Corporate Tax Asymmetry and Market Power

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Abstract

This paper analyzes the extent to which asymmetric corporate income taxation reinforces the advantage of market power. Lower markup firms face larger expected penalties due to time discounting of carryforwards, while higher expected profitability and faster utilization of losses shield high market power firms. Evidence from U.S. publicly traded companies indicates a modest tax penalty differential between firms in the lowest and highest markup quintiles. The paper then assesses the impact of the provisions of the Tax Cuts and Jobs Act of 2017 that restricted the ability of firms to use their loss carryforwards. Among firms with carryforwards, high markup firms increased investment and acquisitions relative to low markup firms following this change.

1 Introduction

All corporate tax systems operate on an annual accounting basis, taxing profits in the year they are earned and delaying refunds on tax losses. Firms must carry forward (or back) their net operating losses against future (past) profits.[1,2] Carrying losses forward reduces their value due to the time value of money or eventual expiration, which can exacerbate liquidity constraints, encourage exit, and distort investment. In the United States, loss carryforwards have an indefinite expiration since the Tax Cuts and Jobs Act of 2017 (TCJA), although they had a 20 year or shorter 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.[3]

There are several reasons why governments still opt for asymmetric systems. One common supporting argument is that tax asymmetry provides protection against fraud. During non-profitable years, firms in a symmetric system (immediate loss offset) would have an incentive to overstate losses to increase their tax refunds. The government could increase enforcement efforts to combat this, but this would incur further administrative costs. Political economy considerations also come into play. 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 differentially benefit firms with market power. It develops a dynamic model of heterogeneous firms of varied markups making output and investment decisions under an asymmetric corporate tax system. The model highlights that the penalty from tax asymmetry shrinks with market power due to higher expected profitability. Higher profitability reduces loss likelihood and therefore reduces the expected time discounting on tax benefits. Empirical evidence from Compustat supports this prediction: the magnitude of the asymmetry penalty negatively scales with market power, although the differential is modest. Finally, the TCJA-imposed cap on carryforward usage generated variation in marginal investment incentives between high and low market power firms. Among firms holding carryforwards, high-markup firms increased investment relative to low-markup firms, consistent with the prior experiencing a lower increase in their expected marginal tax rates.

Under tax asymmetry, a given loss generates a tax benefit only once the firm becomes profitable again.[4] Because loss carryforwards are not inflation adjusted, the value of the benefit diminishes with each period it takes to reach profitability. If the firm never becomes profitable, it forfeits the benefit entirely. Thus, the cost of asymmetry scales with the expected duration before a loss can be used.

For a given statutory rate, all firms thus face higher expected average tax rates under asymmetry

[1] Prior to the TCJA of 2017, firms could carry losses back two years. The TCJA eliminated carrybacks, but the CARES Act of 2020 introduced a special five-year carryback for taxable years 2018-2020.

[2] Inflation-indexed carryforwards are historically rare, possibly due to administrative complexity, but not unprecedented. For example, in 2024 Argentina introduced inflation adjustment on tax losses.

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

[4] If a firm already has an existing stock of carryforwards, then this profitability must be above and beyond the initial stock.

than under immediate offset. Market power can mitigate this penalty in at least two ways. First, higher market power typically implies higher profitability, reducing the likelihood of interacting with the asymmetry. However, due to shocks or other uncertainties, these firms may still experience loss events. Conditional on having net operating losses in a given year, higher markup firms are still 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.

Second, firms with higher market power may be better positioned to smooth income over time. Even conditional on the same present value of pre-tax profits, a firm can reduce the negative effects of tax asymmetry by reducing the size of losses or shortening the average duration of carryforwards. For instance, a low but consistently positive income stream is preferable to one that alternates between large gains and losses. Whether achieved ex ante through project selection or ex post through income shifting, such smoothing increases after-tax profits.

A lower average tax rate does not automatically increase market power, as redistribution of rents can occur without changing relative market shares. However, a persistent reduction in after-tax profits lowers a firm's continuation value. Consequently, shifting rents from low to high market power firms raises the likelihood of exit for low market power firms. Similarly, tax asymmetry can act as a barrier to entry, as less productive firms require higher pre-tax profits to cover entry costs. As the market contracts, remaining firms capture a larger sales share by absorbing the capacity made available by exiting or excluded firms.

These advantages for high market power firms, however, need not translate to lower the effective marginal tax rate on investment. The marginal cost of investment weakly increases under asymmetry for all firms due to the potential discounting on the cost deduction. This cost increase diminishes with markup as expected taxability improves. Marginal benefits, however, follow the opposite pattern. Investment returns are effectively shielded when firms remain in a nontaxable state, decreasing the marginal tax burden on future income. Firms that are more likely to be persistently nontaxable, more typical of low markup firms, therefore operate closer to a more lightly taxed outlook, conditional on survival. Firms with a large stock of NOLs may face an even stronger incentive to invest under these conditions.

These differences in effective marginal tax rates (EMTRs) also shape competitive dynamics. The tax advantage during loss periods may support continued investment and market participation. If low markups reflect competitive pressure rather than fundamental inefficiency, this effect can help sustain competition and prevent market concentration. The net welfare impact depends on whether EMTR differences primarily misallocate capital toward persistently unproductive firms, creating efficiency losses, or aid viable but temporarily distressed firms, producing dynamic benefits that partially offset misallocation costs.

Compustat financial data across all years between 1950 and 2019 allow for an empirical examination of the relationships between market power, profitability, and tax losses. Following De Loecker et al. (2020), price markups proxy for market power and equal the product of output elasticities and inverse revenue shares. Tax loss measures use both Compustat's loss carryforward field, adjusted for known accounting issues, and an alternative constructed measure based on Edgerton (2010). The following results are broadly consistent across both measures.

The data show that firms with higher market power are less likely to enter loss states and, when they do, use carryforwards more quickly. Firms in the top markup quintile are 20-30 percentage points less likely to experience a loss event than firms in the lowest quintile, controlling for firm and year fixed effects to account for persistent firm characteristics and aggregate shocks. Conditional on a loss, faster carryforward utilization by high markup firms reduces the asymmetric tax penalty on the loss by roughly 2 percentage points relative to low markup firms. Together, these effects imply a contemporaneous expected difference in the penalty, measured in average tax rate terms, of 0.34-0.51 percentage points.

This penalty and broader carryforward and tax status duration estimates shape simulated EMTRs. On average, firms with higher markups face slightly higher EMTRs (roughly 1.5 percentage points) on investment, reflecting their reduced exposure to expected tax shielding. When estimates are stratified by current-period tax position, the EMTR gap between loss and gain firms narrows among high-markup firms, indicating that investment distortions stemming from tax asymmetry are weaker for these firms. While these differences do not reach conventional levels of statistical significance, the qualitative pattern supports the interpretation that greater market power dampens the effect of loss asymmetry on marginal investment incentives.

To test the alternative mechanism of income smoothing, the analysis then examines loss ratios conditional on net present value. Firms with higher markups exhibit lower loss ratios, measured as total losses relative to the sum of losses and gains, indicating lower loss exposure beyond what arises from higher pre-tax profitability. This pattern provides some evidence that high markup firms can smooth income over time. All in all, these results imply that firms with greater market power face smaller time-value losses due to tax asymmetry. While the magnitude of these effects across the markup distribution is modest, the sample is highly selected. Even lower markup firms in this dataset are not the smallest or lowest-tier market participants.

The paper then exploits changes in tax asymmetry introduced by the TCJA to test for differential changes in expected marginal tax rates. The legislation immediately reduced the value of carryforwards by capping annual usage at 80% of taxable income and lowering the statutory rate from 35% to 21%.[5] Triple-difference regressions examine investment changes around the TCJA, comparing groups defined by pre-TCJA average markup and the presence of positive carryforward stock immediately before the reform.

The cap on usage directly affects investment incentives. For firms likely to remain in traditionally nontaxable states, the policy effectively raises the marginal tax on investment, shifting the relevant probability from current carryforwards exceeding taxable income to taxable income falling below zero. Firms near this margin, typically lower markup firms, experienced a sharp increase in their marginal tax rate. Meanwhile higher markup firms with carryforwards, more likely to return to taxable status quickly, likely faced more muted changes to their expected rate.

[5] As noted earlier, the TCJA also extended the duration of carryforwards from 20 years to indefinite.

The regression results indicate that, conditional on having carryforwards, high markup firms increased their investment rate (1.8 percentage points for investment over lagged capital) relative to low markup firms. Acquisition spending, another form of investment, also rose on both intensive and extensive margins. Taken together, these patterns support the prediction that lower-markup firms exerienced a larger increase in expected marginal taxes from the TCJA carryforward changes.

1.1 Literature Review

The effects of corporate tax system asymmetry on firm incentives have been extensively analyzed (Auerbach, 1986; Mayer, 1986; Shevlin, 1990; Devereux et al., 1994; Edgerton, 2010). 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).[6] 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 argument in Auerbach (1986) that 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 study 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 details one link between tax asymmetry to market power and the distributional impacts of tax asymmetry across these firm types.

Past empirical work on tax asymmetry has shown that a high fraction of net operating losses are never used or used 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, although this may not 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

[6] 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.

proxies to those 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).

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) address how to 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. The former method is adopted here, along with those previously mentioned in Edgerton (2010) in a catch-all approach to measuring tax loss and taxable status.

Finally, note that measurements of capital have often only included data on property, plant, and equipment (PP&E). However, over the last several decades, the share of intangible capital has been increasing and is 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 "total q" modification of Peters and Taylor (2017) to better capture intangible 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, which stochastically affects its future markup by altering marginal costs. The firm incurs fixed cost F and experiences an idiosyncratic profit shock ε_t^i before remitting taxes.[7] Therefore, the firm obtains pre-tax profits

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

and productivity evolves according to

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

where G is increasing in both ϕ_t^i and I_t^i, and $c(G(\cdot))$ is concave decreasing in I_t.[8] The random variable ξ_{t+1}^i represents either investment uncertainty or a productivity shock, realized at the beginning of period $t + 1$. The model abstracts from financing frictions by ignoring interest rates on debt-financed investment (which can otherwise be included by multiplying I_t by 1 + the user

[7] 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.

[8] This last condition ensures that investment has decreasing marginal returns. Higher investment raises productivity, but productivity yields decreasing returns in lowering marginal costs.

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 the corporate tax at rate τ. Firms deduct all non-capital production costs and deduct a share $\theta \in [0,1]$ of investment expenditures. Losses are not immediately refunded. Instead, firms carry them forward and offset future taxable profits. Let L_t^i represent a firm's stock of tax loss carryforwards (TLCF) at the beginning of period t.[9] Each period, the firm can (1) accumulate additional TLCF if it incurs a loss, (2) reduce its TLCF stock if profits are positive but smaller than existing carryforwards, or (3) completely exhaust its available carryforwards. In other words, carryforwards evolve according to

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

where $B_t^i = \Pi_t^{i,P} - L_t^i + (1-\theta)I_t^i$ is the virtual tax base. If $B_t^i > 0$, the firm has positive taxable income. If $B_t^i < 0$, it incurs a net operating loss, and the firm remits no tax in the period. After-tax profits are therefore

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

A firm that newly enters a market at time t has an initial stock $L_t^i = 0$. The sequence of events within each period thus proceeds as follows:

Entry/Exit — Choose (x_t, I_t) — Realize ε_t — Remit Taxes — Update L_t

2.1 Value Function and States

The productivity and carryforward tuple $\omega_t^i \equiv (\phi_t^i, L_t^i) \in \Omega$ defines 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 is the firm's discount factor, assumed identical across firms, and the expectation integrates over the distributions of ε_t and ξ_{t+1}. Though not explicitly written out each time, V is bounded below by the exit (scrap) value which is assumed independent of the tax system. For simplicity, all firms will have the same exit value of $\overline{V}$. This outside option highlights the distinction between economic and accounting profits: because economic profits are weakly lower, firms stay in the market only if they expect positive accounting profits.

In practice, accounting income and taxable income also differ for the tax authority, particularly in the treatment of deductions and the creation of carryforwards. The model abstracts from these

[9] While several countries have (limited) tax loss carryback systems, including the United States prior to 2018, the analysis here ignores carrybacks. Section D.2 provides a brief discussion of the implication of carrybacks.

complexities, so accounting and "tax" income coincide, but this distinction becomes important when comparing the model to the financial statement data from Compustat.

2.2 Symmetric System Benchmark

As a point of comparison, consider an alternative symmetric corporate tax system with the same tax rate τ. Under this system, tax losses are immediately refunded, and so no carryforward system exists. 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 corresponding value function is

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

If a firm could fully deduct investment ($\theta = 1$), it could factor the retention rate $(1-\tau)$ out of its value function. In that case, the firm would choose output and investment just as it would under no corporate tax, with the only difference being that its value is scaled by the retention rate.

This paper considers two types of comparisons between the asymmetric and symmetric tax systems: (1) zero-start comparisons and (2) realized-history comparisons.

