted) TLCF value can be described as the expected marginal cost. For any given period with positive taxable income, the benefit of another dollar of TLCF is equal to the tax savings in reducing taxable

[9] $P(B_t < 0)$ is equal to the integral over the probability distribution of ε up to the point where, for a given level of investment and output and conditional on the market state, $B_t = 0$. This is equal to $\varepsilon^* = \theta I_t + L_t - F - \mu_t x_t$.

income by a dollar, which is just equal to the tax rate $\theta\tau$. Thus,

$$\beta \mathbb{E}_t \left[\frac{\partial V^i}{\partial L^i_{t+1}} \middle| B_t < 0 \right] = \beta\theta\tau\rho_{t+1} \tag{19}$$

If the firm were 100% confident the extra dollar of TLCF is used immediately in the next period, then $\rho_{t+1} = 1$. The firm would receive the full value of $\beta\theta\tau$. If the firm believes it will never use the TLCF, i.e., $\rho_{t+1} \to 0$, then the firm receives no value from the TLCF. Thus, the value of this term is bounded between 0 and $\beta\theta\tau$.

Finally, there are two effects of increasing investment on markup value. First, there is the direct effect on increasing productivity, which may increase profitability in the next period (and beyond). This return on investment will be scaled by $(1-\tau)$ in profitable scenarios unscaled in non-profitable scenarios. However, this investment will, in fact, also affect the equilibrium prices if the market structure is endogenous. In other words, it can have an effect on the state of the market in period $t+1$, and this effect can differ across tax systems.

The full investment FOC can be rewritten as

$$1 - \theta\tau P(B_t > 0) - \beta\theta\tau\rho_{t+1}P(B_t < 0) = \beta\mathbb{E}_t \left[\frac{\partial V^i}{\partial \phi^i_{t+1}} \frac{\partial G}{\partial I^i_t} + \frac{\partial V^i}{\partial \omega^{-i}_{t+1}} \frac{\partial \omega^{-i}_{t+1}}{\partial I^i_t} \right] \tag{20}$$

where the LHS is the expected marginal cost of investment, and the RHS is the expected marginal benefit.

In the symmetric system, the equivalent FOC is

$$1 - \theta\tau = \beta\mathbb{E}_t \left[\frac{\partial V^i}{\partial \phi^i_{t+1}} \frac{\partial G}{\partial I^i_t} + \frac{\partial V^i}{\partial \omega^{-i}_{t+1}} \frac{\partial \omega^{-i}_{t+1}}{\partial I^i_t} \right] \tag{21}$$

Notice that the RHS of equation (21) has the same form as the RHS of equation (20). However, these two expressions are not equivalent. First, the returns to investment in the asymmetric system are only taxed if $B_{t+1} > 0$. Second, as previously stated, the asymmetric system has different implications for the overally market state, e.g., through raising the required productivity to remain in the market. If this market impact is negligible, then differences in the investment decision stems from solely from returns from reducing expected marginal cost.

Under full deductibility, the value function can be rewritten as

$$V^i = \mathbb{E}_t \left[(1-\tau)\Pi^{i,P}_t + (1-\tau) \sum_{s=t+1} \beta^{s-t}\Pi^{i,P}_s \right] \tag{22}$$

The investment FOC then becomes

$$1 = \beta\mathbb{E}_t \left[\frac{\partial v^i_{t+1}}{\partial \phi^i_{t+1}} \frac{\partial G}{\partial I^i_t} + \frac{\partial v^i_{t+1}}{\partial \omega^{-i}_{t+1}} \frac{\partial \omega^{-i}_{t+1}}{\partial I^i_t} \right] \tag{23}$$

where $v_t = \frac{V}{1-\tau}$, which is entirely independent of the tax rate. Thus, under an symmetric system with full deductibility, the investment decision is invariant to the tax rate, and this is true regardless of the firm's markup.

2.6 Tax Asymmetry and Markup on Incentives

The different FOCs imply that firms behave differently under the two systems, and the extent of which may interact with market power. To formalize this, directly compare the FOCs for a firm with the same expected markup and TLCF (set to 0) entering the period. For a firm under a symmetric system, marginal cost of investment is simply equal to $1 - \theta\tau$, and this is for certain. For a firm under an asymmetric system, this is equal to

$$MC^A = 1 - \theta\tau P(B_t > 0) - \beta\theta\tau\rho_{t+1}P(B_t < 0) \tag{24}$$

where again $\rho_{t+1} \in [0, 1]$ as before is expected discounted usage of the TLCF. Since ρ_{t+1} is bounded above by 1, then

$$MC^A \geq 1 - \theta\tau P(B_t > 0) - \beta\theta\tau P(B_t < 0) \tag{25}$$

The right hand side of thid expression is bounded between $1-\beta\theta\tau$ (when $P(B_t > 0) = 0$) and $1-\theta\tau$ (when $P(B_t > 0) = 1$). Thus, since $\beta \in [0, 1]$, the marginal cost in the asymmetric system is always weakly smaller than the marginal cost in the symmetric system. There are two instances where the equality holds: (1) there is no time discounting ($\beta = 1$), or (2) investment is fully non-deductible ($\theta = 0$). In the prior, so long as there are no cash flow constraints, there is no explicit disadvantage of tax asymmetry as money retains its value across time. In the latter, there is no disadvantage of tax asymmetry on investment since investment is never taxed (subsidized) and firms will always bear the full cost.

Outside of those two edge cases of equality, the difference in marginal cost across systems shrinks as market power (markup) rises. All else equal, a higher markup will imply higher profits in a given period. This implies both that $\frac{dP(B_t>0)}{d\mu} > 0$ and that $\frac{d\rho_{t+1}}{d\mu} > 0$. The combination of these effects pushes toward an unambiguous decrease in the marginal cost in the asymmetric system toward the marginal cost in the symmetric system.

If this were the only side of things, it would be unambiguous that firms with higher markup (within a given market) are less distorted relative to the symmetric system to low markup firms. However, this is not strictly the case and that is because of the returns to investment. Since returns on investment are taxed at the statutory rate in taxable states, but face no tax in nontaxable states, the relative direction on the benefits side is reversed. Firms that don't anticipate being taxable soon, predict lower marginal tax on returns, which drives their investment up. Conditional on the stock of carryforwards, it is the *low markup* firms that are more likely to be non-taxable due to their lower profitability. Thus, there exists ambiguity on how market power affects the marginal investment decision.

2.7 Two-Period Horizon

While an infinite time horizon is closer to reality, the relevant insight can be derived in simpler terms in a finite two-period model. The FOC with respect to investment simplifies to

$$1 - \theta\tau P(B_t > 0) - \beta\theta\tau P(B_{t+1} > 0)P(B_t < 0) = \beta\mathbb{E}_t\left[\frac{\Pi_{t+1}}{\partial\phi_{t+1}}\frac{\partial G}{\partial I_t}\right] \tag{26}$$

where future value is just the expectation on the next period's profits (the market structure term has been temporarily ignored), or

$$1 - \theta\tau P(B_t > 0) - \beta\theta\tau P(B_{t+1} > 0)P(B_t < 0) = \beta\mathbb{E}_t\left[\frac{\Pi^P_{t+1}}{\partial\phi_{t+1}}\frac{\partial G}{\partial I_t}\right](1 - \tau P(B_{t+1} > 0)) \tag{27}$$

This mirrors the infinite horizon problem on a smaller scale. The net cost of investment is one minus the expected time on profitability. If the firm is immediately taxable this period, then the firm obtains the full refund. If the firm is not taxable this period, the refund is time discounted and scales with the probability of being profitable in the following (terminal) period. The marginal return on investment is how after-tax profits change in the second period with an increase in investment, which follows from the mapping of productivity onto marginal cost. This is multiplied by the expected retention rate.

2.7.1 Deterministic Cases

Consider two extremes in a deterministic setting. Suppose there exists a firm that knew for certain that its current productivity is not enough to cover fixed costs plus a known shock, and therefore $B_t < 0$, and no matter their investment $B_{t+1} < 0$. In this case, there is no effective marginal cost on investment as neither investment costs nor investment returns are tax. The interior solution of investment is undistorted (of course, however, this firm would choose to shut down). On the other extreme, suppose there existed an extraordinarily powerful firm that could virtually guarantee that it would be profitable in both periods. Then investment cost is $1 - \theta\tau$ while investment return is taxed at τ. Under full deductibility, then again this firm faces no effective marginal tax.

These two tentpoles further illustrate the potential nonmonotonicity in relative investment behavior due to asymmetry, and this becomes even more true when in the middle of an already realized history. For a low markup firm that already has accumulated a large stock of loss carryfowards, potential past unprofitability is no longer important. Looking forward into the future, this high stock of carryforwards grants them likely nontaxable status for the forseeable future, shielding investment returns. Therefore, investment is relatively undistorted. A high markup firm, however, with a high stock of carryfowards faces a reverse issue. Additional investment is not refunded, but this firm is much more likely to be profitable again in the near future. Thus, there is a higher expectation of marginal investment returns being taxed, and therefore this lowers the incentive to invest. In this situation, the high markup firm is distorted more so than the low markup firm, and the gap between their two markups will shrink.

Now consider a slightly more general, and with two firms i and j that take on two of the three values in {Low, Med, High}. Assume investment costs are also fully deductible, as non-deductible costs are not needed to make the following points. Suppose that the profit shock ε is known. As illustrated previously, both firm's will choose the profit maximizing quantity in both periods, conditional on the market state, as they would if they were untaxed. For all cases and all firms, the interior first order condition for the symmetric system is

$$-1 + \tau + (1-\tau)\beta \frac{\partial \Pi_1}{\partial \phi_1} \frac{\partial \phi_1}{\partial I_0} \tag{28}$$

Suppose that a Low type firm is in a region such it will be taxed in $t = 0$ and will not be taxed in $t = 1$. Then it's first order condition will be

$$-1 + \beta \frac{\partial \Pi_1}{\partial \phi_1} \frac{\partial \phi_1}{\partial I_0} = 0 \tag{29}$$

Suppose that a Med type firm is in a region such it will not be taxed in $t = 0$, but it can invest such that it will be taxed in $t = 1$ (e.g. if the shock barely pushed the firm to nontaxability in time 0). Then it's first order condition will be

$$-1 + (1-\tau)\beta \frac{\partial \Pi_1}{\partial \phi_1} \frac{\partial \phi_1}{\partial I_0} = 0 \tag{30}$$

Finally, suppose that the High type firm figured it will be taxed in both periods. Then it's first order condition will be

$$-1 + \tau + (1-\tau)\beta \frac{\partial \Pi_1}{\partial \phi_1} \frac{\partial \phi_1}{\partial I_0} = 0 \tag{31}$$

First consider the zero start comparison. If the starting point of carryforwards are 0, then the Low firm will exit the market. If the firm does not have greater profits in the second period than the loss experienced in the first, which nontaxability in period 1 implies, then the net present value of income is strictly lower than 0. Thus, even though the interior solutions may imply that the low markup firm invests relatively more than the Med firm, the actual investment by the Low firm is zero.

Instead suppose the two firms are the Med firm and the High firm. In this situation, the medium markup firm invests less than they would in the asymmetric system, while the high markup firm invests more. Thus, the ratio of markups increases more than it would have in the symmetric case. The high firm obtains a higher share of the market.

Now consider the "history realized" comparison. In this case, suppose that the profit shock is smaller, but all firms start with a decently size stock of carryforwards. Now, it is possible that the Low markup firm makes enough total profit to stay in the market but remain taxable in both periods. Similarly, if the carryforward is not too large, it is possible for the medium markup firm to still be untaxed in the current period while becoming taxable in the next. In this situation, the low markup firm invests the same as it would in a symmetric system, while the medium markup firm invests less. Thus, the ratio of markups decreases more than it would have in the symmetric case, and the low markup firm gains relative to the medium markup firm.

This then implies that, at least in period-to-period transitions, it is possible for low markup firms to have higher relative investments and close the gap in relative market shares. Although these firms have less value on the actual usage of carryforwards, having carryforwards increases their marginal incentive to invest due to more persistent nontaxability. Again this distinction between average taxation and marginal taxation can have different implications for market power.

In the more general model, the uncertainty of shocks, number of competitors and market states, and infinite time horizon make it difficult to pin down exact conditions for when asymmetric taxes may decrease or increase markups in the following periods. However, the same general intuition applies, where certainties are replaced with probabilistic expectations, durations, and more extensive discounting.

3 Profit Smoothing

While higher markups will mechanically provide an advantage in the corporate tax system, so to would the ability to smooth profits temporally. This can be thought of in at least two different manners. First is an ex ante "projects" based mechanism, where higher market power allows weakly greater access to projects of different income profiles. Second is an ex post profit shifting mechanism, where higher market power implies more access to clever accounting that can control when profits are realized for taxation purposes.

3.1 A Simple Example

Consider two pre-tax profits streams $S^m = \{\Pi_t^m\}_{t=0}^{\infty}$ and $S^n = \{\Pi_t^n\}_{t=0}^{\infty}$ such that $NPV(S^m) = NPV(S^n)$, i.e., the net present value of the two profit streams are equal. Suppose that $\forall t, \Pi_t^m = C$. And suppose that $\Pi_0^n = -\overline{L}$, while $\forall t \geq 1, \Pi_t^n = \frac{C+\overline{L}(1-\beta)}{\beta}$. Then $V(S^m) = V(S^n) = \frac{C}{1-\beta}$.

Under a symmetric tax system, the value of both of these profit streams is scaled down by $1-\tau$. Under an asymmetric system, the value of stream S^m is likewise scaled down by $1-\tau$. However, the after-tax present value of stream S^n is

$$V(S^n) = -\overline{L} + \tau\beta\overline{L} + \frac{C + L(1-\beta)}{\beta} = \frac{C}{1-\beta} - \tau\beta\overline{L} \tag{32}$$

In this case, the firm faces a one period penalty on the initial loss equal to $\tau\beta\overline{L}$. Thus, while a firm would be indifferent between these two profit streams under a symmetric tax system, they would strictly prefer stream S^m over stream S^n. As $\overline{L}$ grows larger, which implicitly increases the variance of the stream m, so too does this penalty.

