ESSAYS ON ASSET PRICING IN MARKETS WITH LAW-RELATED IMPERFECTIONS

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ABSTRACT OF THE DISSERTATION

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This dissertation consists of two essays on the effects of legal frictions on asset prices. The first essay comprises the derivation of a theoretical valuation of tax deductions with fixed upper bounds. There are numerous examples in practice where the taxpayer, corporations, or individuals are constrained by tax laws that disallow tax deductions beyond a fixed limit. Typical examples would be the upper bound on State and Local Tax deductions for individuals introduced recently in 2018, and Section 382 of the Internal Revenue Code that imposes a ceiling on tax deductions stemming from the losses of acquired corporations. Despite the ubiquity of such tax frictions, there is very little in the academic literature on the impact of these on the consumption-investment decisions and asset prices. We develop a Consumption Capital Asset Pricing Model (CCAPM) where a risk averse investor makes consumption investment decisions in the presence of taxes, but faces fixed legal limits on tax deductions, and show the modifications required of the traditional CCAPM model without frictions, including the well-known Hansen-Jagannathan bound. Interestingly, it turns out that under certain conditions, increasing the tax deduction limit actually reduces investment in risky assets.

In the second essay, we investigate the stock and option market reactions to events in the United States Supreme Court (SC) relating to cases where at least one party involved is a public firm. Typically, cases that reach the SC level would have passed through multiple lower courts. Consequently, much of the information content of these cases would be publicly known and priced by the financial markets. If the market has perfectly anticipated that the SC would grant (a rare event) the writ of certiorari (accept a case), the tone of the subsequent legal arguments, and the final decision, then there should be no reaction to any of these events, as and when they unfold. Using a comprehensive dataset of more than 500 cases, we find that the stock market reacts to both the grant of certiorari and to the announcement of the final decision, suggesting that the stock market could not predict the SC actions. We also find that specific case characteristics, such as parties involved, the type of legal issue, and press coverage explain some of the cross-sectional variations in the stock returns across cases. Our tests also indicate that there is no information leakage prior to the events, and no stock price drift after the events. However, we find that the option market anticipates the final decision as early as the date certiorari is granted, reinforcing the theory that smart money comes early to the option market.

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Contents

List of Tables

List of Figures

Chapter 1

Consumption-Based Asset Pricing with Fixed Upper Bounds on Tax Deductions

1.1 Introduction

In the classical models of equity pricing dating back to the 1960s (Breeden, 1979; Feltham & Ohlson, 1995; Lintner, 1965; Mossin, 1966; Ohlson, 1995; Samuelson & Merton, 1969; Sharpe, 1964), it was typically assumed that a risk-averse representative individual was making optimal consumption-investment decisions under uncertainty in frictionless, complete markets. Since then, however, there has been mounting empirical evidence that actual asset prices are not consistent with the predictions of these theoretical models. A famous example is the so-called Mehra-Prescott equity premium puzzle (Mehra & Prescott, 1985), which documents that historically, equity risk premiums were way too high to be explained under plausible assumptions of investor characteristics. This led to modified asset pricing models, such as habit-formation models (e.g., Constantinides, 1990; Sundaresan, 1989) and more exotic models seeking to explain real equity prices. Since then, there has been accumulating evidence of anomalies, or deviations, from the predictions of the classical models and their refinements. This has led, in recent years, to the rise of behavioral economic theory to explain real equity prices. However, as has been pointed out by Rubinstein (2001), it may be best to first rule out other causes, such as market frictions within a rational investor framework, before embarking on behavioral explanations, and there is such literature (for example, De Roon & Szymanowska, 2012; De Roon et al., 2001; He & Modest, 1995; Luttmer, 1996).

There are numerous frictions and imperfections in the market, including trading costs, short sales constraints, asymmetric information, and contracting costs. In this paper, our focus is on taxes. While taxes are accepted as essential tools of governance and social welfare, they are also externalities that interfere with the "natural" market forces that govern how rational agents in the economy plan their consumption and investments. Despite the omnipresence of taxes and awareness of its impact on the economy, most analytical models of consumption-investment and asset pricing simply assume away taxes (as in Jensen, 1969; Lintner, 1965; Merton, 1973). This is because tax rules are often so complex that incorporating them in an analytical model becomes intractable.

We are specifically interested in studying the implications of tax rules with limiting upper bounds on tax deductions for consumption-investment decisions made by rational, risk-averse investors, and by extension, their impact on asset prices. One such case for the individual is the upper limit imposed on deductions allowed for State and Local Tax (SALT), introduced in 2018. For corporations,[1] an example would be the upper limit on permissible tax deductions (e.g., net operating losses) that can be deducted in any given year. However, unlike the SALT deduction for individuals, some of these unused corporate tax deductions can be carried forward indefinitely and applied against future profits.

[1] While firms are usually modeled as risk neutral, it is not unusual for firms to be risk-averse (Bickel, 2006).

We develop a consumption-investment model in a market with a single risky asset and a riskless asset. There is a representative risk-averse investor endowed with initial wealth and an inventory of available tax deductions. The investor will deviate considerably in their optimal decisions from the classical Consumption Capital Asset Pricing Model (CCAPM). We show that it is not only the expected risky and riskless returns that influence these decisions, but the legal bound on how much of the deductions can be applied against future profits.

It turns out that there are three specific regions of interest. The first region is where the deduction limit is very tight. The lower bound on this regions is where the limit is zero and no deductions are allowed. As the deduction limit starts to increase from zero, investors will consume more, but invest *less* in the risky asset, until an endogenously determined boundary is reached. As the deduction limit exceeds this bound, the second region emerges, where investments are such that profits are designed to equal the deduction limit. In this region, as the deduction limit rises, investment in the risky asset starts to rise while consumption increases at first and then declines, until another endogenously determined boundary for the deduction limit is reached. In this third region, with relatively large values for the deduction limit, the tax deduction constraint becomes of little consequence, and we recover the standard results of the classical CCAPM.

Needless to say, these variations in consumption and in the demand for risky assets induced by tax deductions have key implications for the economy and for the calculation of the risk premium for risky securities. We show how the required risk premium is affected by deductions. We also show how the so-called Hansen-Jagannathan bound (Hansen & Jagannathan, 1991) is affected by the existence of deductions and related legal ceilings on using them to save on taxes.

As part of our analysis, we also provide a method to value these deductions. This is particularly useful because issues relating to the valuation of tax deductions arise frequently in the theory and practice of corporate finance, taxation, asset pricing, mergers and acquisitions,[2] and accounting and tax planning, in addition to having implications for macroeconomic policy.

Perhaps one reason for the lack of literature incorporating limitations on tax deductions in asset pricing models is the uncertainty of future earnings, and the related uncertainty about how much of the deductions can actually be used and how to estimate their ultimate benefits and value. Another important reason is the complexity of the tax code and legal restrictions on the use of tax deductions. Laws are formulated by lawmakers with vested interests representing varied economic and political parties, the result of which is a bewildering maze of rules and exceptions. We believe our paper makes a significant contribution to the existing literature by explicitly showing the effects of allowing limited tax deductions on asset prices and the impact on consumption-investment decisions of rational investors.

The rest of the paper is organized as follows. Section 1.2 discusses the relevant extant literature. Section 1.3 introduces the theoretical model. Section 1.4 solves the model explicitly for the log utility case, and Section 1.5 concludes.

1.2 Related Prior Literature

While there is no prior work on the implications of tax deduction limits for consumption-investment decisions and the demand for risky and riskless assets, there is a body of related literature devoted to capital loss carryforwards and deferred tax assets. There are several authors who have attempted to obtain analytical solutions to value capital loss carryforwards. One approach for valuing the loss carryforwards is to treat them as

[2] As an example, consider the case of mergers and acquisitions in the United States. The acquirer, after complying with the valid business purpose doctrine of Internal Revenue Code (IRC) Section 269, which voids acquisitions primarily aimed at avoiding taxes, may also have to conform to the provisions of IRC Section 382, which dictates how much of the tax loss carryforwards of the acquired company can actually be used annually in the future. In addition, firms may be subject to Separate Returns Limitation Yearly, or Section 1502 of the United States Treasury Department regulations, and even other regulations of the department, such as Section 1503 dealing with Dual Consolidation Losses.

options and use existing analytical tools from derivative pricing, which largely ignores the unique institutional characteristics of the tax code (Sarkar, 2014; Streitferdt, 2013). However, the closest in spirit to our work is Constantinides (1983, 1984), who examines the role of tax laws relating to capital gains and losses in consumption-investment decisions. In some ways his problems are similar to ours, however, there are many structural and institutional differences that demand a different analytical approach.