1. Zero-start comparisons examine firms that begin with no tax loss carryforwards ($L_t^i = 0$). This scenario applies when a market has just opened or all firms were fully taxable in the previous period. Although idealized, it provides a neutral baseline, because pre-existing carryforwards would otherwise give firms in the asymmetric system an advantage.

2. Realized-history comparisons consider firms that already hold a stock of carryforwards. The challenge is that the symmetric system has no analogous state variable. Even if two firms share the same current markup, the firm in the asymmetric system retains latent tax benefits from its history, whereas the firm in the symmetric system has already realized any potential benefits. These comparisons therefore reveal how holding carryforwards affects forward-looking investment and output decisions.

2.3 Entry and Exit

Firms exit the market when their continuation value falls below the outside option $\overline{V}$. Because this outside option is neutral to the tax system, exit decisions relate directly to productivity.

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 two perhaps obvious points. First, the exit threshold is higher under the asymmetric system. This follows directly from the fact that the present value of tax benefit is weakly larger for any given profit stream in the symmetric system. Second, conditional on a loss, holding tax loss carryforwards weakly increases firm value. 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 extract these benefits.

This latter mechanism can prolong competition relative to a counterfactual 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. This highlights the importance of distinguishing between early ex ante incentives and post loss realization incentives.

The same logic that raises the exit threshold at $L_t = 0$ also deters entry. For a given productivity level, tax asymmetry reduces the expected net present value conditional on entry. Prior work has highlighted that asymmetric taxation can be harmful to new or young firms, but this analysis extends that insight: tax asymmetry not only affects firms that have already entered, but also reduces the incentive for potential entrants to enter in the first place. In this sense, 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 a distribution of firms has various productivities and all firms begin with zero carryforwards. In the symmetric system, the first-order condition (FOC) reduces to a pure profit tax, which implies the same output choice as in an untaxed setting. For the asymmetric system, the FOC 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} represents the expected time usage of an incremental loss (equal to 1 if the firm knew for certain it would be taxable in the following period).

This FOC combines the expected current-period payoff with the value of a tax loss carryforward generated if the firm experiences a loss. As in the symmetric case, the untaxed FOC can be factored out, so the firm chooses the same quantity that maximizes untaxed profits. Under full deductibility of costs, the quantity that maximizes firm value in a profit state is identical to the quantity that maximizes value in a loss state. In other words, the firm faces either a nondistortive profit tax or no tax at all on the marginal income generated in the current period.

The above implies that market power, at least as defined by markups or market share, is identical under either a symmetric or asymmetric systems if there is no exit. What differs, however, is the distribution of after-tax profits. The value of a firm under a symmetric system is

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

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

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

The per-period difference in firm value is

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

i.e., the expected asymmetric penalty on any newly accrued carryfowards. This penalty scales with the tax rate, the size of the loss, and the expected time before using the carryforwards, while it decreases with the discount factor. All else equal, higher markups reduce the magnitude of the penalty, shifting the distribution of after-tax profits toward firms with higher markups.

Because tax collections are higher under the asymmetric system (pre-tax profits are the same, but firms are remitting more taxes), the government could lower the statutory tax rate to match revenue under a counterfactual symmetric system. In this setting, asymmetric taxation effectively redistributes rents from the lowest-markup firms to the highest-markup firms without distorting market output.[10]

There is, however, an important caveat. While the intensive margin remains undistorted, as firms experience zero effective marginal tax on production, the extensive margin can be distorted. Under asymmetry, the pre-tax profit required to remain in the market rises for all firms, especially for those facing larger penalties. Because the penalty grows as productivity or markup declines, firms that were previously on the margin may be driven out of the market.

These extensive-margin distortions have efficiency consequences and alter market power and

[10]While this paper does not formally address welfare, the two systems are not necessarily welfare neutral. For example, if firm market power correlates positively with the income of firm owners, asymmetry could produce a regressive redistribution of profits.

market shares. As low-productivity firms exit, remaining firms gain room to expand output. With higher pre-exit markups, these firms can increase production more easily. This mechanism also implies that high-market-power firms may be better off in absolute terms under an asymmetric system if the gains from expanded market share exceed the expected penalty from carryforwards. All of these insights are summarized in the following proposition.

Proposition 1. *Suppose all firms start with zero carryforwards in a neutral, zero-start scenario. If production costs are fully deductible, interior output decisions are identical under asymmetric and symmetric tax systems. When no firm is induced to exit by the asymmetric system, the distribution of pre-tax profits, markups, and market shares remains unchanged, while after-tax profits are shifted in favor of high-markup firms.*

If, however, asymmetry induces firm exit, quantities do change relative to the symmetric system. The probability of exit declines with markup, reflecting the lower expected penalty on firm value. Firms that remain in the market experience higher markups and expanded market shares.

This impact on the exit margin can have broader implications for firm behavior. For example, this uneven distribution of the penalty can make predatory behavior more attractive, as it pushes lower-end firms closer to the brink of exit. An in-power firm that previously would not find predatory behavior profitable may be induced to do so due to asymmetry. Section D.1.1 in the Appendix presents a simple two-period, two-firm model illustrating this point.

Of course, the previous statements are made from the "zero start" ex ante point of view. As previously discussed, once history is already realized, behavior becomes more ambiguous as weaker firms may persist in the market to use their net operating losses.

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 allows expectations to be expressed as a probability function.[11]

The combination of current marginal costs and the expected value of the investment deduction make up the firm's expected marginal cost. If the firm is currently taxable, the firm immediately receives the deduction benefit. If the firm is nontaxable, the deduction converts to an increase in carryforward stock. In any future period with positive taxable income, the benefit of an additional dollar of TLCF equals the tax savings from reducing taxable income by one dollar, i.e., $\theta\tau$. 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 fully confident the extra dollar of TLCF will be 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 instead expects to never use the TLCF, $\rho_{t+1} \to 0$, and the marginal value of the TLCF is zero. Therefore the value of this term is bounded between 0 and $\beta\theta\tau$.

Finally, increasing investment affects the value of markups in two ways. First, it directly boosts productivity, which can raise next-period and future profitability. In taxable states, the firm scales this return by $(1-\tau)$, while in nontaxable states it captures the full return. Second, investment can also influence equilibrium prices through the endogenous market structure, changing the market state in period $t+1$. This effect can differ across tax systems.

The rewritten asymmetric investment FOC is

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

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

In the symmetric system, the corresponding FOC is

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

The RHS of equation (21) looks the same as the RHS of equation (20), but they differ internally. In the asymmetric system, the firm remits taxes on investment returns only when $B_{t+1} > 0$. Each system can influence the overall market state, but asymmetry changes it in a different way, for example by raising the productivity required for a firm to remain active. Even if this market effect is small, investment decisions can still differ because of the expected tax shielding on returns in nontaxable states.

[11] $P(B_t < 0)$ equals the integral of the 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 threshld is equal to $\varepsilon^* = \theta I_t + L_t - F - \mu_t x_t$.

Under full deductibility of investment, the symmetric value function takes the form

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

The investment FOC then simplifies to

$$1 = \beta \mathbb{E}_t \left[\frac{\partial v_{t+1}^i}{\partial \phi_{t+1}^i} \frac{\partial G}{\partial I_t^i} + \frac{\partial v_{t+1}^i}{\partial \omega_{t+1}^{-i}} \frac{\partial \omega_{t+1}^{-i}}{\partial I_t^i} \right] \tag{23}$$

where $v_t = \frac{V_t}{1-\tau}$, which is entirely independent of the tax rate. In this case, the investment decision does not depend on the tax rate and is invariant across firms, regardless of their markups. This contrasts with the asymmetric system, where the expected mismatch between costs and benefits introduces a tax-dependent distortion.

2.6 Tax Asymmetry and Markup on Incentives

The different FOCs imply that firms behave differently under the two systems, and the extent of this difference may depend on market power. To formalize this, consider two identical firms with the same expected markup and no existing TLCF at the start of period t. Under a symmetric system, marginal cost of investment is simply equal to $1 - \theta\tau$. Under an asymmetric system, marginal cost equals

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

where, as before, $\rho_{t+1} \in [0, 1]$ is the expected discounting on the cost deduction. Since $\rho_{t+1} \leq 1$, it follows that

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

The right hand side of this expression is bounded between $1 - \beta\theta\tau$ (when $P(B_t > 0) = 0$) and $1 - \theta\tau$ (when $P(B_t > 0) = 1$). Because $\beta \in [0, 1]$, the marginal cost under asymmetry is always weakly smaller than the marginal cost under symmetry. Equality holds only in two special cases: (1) there is no time discounting ($\beta = 1$), or (2) investment is fully non-deductible ($\theta = 0$). In the first case, absent cash flow constraints, there is no disadvantage of tax asymmetry as money retains its value across time. In the second case, there is no disadvantage of tax asymmetry since firms always bear the full cost of investment.

Outside these edge cases, the difference in marginal cost across systems shrinks as market power (markup) rises. All else equal, a higher markup implies higher expected profit in a given period, such that $\frac{dP(B_t>0)}{d\mu} > 0$ and $\frac{d\rho_{t+1}}{d\mu} > 0$. Together, these effects lower MC^A, bringing it closer to the symmetric benchmark as markup rises.

If this were the only channel, firms with higher markups would experience less downward pressure on investment relative to the symmetric system than low-markup firms. However, investment also generates future returns, and the taxation of these returns differs across states of profitability.

In taxable states, investment returns are taxed at the statutory rate, whereas in nontaxable states they face no tax at all. This asymmetry reverses the direction of the effect on the benefit side. Firms that do not expect to be taxable soon face a lower expected marginal tax on returns, which strengthens their incentive to invest. Conditional on the stock of carryforwards, low-markup firms are more likely to fall into this category because of their lower profitability. Thus, while asymmetry raises the effective marginal cost of investment more for low-markup firms, it can simultaneously increase their expected after-tax return. The overall effect on investment therefore depends on the relative strength of these two opposing forces.

2.7 Two-Period Horizon

While an infinite horizon better reflects reality, a finite two-period setting can more transparently illustrate the relevant insight. The first-order condition 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 equals one minus the expected deduction value. 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. First, suppose a firm knows for certain that its current productivity is insufficient to cover fixed costs plus a shock, so that $B_t < 0$, and no matter its investment, $B_{t+1} < 0$. In this case, neither the cost of investment nor the returns are taxed, so the effective marginal tax rate on investment is zero. The interior investment choice is therefore undistorted (although the firm should optimally choose to exit).

On the other extreme, suppose a very powerful firm can virtually guarantee profitability in both periods. For this firm, investment cost is $1 - \theta\tau$, while investment returns are fully taxed at τ. There is no additional distortion relative to the symmetric system, and the firm's investment decision remains unchanged.

These two extreme cases 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 carry-fowards, potential past unprofitability is no longer important. Looking forward into the future, this high stock of carryforwards grants them likely nontaxable status for the foreseeable 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 example with two firms, i and j, that take on two of the three productivity 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. For all cases and all firms, the interior first order condition for investment in the symmetric system is

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

so that the tax rate can be factored out. Consider the asymmetric system. A Low-type firm that presumes it will be nontaxable in both periods has the FOC

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

In this situation, the Low-type firm does not receive the investment deduction, but its marginal income is fully shielded. A Medium-type firm that is nontaxable in $t=0$ but taxable in $t=1$ has the FOC

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

In this situation, the Medium-type firm receives a discounted deduction benefit and no shielding on marginal income. Finally, a High-type firm that expects to be taxed in both periods has FOC

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

and again the tax rate can be factored out. The firm receives the full investment deduction, which compensates returns being fully taxed.

First, consider the zero-start comparison. If carryforwards begin at zero, the Low-type firm will exit the market. Even though its interior FOC implies higher relative investment than the Medium firm, the Low firm cannot generate enough future profit to cover losses, so its realized investment is zero. Comparing the Medium and High firms, the Medium firm invests less than in the symmetric system, while the High firm invests the same. Relative investment therefore shifts toward the High firm, expanding its market share.

Now consider the history-realized comparison. Suppose shocks are smaller, but all firms begin with a substantial stock of carryforwards. In this setting, the Low-type firm may generate enough profit to remain active yet stay nontaxable in both periods. The Medium firm, by contrast, may remain untaxed in the current period but become taxable in the next. As a result, the Low firm invests roughly as it would under the symmetric system, while the Medium firm invests less. The ratio of markups thus declines more than in the symmetric case, and the Low firm gains relative to the Medium firm.

These cases show that, especially in intermediate, period-to-period transitions, low-markup firms can invest relatively more and narrow gaps in market share. Although these firms place less value on the eventual use of carryforwards, their stock of carryforwards increases the marginal incentive to invest by maintaining nontaxable status over time. This distinction between average and marginal taxation, combined with a firm's realized history, can therefore shape relative investment and market dynamics in subtle ways.

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. Yet the same underlying logic applies: firms' relative investment depends on the interaction between expected profitability, existing carryforwards, and the likelihood of future taxation.