3.2 Generalized Example

Consider a profit stream $S \in \mathcal{S}$, the set of all potential futures with the same expected net present value of income, i.e., $\forall S \in \mathcal{S}$,

$$V(S) \equiv \sum_{t=0}^{\infty} \beta^t \Pi_t = C \tag{33}$$

Under a symmetric system, $\forall S \in \mathcal{S}$, the after-tax present value is

$$V^S(S) = \sum_{t=0}^{\infty} \beta^t (1-\tau)\Pi_t = (1-\tau)C \tag{34}$$

Under an asymmetric system, the after-tax present value is

$$V^A(S) = \sum_{t=0}^{\infty} \beta^t \left(\Pi_t - \tau \max(B_t, 0)\right) = C - \tau \sum_{t=0}^{\infty} \beta^t \max(B_t, 0) \tag{35}$$

where $B_t = \Pi_t - L_t$ is again the tax base, and TLCFs evolve as $L_{t+1} = \max(0, -B_t)$. Then the difference in value of the streams between systems is

$$\Delta(S) = V^S(S) - V^A(S) = -\tau \sum_{t=0}^{\infty} \beta^t \left(\Pi_t - \max(0, \Pi_t, -L_t)\right) \leq 0 \tag{36}$$

We can write this in terms of the average duration. Conditional on the same NPV and the same carryforward utilization pattern, having a greater present value of losses (which would also imply a greater present value of profits) implies a higher loss due to asymmetry. Similarly, conditional on the same NPV and the same present value of losses, having a slower carryforward utilization pattern implies a higher loss due to asymmetry. This is formalized in the following lemma.

Lemma 2. *Let $S = \{\Pi_t\}$ be a profit stream of present value C with discounted losses and gains*

$$Q \equiv -\sum_{t=0}^{\infty} \beta^t \min\{\Pi_t, 0\}, \qquad G \equiv \sum_{t=0}^{\infty} \beta^t \max\{\Pi_t, 0\} \tag{37}$$

and define the present-value loss ratio $R \equiv \frac{L}{L+G} \in [0,1)$. Let $U_{t,s}$ be the fraction of a loss at time t that is deducted at time s, and the loss-weighted average utilization

$$\bar{\rho} \equiv \frac{\sum_{t=0}^{\infty} \beta^t \rho_t L_t}{\sum_{t=0}^{\infty} \beta^t L_t}, \qquad \rho_t \equiv \sum_{s \geq t} \beta^{s-t} U_{t,s} \in [0,1]. \tag{38}$$

Then the value loss from tax asymmetry can be written as

$$\Delta(S) \;=\; \tau(1-\bar{\rho})\, L \;=\; \tau(1-\bar{\rho})\, \frac{R}{1-2R}\, C, \tag{39}$$

implying that the penalty is increasing in the loss ratio and decreasing in the average utilization.

This lemma motivates the use of loss ratio and carryforward durations in the data as a measure of profit smoothing when conditioning on pre-tax profitability.

4 An Empirical Inspection

This section empricially examines the relationship between market power and the asymmetric penalty. It will show that (1) higher markup firms are less likely to nontaxable states, and (2) conditional on entering non-taxable states, they are likely to exit them quicker. These two points illustrate the near mechanical lower time value loss due to tax asymmetry that higher market power provides.

Additionally, conditional on similar net present value of income over a given time horizon, higher markup firms have lower exposure to loss. This provides suggestive evidence on either the ex ante or ex post ability to manipulate profit streams to minimize loss due to asymmetry. The combination of these estimates can provide some information on the size of the asymmetric penalty. As given, the implied penalty here would be fairly small. However, as will be noted again later, Compustat firms are of course a highly selected group of firms that are more profitable than most.

The final subsection describes a policy change (TCJA) that substantially affected carryforwards. TCJA both directly reduced the value of carryforwards, and it differentially altered the marginal tax on investment for lower markup firms. The results suggest that this change is associated with higher relative investment and expanded operations by high market power firms with carryforwards over low market power firms with carryforwards.

4.1 Data

Data on yearly firm financials from Compustat and include the all available firms across all years from 1950 to 2024, though certain exercises will focus on smaller subsamples due to data variable availability.

One concern may be that publicly traded firms, which represent the majority of Compustat firms, are a strongly selected sample of firms. These firms are likely to be on the higher end of the market power distribution and less likely to experience tax losses. Basic summary stats are provided in Table A2 However, the purposes of these empirical exercises is not to map out firm dynamics across the entire market power distribution, but rather to just show evidence of differences across markup levels. Therefore, all that is needed is sufficient variation in markups within the sample. Moreover, the sample selection may imply that the modest differentials found here are underestimating the scaling that would be found across a more representative set of firms.

Several sample restrictions and data adjustments are applied. As is standard, utility (SIC 4900-4999), real estate (SIC 5300-5399), and financial (SIC 6000-6999) firms are dropped. All firm-year observations that are missing key variables such as sales and cost of goods sold, where a missing is highly unlikely to translate to a zero, are dropped. All relevant dollar based variables are deflated using the GDP Deflator with a base year of 2010. A more detailed description of the sample restrictions, cleaning, and imputation processes can be found in the Data Appendix.

4.2 Measures of Market Power and Profitability

Firm markups are used as a proxy for market power. The measure of markups follows the De Loecker et al. (2020) "production approach," which derives markups from the cost minimization of variable inputs of production and capital.[10] Markup is defined as the price to marginal cost ratio and is equal to the product of the output elasticity and the (inverse of) revenue share of a variable input:

$$\mu_t^i = \eta_t^i \frac{p_t^i x_t^i}{p_t^{i,V} V^i} \tag{40}$$

where V represents the variable input, and η_t is the output elasticity. Compustat's cost of goods sold (*cogs*) field is used as a measure of total variable costs. Estimates for ouput elasticities are retrieved from De Loecker et al. (2020) and applied to the sample here. Nearly all following analysis will stratify firms into markup quintiles, redefined each year. This level of differentiation is preferred to the continuous variable in case there are nonlinear relationships in the data. Versions of select results using markup as continuous independent variable can be found in the Appendix.

Their measure of economic profits is simarly adopted. These profits are defined as $\Pi_t^i = S_t^i - P_t^V V^i - r_t K_t^i - F_t^i$, where S_t is sales, r_t is the user cost of capital, K_t is capital, and F_t are fixed costs. The user cost of capital is set to the difference between the federal funds rate and the inflation rate, plus a fixed deprectiation rate and risk premium of 12%. Fixed costs and other nonvariable costs are proxied by Compustat's field $xsga$, which are labeled as selling, general, and administrative expenses. Dividing through by sales gives the profit rate:

$$\pi_t^i = 1 - \frac{\eta_t^s}{\mu_t^i} - \frac{r_t K_t^i}{S_t^i} - \frac{F_t^i}{S_t^i} \tag{41}$$

Key figures from De Loecker et al. (2020) are replicated in the Appendix to ensure a close match.

4.3 NOLs and Tax Status

Carryforward stock is measured in two ways. First is the direct use of the *tlcf* field in Compustat. A frequently cited issue with this variable is that there are a substantial number of missing values. While it is common in the literature to assume that missings are equivalent to zeroes, this has been shown to be misleading as firms with missing values often have positive reported values in actual filings (Kinney and Swanson, 1993; Heitzman and Lester, 2021). To address this shortcoming, imputed values of TLCF from Max et al. (2023) are applied. For firms with missing TLCF values, they estimate expected TLCF based on other Compustat data on firm pre-tax book income and deferred tax liabilites and, if they exist, surrounding year data on TLCF.

[10] This approach assumes the following: (1) variable inputs adjust frictionlessly, while capital has frictions and adjustment costs. (2) Firms are price takers on inputs.

As an alternative to this measure, and as a broader measure of taxable status (which can incorporate carryback usage), an indicator for taxable status and for stocks of carryforward and carryback are constructed using the process of Edgerton (2010). This process uses other fields of Compustat and tax rules over time to engineer estimates of net operating losses and taxable status. A more detailed description of this process, as well as a comparison table between carryforward measures, can be found in the Data Appendix. Table A3 demonstrates the internal consistency of this constructed measure as well as simple correlationsh between the direct and constructed measures. While actual values can differ substantially, the two correlate well (56%) as indicators for positive carryforward stock.

Figure A2 shows the distribution of markups by carryforward status (positive or not) across all firm-years. While the mean markup is higher for firm-years for which there is no carryforward stock, there is clearly a wide range of markups for either case. In fact, both tails are thicker for the firm-years with a carryforward stock. The left tail is clear: the lower price margins indicate a higher probability of experiencing losses. The right tail is less clear. However, these could be firms that are using high markups to cover high overhead costs. If this were a systematic, widespread reason for high markups, this would hurt the use of markups as a proxy for overally profitability and market power.

4.3.1 Markups, Profits, and Losses

Figure 1 illustrates the difference in the profit to sales rate of higher markup quintiles compared to the baseline lowest quintile (Q1).[11] As expected, throughout history higher markup has been associated with higher economic profit rates. These differentials have increased since the 1980s as markups have diverged, a trend analyzed in more detail by De Loecker et al. (2020). While this may seem straightforward, it validates that high markups typically imply higher overall profitability and not that firms are solely covering large fixed or overhead costs.

Figure 2 provides a similar illustration of the differences in the average probability of loss. A similar story applies to these accounting record of losses. Across most of the historical sample, the average loss likelihood is lower for firms with higher markup. Figure A5 constructs the same figure using positive changes of carryforward stock as an alternative indicator for a loss.[12] Results are similar.

Table 1 pools all firm years in two-way fixed effects regressions to control for underlying firm characteristics and common macroeconomic trends. A steady gradient appears in all three columns. Most importantly, both columns (2) and (3) demonstrate that increasing markup reduces the probability of having a loss event. These estimates imply that the highest markup firms are 20 to 30 percentage points less likely to incur a loss than the lowest markup firms.

[11] While profit rate is bounded above by 1, is is not bounded below by 0 as negative profit rates are possible. This is why it is possible for the differentials to exceed 1.

[12] These two measures differ for two reasons. The first is superficial, as reporting differences by firms for pre-tax income and carryforward stocks may lead to mismeasurement. However, the second is a real difference. A firm that has a loss may not necessarily have an increase in carryforwards if they can fully carry back against past profits.

Figure 1: Profitability by Markup Quintile

Figure 2: Likelihood of Loss by Markup Quintile

Table 1: Profit Rate and Loss Probability

	(1) Profit Rate	(2) Loss (pi<0)	(3) Loss ($\Delta tlcf > 0$)
Q2	0.214***	-0.145***	-0.108***
	(0.008)	(0.005)	(0.005)
Q3	0.339***	-0.233***	-0.157***
	(0.011)	(0.005)	(0.005)
Q4	0.467***	-0.271***	-0.184***
	(0.015)	(0.005)	(0.005)
Q5 (highest)	0.625***	-0.297***	-0.200***
	(0.018)	(0.005)	(0.005)
Outcome Mean	-0.127	0.343	0.311
Observations	200,419	221,074	204,490

Notes: All regressions control for log sales, log assets, and include firm (gvkey) and year fixed effects. Standard errors are clustered at the firm level. Quintile 1 (lowest markup) is the omitted category. Profit rate regression limited to firms with 5 million in sales to prevent overinfluence of firms with very high cost to sales ratios.
* p<0.10, ** p<0.05, *** p<0.01

The simple importance of this in relation to the theory is to provide a general magnitude for the modeling assumption that $\frac{\partial P(B_t>0)}{\partial \mu_t} > 0$. The stronger the connection between profitability and markup, or the inverse relationship between loss likelihood and markup, the more likely it is to be the case that a high markup firm is currently in a taxable state ($L_t = 0$), reducing the likelihood that the firm interacts with the asymmetric penalty.

4.3.2 Taxable Status and Carryforward Duration

While the probability of a loss event is important in a given year, so too are long-term outlooks on carryforward usage and taxable status. This is especially important for marginal behavior as status expectations impacts expected marginal tax rates. Past research often presents, for example, second order transition matricesto gauge these outlooks. As the purpose of this paper is to infer the strength of these transition relationships with market power, the analyses here instead opt for a spell analysis approach. Spell starts are identified as the first year of transition between one state to another. If a firm remains in the same state for multiple periods in a row, these later periods are not double counted as their own spells.

Table 2 presents the results of two way fixed effects regressions on duration variables related to tax status and carryforward usage. Estimates again are relative to firms in the lowest markup quintile (Q1). The outcome variables in order are (1) the length of time of TLCF being positive, (2) the same as (1) using the alternative constructed measure, (3) the length of a taxable spell, (4) the length of a non-taxable spell. The variables in (2), (3), and (4) are from the imputation method of

Edgerton (2010), while column (1) directly uses Compustat's tlcf variable. All regressions control for initial (log) assets, operating cash flow, and for the two carryforward regressions, the size of the initial carryforward stock.

Table 2: Spell Duration and Initial Markup Quintiles

	CF (Direct)	CF (Constructed)	Taxable	Nontaxable
Q2	-0.609*	-0.496***	0.466**	-0.147
	(0.317)	(0.192)	(0.184)	(0.168)
Q3	-0.508	-0.418*	0.780***	-0.261
	(0.355)	(0.219)	(0.192)	(0.204)
Q4	-0.769**	-0.440*	1.245***	-0.255
	(0.381)	(0.242)	(0.201)	(0.224)
Q5 (highest)	-0.843**	-0.532**	1.363***	-0.705***
	(0.421)	(0.246)	(0.205)	(0.254)
Outcome Mean	5.60	3.65	5.93	4.32
Observations	4,696	5,931	12,342	8,396

Notes: Markup quintiles calculated in the year of the spell start.
* $p<0.10$, ** $p<0.05$, *** $p<0.01$

In all 4 columns, the relationship with markup is as expected. Higher markup firms are more likely to have longer taxable spells, shorter nontaxable spells, and similarly less time before using up carryforwards after a loss event. However, the observed scaling across markup range are moderate. At the extreme, a firm in the highest markup quintile is expected to retain taxable status for 1.4 years longer than a the lowest markup firms. Following a loss event, these highest markup firms are expected to fully use up carryforwards less than a year quicker than low markup firms.

Raw value Kaplan-Meier survival curves for taxable and non-taxable status can be found in the Appendix (see Figure A6). Mirroring the table, these figures show that when comparing low to higher markup firms, high markup firms "survive" in taxable status at each successive point in time, and to exit nontaxable periods quicker. The highest markup quintile firms, however, do trend closer to the rates of the lowest markup firms. This could either indicate that the highest markup firms are engaging in more tax planning or that these are representative of firms using high markups to try to combat initial periods of high fixed costs, etc. When adjusted for firm characteristics, the survival rates become more monotonic with respect to markup quintiles (see Figure A7).

4.4 Average Loss Recovery: Quantification of Loss Penalty

The previous analysis presents the general patterns between market power and factors of the asymmetric penalty. This section more formally quantifies how the loss penalty scales with market power in the case when a loss is incurred.