As is well known, capital gains and losses on an asset are not taxed until the asset is sold. This gives investors the ability to choose when capital gains and losses are realized, thereby controlling the “timing” of their taxes. Constantinides (1983) explores the value of this timing option. Not surprisingly, he finds that the optimal policy is to realize losses immediately, and to defer gains as long as possible. More importantly, given certain assumptions, he shows that the optimal consumption and investment decision is independent of the optimal liquidation decision. Based on this, he derives a CAPM for taxable securities, and shows that the effective tax rate (given the optimal liquidation policy) is increasing in security price variance, likelihood of forced liquidations, and dividends.

In a follow-up paper, Constantinides (1984) investigates the effect of the differential tax treatment of long term capital gains and losses as compared to short term.[3] A rational investor can take advantage of this additional timing option by realizing losses short term. Furthermore, he shows that for relatively high volatility securities with an unrealized long term gain, it is advantageous to sell and repurchase in order to reestablish the basis and capture a potential future loss as short term.

Dammon et al. (2001) develop a dynamic consumption and investment model that spans an investor’s life and incorporates capital gains taxes. Because capital gains are not taxed posthumously, and contrary to the prevailing beliefs, the demand for investments in equity optimally increases with an investor’s age.

[3] At the time this paper was written, $2 of long term capital losses could only offset $1 of ordinary income. However, the Tax Reform Act of 1986 changed this to the current rule of a one-to-one offset.

The main limitations of Constantinides (1983, 1984), Dammon et al. (2001) are that they assume an immediate tax rebate for realized capital losses and ignore any constraints (legal or otherwise) on the use of capital gains and losses, realized and unrealized. Our paper explicitly considers and allows for some of these constraints.

More recently, several papers have introduced the constraint that limits the tax rebate from capital losses to the taxes on existing capital gains. Ehling et al. (2009) show that this constraint decreases optimal equity investment, and Gallmeyer and Srivastava (2011) demonstrate that given this constraint, the lack of pre-tax arbitrage implies that there is no post-tax arbitrage. Dai et al. (2015), Marekwica (2012) also allow for capital loss usage constraints, but their focus is on the optimal timing of realizing gains/losses given these constraints. Dai et al. (2015) offer some insight into why investors defer short term capital losses, since Constantinides and other earlier models preclude this under optimality. Marekwica (2012) discusses investors' ability to offset regular income with capital losses. The higher tax rate on income gives an immediate tax rebate of greater value than offsetting capital gains. This can justify why an investor would realize a capital gain immediately—in order to reestablish the possibility of earning this rebate on a future loss.

On the valuation side, Waegenaere et al. (2003) develop a framework with which to value tax loss carryovers. They focus on the market-to-book ratio of the carryover, and analytically derive several explanations for why it is not equal to 1. Their findings include the effect of discounting, which is ignored by GAAP, and the establishment of a valuation allowance, which is a binary decision, as opposed to the more economically correct expected value. There are several other papers that discuss the value of deferred tax assets, which are simply a signal of future tax savings (e.g., Amir et al., 1997, 2001; Amir & Sougiannis, 1999; Ayers, 1998; Guenther & Sansing, 2000). The consensus, demonstrated both analytically and empirically, is that deferred tax assets have positive value.

It is clear from the literature that tax deductions are valuable to investors and affect their consumption-investment patterns. Our paper answers the question of how the legal constraints on the use of tax deductions affect the optimal consumption and investment decisions of a rational investor, and by extension, how they affect asset prices. We also demonstrate how, through changes in tax regulation, the government can effect change in market-wide consumption and investment.

1.3 Single-Period Model

1.3.1 Model

We consider a situation where a risk-averse investor has to decide on how much to consume and how much to invest in a portfolio consisting of a single risky asset and a riskless asset. The investor is assumed to derive utility from initial consumption, and consumption at the end of a single investment period. We make the following assumptions.

Let W_0 and C_0 be the risk-averse investor's initial date, $t = 0$, wealth and consumption. At the end of the period, $t = 1$, we assume the investor consumes all her wealth, and we denote this by $\tilde{C}_1$. The investor's utility function, defined over initial and final consumption, is assumed to be increasing, concave, differentiable, and time-separable, and is given by the following:

$$U(C_0) + \delta\,\mathbb{E}_0\Big[U(\tilde{C}_1)\Big] \tag{1.1}$$

where δ is a subjective discount factor reflecting the investor's rate of time preference. $\mathbb{E}_0[\bullet]$ is the expectation operator conditional on information available at initial time $t = 0$.

The investor can choose to invest in one risky asset, i, associated with a random payoff of $\tilde{R}_{i,1}$ at time $t = 1$, or a riskless asset with a sure payoff of R_f at time $t = 1$. Without loss of generality, the riskless asset is assumed to be tax-free. We assume that there are no transaction costs associated with these investments. We also assume that a dollar of investment in the risky asset at initial time $t = 0$ provides an after-tax return of $R^h_{i,1} = 1 + r^h_{i,1}(1 - \tau)$ with probability p (good state) at time $t = 1$, and a return of $R^l_{i,1} = 1 + r^l_{i,1}$ with probability $1 - p$ (bad state) at the end of the period, $t = 1$. $r^h_{i,1}$ is positive and takes value in the interval $(0, 1]$. $r^l_{i,1}$ is negative, taking a value in $[-1, 0)$. τ is the relevant tax rate mandated by the government that is applied to taxable positive returns $r^h_{i,1}$ in the good state, and takes a value in $[0, 1)$. Since $r^l_{i,1}$ is assumed to be negative (a loss), it is non-taxable. A dollar of investment in the riskless asset yields a sure payoff of $R_f = 1 + r_f$, where r_f takes value in the interval $[0, 1)$, and $r_f < r^h_{i,1}$. The distribution of the returns on the risky asset and r_f are assumed to be known at $t = 0$. Without loss of generality, we assume the investor has no other income.

Thus far, our assumptions follow the classical structure of consumption-investment models in the literature (see, for example, Merton, 1971). We now diverge from these by introducing tax deductions in the model. We assume that the investor is able to reduce end-of-period taxable profits with tax deductions that are capped at an exogenously specified deduction limit,[4] L_1, which takes a value in the interval $[0, \infty)$. L_1 is assumed to be known at $t = 0$. Any unused deductions at time $t = 1$ are assumed to be lost. The amount of deductions that can be claimed at $t = 1$ is bounded above by the taxable profit and by the amount of legally available deductions.

Let ω_0 represent the proportion of savings at $t = 0$ that is invested in the risky asset, implying that $1 - \omega_0$ is invested in the riskless asset. In order to keep the problem tractable, we do not allow short sales of the risky asset, and all assets are assumed to be held, so $\omega_0 > 0$. Define A_1 as a decision variable indicating the amount of deductions used to offset taxes at time $t = 1$. In addition, let $\tilde{H}_1$ be a random function taking value 1 in the high state with probability p, and 0 in the low state with probability $1 - p$. Consequently, $A_1 \tau \tilde{H}_1$ is the tax savings associated with the

[4]This limit is imposed by the government, and varies between different deductions, and from one state and country to another.

deductions claimed at terminal time $t = 1$. The terminal consumption (equal to terminal wealth $\tilde{W}_1$) for the investor at $t = 1$ is given by

$$\tilde{W}_1 \equiv \tilde{C}_1 = (W_0 - C_0)(R_f + \omega_0(\tilde{R}_{i,1} - R_f)) + A_1 \tau \tilde{H}_1 \tag{1.2}$$

Let $I_0 = (W_0 - C_0)$, where I_0 is the savings at time $t = 0$ to be invested in the risky and riskless asset. Let the total return at time $t = 1$ be $\tilde{R}_1 = R_f + \omega_0(\tilde{R}_{i,1} - R_f)$. The terminal time wealth is given by

$$\tilde{W}_1 = I_0 \tilde{R}_1 + A_1 \tau \tilde{H}_1 \tag{1.3}$$

Without loss of generality, we set $\delta = 1$. The investor's maximization problem can now be stated as

$$\begin{aligned} J(W_0, t=0) = \underset{C_0, \omega_0, A_1}{\text{maximize}} \quad & U(C_0) + \mathbb{E}_0\Big[U(\tilde{C}_1)\Big] \\ \text{subject to} \quad & A_1 \le L_1 \qquad \text{(deduction constraint)}, \\ & A_1 \le I_0 \omega_0 r^h_{i,1} \quad \text{(profit constraint)}, \\ & 0 \le \omega_0 \qquad \text{(short-sale constraint)} \end{aligned} \tag{P1}$$