3 Profit Smoothing

While higher markups will mechanically provide an advantage in the corporate tax system, so too would the ability to smooth profits temporally. This advantage can arise through at least two channels. First is an ex ante "projects" based mechanism, where higher market power allows weakly greater access to projects of different income profiles. This relates to the literature showing that tax asymmetries discourage risk-taking and volatile investment returns (Auerbach, 1986; Majd and Myers, 1987; Langenmayr and Lester, 2018; Goodman et al., 2023; Ferguson et al., 2025).[12] Second is an ex post profit shifting mechanism, where higher market power implies more access to accounting schemes that can reallocate profits over time for tax purposes.

In practice, both mechanisms likely depend on firm size or a combination of financial and market power rather than pricing power alone. Within a given market, however, these characteristics tend to overlap, and both channels provide avenues through which higher-markup firms can mitigate the effects of tax asymmetry. A brief treatment of these ideas follows.

[12] The argument here is not that high market power firms are more risk averse. In fact, the greater profitability may help high market power firms increase their tolerable level of risk taking. However, conditional on a level of profitability, higher markup firms may have access to safer projects of equal return.

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 $V(S^m) = V(S^n)$, i.e., both have the same net present value. Suppose that $\forall t, \Pi_t^m = C$. For the second stream, let $\Pi_0^n = -\overline{L}$, 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 after-tax value of both streams is simply scaled by $(1-\tau)$, preserving indifference between the two. Under an asymmetric system, the value of stream S^m is still scaled down by $(1-\tau)$. However, the after-tax present value of stream S^n is

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

In this case, the firm faces a one period penalty on the initial loss equal to $\tau\overline{L}(1-\beta)$. Thus, while a firm would be indifferent between these two profit streams under a symmetric tax system, it would strictly prefer stream S^m over stream S^n in an asymmetric system. 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

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

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 $R \equiv \frac{Q}{Q+G} \in [0,1)$. 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 be

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

Then the value loss from tax asymmetry can be written as

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

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

Lemma 2 makes two simple points. First, what matters for the asymmetry penalty is variance around zero rather than total variance. If a firm has extremely high markup, then having higher general variance matters less. The loss ratio R captures the fraction of the value of absolute income outlays that are below this zero threshold. Streams with more (discounted) downside mass suffer larger penalties. Second, the penalty falls the faster the firm can utilize losses (higher $\overline{\rho}$). In other words, slow utilization of carryforwards (low $\overline{\rho}$) increases the present-value cost of asymmetry.

This characterization motivates using two empirical primitives when measuring profit smoothing: (i) a loss ratio that captures the fraction of discounted cash flows below zero, and (ii) a carryforward duration/utilization measure that proxies $\overline{\rho}$. Conditional on pre-tax profitability, markups that associate with lower loss ratios and faster utilization will face smaller penalties from tax asymmetry.

4 Empirical Analysis

This section empirically examines the relationship between market power and the extent of the asymmetric tax loss penalty. It first documents that firms with higher markups face a lower probability of incurring a loss and, conditional on a loss, utilize carryforwards more quickly. These two factors imply a lower penalty on firm value. A complementary spell analysis shows that high markup firms also expect shorter durations in nontaxable status, which translate into qualitatively weaker effective marginal tax distortions. Although EMTRs rise with markup, the difference between loss and gain firms is smaller at high markup levels, consistent with reduced asymmetry-related distortion.

Second, conditional on similar net present value of income over a given time horizon, higher markup firms exhibit lower exposure to loss. This pattern provides evidence consistent with an ex ante or ex post ability to smooth or manipulate income streams to mitigate the effects of tax asymmetry.

The final subsection examines a policy change (TCJA) that substantially affected carryforwards. TCJA both directly reduced the value of carryforwards and differentially altered the marginal tax on investment for lower markup firms. The results imply that this reform increased investment and acquisitions by high market power firms with carryforwards relative to low market power firms with carryforwards, consistent with the latter group experiencing a larger increase in expected marginal tax rate.

4.1 Data

Yearly firm financial data come from Compustat, covering firms from 1950 to 2019, with certain exercises focusing on smaller subsamples. The long panel structure allows firms to transition between taxable and nontaxable states, which is essential for capturing tax asymmetry and studying expectations over time. However, standard limitations apply. Compustat reports income on a financial accounting basis rather than an economic or tax basis, introducing measurement noise in tax-related variables.

A potential concern is that publicly traded firms, which represent the majority of the Compustat sample, are a highly selected group of firms. These firms are likely to be on the higher end of the market power distribution and less likely to experience tax losses.[13] However,the empirical goal here is not to describe the full distribution of market power but to document differences across markup levels. For that purpose, sufficient within-sample variation is what matters. If anything, the concentration of larger, more profitable firms in the sample likely biases results toward smaller differentials, suggesting that measured effects may understate the scaling present in the broader firm population.

The sample undergoes several restrictions and data adjustments. Following common practice, utility (SIC 4900–4999), real estate (SIC 5300–5399), and financial (SIC 6000–6999) firms are excluded due to their distinct regulatory and tax treatment. Firm-year observations missing key variables, such as sales or cost of goods sold, where missing values are unlikely to be true zeros, are also removed. All relevant dollar-denominated variables are deflated using the GDP Deflator with 2010 as the base year. A more detailed description of the sample restrictions, cleaning, and imputation procedures appears in the Data Appendix.

4.2 Measures of Market Power and Profitability

Firm markups serve as a proxy for market power. The markup measure used here follows the De Loecker et al. (2020) "production approach," which derives markups from the cost minimization

[13] Table A2 provides basic summary statistics.

of variable inputs of production and capital.[14] Markup equals the price to marginal cost ratio, calculated as the product of the output elasticity and the inverse of revenue share of a variable input:

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

where V represents the variable input, and η_t is the output elasticity. Compustat's cost of goods sold (*cogs*) field measures total variable costs, and total sales (*sale*) measures revenue. Estimates for output elasticities come from De Loecker et al. (2020). The analysis stratifies firms into annual markup quintiles, rather than using the continuous variable, to capture potential nonlinear relationships in the data. Selected results using markup as a continuous independent variable appear in the Appendix.

Profits are defined as $\Pi_t^i = S_t^i - P_t^V V_t^i - r_t K_t^i - F_t^i$, 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 equals the difference between the federal funds rate and the inflation rate, plus a fixed depreciation rate and risk premium of 12%. Fixed costs and other nonvariable costs are proxied by Compustat's field $xsga$, which reports selling, general, and administrative expenses. Dividing through by sales gives the profit rate:

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

Figure A4 replicates key figures from De Loecker et al. (2020) to ensure a close match.

4.3 NOLs and Tax Status

The analysis defines carryforward stocks using two approaches. The first approach draws directly from the Compustat *tlcf* field, which contains many missing entries that often do not represent true zeros (Kinney and Swanson, 1993; Heitzman and Lester, 2021). To address this issue, imputed values from Max et al. (2023) replace missing observations, using related tax and accounting variables to estimate likely carryforward amounts. The second approach follows Edgerton (2010) to construct a broader measure of taxable status that incorporates both carryforwards and potential carryback use. Table A3 demonstrates the internal consistency of this constructed measure as well as simple correlations 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 expected: the lower price margins suggest 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

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

reason for high markups, this would hurt the use of markups as a proxy for overall profitability and market power.

4.3.1 Markups, Profits, and Losses

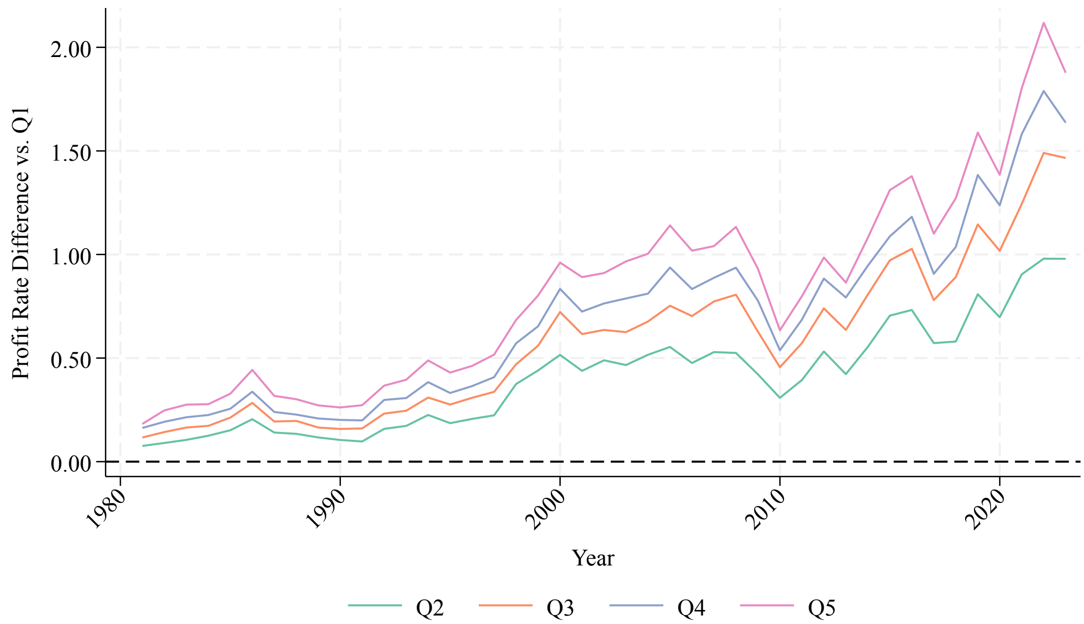

Figure 1: Profitability by Markup Quintile

Notes: Profit rate is defined as the ratio of profits to sales. Each line plots the difference in average profit rate for that markup quintile in comparison to lowest quintile (Q1). Difference values exceeding 1 can exist since profit rate can be negative. Group averages are unweighted.

Figure 1 displays the difference in the profit-to-sales ratio between higher markup quintiles and the baseline lowest quintile (Q1).[15] As expected, higher markups have historically been associated with higher economic profit rates. These differentials have widened since the 1980s as markups have diverged, a trend examined in greater detail by De Loecker et al. (2020). While this pattern may appear straightforward, it validates that high markups generally reflect greater overall profitability rather than merely the recovery of large fixed or overhead costs.

Figure 2 presents analogous results for differences in the probability of loss. The figure plots the difference in the fraction of firms within each markup quintile reporting a loss year relative to the fraction in the lowest quintile. Throughout most of the historical sample, firms with higher markups exhibit a lower likelihood of loss. Figure A5 replicates the analysis using positive changes

[15] Although the profit rate is bounded above by 1, it is not bounded below by 0, as negative profit rates are possible. Consequently, the differentials can exceed 1.

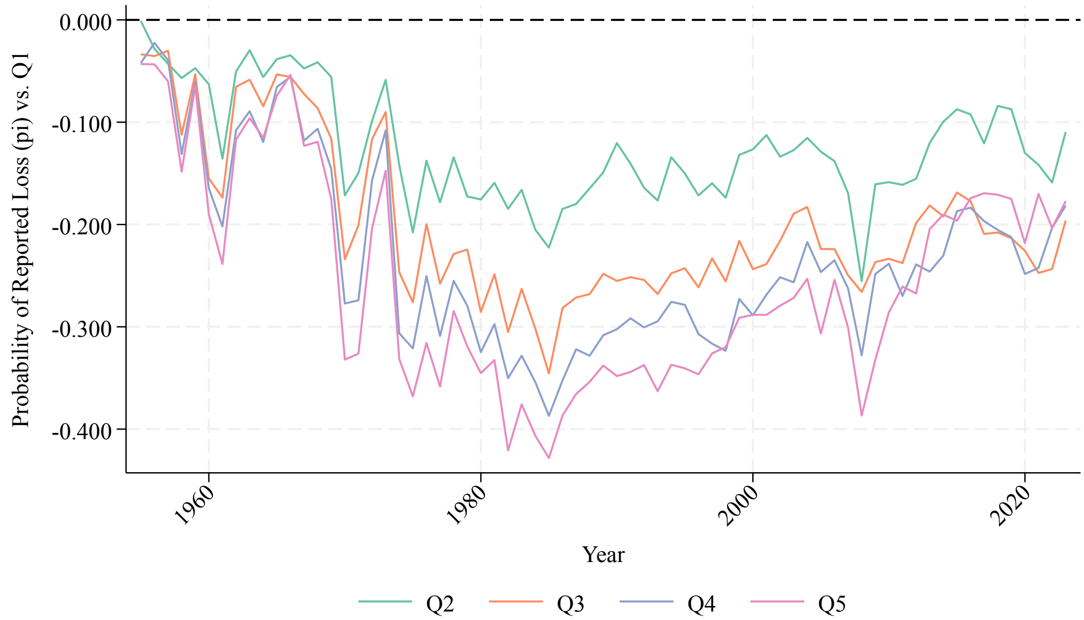

Figure 2: Likelihood of Loss by Markup Quintile

Notes: This figure plots the difference in average fraction of loss firms for firms in upper quintiles in comparison to lowest quintile (Q1). Loss years here are proxied by accounting losses (reported pre-tax income below 0). Group averages are unweighted.

in carryforward stock as an alternative indicator of tax losses.[16] The results are qualitatively similar.