Goodman et al. (2023) provide the structure of such a quantification exercise.[13] The average tax rate (ATR) on a loss is calculated as the ratio of the present value of tax liability reductions over a following time horizon, divided by the initial size of the loss. A counterfactual is simulated as follows: The initial loss is instead treated as an initial gain (positive taxable income), and the present value of tax liability is recalculated over the same horizon. This counterfactual simulates treatment of the loss under a symmetric system.[14] The difference between the two average tax rates is the implied penalty on a loss moving forward.

As actual taxable income is not observed in the data, tax savings (or increased liabiltiy in the counterfactual) are deduced from carryforward usage behavior. In the instance of a loss year (carryforward stock increases), previous carryforward stock is recorded. Carryforwards are then assumed to follow a first-in-first-out mechanism. That is, if a firm already has an existing stock of carryforwards when they have another loss year, the calculated tax benefits will only be start once cumulative usage has exceeded the initial size of the stock.

The exercise uses a horizon of 10 years, and the discount rate is assumed to be a constant 0.05 ($\beta \approx 0.952$) across all firms and years. There are two samples. The full sample includes all loss-year events regardless of whether the firm remains in the sample for the entire horizon. The second, restricted sample includes only loss events that have all 10 years of future outlays available in the data.

Table 3 provides the results of a regression of these average tax rates on markup quintiles, controlling for time and firm fixed effects.[15] The average tax rate penalty across all firms is in the neighborhood of 5 and 7%. This is similar in magnitude to the 6.6% difference found Goodman et al. (2023) in the context of loss rates for S corporation owners. At the extremes, a lowest markup firm is expected to have a penalty of 2% in higher average tax rates over the 10 year horizon.

A simple multiplicative calculation between the differential in the probability of a loss event and this differential in the realized loss penalty would imply a 0.34 to 0.51 percentage point lower expected average tax rate in a given period for the highest quintile markup firm relative to the lowest.[16]

4.5 Loss Shares Conditional on NPV

As previously discussed, the loss penalty can be avoided through not just a sheer increase in pre-tax profitability, but also through minimizing loss exposure even conditional on profitability. Table 4 compares firms of similar pre-tax profitability over a given time horizon and displays the the loss values and taxability durations. If the presumption that high market power aids in intertemporal profit smoothing holds, higher markup firms to have lower loss values and lower

[13]See Section III.C and Table 2 in Goodman et al. (2023).

[14]Previous carryforwards are still applied, however. This is done by differencing out the results of a third counterfactual where there is no loss or gain at the start. This exercise isolates the impact of asymmetry on only the current loss.

[15]Table A4 provides the raw rates across markup quintiles in both samples.

[16]This range is calculated as the 1.7 percentage point ATR differential multiplied by the low and high end of loss probability differential estimates of 20 and 30 percentage points

Table 3: ATR Differences by Markup Quintiles

	(1) All Firms	(2) Full Horizon
Q2	-0.011***	-0.011***
	(0.002)	(0.003)
Q3	-0.015***	-0.015***
	(0.002)	(0.003)
Q4	-0.019***	-0.019***
	(0.003)	(0.003)
Q5 (highest)	-0.017***	-0.017***
	(0.003)	(0.004)
Outcome Mean	0.076	0.051
Observations	39,088	12,870

Notes: Difference is between (1) ratio of discounted tax benefit of actual loss to loss size and (2) ratio of additional tax liability if loss had been a counterfactual gain relative to coutnerfactual of zero gain to loss size. Markup quintiles calculated at loss year. Controls include log assets, log sales, industry (NAICS3), and year fixed effects.
* p<0.10, ** p<0.05, *** p<0.01

average nontaxability durations. This too would curtail the effects of the asymmetry penalty.

Net present value of income is calculated over a 10 year horizon starting at each firm-year observation with inflation injusted pre-tax income and again an assumed real discount factor of 0.05.[17] Loss NPV is calculated as the absolute value of the present value of all losses over the same time horizon. Loss Ratio is defined as the ratio of the sum of the absolute value of losses to the sum of the absolute value of all income outlays. Share Loss Years is calculated as the fraction of years where the firm had a loss. Share Nontaxable Years is the fraction of years where the firm was deemed nontaxable according to the constructed measure.

All regressions in the table of these outcomes control for NPV, in addition to controls for log assets, initial carryforward stock, and year and industry. Estimates in columns (2) through (4) all increase in magnitude as the markup quintile rises. The loss ratio in particular indicates that as markup increases, a smaller fraction of total income outlays are losses.

Since this exercise controls for pre-tax NPV, this is not directly a story of mechanically higher profitability. Instead this provides some evidence that higher market power firms have a stronger degree of control over the volatility of their profits across the zero threshold. This control allows them to better navigate the negatives of tax asymmetry. Though, similar to before, there differences do not seem to scale steeply as markup increases. Much of the impact is in the initial jump from the lowest markup firms. This implies that the penalty is largest at lower transitions in the markup

[17] Alternative time horizones and discount factors are tested in the Appendix and leads to very similar results.

Table 4: Loss and Duration Conditional on NPV (10 Years)

	(1) Loss Ratio	(2) Share Loss Years	(3) Share Nontaxable Years
Q1 (lowest)			
Q2	-0.00782	-0.0499***	-0.0545***
	(0.00485)	(0.00525)	(0.00764)
Q3	-0.00944	-0.0638***	-0.0769***
	(0.00592)	(0.00607)	(0.00889)
Q4	-0.0108	-0.0729***	-0.0880***
	(0.00662)	(0.00629)	(0.00932)
Q5 (highest)	-0.00742	-0.0861***	-0.105***
	(0.00807)	(0.00710)	(0.0103)
Outcome Mean	0.24	0.18	0.52
Observations	96,713	97,216	97,216

Standard errors in parentheses

Year and Industry FE are included. Controls for NPV of income over a 10 year window. Also controls for log assets, and initial carryforwards.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

distribution, but as firms reach a certain level of expected profitability, there is more incremental improvements.

4.6 Tax Cuts and Jobs Act

This final section examine how changes to the corporate tax system in the Tax Cuts and Jobs Act of 2017 (TCJA) impacted firm incentives. There were several major changes introduced by this law that interacted with the asymmetry of the corporate tax system. These include

1. The statuory corporate tax rate decreased from 35% to 21%.
2. NOL carryforward deductions were limited to 80% of taxable income.
3. Loss carryforwards no longer expired.
4. Loss carrybacks were completely eliminated.

These changes reduced the value of holding onto carryforwards. More importantly, they also affected the usage of carryforwards on marginal investment. Since carryforwards can only cover 80% of taxable income, having enough carryfoward stock is no longer enough to maintain nontaxable status. If a firm has positive taxable income prior to applying carryforwards, then it will be taxed on the margin. Thus, firms who were driven to invest relatively more due to expected nontaxable status experienced a discrete jump in their effective marginal tax on investment.

To test for a differential change in marginal incentives, the following analysis runs triple difference regressions of the form

$$Outcome_{it} = \beta \text{ Post TCJA} \times \text{High Markup} \times \text{TLCF2017} + \vec{B}X_{it} + \alpha_i + \gamma_t + \varepsilon_{it} \tag{42}$$

where High Markup is an indicator for whether the firm's pre-TCJA average markup is above the median average, and TLCF2017 is an indicator for if the firm has positive TLCF stock in fiscal year 2017. X is a set of controls that include log assets, cash flow (extraordinary income + depreciation and amortization, scaled by capital). As is standard (lagged) Tobin's q, defined in more detail in the following section, is included to account for differences in investment opportunities. α_i and γ_t are firm and year fixed effects, respectively.

The core idea of this regression is that all firms that had (in the transition from 2017 to 2018) a stock of TLCFs were hurt by the new rules. However, high markup firms are presumed to have already expected to returned to taxable status. Thus the cap is less likely to have impacted their expected marginal tax. On the other hand, firms that had expected their stock of carryforwards to allowed them to maintain nontaxable status were less likely to have this shield. Lower markup firms are more likely to be in this position.

4.6.1 Investment

Measures of investment here adopt the q-theory of investment standard in the corporate finance literature (Hayashi, 1982). Tobin's q, defined as the ratio of market value to replacement cost of capital, is assumed to represent a firm's investment opportunities, where $q > 1$ indicates potential for positive investment growth. For many reasons, firms with different markups may face differing opportunities for growth. Regressions with investment as the outcome variable thus include lagged q as a control for differences in assumed opportunities.

While past literature has traditionally focused on physical investment, a larger and larger share of recent investment has been into intagible capital. To accommodate this trend, Peters and Taylor (2017) develop a "total q" approach that includes intagible capital. Intangible capital is taken as a combination of externally purchased intangible capital (Compustat item *intan*) and internal tangible capital constructed via perpetual inventory method using measures of R&D and Selling, General, and Administrative expense. The preferred measure of investment used here is thus physical plus intangible investment, scaled by total (lagged) capital.

4.6.2 Results

Table 5 presents the results where total investment is the outcome variable. The first column is with the direct measure of carryforwards, while the second is with the constructed measure. If the sign of the point estimate in the first column is taken at face value, the coefficient of the triple interaction term indicates that the "harm" of TCJA on firms with TLCFs is in fact smaller for high markup firms vs low markup firms, as comparatively their investment increases by 1.7 percentage

Table 5: Differential Impacts on Investment

	CF (Direct)	CF (Constructed)
High Markup × CF2017 × PostTCJA	0.017*	-0.007
	(0.010)	(0.009)
High Markup × PostTCJA	-0.028***	-0.013***
	(0.010)	(0.003)
CF2017 × PostTCJA	-0.007*	-0.005
	(0.004)	(0.005)
Lagged Q	0.032***	0.032***
	(0.002)	(0.002)
Observations	17511	17511
Outcome Mean	0.143	0.143

Notes: Firm and year FEs included. Regression controls for firm cash flow and leverage. Variables scaled by either lagged total capital or assets.*** p<0.01, ** p<0.05, * p<0.10. Standard errors clustered by firm.

points (or, alternatively stated, decreased by 1.7 percentage points less). The estimate with the constructed measure gives a null result, and a very slightly negative point estimate.

Figure 3 provides the year-by-year estimates. While the investment measure is overall noisy, this plot provides some evidence that there were not systematically strong differences in investment trends by the two comparison groups prior to 2017. The figure also highlights a potential point of ambiguity in what is deemed as the "start" of the policy. TCJA was signed into law at the end of 2017 and enacted for tax year 2018. What is important however, are when the *returns* from investment are taxed. Thus, if there were sufficient runup and prediction to the actual signing of the bill, firms may have already altered their investment behavior in 2017 in anticipation of differential tax treatment on future returns on investment. The figure here thus illustratively uses 2016 as the baseline zero year, but the average estimates in Table 5 more conservatively identify the post period as just 2018-2019.

Table 6 presents results using outcomes of (asset scaled) acquisition spending and an indicator for positive spending. Figures A9 and A10 show the corresponding event study plots. Similar to previous table, the first two columns represent the results using a more direct application of $tlcf$ from Compustat, while the third and fourth use the constructed measures.

While only the estimates on scaled acquisitions are significant, the positive triple interaction terms across the board indicate that the relative change in acquisition activity by high markup firms with TLCFs is greater than those for low markup firms with TLCF. This would support the previous story about firms with high markups being mostly shielded from the negative impact of TCJA on carryforwards on marginal incentives, and potentially helping high markup firms attempt to further increase their reach.

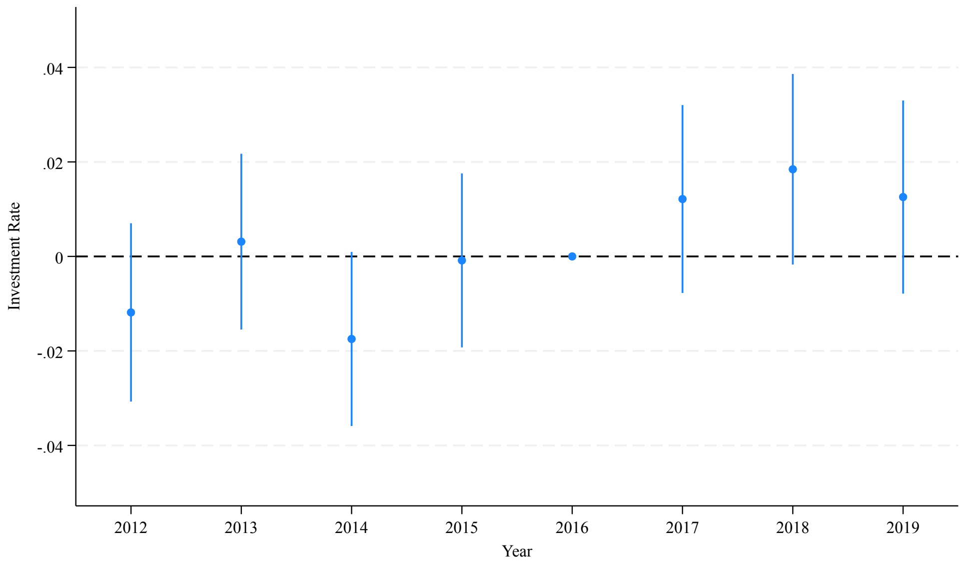


Figure 3: Investment Year-by-Year Coefficients

Table 6: Differential Impact on Acquisition Expenditures

	CF (Direct)		CF (Constructed)	
	Scaled ACQ	Positive ACQ	Scaled ACQ	Positive ACQ
High Markup × CF2017 × PostTCJA	0.030 **	0.072 **	0.040 **	0.049
	(0.013)	(0.036)	(0.019)	(0.036)
High Markup × PostTCJA	-0.019*	-0.037	-0.004	0.007
	(0.011)	(0.031)	(0.006)	(0.018)
CF2017 × PostTCJA	-0.012	-0.033	-0.015	-0.050**
	(0.008)	(0.026)	(0.010)	(0.025)
Observations	17263	17374	17263	17374
Outcome Mean	0.041	0.389	0.041	0.389

Notes: Firm and year FEs included. Regression controls for firm cash flow and leverage. Variables scaled by either lagged total capital or assets. *** p<0.01, ** p<0.05, * p<0.10. Standard errors clustered by firm.

The magnitude of all of these estimates are economically large but noisy, owing to both the source data and difficulty in measuring investment. Thus caution is important in direct interpretation of the point estimates. However, nearly all estimates qualitatively support the hypothesized direction due to differential changes in marginal tax rates by markup.