Let λ_1, λ_2, and λ_3 be the three Lagrange multipliers associated with each of the three constraints respectively. As mentioned above, ω_0 is strictly greater than 0, which implies $\lambda_3 = 0$. We will therefore ignore λ_3 going forward. We obtain the following three first order conditions by differentiating with respect to C_0, ω_0, and A_1:

$$U'(C_0^*) = \mathbb{E}_0\Big[U'(\tilde{C}_1)\tilde{R}_1\Big] + \lambda_2^* \omega_0^* r^h_{i,1} \tag{1.4}$$

$$\mathbb{E}_0\Big[U'(\tilde{C}_1) I_0^* (\tilde{R}_{i,1} - R_f)\Big] + \lambda_2^* I_0^* r^h_{i,1} = 0 \tag{1.5}$$

$$\mathbb{E}_0\Big[U'(\tilde{C}_1)\tau \tilde{H}_1\Big] = \lambda_1^* + \lambda_2^* \tag{1.6}$$

Since I_0 must be positive, combining Eqs. (1.4) and (1.5) yields

$$U'(C_0) = R_f\, \mathbb{E}_0\Big[U'(\tilde{C}_1)\Big] = \mathbb{E}_0\Big[U'(\tilde{C}_1)\tilde{R}_{i,1}\Big] + \lambda_2 r^h_{i,1} \tag{1.7}$$

Using Eqs. (1.4) and (1.5), we can also derive the expected return on the risky asset as

$$\mathbb{E}_0\Big[\tilde{R}_{i,1}\Big] = R_f - \frac{\sigma_{U'(\tilde{C}_1), \tilde{R}_{i,1}} + r^h_{i,1}\lambda_2}{\mathbb{E}_0\Big[U'(\tilde{C}_1)\Big]} \tag{1.8}$$

Let P_0 be the price of the risky asset at $t = 0$, and let $\tilde{X}_1$ be its after-tax payoff at $t = 1$, so that $\tilde{R}_{i,1} = \tilde{X}_1/P_0$. Then, from Eq. (1.8),

$$P_0 = \mathbb{E}_0\left[\frac{U'(\tilde{C}_1)}{U'(C_0^*)}\tilde{X}_1\right] + \frac{r_{i,1}^h \lambda_2}{U'(C_0^*)} \tag{1.9}$$

Proposition 1. *In the optimization problem specified in Program (P1), where the tax rate is positive ($\tau > 0$), a valid solution must have at least one binding inequality constraint.*

Proof. Assume both inequality constraints are non-binding, which means more tax deductions can be used. Then $\lambda_1 = \lambda_2 = 0$. But then Eq. (1.6) implies $\mathbb{E}_0\Big[U'(\tilde{C}_1)\tau\tilde{H}_1\Big] = 0$ which can't be true. So for any optimal solution, tax deduction usage will be the most allowed, thereby tightening at least one constraint. This makes sense, since there is no point in "leaving over" any tax deductions, so the maximum allowable tax deduction should be used. □

If taxes are removed ($\tau = 0$), then Eq. (1.6) implies $\lambda_1 = \lambda_2 = 0$, and $\tilde{W}_1 = I_0(R_f + \omega_0(\tilde{r}_{i,1} - r_f))$. All the results then become equivalent to the standard model without taxes.

If just tax deductions are removed ($L_1 = 0$), then $A_1 = 0$, which means that $\tilde{W}_1 = I_0(R_f + \omega_0(\tilde{R}_{i,1} - R_f))$. Additionally, $A_1 = 0$ implies $\lambda_2 = 0$, due to slackness, so the risk premium, $U'(C_0)$, and P_0 all revert to their values in the standard model with taxes and without tax deductions.

In the baseline case of no tax deductions, $\tilde{W}_1 \equiv \tilde{C}_1$ is the same in the low state and lower in the high state, which by the concavity of the utility function implies that $\mathbb{E}_0\Big[U'(\tilde{C}_1)\Big]$ would be higher. From Eq. (1.7) it is clear that $U'(C_0)$ is higher in the baseline case, or equivalently, C_0 is higher with the existence of tax deductions. This is another way of saying that with an increased payoff in the future, a risk-averse investor chooses to consume more now.

For a risk-neutral investor, $U'(C) = 1$, so Eq. (1.8) becomes $\mathbb{E}_0\Big[\tilde{R}_{i,1}\Big] = R_f - r^h_{i,1}\lambda_2$. This implies a *negative* "risk" premium, which is the effect of the added benefit of tax deductions to the risky asset, making it more desirable for the risk-neutral investor.

1.3.2 Consumption CAPM with Tax Deductions

If we introduce the assumption that there exists $\tilde{R}_{M,1}$ that is perfectly negatively correlated with $U'(\tilde{C}_1)$, such that $U'(\tilde{C}_1) = -\kappa \tilde{R}_{M,1},\ \kappa > 0$, we have

$$\sigma_{U'(\tilde{C}_1),\tilde{R}_{M,1}} = -\kappa\sigma^2_{\tilde{R}_{M,1}} \tag{1.10}$$

$$\sigma_{U'(\tilde{C}_1),\tilde{R}_{i,1}} = -\kappa\sigma_{\tilde{R}_{M,1},\tilde{R}_{i,1}} \tag{1.11}$$

Substituting these relationships into Eq. (1.8) yields

$$\mathbb{E}_0\Big[\tilde{R}_{i,1}\Big] - R_f = \frac{\kappa\sigma_{\tilde{R}_{M,1},\tilde{R}_{i,1}} - r^h_{i,1}\lambda_2}{\mathbb{E}_0\Big[U'(\tilde{C}_1)\Big]} \tag{1.12}$$

$$\mathbb{E}_0\Big[\tilde{R}_{M,1}\Big] - R_f = \frac{\kappa\sigma^2_{\tilde{R}_{M,1}} - r^h_{M,1}\lambda_2}{\mathbb{E}_0\Big[U'(\tilde{C}_1)\Big]} \tag{1.13}$$

and from Eq. (1.5) we get

$$\mathbb{E}_0\Big[\tilde{R}_{i,1}\Big] - R_f = \frac{\kappa\sigma_{\tilde{R}_{M,1},\tilde{R}_{i,1}} + \mathbb{E}_0\Big[U'(\tilde{C}_1)(\tilde{R}_{i,1} - R_f)\Big]}{\kappa\sigma^2_{\tilde{R}_{M,1}} + \mathbb{E}_0\Big[U'(\tilde{C}_1)(\tilde{R}_{M,1} - R_f)\Big]} \cdot \Big(\mathbb{E}_0\Big[\tilde{R}_{M,1}\Big] - R_f\Big) \tag{1.14}$$

The inclusion of tax deductions adds an extra positive term to both the numerator and the denominator of the risky asset's market beta.

1.3.3 Hansen-Jagannathan Bound with Tax Deductions

From Eq. (1.7), we get

$$\frac{1}{R_f} = \mathbb{E}_0\left[\frac{U'(\tilde{C}_1)}{U'(C_0)}\right] = \mathbb{E}_0[\tilde{m}_{01}] \tag{1.15}$$

where $\tilde{m}_{01}$ is the stochastic discount factor from time $t = 1$ to time $t = 0$. Combining Eqs. (1.8) and (1.15) yields

$$\frac{\mathbb{E}_0\left[\tilde{R}_{i,1}\right] - R_f}{\sigma_{\tilde{R}_{i,1}}} = -\rho_{\tilde{m}_{01},\tilde{R}_{i,1}} \cdot \frac{\sigma_{\tilde{m}_{01}}}{\mathbb{E}_0[\tilde{m}_{01}]} + \frac{r^h_{i,1}\lambda_2}{\sigma_{\tilde{R}_{i,1}}\,\mathbb{E}_0\left[U'(\tilde{C}_1)\right]} \tag{1.16}$$

$$\left|\frac{\mathbb{E}_0\left[\tilde{R}_{i,1}\right] - R_f}{\sigma_{\tilde{R}_{i,1}}}\right| \leq \sigma_{\tilde{m}_{01}} R_f + \frac{r^h_{i,1}\lambda_2}{\sigma_{\tilde{R}_{i,1}}\,\mathbb{E}_0\left[U'(\tilde{C}_1)\right]} \tag{1.17}$$

This is the general solution for the Hansen-Jagannathan bound (Hansen & Jagannathan, 1991) with tax deductions, which has an additional term on the right-hand side, as well as a different $\sigma_{\tilde{m}_{01}}$. This solution must therefore hold true in the specific case of log utility. We discuss the bound under log utility in Section 1.4.