The simple importance of these results 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 less likely it is to be the case that a high markup firm interacts with the asymmetric penalty.

Because firms with different markups may differ systematically along other dimensions, Table 1 pools all firm-year observations in two-way fixed effects regressions to control for firm-specific characteristics and macroeconomic trends. A consistent gradient emerges across all specifications. The positive association between profit rates and markups persists, and columns (2) and (3) highlight the negative relationship between markup and loss probability. The estimates indicate that the highest-markup firms are 20-30 percentage points less likely to incur a loss than the lowest-markup firms.

[16]The two measures differ for several reasons. The first is superficial, as reporting inconsistencies in pre-tax income and carryforward stock can generate measurement error. The second and third reflect genuine differences: a firm may report a loss without an increase in carryforwards if prior profits allow full carryback utilization, and reported accounting income may diverge from taxable income (and hence from true tax losses).

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: This table provides the difference in each outcome relative to the lowest markup quintile (Q1). Profit rate is defined as profits over sales. Probability of loss is the share of firms in the group with a loss year. Loss years in (2) are proxied using negative reported income. Loss years in (3) are defined as instances when tlcf changes are positive. 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.

* $p<0.10$, ** $p<0.05$, *** $p<0.01$

4.3.2 Taxable Status and Carryforward Duration

While the probability of a loss event in a given year is informative, long-term dynamics of carryforward usage and taxable status are equally important. Firms make investment decisions based not only on current deductibility, but also on expectations of how quickly they will return to taxable status and how long any accumulated losses will persist. These expectations directly shape effective marginal tax rates, and thus the relevant margin for behavior lies in the evolution of taxable versus nontaxable states over time rather than in one-period loss realizations alone.[17]

Table 2 presents the results of two way fixed effects regressions on duration measures 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 two carryforward regressions, the size of the initial carryforward stock.

Table 2: Spell Duration and Initial Markup Quintiles

	CF (Direct)	CF(Constructed)	Taxable Duration	Nontaxable Duration
Q2	-0.645**	-0.664***	0.492**	-0.293
	(0.317)	(0.200)	(0.192)	(0.179)
Q3	-0.533	-0.486**	0.905***	-0.341
	(0.356)	(0.227)	(0.202)	(0.212)
Q4	-0.799**	-0.590**	1.281***	-0.375
	(0.381)	(0.250)	(0.207)	(0.232)
Q5 (highest)	-0.856**	-0.772***	1.368***	-0.892***
	(0.424)	(0.255)	(0.210)	(0.263)
Outcome Mean	5.59	3.67	6.17	4.34
Observations	4,695	5,604	11,945	7,918

Notes: This table shows the difference in duration of each markup group relative to the lowest quintile (Q1). Duration is defined as the number of years of a spell. Spell starts are defined as the first year in which the firm transitions from one state to another. Intial markup is defined in the year of the spell start. Spells due to gaps in data are ignored. CF (Direct) uses the carryforward measure from Computstat's tlcf with adjustments. CF (Constructed) uses the carryforward measure using the process of Edgerton (2010). Firm fixed effects and for year of the spell start are included.
* p<0.10, ** p<0.05, *** p<0.01

Across all specifications, the relationships with markups align with theoretical predictions. Higher-markup firms tend to exhibit longer taxable spells, shorter non-taxable spells, and more

[17] Previous research often employs second-order transition matrices to capture these outlooks. In contrast, this analysis adopts a spell-based approach to better isolate the relationship between market power and status persistence while controlling for other firm characteristics. Spell onsets are defined as the first year in which a firm transitions from one state to another. Consecutive years in the same state are not double-counted as separate spells.

rapid depletion of carryforwards following loss events. These dynamics influence the effective marginal tax rate, as the expected duration in each tax status shapes how investment returns are taxed. In both taxable and non-taxable states, the results indicate that higher-markup firms face a higher probability of maintaining or regaining taxable status. When in taxable status, investment returns are taxed at the statutory rate, implying that higher-markup firms experience relatively higher expected taxation on marginal returns.

On the other hand, durations also impact the penalty on the expected cost of investment. Firms that return more quickly to taxable status can utilize new carryforwards sooner, thereby reducing the temporal component of the asymmetry penalty. The next two sections will quantifies how differences in recovery rates translate into differences in this expected cost.

The observed scaling across the 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.

Figure A6 illustrates Kaplan–Meier survival curves for taxable and non-taxable status. Consistent with the regression results, the raw survival functions show that higher-markup firms remain in taxable status longer and exit non-taxable spells more quickly than lower-markup firms. Firms in the highest markup quintile, however, converge somewhat toward the behavior of the lowest-markup firms. This convergence may reflect greater tax planning activity among the most profitable firms or the presence of firms using high markups to offset initially high fixed costs. When survival rates are adjusted for firm characteristics (Figure A7), the relationship between markup and duration becomes more monotonic across quintiles.

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.[18] The average tax rate (ATR) on a loss equals the present value of future tax savings generated by that loss divided by the initial loss amount. To create a symmetric benchmark, a counterfactual calculation treats the initial loss as a gain (positive taxable income) and recalculates the present value of tax liabilities over the same horizon.[19] The difference between the two average tax rates is the implied penalty on a loss.

Because Compustat does not report taxable income, the analysis infers tax savings from carryforward usage. When a firm records a loss (increasing carryforward stock), the existing stock at the start of the loss serves as the reference point. Future taxable profits reduce this stock on a

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

[19] 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.

first-in-first-out basis, so newly generated losses provide benefits only after earlier losses have been fully used. The exercise uses a 10-year horizon and a constant discount rate of 0.05 ($\beta \approx 0.952$) for all companies and years. There are two samples. The full sample includes all initial loss-year events between 1993 and 2006 regardless of whether the firm remains in the sample for the entire horizon.[20] The second, restricted sample includes only loss events that have all 10 years of future outlays available in the data.

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: Estimates are relative to the lowest markup quintile (Q1). ATR difference is between (a) ratio of discounted tax benefit of actual loss to loss size and (b) ratio of additional tax liability if loss had been a counterfactual gain relative to counterfactual of zero gain to loss size. Markup quintiles calculated at loss year. Controls include log assets, log sales, firm and year fixed effects.
* p<0.10, ** p<0.05, *** p<0.01

Table 3 provides the results of a regression of these average tax rates on markup quintiles, controlling for time and firm fixed effects.[21] The average tax rate penalty across loss events ranges roughly from 5 to 8 percentage points. For comparison, Goodman et al. (2023) report a 12.2 percentage point difference in a counterfactual where S corporation owners were treated like C corporations. The smaller difference here may reflect the fact that Compustat firms are generally larger and more profitable than typical S corporations.

At the extremes, a lowest markup firm is expected to have an additional penalty of 2 percentage points on the ATR of a loss relative to a gain 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

[20] This restriction is to avoid interaction with rules under TCJA.
[21] Table A4 provides the raw rates across markup quintiles in both samples.

in a given period for the highest quintile markup firm relative to the lowest.[22]

This penalty has two implications. First, it raises relative expected firm value for higher-markup firms, potentially influencing entry and exit decisions. Second, it affects investment costs: marginal investment costs are less sensitive to tax asymmetry for higher-markup firms.

4.5 Effective Marginal Tax Rates

To examine how durations and loss penalties influence marginal behavior, the analysis follows Cooper and Knittel (2010) and Goodman et al. (2023) to calculate effective marginal tax rates (EMTRs). The exercise models a \$1 investment in seven-year MACRS property generating income proportional to the depreciation schedule.[23] For firms with NOL carryforwards, depreciation deductions increase loss carryforwards rather than generating immediate tax savings, and investment income is taxed only once existing NOLs are exhausted. Simulating an 11-year (base year plus 10 year horizon) tax path for each firm and discounting at 5% produces firm-year EMTRs that capture both the statutory depreciation schedule and the timing effects of NOLs. As in the previous exercise, the sample contains base years between 1993 and 2006.

Table 4: ETR Differences by Markup Quintiles

	(1) All	(2) TLCF > 0	(3) TLCF = 0
Q2	0.004*	0.006*	0.003
	(0.002)	(0.003)	(0.002)
Q3	0.009***	0.010***	0.006*
	(0.003)	(0.004)	(0.003)
Q4	0.012***	0.015***	0.006*
	(0.003)	(0.004)	(0.003)
Q5 (highest)	0.015***	0.017***	0.011***
	(0.004)	(0.005)	(0.004)
Outcome Mean	0.296	0.256	0.329
Observations	26,471	12,045	13,999

Notes: Estimates are relative to the lowest markup quintile (Q1). MTR is calculated as the an additional dollar of income from investment on sever-year MACRS property. Markup quintiles calculated at base year. Controls include log assets, cash flow, firm and year fixed effects.
* p<0.10, ** p<0.05, *** p<0.01

Unlike the previous analysis, constructing EMTRs requires a measure of taxable income to evaluate the effect of a marginal dollar of investment. To this end, this paper proxies taxable

[22]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

[23]This assumption implies that the EMTR equals the statutory tax rate in a system with full loss offset. For a more detailed description of EMTR calculations, see Online Appendix E of Goodman et al. (2023).

income following Hanlon et al. (2005) using reported tax bills.[24] Using the alternative construction from Edgerton (2010) yields similar results.

Table 4 presents the differences in these simulated EMTRs. Columns (2) and (3) separate the sample into firms with and without carryforward stock in the baseline period. Consistent with prior literature, firms with an initial stock of carryforwards face lower EMTRs, reflecting the benefit of shielded investment returns and the expected prolonged nontaxable status. The aggregate mean difference in EMTRs between current-year loss firms and gain firms is approximately 7.3 percentage points.

On average, firms with higher markups face EMTRs about 1.5 percentage points higher than those with low markups, reflecting their quicker return to taxability and reduced exposure to loss-related tax shielding.[25] However, when comparing loss and gain firms within each markup group, the EMTR gap narrows as markup increases. This pattern suggests that tax asymmetry generates smaller investment distortions among firms with greater market power. Although these differences are not statistically significant, they qualitatively indicate that higher-markup firms are less affected by the asymmetric treatment of losses, implying that investment distortions from tax asymmetry are more important among lower-markup firms, while firms with greater market power face more symmetric effective incentives.

However, if these differences are in fact minimal, the apparent insulation of high-markup firms from tax asymmetry has limited economic significance. While tax asymmetry generates allocative distortions between gain and loss firms, market power does not substantially amplify these distortions.

4.6 Loss Shares Conditional on NPV

As previously discussed, firms can mitigate the loss penalty not only by increasing pre-tax profitability but also by actively managing loss exposure conditional on profitability. Table 5 compares firms with similar pre-tax income over a given time horizon and reports loss values and taxability durations.[26] If high market power allows firms to smooth income over time, higher-markup firms should generate lower loss values and shorter nontaxable durations, reducing the impact of the asymmetry penalty.

Net present value (NPV) of income measures income over a 10-year horizon starting at each firm-year observation, using inflation-adjusted pre-tax income and a real discount factor of 0.05.[27] The Loss Ratio captures the sum of absolute losses divided by the sum of absolute income outlays. Share Loss Years records the fraction of years with a loss, and Share Nontaxable Years records the fraction of years deemed nontaxable.

[24] Taxable Income $= \frac{txfed+txfo}{\tau} + \Delta tlcf$

[25] Whether low or high markup firms have higher EMTRs can strongly depend on the assumed depreciation and income schedule. Therefore, the following statements about the EMTR gap between loss and gain firms within markup groups better captures asymmetry related distortion.

[26] Figure A8 shows sufficient variation by markup for different NPV levels.

[27] Alternative horizons and discount factors in the Appendix yield very similar results.

Table 5: Loss and Duration Conditional on NPV (10 Years)

	(1) Loss Ratio	(2) Share Loss Years	(3) Share Nontaxable Years
Q1 (lowest)			
Q2	-0.0610***	-0.0499***	-0.0545***
	(0.00648)	(0.00525)	(0.00764)
Q3	-0.0764***	-0.0638***	-0.0769***
	(0.00749)	(0.00607)	(0.00889)
Q4	-0.0838***	-0.0729***	-0.0880***
	(0.00785)	(0.00629)	(0.00932)
Q5 (highest)	-0.101***	-0.0861***	-0.105***
	(0.00882)	(0.00710)	(0.0103)
Outcome Mean	0.24	0.18	0.52
Observations	97,216	97,216	97,216

Standard errors in parentheses

Notes: This table provides the differences in each outcome relative to the lowest markup quintile (Q1). Outcomes are calculated over a 10 year window. Loss ratio is defined the sum of discounted absolute losses over the sum of discounted absolute losses and gains. Share loss years is the fraction of the horizon with negative reported income. Share nontaxable years is the same but with the constructed nontaxable measure. All regressions control for NPV of income over a 10 year window. Year and Industry FE are included, as well as controls for log assets, and initial carryforwards.