5 Conclusion

Every corporate tax system features some degree of asymmetry in how profits and losses are treated. While there are many reasons for not doing so, this paper highlights one potential side effect of this feature: a system that can promote diverging market power in certain conditions. Highly and persistently profitabile firms are less likely to intentionally interact with the downsides of tax asymmetry, thereby giving them an absolute advantage over their competitors. While the mapping to marginal investment incentives is not as clear cut, even there it is possible that asymmetry can relatively subsize higher markup firms and an increased market advantage. Examining firms in Compustat lends support to this penalty being negatively related to market power, though the implied magnitude of the penalty in this sample is modest.

This, however, need not imply that the penalty is modest across the entire market power distribution. Compustat firms are significantly larger, likely more profitable, and more stable than the average firm. Even if they do not have significant product market power, they may have market power in the input market or other parts of the supply chain.

References

Altshuler, Rosanne and Alan J. Auerbach, "The Significance of Tax Law Asymmetries: An Empirical Investigation," *Quarterly Journal of Economics*, 1990, *105* (1), 61–86.

Auerbach, Alan J., "The Dynamic Effects of Tax Law Asymmetries," *Review of Economic Studies*, 1986, *53* (2), 205–225.

Cooper, Michael and Matthew Knittel, "Partial Loss Refundability: How Are Corporate Tax Losses Used?," *National Tax Journal*, 2006, *59* (3), 651–663.

Cooper, Michael G. and Matthew J. Knittel, "The Implications of Tax Asymmetry for U.S. Corporations," *National Tax Journal*, 2010, *63* (1), 33–61.

Edgerton, Jesse, "Investment Incentives and Corporate Tax Asymmetries," *Journal of Public Economics*, 2010, *94* (11-12), 936–952.

Eisfeldt, Andrea L. and Dimitris Papanikolaou, "The Value and Ownership of Intangible Capital," *American Economic Review, Papers & Proceedings*, May 2014, *104* (5), 189–194.

Ericson, Richard and Ariel Pakes, "Markov-Perfect Industry Dynamics: A Framework for Empirical Work," *Review of Economic Studies*, 1995, *62* (1), 53–82.

Falato, Antonio, Dalida Kadyrzhanova, Jae W. Sim, and Roberto Steri, "Rising Intangible Capital, Shrinking Debt Capacity, and the U.S. Corporate Savings Glut," *Journal of Finance*, Oct 2022, *77* (5), 2799–2852.

Goodman, Lucas, Elena Patel, and Molly Saunders-Scott, "Implications of Tax Loss Asymmetry for Owners of S Corporations," *American Economic Journal: Economic Policy*, 2023, *15* (1), 342–369.

Graham, John R., "Debt and the Marginal Tax Rate," *Journal of Financial Economics*, 1996, *41* (1), 41–73.

Graham, John R and Lillian F Mills, "Using Tax Return Data to Simulate Corporate Marginal Tax Rates," *Journal of Accounting and Economics*, 2008, *46* (2-3), 366–388.

Gutiérrez, Germán and Thomas Philippon, "Declining Competition and Investment in the U.S.," NBER Working Paper 23583, National Bureau of Economic Research July 2017.

Hayashi, Fumio, "Tobin's Marginal q and Average q: A Neoclassical Interpretation," *Econometrica*, 1982, pp. 213–224.

Heitzman, Shane and Rebecca Lester, "Tax Loss Measurement," *National Tax Journal*, 2021, *74* (4), 867–893.

Hopenhayn, Hugo A., "Entry, Exit, and Firm Dynamics in Long Run Equilibrium," *Econometrica*, 1992, *60* (5), 1127–1150.

Jovanovic, Boyan, "Selection and the Evolution of Industry," *Econometrica*, 1982, *50* (3), 649–670.

Kinney, Michael R. and Edward P. Swanson, "The Accuracy and Adequacy of Tax Data in Compustat," *The Journal of the American Taxation Association*, 1993, *15* (1), 121–135.

Lev, Baruch and Suresh Radhakrishnan, "The Valuation of Organization Capital," in Carol Corrado, John Haltiwanger, and Daniel Sichel, eds., *Measuring Capital in the New Economy*, University of Chicago Press, 2005, pp. 73–110.

Loecker, Jan De, Jan Eeckhout, and Gabriel Unger, "The Rise of Market Power and the Macroeconomic Implications," *The Quarterly Journal of Economics*, 2020, *135* (2), 561–644.

Max, Malte M., Jacco L. Wielhouwer, and Eelke Wiersma, "Estimating and Imputing Missing Tax Loss Carryforward Data to Reduce Measurement Error," *European Accounting Review*, 2023, *32* (1), 55–84.

Mayer, Colin, "Corporation Tax, Finance and the Cost of Capital," *The Review of Economic Studies*, 1986, *53* (1), 93–112.

Peters, Ryan H. and Lucian A. Taylor, "Intangible Capital and the Investment-q Relation," *Journal of Financial Economics*, 2017, *123* (2), 251–272.

A Table and Figures

A.1 Descriptives

Table A1: Comparison of NOL Carryforward and Carryback Rules by Country (2025)

Country	Carryforward	Carryback	Limitations / Notes
Australia	Unlimited	0 yrs	No carryback allowed
Belgium	Unlimited	0 yrs	Carryforward capped at 70% above €1M
Canada	20 yrs	3 yrs	No significant limitations
China	10 yrs	0 yrs	Extended from 5 yrs; SMEs/high-tech firms benefit most
Estonia	Indefinite	Indefinite	Cash-flow tax system (no traditional loss rules)
France	Unlimited	1 yr	Carryback max €1M; carryforward capped at 50% above €1M
Germany	Unlimited	2 yrs	Carryback limited; carryforward capped at 70% above €1M
Japan	10 yrs	1 yr	Carryforward capped at 50%; carryback mainly for SMEs
Latvia	Indefinite	Indefinite	Cash-flow tax system (no traditional loss rules)
Luxembourg	17 yrs	0 yrs	Fixed period
Poland	5 yrs	0 yrs	Carryforward limited to 50% of loss per year
Romania	5 yrs	0 yrs	Restricted from 7 → 5 yrs; 70% cap
Singapore	Unlimited	1 yr	Generous provisions
Slovenia	5 yrs	0 yrs	Changed from unlimited to 5 yrs (2025)
South Korea	15 yrs	0 yrs	No carryback (except SMEs); carryforward capped at 60% for large firms
UK	Unlimited	1 yr	Carryforward capped at £5M, then 50%
USA	Unlimited	0 yrs	Carryforward capped at 80%; no carryback

Table A3 provides the same consistency checks with the constructed carryforward measure and the Compustat built in measure. Finally, while correlation between actual levels of these two variables is small, there is strong correlation in signage. All in all, I think including both measures throughout the analysis is valuable.

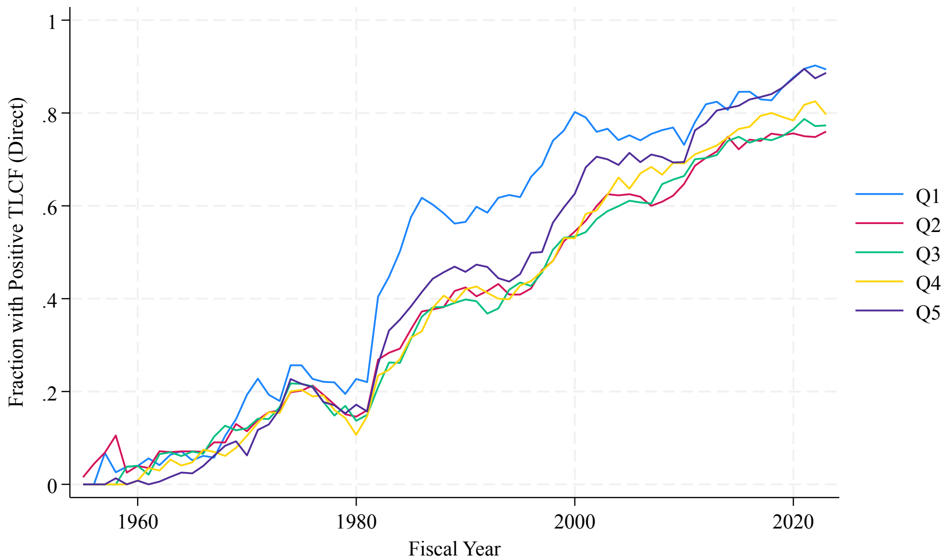
Table A2: Summary Statistics (Overall)

	Mean	Median	SD
Markup	1.52	1.25	1.06
Total Assets	2,193.74	154.46	13,122.36
Sales	1,954.06	164.23	10,122.21
Pre-tax Income	153.55	4.15	1,339.22
Market Value	2,706.08	141.16	21,731.38
Employment	8.24	0.88	38.41
Observations	221666		

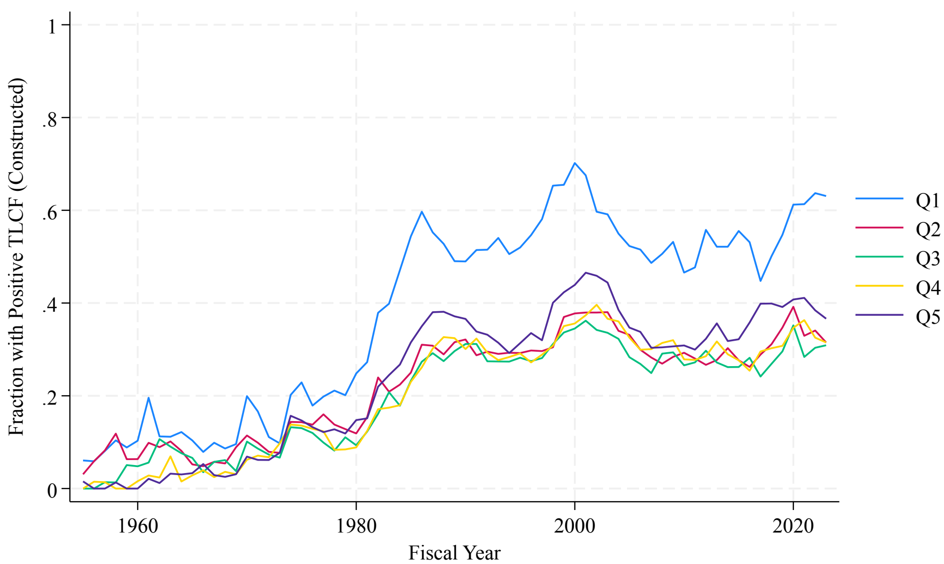
Table A3: Loss Carryforward Consistency Checks

Consistency Check	Rate (%)	Observations
Panel A: CF-Based Checks		
$P(NT = 0 \mid CF > 0)$	0.54	62003
$P(CF > 0 \mid NT = 0)$	0.34	98906
$P(CB > 0 \mid CF > 0)$	4.65	54148
$P(CF > 0 \mid CB > 0)$	2.59	97129
Panel B: TLCF-Based Checks		
$P(NT = 0 \mid tlcf > 0)$	28.57	95822
$P(tlcf > 0 \mid NT = 0)$	27.67	98906
$P(CB > 0 \mid tlcf > 0)$	32.03	84713
$P(tlcf > 0 \mid CB > 0)$	27.94	97129
Panel C: Correlations		
$Corr(CF, tlcf)$	0.0669	204338
$Corr(CF > 0, tlcf > 0)$	0.5601	204338

Notes: Panel A reports checks using CF (constructed carryforward measure), Panel B uses TLCF (Compustat item tlcf). In Panels A and B, lower percentages imply better internal consistency.

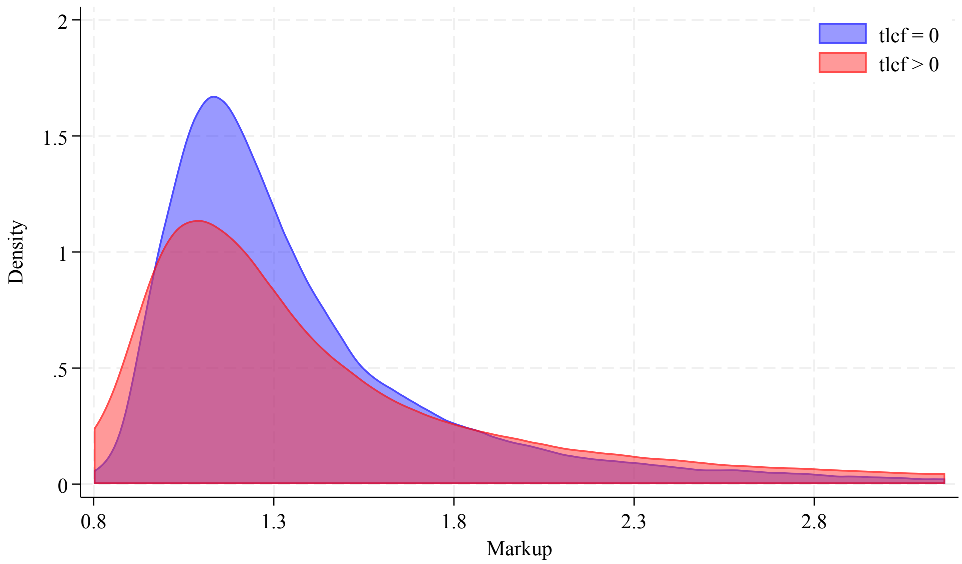


(a) Fraction of Firms with TLCF (Direct) by Markup Group

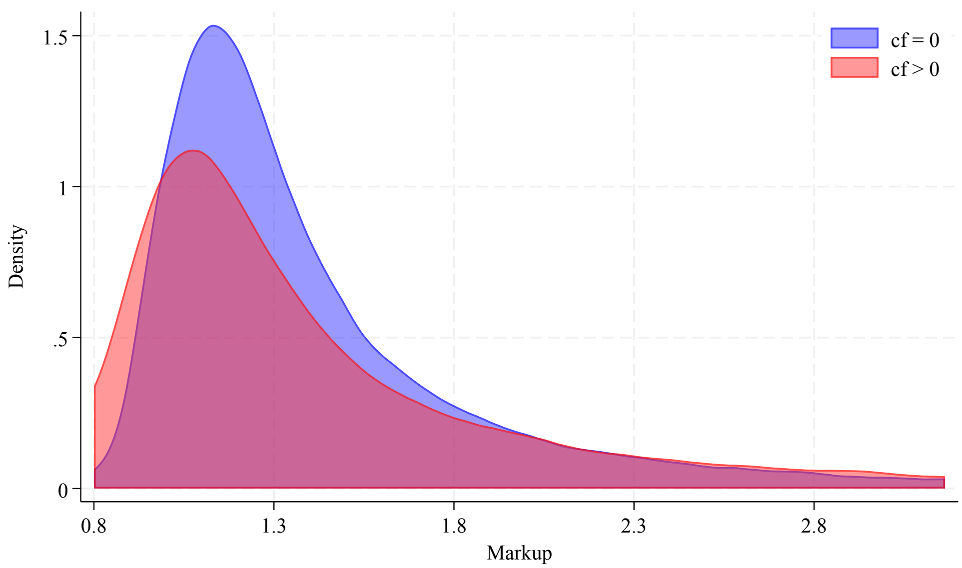


(b) Fraction of Firms with TLCF (Constructed) by Markup Group

Figure A1: Markup Distribution by Carryfoward Status



(a) Using Compustat tlcf



(b) Using constructed carryforwards

Figure A2: Markup Distribution by Carryfoward Status

Potentially intriguing in both panels of Figure A2 is that in the right tail the density of firms with carryforwards is (mildly) higher. There are at least two explanations of this pattern. First, it may be the case that these are firms that are forcing high markups to cover high fixed costs or high volatility rather than being indicative of higher profitability. Thus, despite the high markups, these firms are still frequently incurring losses. An alternative explanation is that these highest markup firms are in fact especially powerful players who have especially careful tax planning schedules and are purposefully retaining their NOLs.