1.4 Log-Utility Solutions

To derive further economic insights, it is necessary to assume a particular form of the utility function. We analyze the case of the log utility function, which is a specific case of Program (P1).

$$\begin{aligned} J(W_0, t=0) = \underset{C_0,\,\omega_0,\,A_1}{\text{maximize}} \quad & \ln(C_0) + \mathbb{E}_0\left[\ln(\tilde{C}_1)\right] \\ \text{subject to} \quad & A_1 \leq L_1 \quad \text{(deduction constraint)}, \\ & A_1 \leq I_0\omega_0 r^h_{i,1} \quad \text{(profit constraint)}, \\ & 0 \leq \omega_0 \quad \text{(short-sale constraint)} \end{aligned} \tag{P2}$$

Next we analyze three possible cases, which are the three regions that the optimal solution may fall into. These regions are defined by endogenous bounds that are solved for in Section 1.4.4.

One region is where the deduction limit is very low. In this region, the investor finds it optimal to invest an amount that would yield a taxable profit greater than the deduction limit, despite having to pay taxes on the additional profit, since the deduction limit is “too” low. The amount of deductions claimed is equal to the deduction limit, or $A_1 = L_1$.

When the deduction limit is very high, the investor’s risk preferences lead to an optimal investment that yields a taxable profit below the deduction limit, even though additional profit would not be taxed. The amount of deductions used is equal to the profit, or $A_1 = I_0\omega_0 r^h_{i,1}$.

The remaining region is where the deduction limit is high enough that the investor is satisfied with a taxable profit equal to the limit, but does not find it worthwhile to invest more because the marginal profit will be taxed. Within this region, the investor adjusts his investment to match the deduction limit, and pays no taxes on the profit. In this region, the amount of deductions claimed is equal to the deduction limit, but there is an additional condition that the profit in the high state equals the deduction limit, or $A_1 = L_1 = I_0\omega_0 r^h_{i,1}$.

What follows is an analysis of the optimal solution for each region. Establishing which region is optimal for a given case is discussed in Section 1.4.4.

1.4.1 Region in Which Only the Deduction Limit Is Binding

Let $U(C) = \ln(C)$. Since it is only the deduction limit that is binding, $\lambda_2 = 0$. The amount of deductions claimed is equal to the deduction limit, or $A_1^* = L_1$. From Eq. (1.5)

$$\mathbb{E}_0\Big[U'(\tilde{C}_1)\tilde{R}_{i,1}\Big] = R_f\,\mathbb{E}_0\Big[U'(\tilde{C}_1)\Big] \tag{1.18}$$

For the log utility function, Eq. (1.18) takes the following form:

$$\mathbb{E}_0\left[\frac{\tilde{R}_{i,1}}{I_0\tilde{R}_1 + L_1\tau\tilde{H}_1}\right] = R_f\,\mathbb{E}_0\left[\frac{1}{I_0\tilde{R}_1 + L_1\tau\tilde{H}_1}\right] \tag{1.19}$$

For binomial outcomes, with $\tilde{H}_1$ taking a value 1 in a good state, and 0 otherwise, we get

$$\frac{pR^h_{i,1}}{I_0R^h_1 + L_1\tau} + \frac{(1-p)R^l_{i,1}}{I_0R^l_1} = \frac{pR_f}{I_0R^h_1 + L_1\tau} + \frac{(1-p)R_f}{I_0R^l_1} \tag{1.20}$$

where $R^h_1 = R_f + \omega_0(R^h_{i,1} - R_f)$ and $R^l_1 = R_f + \omega_0(R^l_{i,1} - R_f)$. Simplifying and solving for the optimal investment in the risky asset, we get

$$\omega_0^* = \frac{pR_f}{R_f - R^l_{i,1}} - \frac{1-p}{R^h_{i,1} - R_f}\left(R_f + \frac{L_1\tau}{I_0^*}\right) \tag{1.21}$$

From Eq. (1.4) we obtain the optimal consumption at time $t = 0$

$$\frac{1}{C_0^*} = \mathbb{E}_0\left[\frac{\tilde{R}_1}{I_0\tilde{R}_1 + L_1\tau\tilde{H}_1}\right] \tag{1.22}$$

For the binomial distribution, and setting $\tilde{H}_1 = 1$ for the good state, we obtain an implicit solution for C_0^*:

$$C_0^* = \frac{I_0^*(I_0^* R_1^{h*} + L_1\tau)}{pI_0^* R_1^{h*} + (1-p)(I_0^* R_1^{h*} + L_1\tau)} \tag{1.23}$$

We note that an explicit solution for C_0^* is given by[5]

$$C_0^* = \frac{3W_0R_1^h + (2-p)L_1\tau - \sqrt{(W_0R_1^h + (2-p)L_1\tau)^2 - 4pW_0R_1^hL_1\tau}}{4R_1^h} \tag{1.24}$$

If we set $L_1 = 0$ in the optimal decisions (Eqs. (1.21) and (1.24)), which is the equivalent of disallowing tax deductions, we recover the standard solution for the case of taxes without deductions:

$$C_0^{b*} = \frac{W_0}{2} \tag{1.25}$$

$$\omega_0^{b*} = \frac{pR_f}{R_f - R_{i,1}^l} - \frac{(1-p)R_f}{R_{i,1}^h - R_f} \tag{1.26}$$

It is immediately apparent from these equations that without tax deductions, consumption is not affected by the tax rate. However, since increasing taxes would decrease $R_{i,1}^h$, from Eq. (1.26) we can see that a tax rate increase would decrease investment.

Comparing Eqs. (1.24) and (1.25), it is clear that consumption increases with the introduction of tax deductions, and continues to increase with the deduction limit. Since the investor pays less taxes, he chooses to increase consumption in order to receive some of that benefit now.

Interestingly, as can be seen from comparing Eqs. (1.21) and (1.26), by allowing deductions to offset taxes, the optimal investment weight for the risky asset becomes

[5]The positive root yields an infeasible solution, since $L_1 = 0 \implies C_0^* = W_0$, and as C_0^* is increasing in L_1, $L_1 > 0 \implies C_0^* > W_0$.

lower than the case of no deductions, and continues to decrease in L_1 while only the deduction limit remains binding. At first glance, it may seem counterintuitive for an investor to demand less of the risky asset when there is an additional payoff in the high state. However, because the deduction limit is binding, the additional payoff in the high state provided by the deduction is a *constant* payoff. This means that the investor can decrease investment in the risky asset, which increases the payoff in the low state, while maintaining the same or higher payoff in the high state (relative to the no-deduction case) due to the tax deduction benefit. This additional payoff in the low state is more valuable than the potential payoff in the high state due to the concavity of the utility function.

To illustrate this, suppose the deduction limit is either 0 or ∞. This implies that the net rate of return to the investor on the risky asset in the high state does not vary with the investment amount. Using $L_1 = 0$ as a baseline, the rate of return to the investor is higher for $L_1 = \infty$, which is equivalent to the removal of taxes. Now let $L_1 \in (0, \infty)$. For investments that would yield a taxable profit less than or equal to L_1 in the high state, the net rate of return to the investor remains constant, and higher than that of the baseline case. But for investments that would yield a taxable profit greater than L_1 in the high state, the net rate of return to the investor is decreasing in investment, since the deduction "discount" does not increase with investment, but instead remains constant at $L_1\tau$. So the overall rate of return to the investor decreases with additional investment.

Looking at Eq. (1.8), in this scenario the covariance term is more negative than in the baseline case of no deductions (since $U'(\tilde{C}_1)$ is lower in the high state), and the denominator is lower, so the risk premium increases when going from no deductions allowed to allowing deductions with the deduction limit binding. Intuitively, since there will be a constant bonus payoff in the high state, the utility of the risky asset's payoff in the high state is less, which implies that investors will demand a higher risk premium. Additionally, since demand for the risky asset is lower, as demonstrated above, the price is lower, so expected returns are higher. Since in this region tax deductions increase the risk premium on the risky asset, this could at least partially explain the equity premium puzzle.

The value of the tax deduction is the difference (expressed in utils) between the value of the maximized objective function with deductions and without deductions. Since $L_1 = 0$ is equivalent to the baseline case of no deductions, utility in the baseline case can be expressed as

$$J(W_0, t=0) = \ln\Big(C_0^{b*}\Big) + \mathbb{E}_0\Big[\ln\Big(W_0 - C_0^{b*}\Big(R_f + \omega_0^{b*}\Big(\tilde{R}_{i,1} - R_f\Big)\Big)\Big)\Big] \tag{1.27}$$

where C_0^{b*} and ω_0^{b*} are as defined in Eqs. (1.25) and (1.26). Therefore, the value of the tax deduction in this scenario is

$$2 \cdot \ln\left(1 + \frac{L_1 \tau (R_f - R_{i,1}^l)}{W_0 R_f (R_{i,1}^h - R_{i,1}^l)}\right) \tag{1.28}$$

As would be expected, if we lower the tax rate to zero, the value of the tax deduction goes to zero as well, and the value increases in τ and L_1.