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

All regressions in the table control for net present value of income, in addition to controls for log assets, initial carryforward stock, and year and industry. Estimates across all columns 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, implying lower value of loss exposure. The share of loss or nontaxable years being lower further support this story. Combined with the previous analysis on quicker carryforward usage by higher markup firms, these results imply a lower realized penalty.

Since this exercise controls for pre-tax income 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.

4.7 Tax Cuts and Jobs Act

This final section examines how changes to the corporate tax system in the Tax Cuts and Jobs Act of 2017 (TCJA) altered firm incentives. TCJA introduced several provisions that directly interacted with the asymmetric features of the corporate income tax:

1. The statutory 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 provisions reduced the value of holding existing carryforwards and, more importantly, changed their role in shaping the marginal incentive to invest. Under the 80% limitation, maintaining non-taxable status requires more than a sufficient stock of carryforwards; firms with positive pre-deduction taxable income face taxation on the remaining 20%. Consequently, firms whose investment behavior was previously influenced by expectations of full non-taxable status experienced a discrete increase in the effective marginal tax rate on new investment.[28]

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 exceeds the median average, and TLCF2017 denotes positive TLCF stock in fiscal year 2017. The vector X is a set of controls that include log assets, cash flow (extraordinary income plus depreciation

[28]The CARES Act of 2020 temporarily reinstated a five-year carryback provision for losses incurred in tax years 2018–2020. Because Compustat data are derived from firms' financial statements rather than amended tax filings, these retroactive carryback claims are unlikely to be reflected in reported financial data.

and amortization, scaled by capital). Following standard practice, lagged Tobin's q is included to account for differences in investment opportunities. Vectors α_i and γ_t represent firm and year fixed effects, respectively.

The core idea of this regression is that all firms holding a stock of TLCFs in the transition from 2017 to 2018 faced a reduction in the value of their carryforwards under the new rules. High-markup firms, however, were more likely to have expected to return to taxable status regardless, so the cap had limited effect on their expected marginal tax rates. In contrast, firms that had anticipated using their carryforwards to remain in a nontaxable state lost more of this shielding. Lower-markup firms were disproportionately likely to be in this position.

4.7.1 Investment

Investment measures follow the standard q-theory approach in corporate finance (Hayashi, 1982). Tobin's q, defined as the ratio of market value to replacement cost of capital, captures a firm's investment opportunities, with q>1 indicating scope for positive investment growth. Because firms with different markups may face heterogeneous growth opportunities, regressions using investment as the dependent variable include lagged q to control for these differences.

While earlier literature focused primarily on physical investment, a growing share of investment occurs in intangible capital. To account for this trend, Peters and Taylor (2017) propose a "total q" approach that incorporates intangible capital. Intangible capital combines externally purchased assets (Compustat item *intan*) with internally generated intangible assets constructed via the perpetual inventory method using R&D expenditures and Selling, General, and Administrative (SG&A) expenses. The preferred investment measure in this paper combines physical and intangible investment, scaled by total lagged capital, and uses total q in place of Tobin's q.

4.7.2 Results

Table 6 reports triple-difference estimates with total investment as the dependent variable. Column (1) uses the direct measure of carryforwards (*tlcf*), while column (2) employs the constructed measure. The sign of the estimate of the triple coefficient in the first column indicates that the "harm" of TCJA on firms with TLCFs is in fact smaller for high markup firms vs low markup firms. The point estimate implies that high markup firms increased their investment by 1.8 percentage points relative to low markup firms (or, alternatively stated, decreased by 1.8 percentage points less). This qualitatively aligns with the theoretical prediction that the lower markup firms experienced a larger increase in their expected marginal tax rates compared to high markup firms. The estimate with the constructed measure gives a statistically null result, with a slightly positive point estimate.

Figure 3 plots the year-by-year estimates. While the investment measure is overall noisy, this figure shows little systematic differences in investment trends between the comparison groups prior to 2017. The timing of the policy's onset introduces some ambiguity. TCJA was signed into law at the end of 2017 and took effect for the 2018 tax year, but the relevant factor for firm decisions is when the returns to investment become taxable. If firms anticipated the policy and expected

Table 6: Differential Impacts on Investment

	CF (Direct)	CF (Constructed)
High Markup × CF2017 × PostTCJA	0.018*	0.004
	(0.010)	(0.009)
High Markup × PostTCJA	-0.025***	-0.012***
	(0.009)	(0.003)
CF2017 × PostTCJA	-0.008**	-0.011**
	(0.004)	(0.005)
Lagged Q	0.031***	0.031***
	(0.002)	(0.002)
Observations	18761	18761
Outcome Mean	0.147	0.147

Notes: This table provides estimates from a triple difference regression with dependent variable of investment (total investment over lagged capital). High Markup is defined as a firm with pre-TCJA average markup above the median average. CF2017 is an indicator if the firm had positive carryforwards in fiscal year 2017. PostTCJA is a dummy for years after TCJA (2018-2019). CF(Direct) defines carryforward status using the Compustat measure, while CF(Constructed) uses the constructed method. Both regressions include firm and year FE, as well as controls for Tobin's q (lagged), cash flow, and leverage.*** p<0.01, ** p<0.05, * p<0.10. Standard errors clustered by firm.

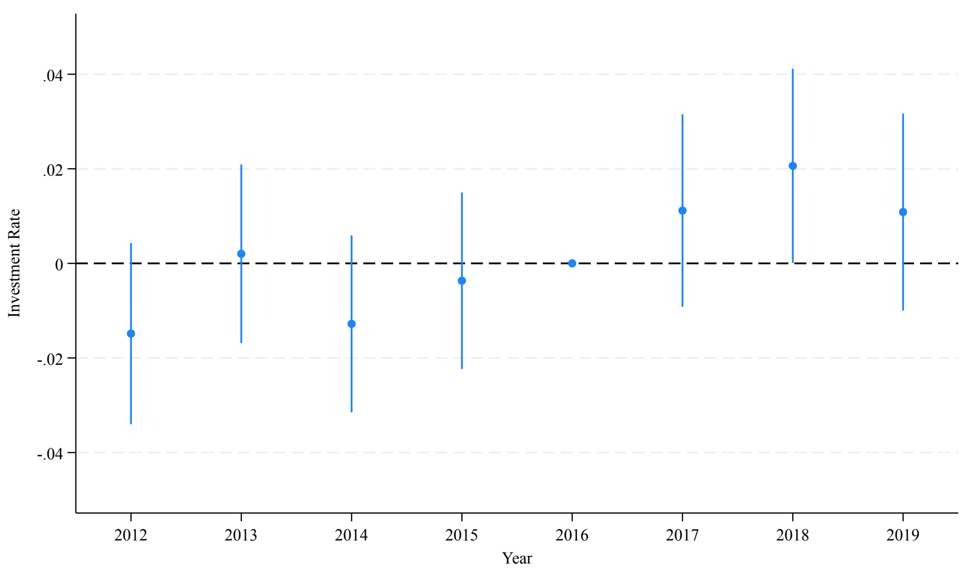

Figure 3: Investment Year-by-Year Coefficients

Notes: This figure plots estimates on the interaction of an indicator for high markup (in the pre-TCJA era) and an indicator for positive carryforwards in 2017, prior to the passing of TCJA. Investment rate is defined as the ratio of total investment (physical + intangible) to total lagged capital.

differential taxation of future returns, investment behavior could have adjusted in 2017. The figure here thus illustratively uses 2016 as the baseline (zero) year, but the average estimates in Table 6 more conservatively define the post period as 2018-2019.

Acquisitions represent an alternative channel of investment. Table 7 reports results using acquisition spending, scaled by assets, and an indicator for positive spending as outcome variables. Figures A9 and A10 show the corresponding year-by-year estimates. Similar to previous table, the first two columns represent the results using the direct Compustat measure of TLCFs, while columns (3) and (4) use the constructed measure.

While only the estimates on scaled acquisitions are significant, the consistently positive triple interaction terms indicate that high-markup firms with TLCFs increased acquisition activity relative to low-markup firms with TLCFs. This pattern reinforces the earlier interpretation that high-markup firms were more insulated from TCJA's reduction in the shielding effect of carryforwards and may have leveraged this position to expand through acquisitions.

The estimated magnitudes are economically large but imprecise, reflecting both data limitations and the inherent difficulty of measuring investment activity. Direct interpretation of the point estimates therefore warrants some degree of caution. Nonetheless, the qualitative patterns remain consistent with the theoretical prediction that differential changes in marginal tax rates across markup levels shaped post-TCJA investment behavior.

Table 7: Differential Impact on Acquisition Expenditures

	CF (Direct)		CF (Constructed)	
	Scaled ACQ	Positive ACQ	Scaled ACQ	Positive ACQ
High Markup × CF2017 × PostTCJA	0.032 **	0.058	0.040 **	0.037
	(0.013)	(0.036)	(0.018)	(0.035)
High Markup × PostTCJA	-0.021*	-0.027	-0.005	0.010
	(0.011)	(0.031)	(0.006)	(0.018)
CF2017 × PostTCJA	-0.012	-0.029	-0.014	-0.045*
	(0.008)	(0.026)	(0.010)	(0.025)
Observations	17446	17511	17446	17511
Outcome Mean	0.041	0.386	0.041	0.386

Notes: This table provides estimates from a triple difference regression with dependent variable of acquisition expenditures (scaled by assets) or an indicator for positive expenditures. High Markup is defined as a firm with pre-TCJA average markup above the median average. CF2017 is an indicator if the firm had positive carryforwards in fiscal year 2017. PostTCJA is a dummy for years after TCJA (2018-2019). CF(Direct) defines carryforward status using the Compustat measure, while CF(Constructed) uses the constructed method. Both regressions include firm and year FE, as well as controls for Tobin's q (lagged), cash flow, and leverage.*** p<0.01, ** p<0.05, * p<0.10. Standard errors clustered by firm.

5 Conclusion

Every corporate tax system treats losses differently to profits. While there are many reasons for doing so, this paper highlights one potential side effect of this feature: it can provide lower average tax rates and less investment distortion to firms with market power. Highly and persistently profitable firms, which high markup implies, are less likely to interact with the downsides of tax asymmetry, thereby giving them an advantage over their competitors.[29] While the mapping to marginal investment incentives is not as clear cut, it is possible that asymmetry can relatively subsidize higher markup firms and an increased market advantage. Evidence from Compustat supports a negative relationship between the effective penalty of asymmetry and market power, although the estimated magnitude is modest.

This, however, need not imply that the penalty is modest across the entire market power distribution. Compustat firms are typically larger, 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. A more extensive examination of the penalty and market power across the entire firm distribution may suggest larger scaling. Conversely, if limited scaling persists across the firm distribution, the policy implications would be more favorable to maintaining asymmetric treatment. Distortions related to market power would be of less concern relative to the pros of fraud prevention and reducing refunds to chronically unprofitable firms.

[29]Though not treated in this paper, firms may strategically acquire carryforwards if anticipating a future tax increase.

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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

Notes: This table provides the current carryback and carryforward rules for net operating losses for several countries around the world.

Table A2: Summary Statistics (Overall)

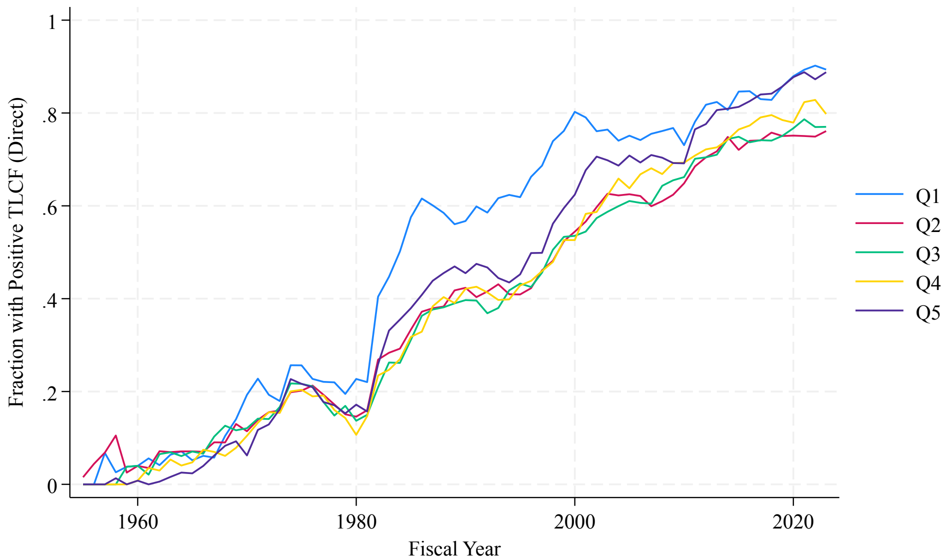
	Mean	Median	SD
Markup	1.50	1.25	0.96
Total Assets	2,197.39	155.06	13,136.88
Sales	1,958.23	165.18	10,134.57
Pre-tax Income	153.68	4.18	1,339.83
Market Value	2,701.93	141.31	21,693.98
Employment	8.26	0.89	38.46
Observations	221081		

Notes: Variables are scaled by a thousand.