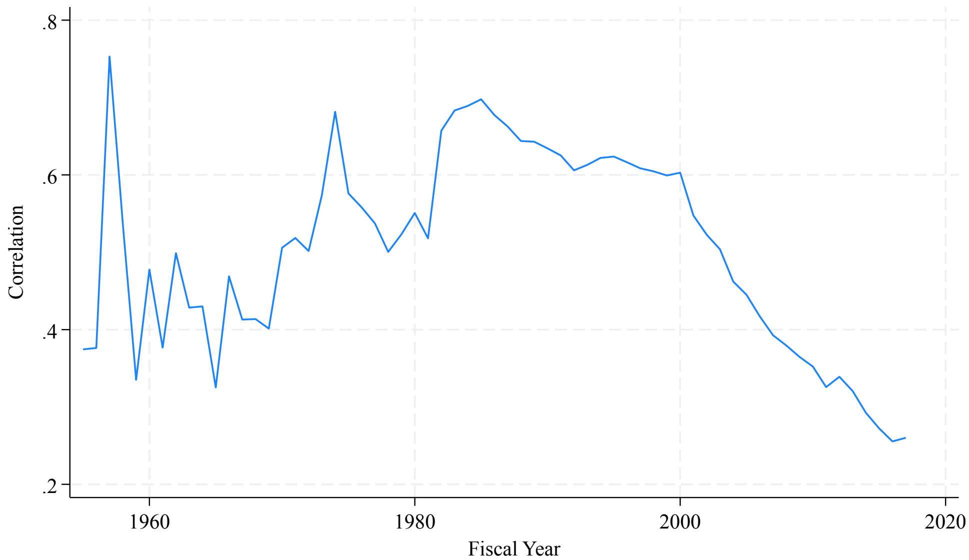
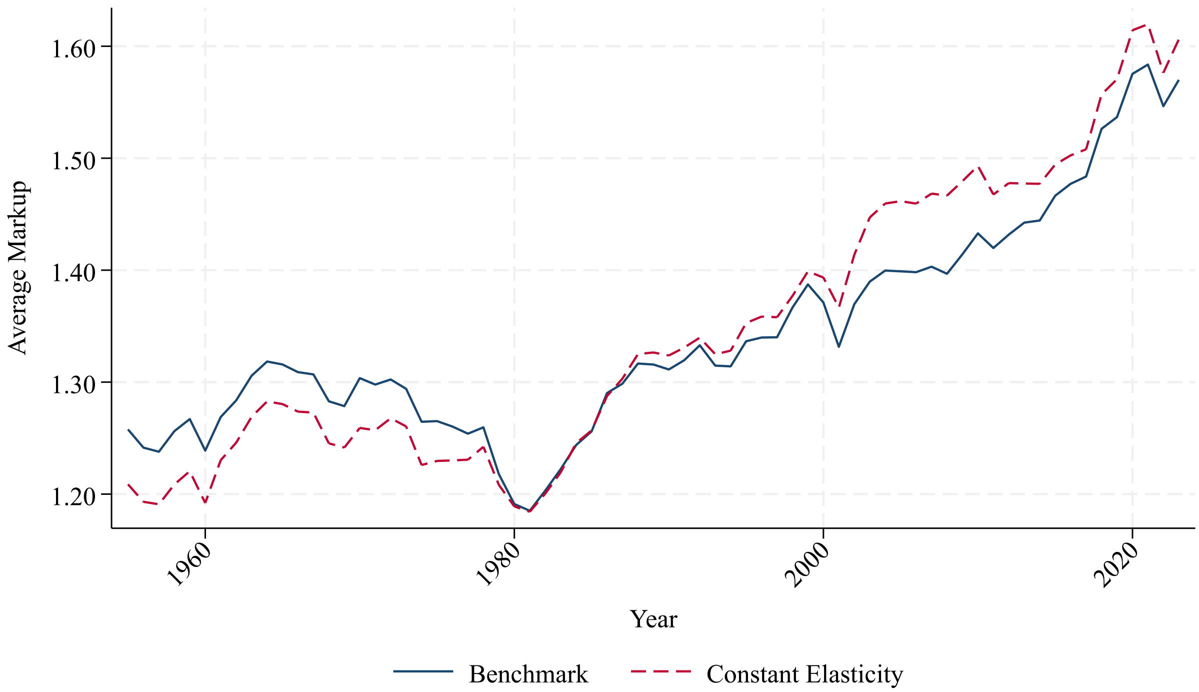


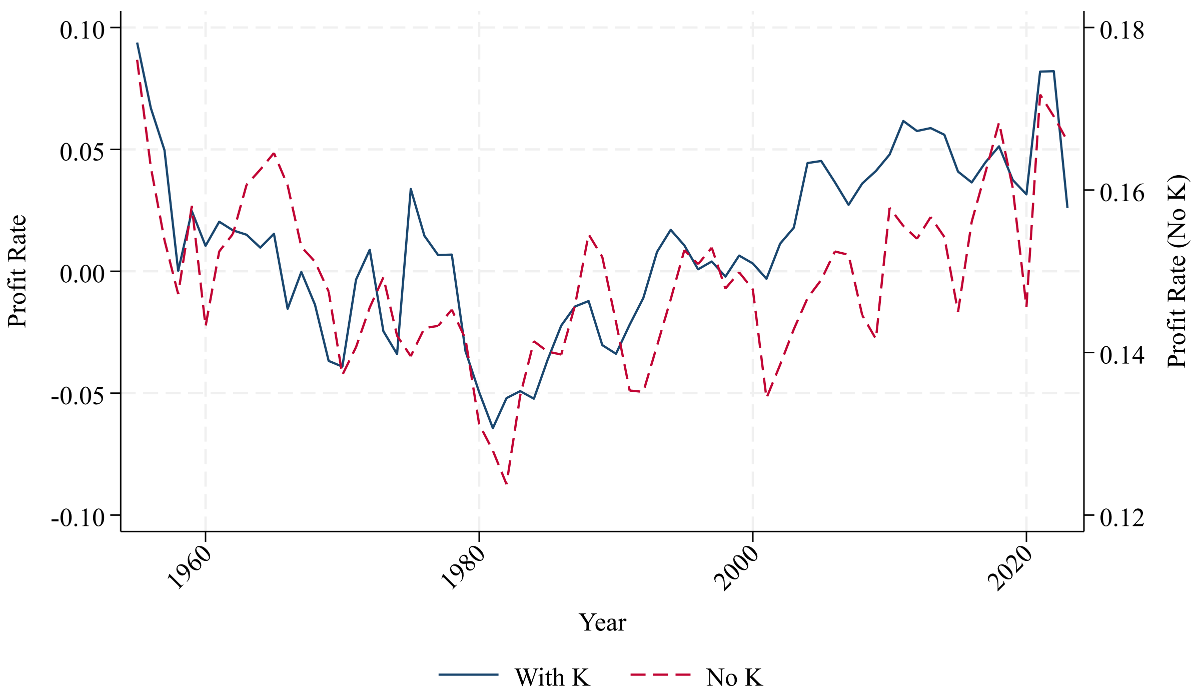
Figure A3: Carryforward Measure Correlations by Year

A.1.1 De Loecker et al. (2020) Replication

Here I reproduce figures IIb and VIII in De Loecker et al. (2020) as a way to test that I am correctly capturing close to the same measure of market power and profitability as they are. The prior illustrates the aggregate trends in markup for both a constant elasticity specification and the preferred input weighted specification. The latter illustrates aggregate trends in profit rates.



(a) Aggregate Markups Over Time



(b) Aggregate Profit Rates Over Time

Figure A4: Sales Weighted Markup and Profit Rates (De Loecker et al., 2020)

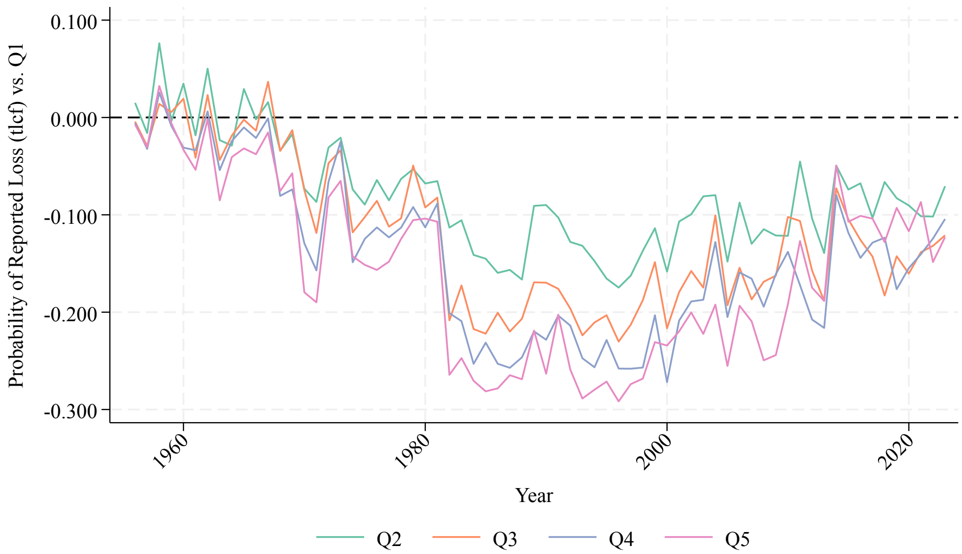


Figure A5: Likelihood of Loss by Markup Quintile

A.2 Average Loss Recovery

A.3 Duration Analysis

Table A4: Loss Recovery Rates by Markup Quintile

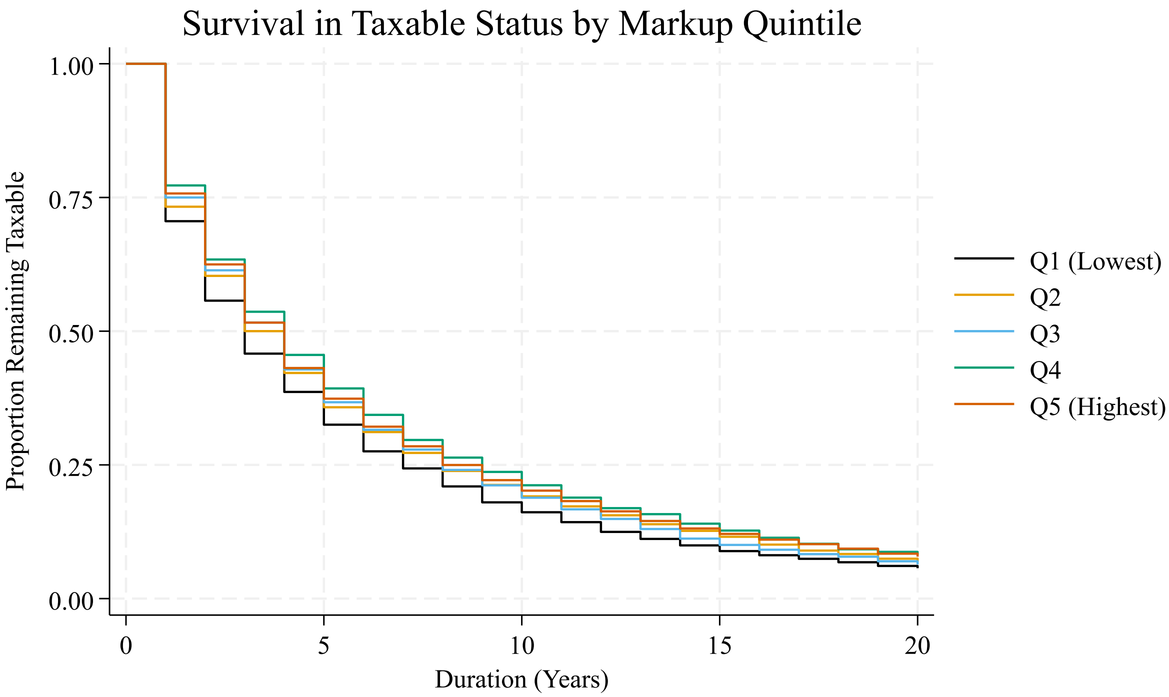
Quintile	Mean	Median	% Zero	N
Panel A: Full Sample				
Q1 (lowest)	0.119	0.000	56.1%	12,030
Q2	0.157	0.147	44.6%	7,532
Q3	0.157	0.145	44.2%	7,054
Q4	0.150	0.108	46.2%	7,019
Q5 (highest)	0.136	0.004	49.9%	7,524
Panel B: Full Horizon (11 years)				
Q1 (lowest)	0.231	0.266	20.7%	3,470
Q2	0.257	0.288	14.2%	2,749
Q3	0.256	0.285	14.0%	2,654
Q4	0.243	0.275	17.2%	2,570
Q5 (highest)	0.229	0.270	20.1%	2,338

Notes: Loss rate is PV of tax benefits divided by loss amount. Panel A includes all loss episodes 2000-2007. Panel B restricts to firms with complete 11-year forward window.