With regard to the Hansen-Jagannathan bound (Eq. (1.17)), we first compare the bound in the case of no taxes ($\tau = 0$) to the case of taxes and no deductions (Eqs. (1.25) and (1.26)). By taking the difference between the bounds using each of those solutions, it is apparent that introducing taxes decreases the bound. Since taxes decrease expected returns in the numerator of the Sharpe ratio, and increase the standard deviation in the denominator, this makes intuitive sense. In this region the bound is the same as in the case of no deductions.

1.4.2 Region in Which Only the Profit Constraint Is Binding

With only the profit constraint binding, we have $\lambda_1 = 0$. Solving in the same manner as the previous case yields the following optimal solutions:

$$C_0^* = \frac{W_0}{2} \tag{1.29}$$

$$\omega_0^* = \frac{pR_f}{r_f - r_{i,1}^l} - \frac{(1-p)R_f}{r_{i,1}^h - r_f} \tag{1.30}$$

These solutions are equivalent to those of the baseline case of no taxes, since if the binding constraint is profit, all taxes are offset by deductions. Optimal consumption in this region is the same as with taxes and no deductions.

Comparing Eq. (1.30) with Eq. (1.26), it is apparent that the optimal investment weight for the risky asset is higher in this scenario than it is in the baseline case of no deductions. Intuitively, since tax deductions increase the net return to an investor in the risky asset, it should also increase an investor's demand for the risky asset.

From Eq. (1.8), the risk premium is lower than the risk premium in the baseline case of no deductions. Intuitively, since the net return to an investor in the risky asset is higher with tax deductions, the investor will accept a lower risk premium. Also, by virtue of the increased demand for the risky asset, the price will increase, lowering the expected return on the risky asset.

In this scenario, the value of the tax deduction (as discussed above) is

$$(1-p) \cdot \ln\left(\frac{R_{i,1}^h - R_f}{r_{i,1}^h - r_f}\right) + \ln\left(\frac{r_{i,1}^h - r_{i,1}^l}{R_{i,1}^h - R_{i,1}^l}\right) \tag{1.31}$$

The value here also goes to zero in the absence of taxes ($\tau = 0$).

In this region, the Hansen-Jagannathan bound is higher than the bound without tax deductions, so long as expected returns are greater than the risk free rate, or $\mathbb{E}_0\left[\tilde{R}_{i,1}\right] > R_f$. Intuitively, since taxes decrease the bound, and in this region all taxable income is offset by deductions, the bound should increase.

1.4.3 Region in Which Both Constraints Are Binding

When the optimal choice of investment is such that the taxable profit in the high state is equal to the deduction limit, both constraints will be binding. The solution in this case is

$$C_0^* = \frac{3W_0}{4} + \frac{((2-p)r_{i,1}^h - 3r_f + (1+p)r_{i,1}^l)L_1 - \sqrt{\alpha}}{4R_f r_{i,1}^h} \tag{1.32}$$

$$\omega_0^* = \frac{L_1}{(W_0 - C_0^*)r_{i,1}^h} \tag{1.33}$$

where

$$\alpha = \left[L_1 p(r_{i,1}^h - r_{i,1}^l) + W_0 r_{i,1}^h R_f + L_1(2r_{i,1}^h - r_{i,1}^l - r_f)\right]^2 - 8L_1 p(r_{i,1}^h - r_{i,1}^l)(W_0 r_{i,1}^h R_f + L_1(r_{i,1}^h - r_f)) \tag{1.34}$$

The value of the tax deduction is

$$\ln\left(\frac{C_0^*}{C_0^{b*}}\right) + \mathbb{E}_0\left[\ln\left(\frac{(W_0 - C_0^*)(R_f + \omega_0^*(\tilde{R}_{i,1} - R_f))}{(W_0 - C_0^{b*})(R_f + \omega_0^{b*}(\tilde{R}_{i,1} - R_f))}\right)\right] \tag{1.35}$$

Optimal consumption in this region is higher than in the baseline case of no deductions. Since investment in this region is defined by the deduction limit (in order to take full advantage of the available deductions), it is increasing in the deduction limit.

The difference between the Hansen-Jagannathan bound in this region and the bound with no tax deductions is analytically intractable. In Fig. 1 we demonstrate numerically that the bound is higher in this region than it is in the case of no deductions. This makes sense, since this region lies in between the other two regions, the difference should increase continuously to connect the two regions.

Insert Fig. 1 here

1.4.4 Boundaries for the Binding Constraints as a Function of the Deduction Limit

Given a set of initial parameters, there are three possible regions in which the optimal decision can be found. For a very low deduction limit, L_1, the only binding constraint will be the deduction limit, since the investor requires a greater profit in the high state, despite the fact that some of it will be taxed. As the deduction limit increases, there comes a boundary point where additional taxable profit is no longer desirable and the investor chooses to invest in a manner that allows all taxable income to be offset by deductions. At this point, the deduction limit is equivalent to the taxable profit, so both the deduction limit and profit constraint are binding.

At this boundary between the region in which only the deduction limit is binding and the region in which both constraints are binding, the solutions given by both of those scenarios are equivalent. In order to find the boundary, we equate the solutions for optimal consumption (or optimal investment) in these two scenarios (Eqs. (1.24) and (1.32)), which yields the free parameter L_1. This bound is labeled *B1*, and is given by

$$B1 = \frac{W_0 R_f r^h_{i,1}(\mathbb{E}_0\left[\tilde{R}_{i,1}\right] - R_f)(R^h_{i,1} - R^l_{i,1})}{(r_f - r^l_{i,1})((1-\tau)(2-p\tau)(r^h_{i,1})^2 + \beta r^h_{i,1} + 2 r_f r^l_{i,1})} \tag{1.36}$$

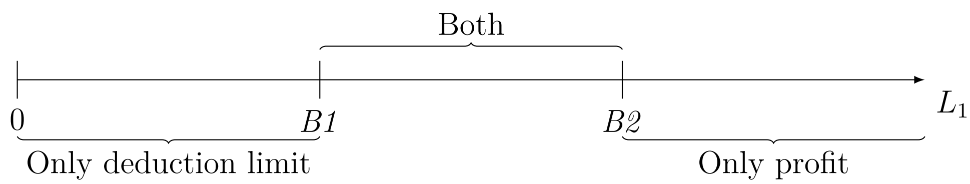
where

$$\beta = \tau(r^l_{i,1}(1+p) + r_f) - 2(r_f + r^l_{i,1}) \tag{1.37}$$

As the deduction limit continues to increase, the investor continues to increase investment to take full advantage of the tax-free profit that the deduction limit is allowing. However, there comes a point where the deduction limit is so high that the investor no longer wishes to invest more, despite the additional investment having tax-free returns. Beyond this point, the deduction limit is no longer binding, and only the profit constraint limits the deduction usage. As with the first bound, for the bound between the region in which both constraints are binding and the region in which only the profit constraint is binding, we equate Eqs. (1.29) and (1.32), which yields

$$\mathit{B2} = \frac{W_0 R_f r^h_{i,1}(p(r^h_{i,1} - r^l_{i,1}) - r_f + r^l_{i,1})}{2(r_f - r^l_{i,1})(r^h_{i,1} - r_f)} \tag{1.38}$$

The appropriate optimal scenario depends on the relationship between L_1 and the boundaries in the following manner:



The first bound, *B1*, can be viewed as the lowest deduction limit at which a rational investor will not be willing to pay taxes on additional marginal investment, and so, chooses to invest an amount that will yield a taxable return in the high state equal to the deduction limit, so that it can be completely offset by tax deductions. For deduction limits below this bound, an investor chooses to invest in a manner that will still yield a tax bill. Since that "extra" return gets taxed, the lower the tax rate, the more worthwhile it is to invest and pay taxes, and so the bound should increase. Mathematically, the derivative of *B1* with respect to τ is negative.

The second bound, *B2*, is the highest deduction limit that an investor will fully take advantage of by investing an amount that yields (in the high state) a taxable return equal to the deduction limit, which is the most that can be invested tax-free. Above this bound, an investor "leaves over" some of the deduction limit, in the sense that he could invest more and still be tax-free, but chooses not to. Since this bound relates to a tax-agnostic investment decision, it should not depend on the tax rate. This intuition is supported by $\frac{d\mathit{B2}}{d\tau} = 0$.