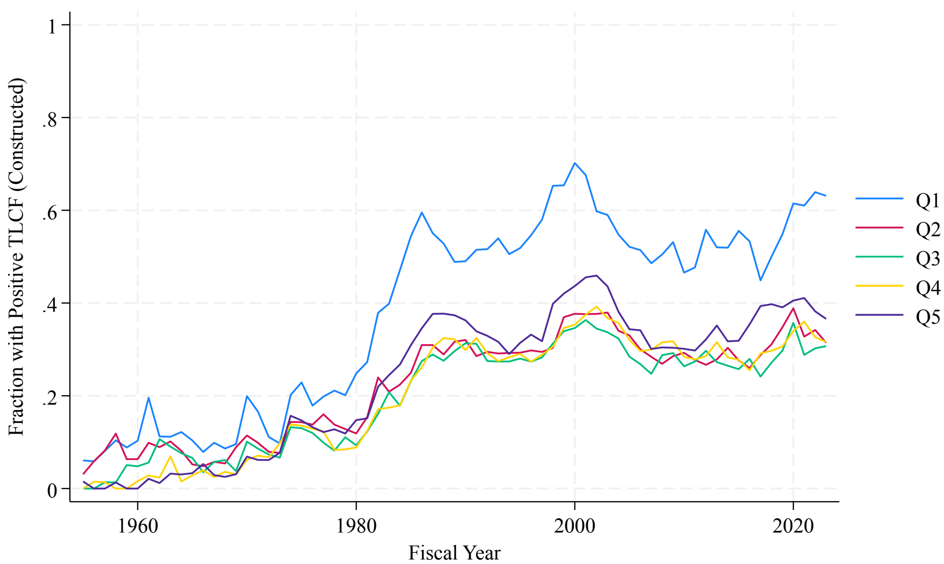
Table A3: Loss Carryforward Consistency Checks

Consistency Check	Rate (%)	Observations
Panel A: CF-Based Checks		
$P(NT = 0 \mid CF > 0)$	0.53	61690
$P(CF > 0 \mid NT = 0)$	0.33	98775
$P(CB > 0 \mid CF > 0)$	4.66	53862
$P(CF > 0 \mid CB > 0)$	2.59	96998
Panel B: TLCF-Based Checks		
$P(NT = 0 \mid tlcf > 0)$	28.61	95425
$P(tlcf > 0 \mid NT = 0)$	27.64	98775
$P(CB > 0 \mid tlcf > 0)$	32.09	84349
$P(tlcf > 0 \mid CB > 0)$	27.90	96998
Panel C: Correlations		
$Corr(CF, tlcf)$	0.0669	203834
$Corr(CF > 0, tlcf > 0)$	0.5598	203834

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.



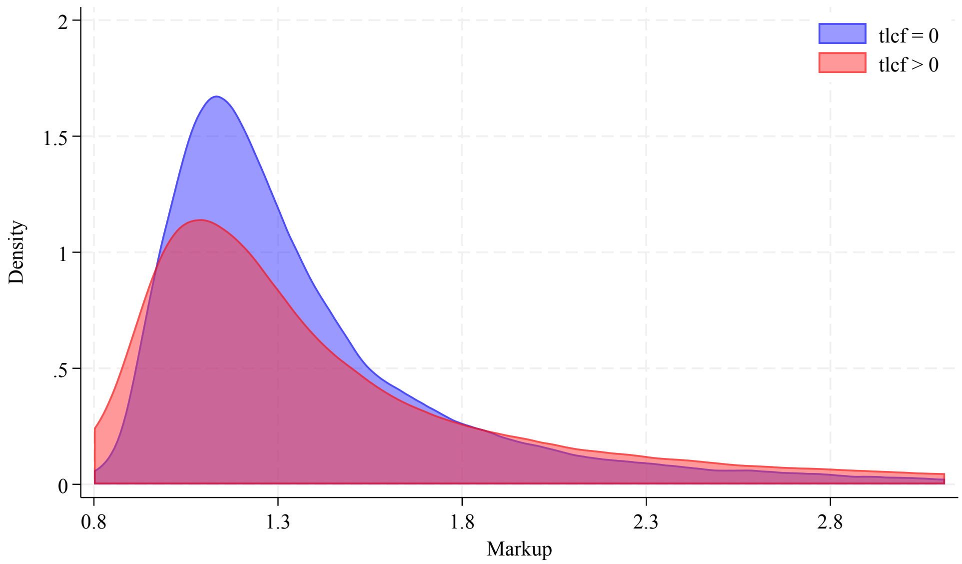
(a) Fraction of Firms with TLCF (Direct) by Markup Group



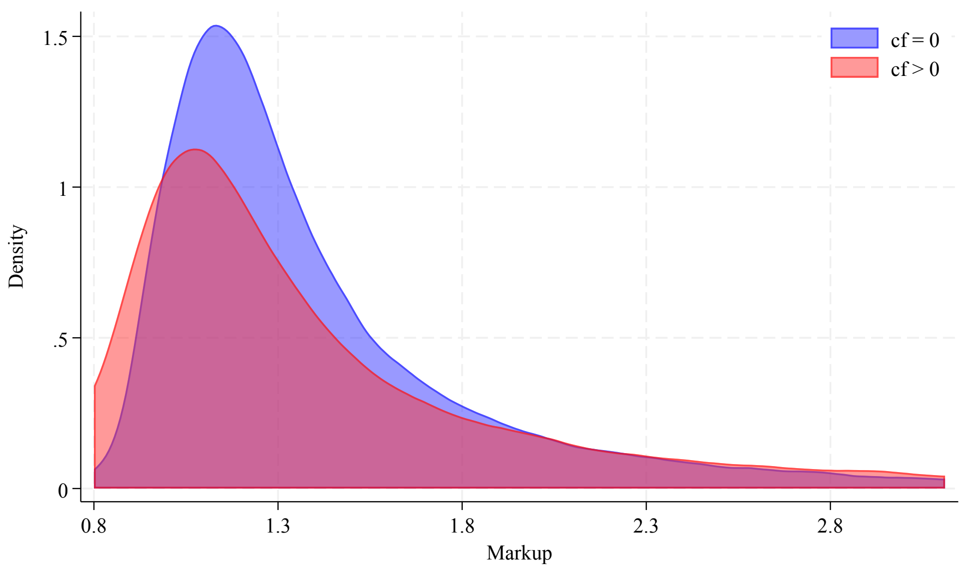
(b) Fraction of Firms with TLCF (Constructed) by Markup Group

Figure A1: Markup Distribution by Carryfoward Status

Notes: These figures plot the share of firms that have positive carryforwards in each year by markup quintile. Panel (a) directly uses the Compustat *tlcf* field. Panel (b) uses the constructed measure. Markup quintile is recalculated each year and thus there may be compositional changes between years.



(a) Using Compustat tlcf



(b) Using constructed carryforwards

Figure A2: Markup Distribution by Carryfoward Status

Notes: This figure plots the distribution of markups by carryforward status (positive or not). Panel (a) directly uses the Compustat *tlcf* field. Panel (b) uses the constructed measure.

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.

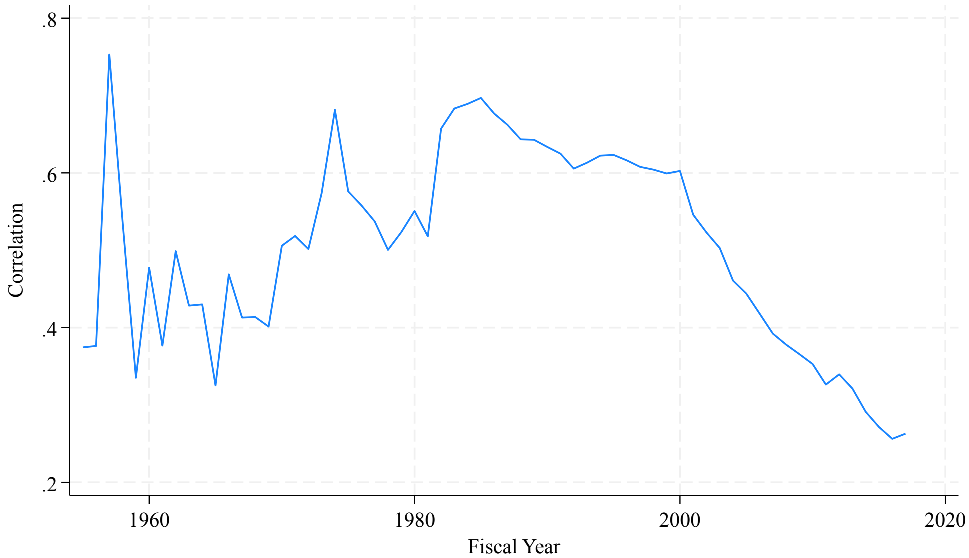
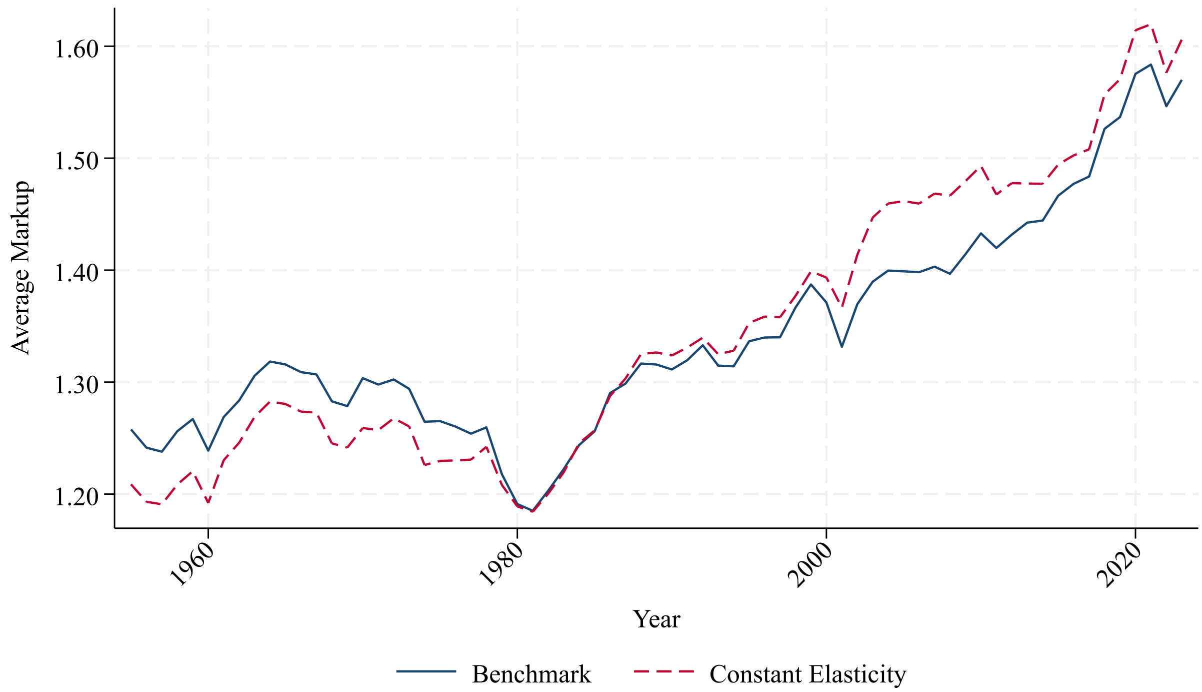


Figure A3: Carryforward Measure Correlations by Year

Notes: This figure plots the the correlation between the two measures of positive status carryforward status. The first measure uses Compustat's $tlcf$ field, adjusted using imputed values from Max et al. (2023). The second measure uses the construction process from Edgerton (2010).

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)

Notes: This figure replicates key figures from De Loecker et al. (2020) to ensure a close match in the markup and profit rate measures used in this paper with their paper. Panel (a) replicates Figure II(A); panel (b) replicates Figure VIII(A) and Figure 8.1 from their Online Appendix.

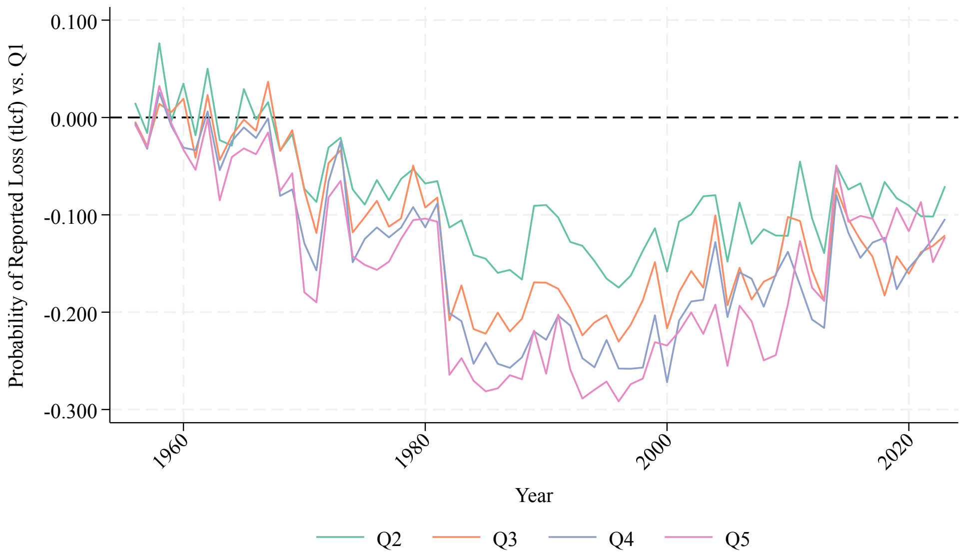


Figure A5: Likelihood of Loss by Markup Quintile

Notes: This figure plots the difference in average fraction of loss firms for firms in upper quintiles in comparison to lowest quintile (Q1). Loss years here are proxied by positive reported changes in Compustat field $tlcf$, i.e., $\Delta tlcf > 0$. Group averages are unweighted and do not include controls.