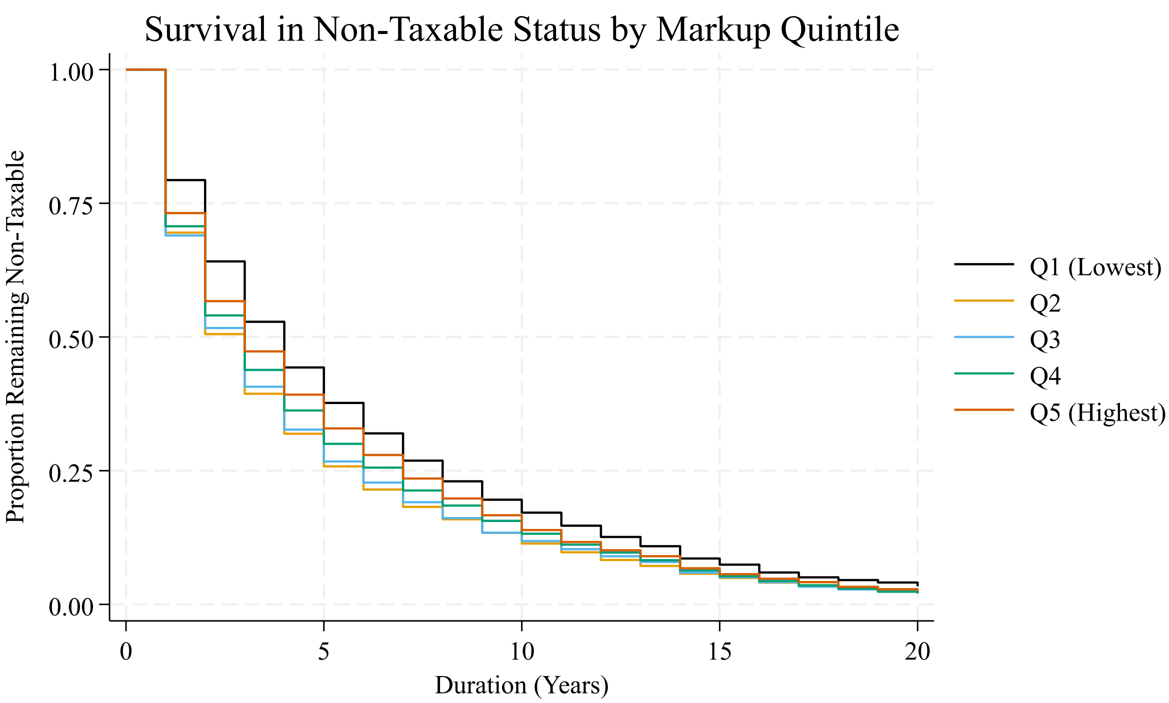
Table A5: Spell Duration and Initial Markup (Continuous)

	CF (Direct)	CF (Construced)	Taxable	Nontaxable
Initial Markup	-0.258*	-0.156**	0.163***	-0.245***
	(0.146)	(0.068)	(0.041)	(0.079)
Outcome Mean	5.60	3.65	5.93	4.32
Observations	4,696	5,931	12,342	8,396

Notes: Intial markup is in the year of the spell start.
* p<0.10, ** p<0.05, *** p<0.01

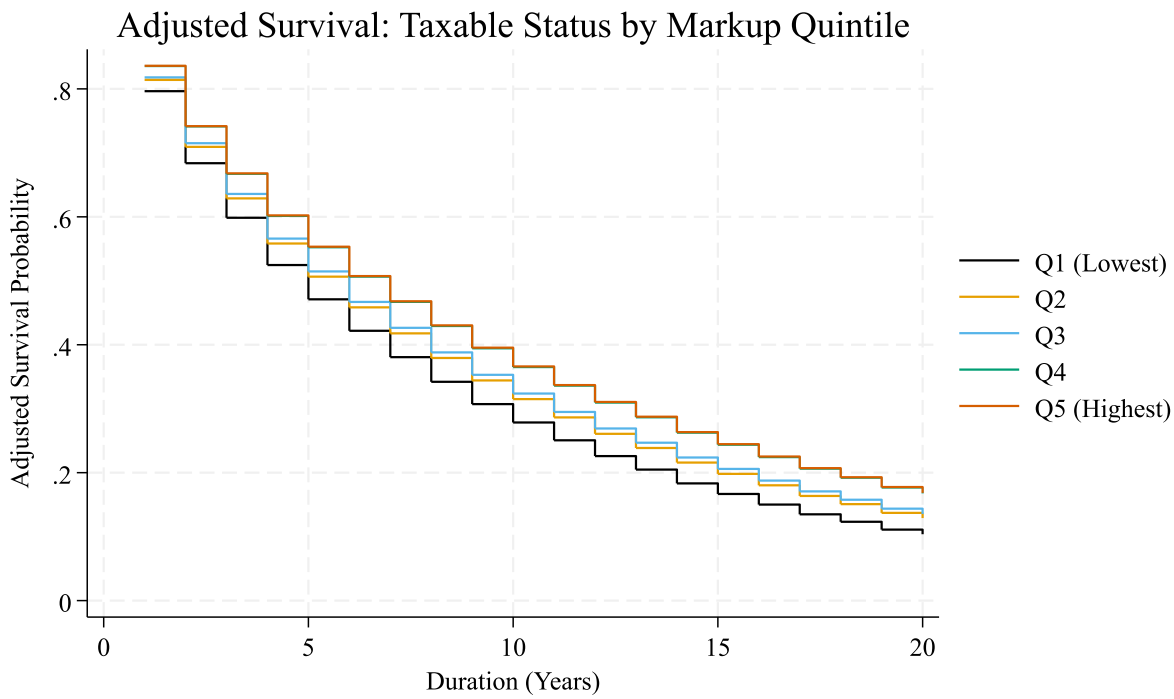


(a)

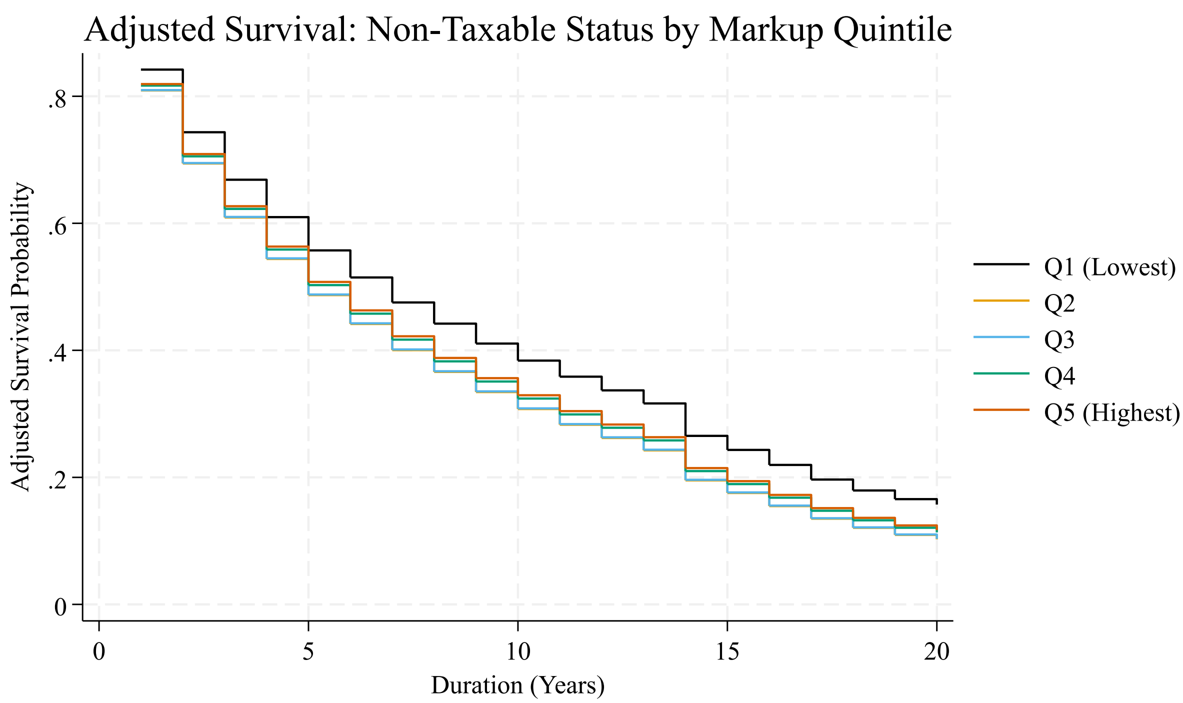


(b)

Figure A6: Duration of spells of (a) Taxability and (b) Nontaxability.



(a)



(b)

Figure A7: Duration of spells of (a) Taxability and (b) Nontaxability.

A.3.1 NPV Analysis

Figure A8: Firm Counts: Markup Quintiles Across NPV Deciles

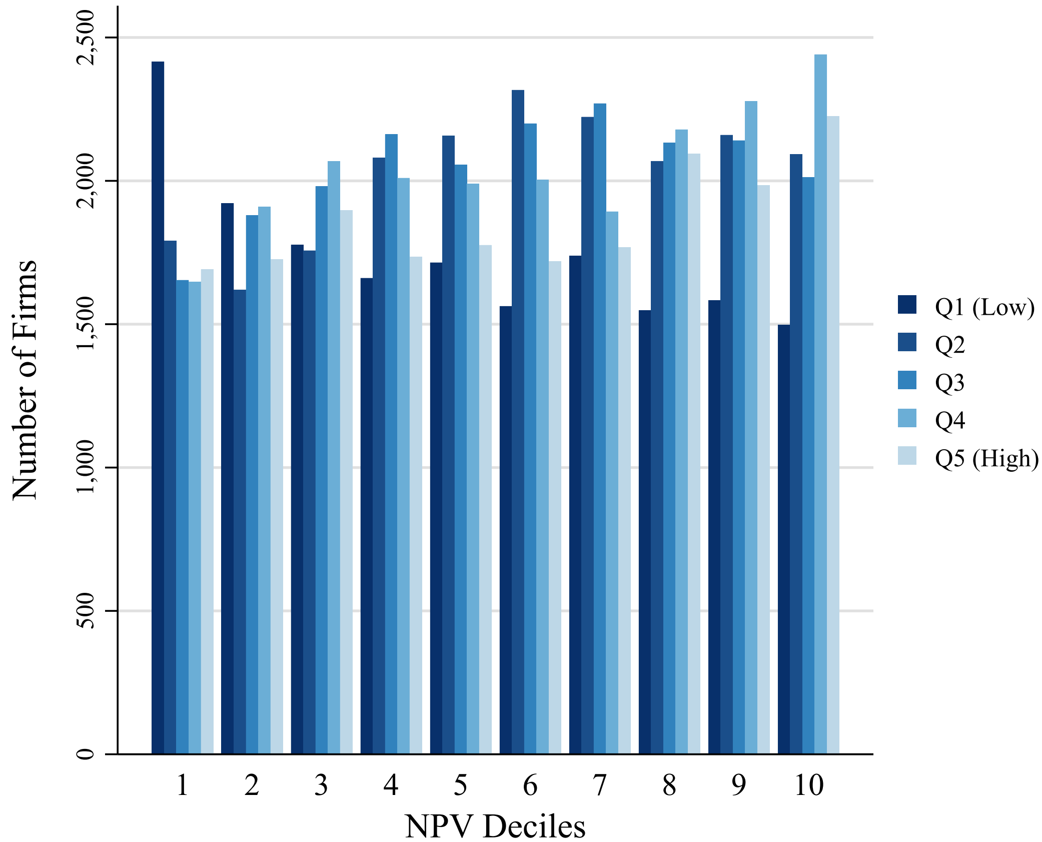


Table A6: Loss and Duration Conditional on NPV (5 Years)

	(1) Loss Ratio	(2) Share Loss Years	(3) Share Nontaxable Years
Q1 (lowest)			
Q2	-0.0186***	-0.0613***	-0.0622***
	(0.00487)	(0.00441)	(0.00589)
Q3	-0.0298***	-0.0833***	-0.0871***
	(0.00587)	(0.00496)	(0.00673)
Q4	-0.0390***	-0.0913***	-0.0985***
	(0.00654)	(0.00514)	(0.00697)
Q5 (highest)	-0.0442***	-0.0976***	-0.110***
	(0.00800)	(0.00571)	(0.00759)
Outcome Mean	0.30	0.20	0.52
Observations	141,632	142,621	142,621

Standard errors in parentheses

Year and Industry FE are included. Controls for NPV of income over a 5 year window. Also controls for log assets, and initial carryforwards.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

A.4 TCJA Analysis

Table A7: Coefficients on Q_{t-1}

Q Measure	Total Inv.	Physical Inv.	Intangible Inv.	Star Inv.
Total Q	0.035	0.017	0.018	
	(0.002)	(0.002)	(0.001)	
Traditional Q				0.006
				(0.001)

Table A8: Triple Difference Coefficients by Investment Type

	Total Investment	Physical Investment	Intangible Investment	Star Investment
A. TLCF Measure	0.017*	0.019**	-0.002	0.065**
	(0.010)	(0.009)	(0.003)	(0.033)
B. CF Measure	-0.006	-0.014*	0.008*	-0.007
	(0.009)	(0.008)	(0.004)	(0.019)
Notes: *** p<0.01, ** p<0.05, * p<0.10. Standard errors clustered by firm.				

Table A9: Triple Difference: Investment Top vs. Lowest Quartile

	CF (Direct)	CF (Constructed)
High Markup $\times$ CF2017 $\times$ PostTCJA	0.035	-0.017
	(0.025)	(0.015)
High Markup $\times$ PostTCJA	-0.055**	-0.022***
	(0.024)	(0.007)
CF2017 $\times$ PostTCJA	-0.012**	-0.009
	(0.006)	(0.008)
Lagged Q	0.032***	0.032***
	(0.002)	(0.002)
Observations	7977	7977
Outcome Mean	0.164	0.164

Notes: Firm and year FEs included. Regression controls for firm cash flow and leverage. Variables scaled by either lagged total capital or assets.*** p<0.01, ** p<0.05, * p<0.10. Standard errors clustered by firm.

Table A10: Triple Difference: Log Market Value

	CF (Direct)	CF (Constructed)
High Markup × CF2017 × PostTCJA	0.077	-0.096
	(0.080)	(0.113)
High Markup × PostTCJA	0.133**	0.213***
	(0.066)	(0.036)
CF2017 × PostTCJA	-0.043	-0.388***
	(0.052)	(0.084)
Observations	21009	21009
Outcome Mean	0.165	0.165

Notes: Firm and year FEs included. Regression controls for firm cash flow and leverage. Variables scaled by either lagged total capital or assets.*** p<0.01, ** p<0.05, * p<0.10. Standard errors clustered by firm.