1.4.5 Policy Decisions

Thus far, our focus has been on the investor maximizing his own utility by making optimal consumption and investment decisions in the presence of tax deductions.

These decisions depend on several exogenous factors, one of which is the deduction limit. Since this limit is imposed by the government, it allows the government a level of control over consumption and investment decisions made by market players. The manner in which the government can affect consumption and investment depends on which region is optimal.

In the region in which only the deduction limit is binding, if a government wanted to effect an increase in consumption and a decrease in risky asset investment through a change in tax policy, it could do so by increasing the deduction limit. The opposite effect would occur from a decrease in the deduction limit.

If the solution lies in the region in which both constraints are binding, then increasing the deduction limit will increase investment in the risky asset. However, because of the quadratic nature of optimal consumption with respect to the deduction limit in this region, the effect of changes in the deduction limit on consumption depends how high the deduction limit is. For lower values of the deduction limit, increasing the limit will increase consumption, but then consumption peaks and starts to decrease in the deduction limit.

Once the deduction limit is no longer binding (in the region where only the profit constraint is binding), changes in the deduction limit will obviously have no effect, unless the limit is reduced to the point at which it becomes binding again.

1.4.6 Proposition

Proposition 2. Assume a single period economy with one risky asset that gives a return of $\tilde{r}_{i,1}$ at terminal time $t = 1$, and a riskless, tax-free asset that pays a sure return of r_f at terminal time $t = 1$. The risky asset returns $r^h_{i,1}$ in a good state ($\tilde{H}_1 = 1$) with probability p, and gives $r^l_{i,1}$ in a bad state ($\tilde{H}_1 = 0$) with probability $1 - p$. The tax rate on profits is assumed to be known at the initial time $t = 0$, and is given by τ. The investor is assumed to be risk-averse with a time-separable log utility function over consumption, and to have an endowment of initial wealth, W_0. The investor is allowed to use tax deductions up to the deduction limit, L_1, to offset taxable profits at time $t = 1$. All terminal wealth net of taxes ($\tilde{W}_1$) is consumed by the investor. The investor maximizes a time-separable utility function over the time period by optimally choosing consumption, C_0^*, investment, ω_0^*, and tax deduction usage, A_1^*, solving Program (P2).

The optimal solution falls into one of the following three regions:

Region in which only the deduction limit is binding ($L_1 < B1$)

$$A_1^* = L_1 \tag{1.39}$$

$$C_0^* = \frac{3W_0R_1^h + (2-p)L_1\tau - \sqrt{(W_0R_1^h + (2-p)L_1\tau)^2 - 4pW_0R_1^hL_1\tau}}{4R_1^h} \tag{1.40}$$

$$\omega_0^* = p\left(\frac{R_f}{R_f - R_{i,1}^l}\right) - \frac{1-p}{R_{i,1}^h - R_f}\left[R_f + \frac{L_1\tau}{I_0}\right] \tag{1.41}$$

The value of the tax deduction is

$$2 \cdot \ln\left(1 + \frac{L_1\tau(R_f - R_{i,1}^l)}{W_0R_f(R_{i,1}^h - R_{i,1}^l)}\right) \tag{1.42}$$

Region in which only the profit constraint is binding ($B2 < L_1$)

$$A_1^* = I_0^*\omega_0 r_{i,1}^h \tag{1.43}$$

$$C_0^* = \frac{W_0}{2} \tag{1.44}$$

$$\omega_0^* = \frac{pR_f}{r_f - r_{i,1}^l} - \frac{(1-p)R_f}{r_{i,1}^h - r_f} \tag{1.45}$$

The value of the tax deduction is

$$(1-p) \cdot \ln\left(\frac{R_{i,1}^h - R_f}{r_{i,1}^h - r_f}\right) + \ln\left(\frac{r_{i,1}^h - r_{i,1}^l}{R_{i,1}^h - R_{i,1}^l}\right) \tag{1.46}$$

Region in which both constraints are binding ($B1 \leq L_1 \leq B2$)

$$A_1^* = L_1 = I_0^*\omega_0 r_{i,1}^h \tag{1.47}$$

$$C_0^* = \frac{3W_0}{4} + \frac{((2-p)r_{i,1}^h - 3r_f + (1+p)r_{i,1}^l)L_1 - \sqrt{\alpha}}{4R_f r_{i,1}^h} \tag{1.48}$$

$$\omega_0^* = \frac{L_1}{(W_0 - C_0^*)r_{i,1}^h} \tag{1.49}$$

where α is defined in Eq. (1.34). The value of the tax deduction is

$$\ln\left(\frac{C_0^*}{C_0^{b*}}\right) + \mathbb{E}_0\left[\ln\left(\frac{(W_0 - C_0^*)(R_f + \omega_0^*(\tilde{R}_{i,1} - R_f))}{(W_0 - C_0^{b*})(R_f + \omega_0^{b*}(\tilde{R}_{i,1} - R_f))}\right)\right] \tag{1.50}$$

The bounds are as follows

$$B1 = \frac{W_0 R_f r_{i,1}^h (\mathbb{E}_0\left[\tilde{R}_{i,1}\right] - R_f)(R_{i,1}^h - R_{i,1}^l)}{(r_f - r_{i,1}^l)((1-\tau)(2-p\tau)(r_{i,1}^h)^2 + \beta r_{i,1}^h + 2r_f r_{i,1}^l)} \tag{1.51}$$

$$B2 = \frac{W_0 R_f r_{i,1}^h (p(r_{i,1}^h - r_{i,1}^l) - r_f + r_{i,1}^l)}{2(r_f - r_{i,1}^l)(r_{i,1}^h - r_f)} \tag{1.52}$$

with β as defined in Eq. (1.37).

Fig. 2 shows what the optimal solution looks like as L_1 increases, given the following set of initial parameters: $\{W_0 = 100, r_{i,1}^l = -0.1, r_f = 0.05, r_{i,1}^h = 0.4, p = 0.5, \tau = 0.4\}$.

Insert Fig. 2 here

In Fig. 3, we can see how the value of the deduction changes with the deduction limit, given the same parameters. As is immediately evident, the value of the deduction increases with the deduction limit, up until the point where the investor chooses not to invest more, at which point the deduction value stops increasing.

Insert Fig. 3 here

1.5 Conclusion

In this paper we derive a valuation model for tax deductions in the presence of legal restrictions on their usage. The model we use is that of a rational investor optimizing consumption and investment decision in order to maximize utility. We allow for the use of tax deductions subject to legal constraints. We also derive a Consumption CAPM that incorporates tax deductions, and discuss the effects deductions have on the Hansen-Jagannathan bound.

We explicitly solve the model for the specific case of log utility and show that the solution falls into one of three regions, depending on the level of the deduction limit in relation to the other model parameters. A surprising result arises, that in the region where only the deduction limit is binding, if the deduction limit increases, the investment *decreases*. We also show that the Hansen-Jagannathan bound in each of the three regions is greater than or equal to the bound without tax deductions.

Prior literature on the valuation of tax deductions is sparse, and none of the extant studies deal with fixed upper bounds on their usage. Our paper fills this gap in the literature, and opens the door for further exploration in this area.

Chapter 2

Do the Stock and Related Option Markets Anticipate Events and Decisions of the United States Supreme Court in Corporate Cases?

2.1 Introduction

The Supreme Court (SC) is one of the three pillars of the federal structure of governance in the United States. The Constitution established the SC of the United States to have both original and appellate jurisdiction, where the SC original jurisdiction is limited to cases involving disagreements between states or ambassadors, while appellate jurisdiction means that the SC can review the decisions of lower courts. The latter constitutes the majority of SC cases.

The SC appellate procedure starts with a petition from parties who are not satisfied with the decisions of lower courts. There are three important dates in the SC appellate process: (i) granting of the writ of certiorari, or accepting a case; (ii) oral arguments by the petitioner and respondent; and (iii) the announcement of the final decision. It requires four or more of the nine Justices' votes to accept the case (granting a writ of certiorari), and less than 1 percent of the petitions are accepted (see Thompson & Wachtell, 2008). Next, the petitioner and the respondent file their corresponding SC briefs and the SC subsequently publicly hears their oral case arguments. After the oral arguments, the Justices discuss, cast votes and decide on the case in a private conference. After that, one of the Justices in the majority is assigned to write the SC opinion. The preparation and the review of the SC opinion might take several months after the case is heard in the SC. Once the SC opinion is prepared, it is presented to the Justices for a review. Before it is released to the public, a majority of Justices must agree to the contents of the opinion. Practically no information leaks out before the day the decision is announced.