A.2 Average Loss Recovery

A.3 Duration Analysis

Table A4: Loss Recovery Rates by Markup Quintile

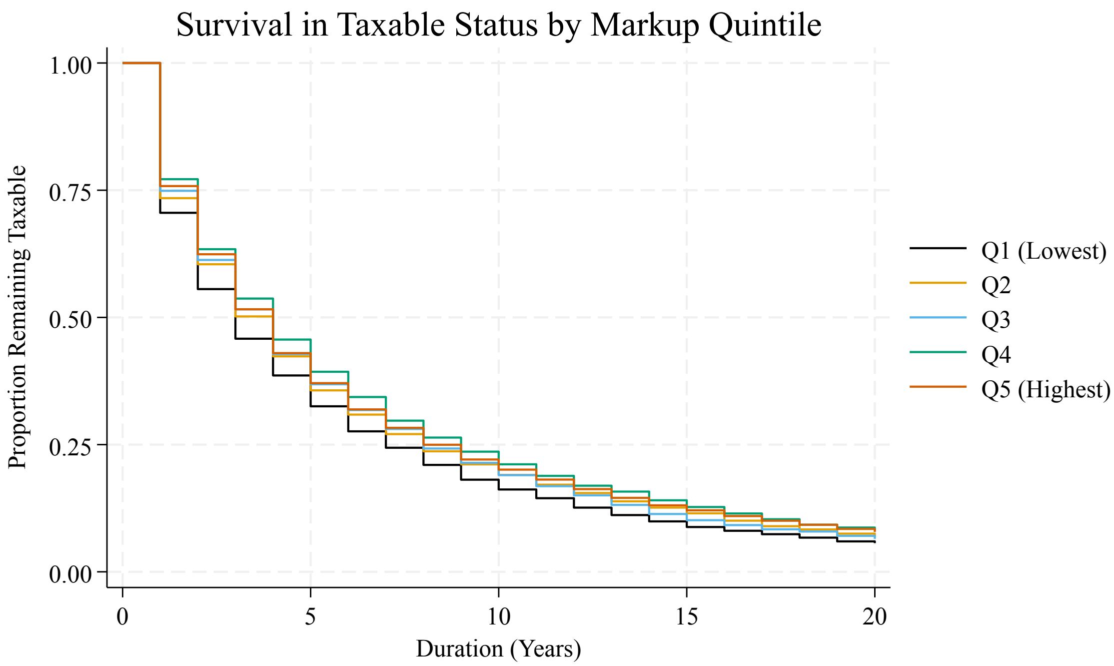
Quintile	Mean	Median	% Zero	N
Panel A: Full Sample				
Q1 (lowest)	0.119	0.000	56.1%	12,030
Q2	0.157	0.147	44.6%	7,532
Q3	0.157	0.145	44.2%	7,054
Q4	0.150	0.108	46.2%	7,019
Q5 (highest)	0.136	0.004	49.9%	7,524
Panel B: Full Horizon (11 years)				
Q1 (lowest)	0.231	0.266	20.7%	3,470
Q2	0.257	0.288	14.2%	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.

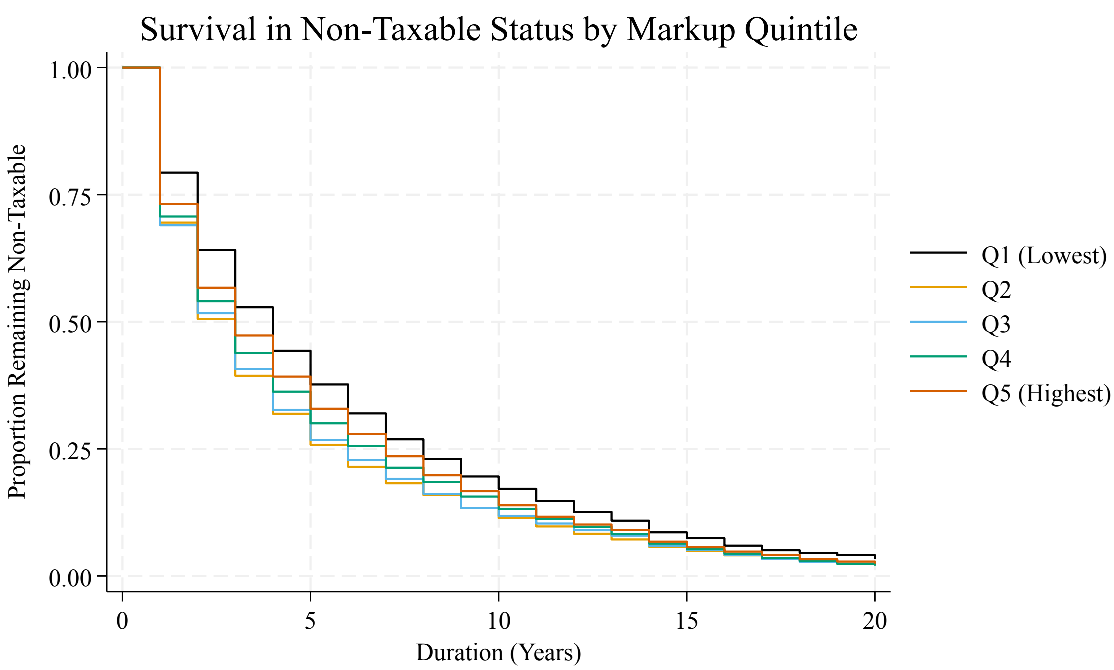
Table A5: Spell Duration and Initial Markup (Continuous)

	CF (Direct)	CF(Constructed)	Taxable Duration	Nontaxable Duration
Initial Markup	-0.292*	-0.251**	0.182***	-0.268***
	(0.165)	(0.108)	(0.046)	(0.085)
Outcome Mean	5.59	3.67	6.17	4.34
Observations	4,695	5,604	11,945	7,918

Notes: Duration is defined as the number of years of a spell. Spell starts are defined as the first year in which the firm transitions from one state to another. Intial markup is defined in the year of the spell start. Spells due to gaps in data are ignored. CF (Direct) uses the carryforward measure from Computstat's tlcf with adjustments. CF (Constructed) uses the carryforward measure using the process of Edgerton (2010). Firm fixed effects and for year of the spell start are included.
*p<0.10, **p<0.05, ***p<0.01



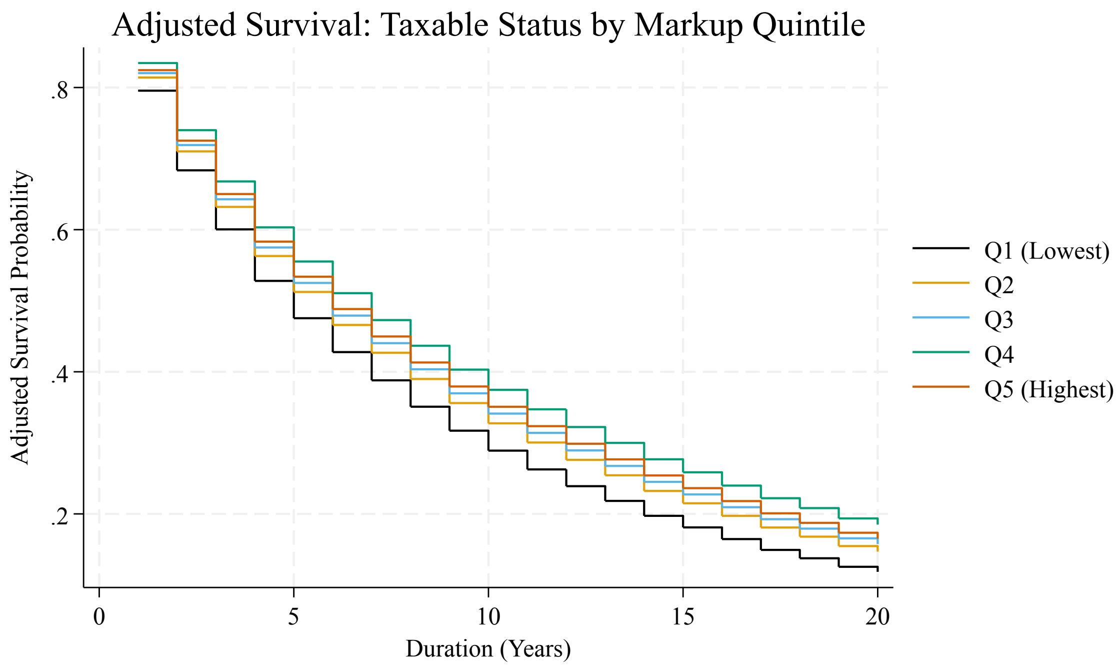
(a)



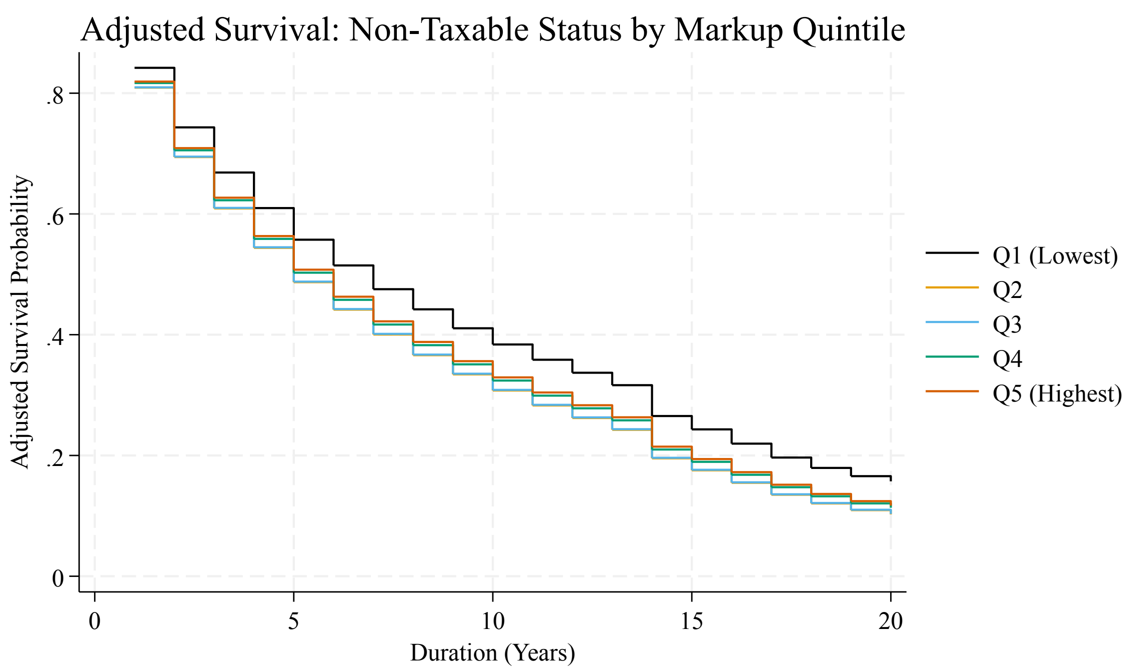
(b)

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

Notes: These figures provide the Kaplan-Meier survival curves for (a) taxable and (b) non-taxable status by markup quintile. These figures are unadjusted for firm characteristics.