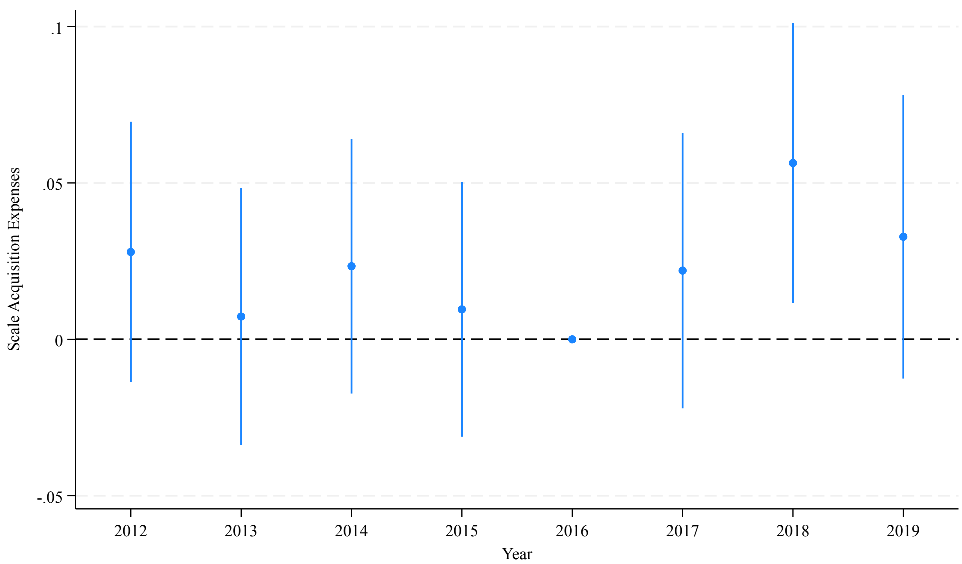


Figure A9: Event Study Coefficients: Acquition Expenses

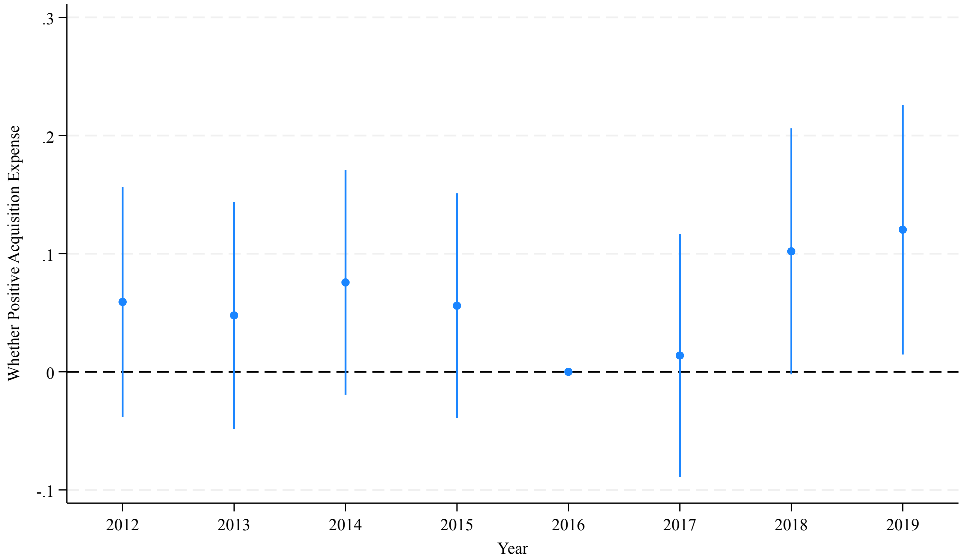


Figure A10: Event Study Coefficients: Probability of Acquisition

B Data Appendix

This section provides more detail on the restrictions, assumptions, and general cleaning done on the data. All variables found in the original data are denoted with italics. E.g. Capital expenditures in Compustat is provided by the variable *capx*.

B.1 Compustat Data

The analysis starts with all firm-year observations available at this time, beginning in 1950 and ending in 2024. Common restrictions from the literature are then applied.

B.1.1 Sample Restrictions

All firm-year observations that meet at least one of the following criteria are dropped from the sample:

1. Utility (SIC 4900-4999), real estate (SIC 5300-5399), and financial (SIC 6000-6999) firms.
2. Non-US incorporated firms.
3. Non-positive reported assets (at).
4. Negative values for one of the following items: *sale, cogs, xsga.*
5. Missing in one of the following items: *at, fyear, naics, pi, sale.*
6. As in De Loecker et al. (2020), firms that are in the 1 and 99% extremes of the cost-of-goods-sold to sales ratio $\left(\frac{cogs}{sale}\right)$ and the $xsga$ to sale ratio $\left(\frac{cogs}{sale}\right)$.

B.1.2 Imputations

Though the corporate tax rate has only been truly flat since 2017, all firms in the sample are assumed to be subject to the top corporate rate in each year. Historical rates are taken from the Tax Foundation and the Tax Policy Center.[18]

Adjustment to R&D (*xrd*) follow, for example, Lev and Radhakrishnan (2005) and Peters and Taylor (2017). In 1974, the Financial Accounting Standards Board (FASB) issued Statement of Financial Accounting Standards No. 2 (FAS2), which became effective fiscal year 1975 and established reporting requirements to disclose R&D expenditures if material. Thus, starting in this year, missing values of *xrd* are set to 0. In-process R&D (*rdip*) is treated the same.

Construction of total intangible capital follows Peters and Taylor (2017). Intangible capital can be divided into two types: externally purchased and internally created. Externally purchased intangible capital is measured by *intan*, and missing values are set as zeros. A proxy for internally created intangible capital is defined as the sum of knowledge capital and organization capital and is constructed via a perpetual inventory method.

As mentioned in the main text, two separate methods of imputation are used for tax loss carryforwards (TLCF). The most common and simplest method is to assume that missing values are equivalent to 0 reporting. As described in the text, this has been shown in the literature to be substantially misleading. Therefore, this method is adjusted by using the imputation method created by Max et al. (2023). Rather than coding this up directly, imputed data is downloaded directly from the publicly available source provided by the authors. The second imputation method is via Edgerton (2010). In this method, taxable income, carryforwards, and carrybacks are proxied for and calculated directly. Tax loss carryforwards are imputed using rules that mimic the real world tax code, with the only main data-based assumption being that the constructed carryfoward measure starts for the firm's second year in the data and is equal to Compustat's direct *tlcf* measure from the first period.

Market valuation is typically directly equal to *mkvalt*. When this variable is missing, it is set equal to the market value of equity: $prcc_f \times csho$. In regressions that include Tobin's q, firms are required to have at least 5 million in total capital value.

For acquisition expenses, the FSAB issued SFAS 95 in 1988. This new standard increased reporting requirements on acquisition expenditures, making it much more likely that missing values in Compustat are true zeroes. Since, the primary analysis that includes this acquisition variable (*aqc*) is the period around TCJA, missing values are simply imputed as zeroes.

B.1.3 Variable Construction

Several variables in the paper and discussed here are constructed from other variables in Compustat. The combination of variables and/or the algorithmic process to develop these variables are discussed in turn.

[18] Tax Foundation: https://taxfoundation.org/data/all/federal/historical-corporate-tax-rates-brackets/
Tax Policy Center: https://taxpolicycenter.org/statistics/corporate-top-tax-rate-and-bracket

Markup

Firm level markups are defined as in the text. In the Compustat data, *sale* is used for revenue while *cogs* is used for variable input costs (all variable inputs are treated as one input). In other words, the translation between theory and data is

$$\mu_t^i = \eta_t^i \frac{p_t^i x_t^i}{p_t^{i,V} V_t^i} \rightarrow \hat{\mu}_t^i = \hat{\eta_t}^i \frac{sale_t^i}{cogs_t^i}$$

The estimated output elasticity $\hat{\mu}_t^i$ is calculated at the industry level by De Loecker et al. (2020) for the years 1950-2016. Those estimates are used here, with the 2016 estimates filled forward to 2024.

User Cost of Capital

The user of cost of capital is defined as standard in the literature:

$$r_t = (INT_t - INFL_t) + DP_t$$

Interest rate is taken from the federal funds rate from FRED. The risk premium and depreciation rate is jointly set at 12%.

Taxable Status, CF, and CB

I follow the process outlined in Edgerton (2010).

1. Define Taxable Income after Dividend ($TIDD$) as

$$TIDD_t^i = pi_t^i + xido_t^i$$

2. Define the taxbill TB_t^i as

$$TB_t^i = txfed_t^i \times (1 - AMT_t^i)$$

   where AMT_t^i is an indicator for whether the firm is (likely to have been) required to pay the Alternative Minimum Tax. Since the AMT, for most of the sample period, allowed firms to use NOL deductions on 90% of income, firms subject to the 20% AMT but with large enough carryfowards to offset taxable income would have paid a 2% marginal tax rate. Thus, following Edgerton (2010), I classify firms with $txfed_t^i + itci_t^i \leq 0.2 \times pi_t^i$ as subject to the AMT and being effectively nontaxable due to the low margin. Firms with this classification represent a very small percentage of the sample.

3. Define the total carryback stock, *in terms of amount of taxes remitted*, as

$$\tilde{CB}_t^i = \sum_{s=0}^{T_B} CB[s]_t^i$$

where T_B is the carryback time limit, which is equal to 2 for most years, and $CB[s]_t^i$ is the potential carryback in year t remaining from taxes paid year $t-s$. To construct carrybacks from the data, first assume that

$$CB[s]_0^i = \max\{TB_0^i, 0\} \quad \forall s$$

i.e., that for a firm's first year in the sample, available carryback for previous years is simply equal to that first taxbill. Then carrybacks evolve according to the following cases:

$$CB[1]_{t+1}^i = \max\{TB_t^i, 0\}$$

$$CB[s|s>1]_{t+1}^i = \begin{cases} CB[s-1]_t^i & -TB_t^i < \sum_{j=s}^{T_B} CB[j]_t^i \text{ or } s > T_B + 1 \\ TB_t^i + \sum_{j=s-1}^{T_B} CB[j]_t^i & \sum_{j=s}^{T_B} CB[j]_t^i \leq -TB_t^i \leq \sum_{j=s-1}^{T_B} CB[j]_t^i \\ 0 & \sum_{j=s-1}^{T_B} CB[j]_t^i \leq -TB_t^i \end{cases}$$

In the second case, In the last case, the entire carryback stock is exhausted (if it exists).

4. The carryforward stock CF_t^i, *in terms of pre-tax income* is constructed as follows. First, the initial stock is defined in a firm's second year of the sample as the direct Compustat reported amount from the previous period:

$$CF_1^i = tlcf_0^i$$

Note that the Compustat variable is the end of the year (post tax) stock, while this new construction is a pre-tax stock. This stock is then evolved with the following rules:

$$CF_{t+1}^i = \begin{cases} 0 & TB_t^i > 0 \\ 0 & TB_t^i = 0, CR_t^i + p_t I_t^i ITC_t^i > 0 \\ \max\{0, CF_t^i - TIDD_t^i\} & TB_t^i = 0, CR_t^i + p_t I_T^t ITC_t^i = 0 \\ 0 & 0 > TB_t^i > -\tilde{CB}_t \\ \max\{0, -TIDD_t^i + TB_t^i/\tau_t\} & 0 > TB_t^i, -\tilde{CB}_t \geq TB_t^i \end{cases}$$

where the variable $itci_t^i$ is used in place of $CR_t^i + p_t I_t^i ITC_t^i$ as the full measure of tax credits.

5. A firm is deemed taxable if it has a positive final tax bill or if it receives (i.e., using carrybacks but not exhausting more than available) carrybacks. Nontaxable status (NT) is then defined by

$$NT_t^i = 1 - \mathbb{1}\left[TB_t^i > 0 \mid \left(0 > TB_t^i > -\tilde{CB}_t\right)\right]$$

and taxable status is simply just $1 - NT_t^i$.

A final note: To match Compustat's $tlcf$ variable, CF in the empirical exercises is shifted to to be the stock of carryforwards at the end of the year. In other words, if CF' is the carryforward as defined in Edgerton (2010) and above, $CF_t = CF'_{t+1}$.

Intangible Capital

Creation of intangible capital stock follows Peters and Taylor (2017).

1. Knowledge capital, G_t^i, evolves via R&D spending under a perpetual inventory method:

$$G_t^i = (1 - \delta_{R\&D})G_{t-1}^i + xrd_t^i$$

   where $\delta_{R\&D}$ is the depreciation rate, assumed to be 15% for all industries. G_0 is simply set to zero in the firm's first year of the sample.

2. Organizational capital, O_t^i, evolves similarly in a perpetual inventory model:

$$O_t^i = (1 - \delta_{SG\&A})O_{t-1}^i + 0.3 \times SGA_t^i$$

   $\delta_{SG\&A} = 20\%$ follows from Falato et al. (2022), and the the fraction of $SG\&A$ developing intangible capital follows from, among others, Eisfeldt and Papanikolaou (2014). SGA_t^i is not directly equal to $xsga_t^i$ from Compustat. Instead, it is defined as

$$SGA_t^i = xsga_t^i - xrd_t^i - rdip_t^i$$

   If xrd_t^i exceeds $xsga_t^i$ but is less than $cogs_t^i$, then SGA_t^i is set directly equal to $xsga_t^i$. If $xsga_t^i$ is missing, then SGA_t^i is set to 0.

Total Investment and Tobin's q

Total investment measures incorporate the previously constructed intangible capital measures into standard measures of investment.

$$q_t^{i,tot} = \frac{MKTVAL_t^i}{K_t^{i,phy} + K_t^{i,int}} \rightarrow \frac{mkvalt_t^i}{ppegt_t^i + intan_t^i +}$$

The typical Tobin's q is calculated based solely on physical capital, i.e.,

$$q_t^{i,*} = \frac{MKTVAL_t^i}{K_t^{i,phy}} \rightarrow \frac{mkvalt_t^i}{ppegt_t^i}$$

Total investment variables are constructed as follows:

$$\iota_t^{i,phys} = \frac{I_t^{i,phys}}{K_{t-1}^{i,tot}} \rightarrow \frac{capx_t^i}{ppegt_{t-1}^i}, \quad \iota_t^{i,int} = \frac{I_t^{i,int}}{K_{t-1}^{i,tot}} \rightarrow \frac{xrd_t^i + 0.3 \times xsga_t^i}{ppegt_{t-1}^i}$$

$$\iota_t^{i,tot} = \iota_t^{i,phys} + \iota_t^{i,int}, \quad \iota_t^{i,*} = \frac{I_t^{i,phys}}{K_{t-1}^{i,phys}}$$

where ι^* is the investment rate more typically used in the literature that depends only on physical investment.