The importance of the SC in society has been well understood over time, and its impact has been researched, scrutinized and analyzed in innumerable articles in the academic literature and the popular press from different points of view, ranging from the political, to gender and ethnicity, to socioeconomic beliefs and more. If the case has reached the SC, by definition, it must be an important issue. Both academics and non-academics often spend an extraordinary amount of time trying to look for clues that will help them predict the actions of the SC justices in any given case. These attempts have met with limited success (see, for example, Katz, Bommarito, & Blackman, 2017).

However, the one area where research has been sparse is from the point of view of the financial markets.[1] This could possibly be attributed to the fact that modern finance is a relatively young field, in addition to the fact that the financial data

[1]Some of the earlier financial market-based studies typically used stock market reaction to assess the loss in value for firms sued for damages related to products sold by them (see for example Bhagat et al., 1998; Govindaraj et al., 2007). There is no prior study examining the option market reactions.

required for analysis has only become available in the last few decades. Perhaps an even more important reason could be that data on legal cases is not yet easily available to conduct archival statistical research. Our work aims to contribute to this stream of legal and financial literature.

The main motivation for our work is to study if the financial markets, specifically the stock and the option markets, are smart enough to correctly predict (on average) and assess the impact of the actions of the justices (granting of the writ of certiorari, and the final decision) of the SC, and actions of the petitioner and respondent in the oral arguments, in cases relating to and affecting business valuation. Unlike many prior studies that look at precedents, as well as social, personal and political characteristics of the individual justices, we use the collective wisdom of the financial market to see (i) if SC activities are predictable, and (ii) to study the direction and impact of the SC related activities on the stock prices of the concerned firms.

For publicly traded firms involved in a SC case, we find a negative reaction in the stock market when the writ of certiorari is granted, for both petitioners and respondents, suggesting that the granting of certiorari is a surprise to the market, and that the market views litigation as costly for all parties involved. The reaction is more negative in civil rights cases and in cases where the opposing party is the government. The SC's final decision triggers a positive (negative) stock market reaction for the winning (losing) firm, hinting at the stock market's inability to predict the SC decision. Despite the stock market's collective wisdom of investors, it has difficulty predicting the actions of the SC.

Our work is also the first one in the literature to examine the reactions in the option market. Black (1975) conjectured that the options market with its fewer restrictions on short sales constraints and higher leverage, offers an attractive alternative to the stock market—especially to those investors who have superior information. Recent empirical evidence supports this conjecture that information is reflected in the options market before it is reflected in the stock market and even predicts future stock returns (e.g., Amin & Lee, 1997; An et al., 2014; Bali & Hovakimian, 2009; Cao et al., 2005; Cremers & Weinbaum, 2010; Govindaraj et al., forthcoming; Johnson & So, 2012; Ni et al., 2008; Pan & Poteshman, 2006; Roll et al., 2010; Xing et al., 2010).

We conjecture that if the option market is really smart in foreseeing the final decision of the SC at the granting of the writ of certiorari, then there should be a significant change in the implied volatilities of calls and puts of the firm involved in the litigation that points correctly at the final decision. If the firm is the petitioner (respondent) and the writ of certiorari is granted, we find a significant positive (negative) change in the implied volatility of the calls (signifying a higher (lower) demand for calls in anticipation of good (bad) future events), and a positive significant change in the implied volatility of puts for the respondent (signifying a higher demand for puts in anticipation of bad news for the respondent). More interestingly, we find that the directions of changes in implied volatility are consistent with the final decisions in the future, suggesting that the option market does seem to anticipate the final decision of the SC. This supports the conjecture that smart money flows in to the option market rather than in to equity markets.

2.2 Prior Literature

There has been a voluminous body of literature showing that financial markets are, on average, quite efficient at processing information, accurately forecasting the future, and unbiasedly pricing expected events (see for example Campbell et al., 1997). Even though there has been a recent surge in the financial economics literature showing that markets are subject to biases, bubbles, and excesses (see for example Shefrin, 2008), both academics and practitioners generally agree that it is hard to beat the market consistently over time. If the markets can predict the actions of the SC, that would further solidify the reputation of the market as an efficient anticipator of future events. If not, then it further enhances the reputation of the SC as an institution that is unpredictable and perhaps independent.

As mentioned earlier, the academic literature in the area of economic analysis of SC decisions is quite sparse. In fact, we are not aware of any prior work relating to writ of certiorari and financial markets. It is only quite recently that researchers have begun to investigate the SC decisions that have a business entity as a party to a SC case. Epstein et al. (2012) show that a SC regime can be classified as pro-business (for example, the court led by Chief Justice John Roberts since 2005) or anti-business (for example, the SC led by Earl Warren from 1953 to 1969). They find that during the pro-business regime, the number of business petitioners relative to the number of business respondents increases, as do the win rates for business entities. They demonstrate that a SC Justice's attitude towards business is determined by the appointing President's party affiliation and the Justice's ideology before their appointment to the SC. Katz, Bommarito, Soellinger, et al. (2017) is (to our knowledge) the first and only study that is similar to ours in that they explicitly consider stock market reactions to the SC decisions. Their study identifies 211 SC cases over the 2000–2014 period that are likely to have an impact on specific firms in the market, and goes on to show that for a subset of these cases (79 out of 211), the share prices of these firms significantly change, in absolute value, on the SC decision date. There are two potentially problematic issues with their study: (i) they do not show directional response of the stock prices to the SC decisions, just the absolute value; and (ii) the authors use their discretion in selecting SC decisions and publicly traded securities associated with the cases, which introduces a selection bias in their sample. Unlike their study, we investigate market reactions to these events using a broad sample of all SC decisions during the years 1946–2018 that have a publicly traded firm as either a petitioner or a respondent.

Section 2.3 develops our hypotheses, Section 2.4 describes our datasets, Section 2.5 describes the methodology used to test our hypotheses, Section 2.6 discusses our results, and Section 2.7 concludes our paper. Appendix A provides the definitions for all the variables used in our statistical models.

2.3 Hypothesis Development

As mentioned earlier, there are three important event dates in any appellate case before the SC, namely, granting the writ of certiorari, the argument date when the lawyers for the petitioner and respondent present their arguments publicly, and finally, the SC decision announcement date. The held assumption throughout is that the financial markets, and the stock market in particular, are efficient in processing information, unbiasedly envisaging the future, and pricing firms.[2] The sources of information could range from private sources to public coverage, such as the newspapers (the Wall Street Journal (WSJ), to name one). For each of these SC events, we discuss and develop arguments for how the stock market may react.

The SC grants writ of certiorari decisions to very few petitioners (less than 1 percent). If granted, it would be a momentous occasion with broad implications (Feldman & Kappner, 2016). Consequently, it is reasonable to expect that the stock market's expectation ex ante would be that the SC would deny a petition. So, acceptance should be a positive surprise for the petitioner. This event should trigger a positive stock price reaction if a firm is a petitioner who now has a chance to win and overturn the losses in the lower courts, and maybe a negative reaction if the firm is a respondent. But this is not so clear cut a priori. If the market has anticipated this rare event, especially given that the case has done its rounds in the lower courts, or if information has been leaked despite the precautionary measures of the SC, then it would simply not react to acceptance of the case. It can also be argued that if the litigation going forward is viewed as costly all around, the stock prices of the firm, whether petitioner or respondent, should fall (Govindaraj et al., 2007). Therefore, we take the agnostic position that there will be no stock market reaction when the writ

[2]While it is true that there is considerable evidence now that financial markets over- or under-react to events and information, and misprice assets at least in the short run (leading to the development of what is come to be known as behavioral economic theory), it is still true that these markets are efficient over a long period of time and across a large cross-section of firms. It is widely acknowledged that to bet and win against the collective wisdom of the financial markets consistently is very unlikely.

of certiorari is granted.

The next significant event is the oral arguments in the SC, which is open to the public. It is possible for new information to come out during the arguments (Jacobi & Schweers, 2017), and it is then to be expected that the stock market will react if the information was unanticipated. Since this information can be positive or negative for the firm concerned, it is hard to predict if the stock market will react positively or negatively. We take the position as a null hypothesis that the market properly anticipates future events, on average, and there would be no stock price reaction.

Finally, the SC decision announcement; the third, and perhaps most important event. Every precaution is taken by the SC to keep the decision under wraps until the day it is announced. Clearly the winner has a lot to gain, and the loser a lot to lose.[3] As before, the reaction of the stock market must be conditioned on what has already been anticipated and priced. If the market has correctly anticipated this decision, there would be no reaction to this event. The market should only react to the decision if it was unanticipated or just partially anticipated, reacting positively for the firm if it is the winner, and negatively if the firm is the loser.