(a)



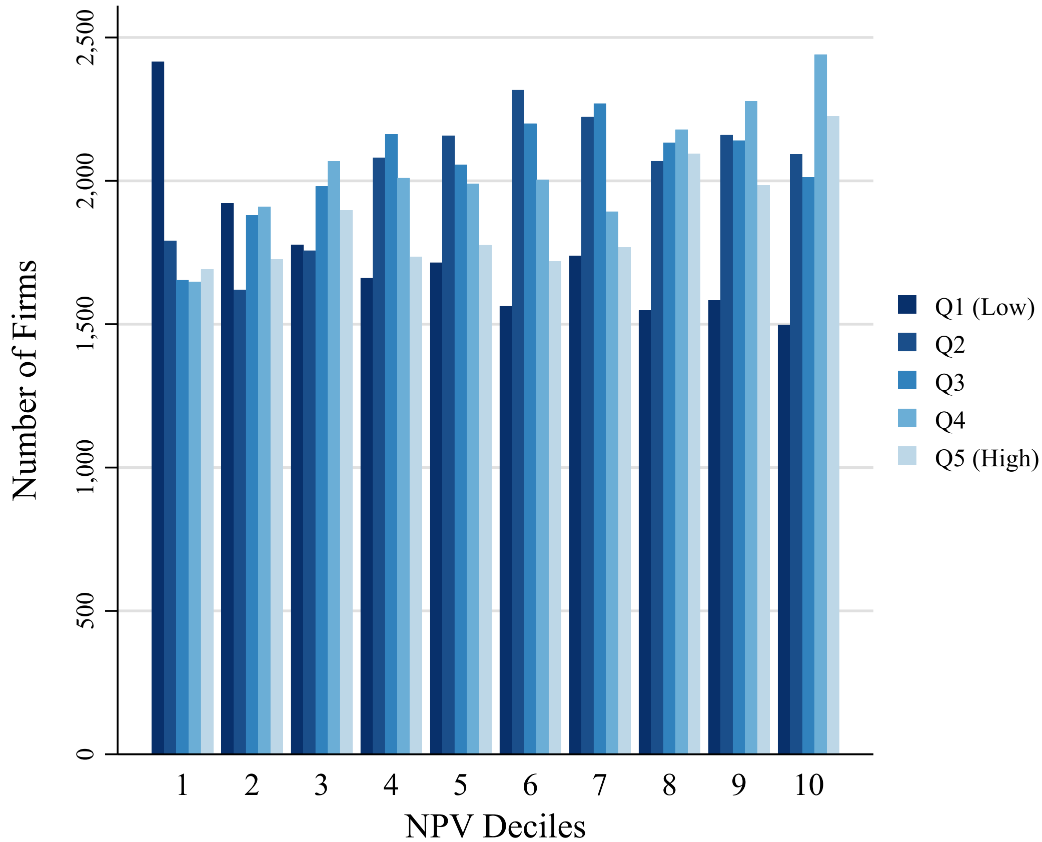
(b)

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

Notes: These figures show survival curves adjusted for firm characteristics using estimates from a Cox proportional hazards model, for (a) taxable and (b) non-taxable status by markup quintile.

A.3.1 NPV Analysis

Figure A8: Firm Counts: Markup Quintiles Across NPV Deciles



Notes: This figure plots the number of firms in each cell of markup quintile and NPV decile. NPV is calculated as the discounted present value of pre-tax income over a 10 year horizon. Markup quintiles are defined at the base year of the NPV calculation.

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)

Notes: This table provides the coefficient for different measures of Q and different measures of investment. Total Q includes intangible capital while Traditional Q only includes physical capital (Compustat field *ppegt*). Physical investment includes only R&D expenditures on physical capital (Compustat field *xrd*). Intangible investment includes both external (Compustat field *intan*) and internal (construction described in Data Appendix) spending on intangible capital. Both measures are scaled by total lagged capital, and Total Investment sums up the two. Star Investment is simply the physical investment over (lagged) physical capital.

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.				

Notes: This table provides the coefficient from regressions of investment on the triple interaction term (High Markup *times* CF2017 *times* PostTCJA). Physical investment is measured as physical investment expenses divided by lagged total capital stock. Intangible investment is measured as intangible investment expenses divided by lagged total capital stock. Total investment is the sum of the previous two measures. Star investment is defined as physical investment expenses divided by lagged physical capital stock. All first three regressions include lagged Total Q (market value over total capital), while the last uses lagged Traditional Q (market value over physical capital).

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.

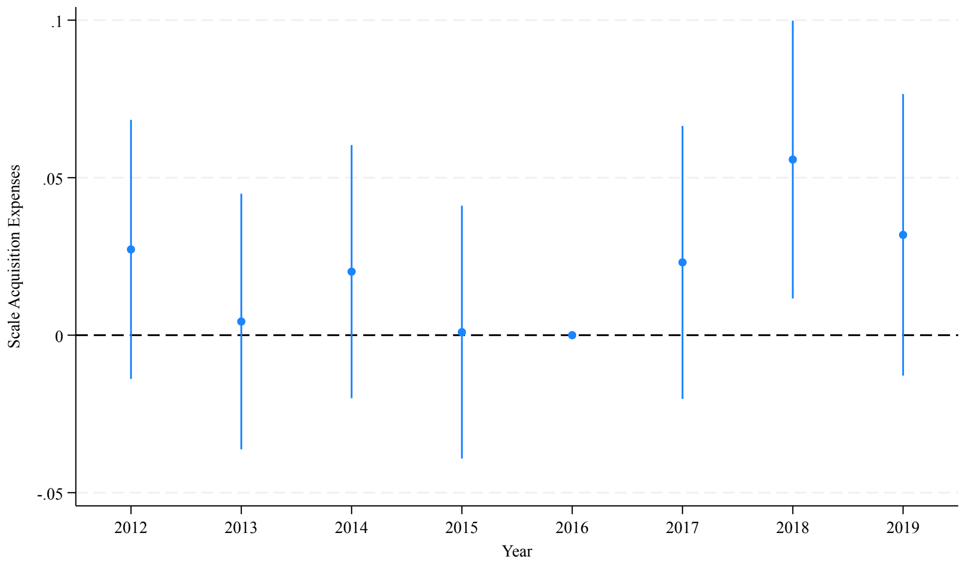


Figure A9: Year-by-Year Coefficients: Acquition Expenses

Notes: This figure plots estimates on the interaction of an indicator for high markup (in the pre-TCJA era) and an indicator for positive carryforwards in 2017, prior to the passing of TCJA. The dependent variable is acquisition expenses, scaled by total assets.

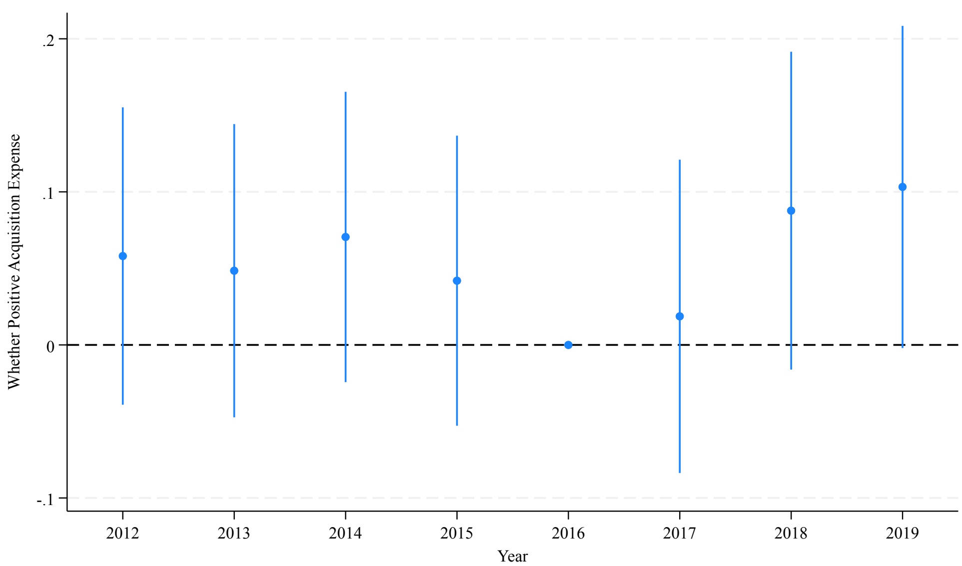


Figure A10: Year-by-Year Coefficients: Probability of Acquisition

Notes: This figure plots estimates on the interaction of an indicator for high markup (in the pre-TCJA era) and an indicator for positive carryforwards in 2017, prior to the passing of TCJA. The dependent variable is an indicator for whether the firm reported positive acquisition expenditures.

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.[30]

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

[30] 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

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.

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:

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

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

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

4. The carryforward stock CF^i_t, *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:

$$CF^i_1 = tlcf^i_0$$

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:

$$CF^i_{t+1} = \begin{cases} 0 & TB^i_t > 0 \\ 0 & TB^i_t = 0, CR^i_t + p_t I^i_t ITC^i_t > 0 \\ \max\{0, CF^i_t - TIDD^i_t\} & TB^i_t = 0, CR^i_t + p_t I^t_T ITC^i_t = 0 \\ 0 & 0 > TB^i_t > -\tilde{CB}_t \\ \max\{0, -TIDD^i_t + TB^i_t/\tau_t\} & 0 > TB^i_t, -\tilde{CB}_t \geq TB^i_t \end{cases}$$

where the variable $itci^i_t$ is used in place of $CR^i_t + p_t I^i_t ITC^i_t$ 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

$$NT^i_t = 1 - \mathbb{1}\left[TB^i_t > 0 \mid \left(0 > TB^i_t > -\tilde{CB}_t\right)\right]$$

and taxable status is simply just $1 - NT^i_t$.

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^i_t, evolves via R&D spending under a perpetual inventory method:

$$G^i_t = (1 - \delta_{R\&D})G^i_{t-1} + xrd^i_t$$

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.

Cash Flow

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 Theory Appendix

C.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

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

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 $d\phi^{*,A}/dL \leq 0$. $\square$

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. □

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 Q 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 $\bar{\rho}$. □

D Extensions

D.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:

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

There is no investment: firms only choose their output each period.

D.1.1 Heterogeneous Firms and Predatory Pricing

Suppose there are two firms i and j such that $c^j < c^i$. 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 Q below zero. Since taxes do not apply, this is also the after-tax profit. This also implies that there are Q 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 R^i. Then firm i's after-tax profits in period 1 are

$$\pi_1^{i,\dagger} = R^i - \tau(R^i - Q)\mathbb{1}_{R^i > Q} \tag{53}$$

Total expected profits at the start of period 0 are

$$-Q + \beta(R^i - \tau(R^i - Q)\mathbb{1}_{R^i > Q}) \tag{54}$$

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

$$Q \geq \frac{\beta R^i(1 - \tau\mathbb{1}_{R^i > Q})}{1 - \beta\tau\mathbb{1}_{R^i > Q}} \tag{55}$$

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 $Q^\dagger = \beta R^i$, where $Q^\dagger$ is the minimum loss needed to force out firm i. Since $\frac{1-\tau}{1-\beta\tau} < 1$ for $\beta < 1$, asymmetry reduces the required loss needed before firm i exits. As β decreases, the required first period loss shrinks, making it easier to force out the prey firm. As long as $\beta < 1$, 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 β increases, the minimum marginal cost of i needed to make predation worthwhile decreases.

The above condition is a necessary condition for predation to work as a strategy, and this is enough to show that predation is easier under tax asymmetry. In order for predatory behavior to be utility maximizing, it must be the case that

$$\sum_{t=0} \beta^t \pi_t^j(x_t^{j,\dagger}) \geq \sum_{t=0} \beta^t \pi_t^j(x_t^{j,*}) \tag{56}$$

or alternatively stated

$$\beta(\pi_1^{j,\dagger} - \pi_1^{j,*}) \geq -(\pi_0^{j,\dagger} - \pi_0^{j,*}) \tag{57}$$

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

$$\Pi_1^{j,\dagger} > \Pi_1^{j,*} + \Pi_1^{i,*} \tag{58}$$

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

$$\pi_1^{j,\dagger} = \Pi_1^{j,\dagger} - \tau B_1^{j,\dagger} = (1-\tau)\Pi_1^{j,\dagger} + \tau \min\{L_t, \Pi_1^{j,\dagger}\} \tag{59}$$

$$\pi_1^{j,*} = \Pi_1^{j,*} - \tau B_1^{j,*} = (1-\tau)\Pi_1^{j,*} \tag{60}$$

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

$$\begin{aligned} \Delta\pi_1^j &= (1-\tau)\left(\Pi_1^{j,\dagger} - \Pi_1^{j,*}\right) + \tau \min\{L_1, \Pi_1^{j,\dagger}\} \\ &> (1-\tau)\Pi_1^{i,*} + \tau \min\{L_1, \Pi_1^{j,\dagger}\} \end{aligned} \tag{61}$$

In period 0, we have that

$$\pi_0^{j,\dagger} = (1-\tau)\Pi_0^{j,\dagger} + \tau \min\{0, \Pi_0^{j,\dagger}\} \tag{62}$$

$$\pi_0^{j,*} = (1-\tau)\Pi_0^{j,*} \tag{63}$$

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

$$\Delta\pi_0^j = (1-\tau)\left(\Pi_0^{j,\dagger} - \Pi_0^{j,*}\right) + \tau \min\{0, \Pi_0^{j,\dagger}\} \tag{64}$$

Adding the two changes together gives

$$\Delta\pi_0^j + \Delta\pi_1^j > (1-\tau)\left(\Pi_1^{i,*} + \Pi_0^{j,\dagger} - \Pi_0^{j,*}\right) + \tau \min\{0, \Pi_0^{j,\dagger}\} + \tau \min\{L_1, \Pi_1^{j,\dagger}\} \tag{65}$$

D.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.