<u>*Cash Flow*</u>

Cash flow is constructed as the sum of extraordinary income plus depreciation, scaled by lagged capital:

$$cashflow_t^i = \frac{ib_t^i + dp_t^i}{ppegt_{t-1}^i}$$

C Industry Level Analysis

As an alternative to the measure of market power used in the main text, this section considers "market leaders" in sales. For each year and NAICS3 cell, firms are classified as market leaders in they are in the top 4 in sales. Table [X] below shows

C.1 Manufacturing, Retail, and Wholesale

Three particularly relevant sectors are manufacturing (NAICS 31-33), retail (NAICS 44-45), and Wholesale (NAICS 42).

D Theory Appendix

D.1 Proofs

Proof of Lemma 1. **(1) Comparison at $L = 0$.** Let $\phi^{*,S}(0)$ represent the required productivity for a firm i to ex ante choose to remain in the market when the market state (outside of firm i) is ω^{-i}. Mechanically, for any given level of investment, it must be the case that for a firm on the margin of exit in the symmetric system that

$$\Pi_t^A \leq \Pi_t^S \tag{43}$$

given the immediate offset of the symmetric system. This will also be true for any firm with productivity below the firm on the margin of exit. This immediately implies the exit cutoff is weakly higher in the asymmetric system.

(2) Comparative static in L for the asymmetric regime. Fix the asymmetric continuation function $\mathcal{C}_t^A(\phi, L)$. By assumption $\mathcal{C}_t^A$ is continuous and strictly increasing in ϕ, and $\partial\mathcal{C}_t^A(\phi, L)/\partial L \geq 0$. At the cutoff we have the identity

$$\mathcal{C}_t^A\big(\phi^{*,A}(L),\, L\big) = 0. \tag{44}$$

Differentiate both sides with respect to L and apply the implicit function theorem:

$$\frac{\partial \mathcal{C}_t^A}{\partial \phi}\big(\phi^{*,A}(L), L\big)\frac{d\phi^{*,A}(L)}{dL} + \frac{\partial \mathcal{C}_t^A}{\partial L}\big(\phi^{*,A}(L), L\big) = 0. \tag{45}$$

Rearranging gives

$$\frac{d\phi^{*,A}(L)}{dL} = -\frac{\frac{\partial \mathcal{C}_t^A}{\partial L}\big(\phi^{*,A}(L), L\big)}{\frac{\partial \mathcal{C}_t^A}{\partial \phi}\big(\phi^{*,A}(L), L\big)}. \tag{46}$$

Because $\partial \mathcal{C}_t^A(\phi, L)/\partial L \geq 0$ and $\frac{\partial \mathcal{C}_t^A}{\partial \mu}\big(\phi^{*,A}(L), L\big) > 0$ at the boundary, the ratio is non-positive; hence $d\phi^{*,A}/dL \leq 0$. □

Proof of Propostion 1. As described in the text, the output FOC of each firm is

$$(1 - \tau\beta P(B_t < 0))(p'(X_t)x_t^i + p(X_t) - c^i) + \beta P(B_t < 0)\rho_{t+1}(p'(X_t)x_t^i + p(X_t) - c^i) = 0 \tag{47}$$

which can be factored as

$$[(1 - \tau\beta P(B_t < 0)) + \beta P(B_t < 0)\rho_{t+1}]\left[p'(X_t)x_t^i + p(X_t) - c^i\right] = 0 \tag{48}$$

Thus, excepting the case where the first bracketed term is equal to zero, it must be the case that current production is chosen to make the second bracketed term equal to zero. But this is just the FOC in an untaxed and a symmetrically taxed system. Thus, if there is no firm exit, all firms experience the same pre-tax proft they would as in the symmetric system.

Let $x_t^*(\phi)$ be the optimal output for the current distribution of productivities of firms. Then,

$$\begin{aligned} P(B_t > 0) &= P(\Pi_t^* - L_t + \varepsilon_t > 0) \\ &= P(\varepsilon_t > -(\Pi_t^* - L_t)) \\ &= \int_{-(\Pi_t^* - L_t)}^{\infty} f_\varepsilon d\varepsilon \end{aligned}$$

where Π_t is clearly increasing with productivity so long as there is no correlation between productivity, fixed costs, and the idiosyncratic profit shock. Then $P(B_t > 0)$ increases with productivity.

The penalty on firm value each period is

$$\Delta V = \tau(1 - \beta\rho_{t+1})P(\Pi_t + \varepsilon_t < 0)\mathbb{E}[\Pi_t + \varepsilon_t \mid \Pi_t + \varepsilon_t < 0]$$

In other words, the firm incurs a penalty on new losses (turned into carryforwards) each period. Whether this penalty is incurred depends on the likelihood of a loss this period ("extensive margin"). The size of the penalty also scales with the recovery time conditional on having a loss ("intensive margin"). As productivity rises, ρ_{t+1} is higher, while the probability and expecations are smaller. Thus, expected size of the penalty decreases as productivity rises. Since exit is based on expected firm value, a higher expected penalty increases the lower productivity threshold to remain in the market. $\square$

Proof of Lemma 2. The asymmetric value loss from the text can be rewritten

$$\Delta(S) \;=\; \tau\sum_{t=0}^{\infty}\beta^t(1-\rho_t)Q_t \;=\; \tau(1-\bar{\rho})\sum_{t=0}^{\infty}\beta^t Q_t \;=\; \tau(1-\bar{\rho})\,Q \tag{49}$$

Using $G = C + Q$ (because $C = G - Q$) we have

$$Q + G = C + 2Q \quad \Rightarrow \quad \theta = \frac{Q}{Q+G} = \frac{Q}{C+2Q}. \tag{50}$$

Solving this last equality for L gives

$$Q = \frac{R}{1-2R}\,C, \tag{51}$$

which is well-defined for $R \in [0, \frac{1}{2})$ (note: $R \geq \frac{1}{2}$ would imply $C \leq 0$ and requires separate sign-discussion; typically in applications one works with $C > 0$ and $R < \frac{1}{2}$). Substituting into the expression for $\Delta(S)$ yields (39).

Two statements then follow immediately: Δ is monotone increasing in the factor $\dfrac{R}{1-2R}$, so larger R gives larger Δ. Similarly, Δ is monotone decreasing in $\bar{\rho}$. $\square$

E Extensions

E.1 Market Predation: Duopoly Model

Here I develop an explicit model of oligopolistic competition to illustrate the theoretical impact the asymmetric system can have on competition. To ease exposition, I use the simplest possible setting to illustrate desired forces in a duopoly in a two period model and ignore investment. I will also begin with a Cournot model of competition. Each firm has the following pre-tax profits in a given period t:

$$\Pi_t^i = (p_t - c_t^i)x_t^i - F \tag{52}$$

where p is the inverse demand function, c^i are the firm's constant marginal costs, F are fixed overhead costs, and x^i is the choice of output. Firms potentially enter the period with some level of tax loss carryforwards (TLCF) L_t. The tax base is

$$TI_t^i = \max\{0, \Pi_t^i - L_t^i\} \tag{53}$$

After-tax profits in each period are then

$$\pi_t^i = \Pi_t^i - \tau TI_t^i \tag{54}$$

and next period TLCFs evolve as

$$L_{t+1} = \max\{0, L_t^i - \Pi_t^i\} \tag{55}$$

Future profits are discounted by a factor of δ.

E.1.1 Heterogeneous Firms and Predatory Pricing

Suppose it is the case that firm j has lower marginal costs $c^j < c^i$. Then we ask whether tax asymmetry affects j's ability to push i out of the market. More directly, does it shrink the required gap in marginal cost for predatory behavior to be a worthwhile endeavor?

I compare two regimes for the (potential) predator firm j: (1) firm j chooses their optimal quantities in both period as normal as both firms stay in business, and (2) firm j intentionally increases output and reduces profits in period 0 to push i out of business and is rewarded in period 1 with higher monopoly profits. There is a minimum competitor marginal cost $\underline{c}$ such that the predator firm is indifferent between standard behavior and the predatory option. Let $\{x_t^{i,*}, x_t^{j,*}\}$ represent the quantity decisions of both firms under standard Nash behavior. Let $\{x_t^{i,\dagger}, x_t^{j,\dagger}\}$ represent the quantity decisions in the situation where firm j engages in predatory behavior.

In order to drive firm i out of the market, it must be the case that price is driven down far enough such that the net present value of profit falls below 0. Suppose pre-tax profits in period 0 are driven ξ below zero. Since taxes do not apply, this is also the after-tax profit. This also implies that there are ξ TLCF for use in period 1. Since period 1 pre-tax profits are "determined" in the sense that optimal quantity is not influenced by TCLF (if not exiting), we can label these as ϕ^i. Then firm i's after-tax profits in period 1 are

$$\pi_1^{i,\dagger} = \phi^i - \tau(\phi^i - \xi)\mathbb{1}_{\phi^i > \xi} \tag{56}$$

Total expected profits at the start of period 0 are

$$-\xi + \delta(\phi^i - \tau(\phi^i - \xi)\mathbb{1}_{\phi^i > \xi}) \tag{57}$$

In order for this to weakly negative, it must be the case that

$$\xi \geq \frac{\delta\phi^i(1 - \tau\mathbb{1}_{\phi^i > \xi})}{1 - \delta\tau\mathbb{1}_{\phi^i > \xi}} \tag{58}$$

From this expression, we can already see the impact of tax asymmetry on the exit condition of the prey firm. First note that, in the absence of asymmetry, then $\xi^\dagger = \delta\phi^i$, where $\xi^\dagger$ is the minimum loss needed to force out firm i. Since $\frac{1-\tau}{1-\delta\tau} < 1$ for $\delta < 1$, asymmetry reduces the required loss needed before firm i exits. As δ decreases, the required first period loss shrinks, making it easier to force out the prey firm. As long as $\delta < 1$, increasing the tax rate will compound this effect as the numerator decreases faster than the denominator with the tax rate. Relatedly, these conclusions also imply that, as δ increases, the minimum marginal cost of i needed to make predation worthwile decreases.

The above condition is a necessary condition for predation to work as a strategy. In order for predatory behavior to be utility maximizing, it must be the case that

$$\sum_{t=0} \delta^t \pi_t^j(x_t^{j,\dagger}) \geq \sum_{t=0} \delta^t \pi_t^j(x_t^{j,*}) \tag{59}$$

or alternatively stated

$$\delta(\pi_1^{j,\dagger} - \pi_1^{j,*}) \geq -(\pi_0^{j,\dagger} - \pi_0^{j,*}) \tag{60}$$

that the (discounted) benefit of monopolization in the second period exceeds the profit sacrifice in the first period.

We now calculate the change in period 1 profits between the two strategies. First, we note that

$$\Pi_1^{j,\dagger} > \Pi_1^{j,*} + \Pi_1^{i,*} \tag{61}$$

since monopoly profits exceed joint duopoly profits and pre-tax profits are unaffected by TLCF. We also note that $\Pi_1^{j,*} = \Pi_0^{j,*}$ and $\Pi_1^{i,*} = \Pi_0^{i,*}$. Since

$$\pi_1^{j,\dagger} = \Pi_1^{j,\dagger} - \tau T I_1^{j,\dagger} = (1-\tau)\Pi_1^{j,\dagger} + \tau \min\{L_t, \Pi_1^{j,\dagger}\} \tag{62}$$

$$\pi_1^{j,*} = \Pi_1^{j,*} - \tau T I_1^{j,*} = (1-\tau)\Pi_1^{j,*} \tag{63}$$

then the change in after-tax profits in period 1 due to monopolization is

$$\begin{aligned} \Delta\pi_1^j &= (1-\tau)\left(\Pi_1^{j,\dagger} - \Pi_1^{j,*}\right) + \tau \min\{L_1, \Pi_1^{j,\dagger}\} \\ &> (1-\tau)\Pi_1^{i,*} + \tau \min\{L_1, \Pi_1^{j,\dagger}\} \end{aligned} \tag{64}$$

In period 0, we have that

$$\pi_0^{j,\dagger} = (1-\tau)\Pi_0^{j,\dagger} + \tau \min\{0, \Pi_0^{j,\dagger}\} \tag{65}$$

$$\pi_0^{j,*} = (1-\tau)\Pi_0^{j,*} \tag{66}$$

Then the change in after-tax profits in period 0 due to predatory pricing is

$$\Delta\pi_0^j = (1-\tau)\left(\Pi_0^{j,\dagger} - \Pi_0^{j,*}\right) + \tau \min\{0, \Pi_0^{j,\dagger}\} \tag{67}$$

The profit decrease to firm i in period 0 is equal to $\Pi_0^{i,*} + \xi$. Let's say that we have the conditions that show this is smaller (in magnitude) than the loss suffered by the prey firm. Then

$$\Delta\pi_0^j > -(1-\tau)\left(\Pi_0^{i,*} + \xi\right) + \tau \min\{0, \Pi_0^{j,\dagger}\} \tag{68}$$

which implies that

$$\begin{aligned}\Delta\pi_0^j + \Delta\pi_1^j &> (1-\tau)\left(\Pi_0^{i,*} - \Pi_1^{i,*} + \xi\right) + \tau\min\{0, \Pi_0^{j,\dagger}\} + \tau\min\{0, \Pi_0^{j,\dagger}\} \\ &= (1-\tau)\xi + \tau\min\{0, \Pi_0^{j,\dagger}\} + \tau\min\{L_1, \Pi_1^{j,\dagger}\}\end{aligned} \tag{69}$$

E.2 Tax Loss Carrybacks

The U.S. has historically allowed for tax loss carrybacks, the ability to apply current tax losses against previous years' profits. Up until its removal in the TCJA, profits in the previous two years could be used to offset current period losses. The biggest advantage of tax loss carrybacks versus carryforwards is that the refund is immediate, meaning that there is no discounting applied to the carryback value.

There are two manners in which carrybacks impact the main analysis. First, all firms weakly gain from carryback provisions due to the effectively immediate refundability. However, the degree of which this benefit (which makes the system closer to a symmetric one) should also be differentially related to profitability. Similar to how the negative impact of carryforwards are reduced with higher expectations on future profitability, so too is the positive impact of carrybacks with higher past profitability. Thus, once again higher markup firms should disproportionately benefit, conditional on a loss event, as they are more likely to have previously profitable periods to carry back against.