Regarding the option market, we conjecture that if the option market is really smart in foreseeing the final decision of the SC at the granting of the writ of certiorari, then there should be a significant change in the implied volatilities of calls and puts of the firm involved in the litigation that points correctly at the final decision. If the firm is the petitioner (respondent) and the writ of certiorari is granted, we should see a significant positive (negative) change in the implied volatility of the calls (signifying a higher (lower) demand for calls in anticipation of good (bad) future events), and a positive significant change in the implied volatility of puts for the respondent (signifying a higher demand for puts in anticipation of bad news for the respondent). In addition, the IV spread, that is the difference between the implied volatility of call

[3] The economic consequences of winning or losing a SC case can be hefty. For example, in the case eBay Inc. v. MercExchange, L.L.C., 547 U.S. 388, eBay could have suffered a huge setback had it lost its right to use "Buy It Now" feature, an essential part of its online auction.

options and put options that have the same strike price and expiration date, should be significantly positive (negative) for the for the petitioner (respondent) if the writ of certiorari is granted; and it should be positively associated with the final decision of a win (loss).[4]

2.4 Data

Our data consists of SC case final decisions and argument dates matched with their respective certiorari dates. For the SC case final decisions and oral argument dates, we start with the 2018 Spaeth Supreme Court Database (Spaeth et al., 2018), which contains 8,893 unique cases that were decided in the SC during the years 1946–2018. For each case, the database has the case name, which includes the name of the petitioner and respondent, the oral argument date, the direction of the decision, and the date that the decision was released to the public.

The majority of SC cases are unrelated to publicly traded firms, so we perform several steps to identify the cases that have a publicly traded firm as one of the parties. First, we drop all cases that have missing data on which party won, and any case where the party names were incorrectly recorded. Second, we split each case into two observations: one observation for the petitioner and one observation for the respondent. The maintainers of the Supreme Court Database (SCDB) classify each party into one of several hundred categories (e.g. "governmental employee," "person accused of a crime," "bank") according to the way they are described in the case. Using this information, we drop any parties with a classification that is obviously not describing a firm (for example, "arrested person"). We also define our own, much broader, categories; specifically, we classify each opposing party as either (i) a

[4] While the original Black-Scholes model forecasts that this spread should be zero, later work has shown that this is not true in practice. As an example, when option traders obtain information about a positive (negative) event, the demand for call (put) options increases relative to the demand for put (call) options, and this results in positive (negative) deviations from zero for the IV spread.

government, (ii) a firm, (iii) an individual, or, (iv) other. Lastly, we manually checked our final sample to ensure that all parties are firms and are correctly matched to the Center for Research in Security Prices (CRSP) database.

In order to get the data for certiorari decision dates, we use the Journal of the Supreme Court of the United States.[5] These journals are published annually, starting from 1889, and contain daily records of the SC's issuance of orders, case dispositions, and other information. Each one is around 1,000 pages long. Most important for our purposes is that the journal includes the date of the SC's decision for every petition for writ of certiorari. A detailed discussion of the text mining process is presented in Appendix B. Our certiorari dataset includes the names of the petitioner and respondent, and the date on which the writ of certiorari was granted. While most cases arrive on the SC's docket via a writ of certiorari, some cases forego this process and go directly to SC. These are generally cases involving States, which the SC is often required to accept. Since there is no granting of writ of certiorari for these cases, there is no specific announcement date for the acceptance of these cases. These cases are marked in the SCDB as "appeal jurisdiction," and we do not use them in our certiorari date analysis.

For both SC decisions and SC certiorari databases, we remove some standard words from the end of the party names (e.g. "et al.") and keep only the actual party name. Using the Stata utility `stdn_compname` (Wasi & Flaaen, 2015), we standardize the firm names in both of our private databases and the data from the CRSP database. We then merge the certiorari dataset and the SC decision dataset by matching on the names of the two parties in the case, and restricting to final decisions that occur within a reasonable period (not more than 2 years). We merge the combined dataset with CRSP daily returns data using the standardized firm name. We drop any firm with multiple share classes or multiple SC events within 5 days of each other. We

[5]These journals are accessible in PDF format at https://www.supremecourt.gov/orders/journal.aspx

retrieve earning announcement dates from Compustat and dividend declaration dates from CRSP, and we drop any observation that is confounded by these events. We require 7 months (140 trading days) of returns data prior to each event date. Lastly, we merge our final dataset with the press coverage variables from Epstein et al. (2012) on the unique SCDB case ID.

For the option market analysis, we get implied volatility data from OptionMetrics. We remove closed contracts and non-standard settlements, and we require the ex-date to be at least 10 days and not more than 60 days into the future. For call options, we require the delta to be between 0.4 and 0.7, and for put options between −0.45 and −0.15 (as in, e.g., Govindaraj et al., forthcoming).

After these procedures, the final number of observations used for the writ of certiorari date analyses is 346; for the argument date we have 454 cases, and for the decision date we have 509 cases.[6] The number of observations for the option market analysis is reported for each test in Table 12.

2.5 Methodology

2.5.1 Examining the Stock Market Reaction

For both our certiorari decision and our final decision samples, we study the stock market reaction to the SC announcement using a well-known, standard statistical regression methodology (see, for example, Govindaraj et al., 2007). Specifically, we calculate abnormal returns using the Fama-French-Carhart 4-factor model (Carhart, 1997; Fama & French, 1993), using a 6-month (120 trading days) estimation window that ends one month (20 trading days) before the event. If the writ of certiorari grant date or argument date is within the estimation window of another event, we remove them from the window. For the writ of certiorari decision and oral argument dates, we

[6]The writ of certiorari database has the least number of observations because there is no date given for cases that arrive via appeals jurisdiction.

cannot be certain that there was no leakage of information prior to the actual dates, and so we use a 5-day cumulative abnormal returns (CAR) event window centered on the event date. However, for the event where the decision on the case is announced, we are certain that information leakage is not a problem, because the announcement is a carefully controlled event. The public and the stock market receive the information exactly on the specified date. Therefore, we use the abnormal returns from just that day. In all these cases, the results remain qualitatively unchanged even if we use different event CAR-window specifications.

In our first set of tests, we perform univariate t-tests of the mean CARs (along with the Wilcoxon signed-rank p-value) for petitioner-firms and respondent-firms in the writ of certiorari decision sample, and the winning firms and losing firms in the argument date and final decision samples. Our null hypothesis is that the mean CAR should be zero for the date on which writ of certiorari is granted, the argument date, and the decision event date.

Additionally, we divide each group into subsamples based on the category of the opponent (firm, government, or individual) and the legal issue at hand (economic, federalism, judicial power, or civil rights), For the final decision sample we also partition by press coverage (Wall Street Journal or New York Times). For each subsample, we report the t-statistics for the mean CARs, as well as the Wilcoxon signed-rank p-value.

For our multivariate regressions, we separate the certiorari decisions into petitioner and respondent and the final decisions into wins and losses. We then estimate the following model for each of the groups[7]:

$$CAR_i = \sum_j \alpha_j FE_{i,j} + \sum_{k=1}^{4} \beta_k ISSUE_{i,k} + \sum_{k=5}^{7} \beta_k CPARTY_{i,k} + \beta_8 MEDIA_i + \beta_9 MVAL_i + \epsilon_i \quad (2.1)$$

For the certiorari decisions dataset, CAR is the 5-day cumulative abnormal return

[7]See Appendix A for definitions of these variables.

for the firm in case i, centered on the day the certiorari decision is announced, and for the SC case final decisions dataset, CAR is the abnormal return on the day the final decision is announced. $ISSUE$ is an indicator variable that relates to the subject matter of the case and is coded as Civil Rights, Economic Activity, Judicial Power, or Federalism. It is set equal to one if the case is categorized under that issue in the SCDB, and zero otherwise. $CPARTY$ is an indicator variable classifying the category of the other party in the case. It represents one of the following categories: Government, Firm, or Individual, and is set equal to one if the opposing party falls into that category, and zero otherwise. $MEDIA$ is an indicator variable for whether or not the final decision garnered attention in the press. It can be either WSJ, which is set equal to one if the decision was cited by the Wall Street Journal, zero otherwise, or NYT, which is set equal to one if the decision was printed on the front page of the New York Times, and zero otherwise. Both of these variables come from the Epstein et al. (2012) dataset. We include a control for size ($MVAL$) that is calculated as the natural log of the market value of the firm, 5 days before the first event date related to the case (certiorari, argument, or decision date). We include controls for industry and period fixed effects (FE) based on the 2-digit SIC industries and the Chief Justices for the period.

2.5.2 Examining the Option Market Reaction

Using the OptionMetrics data, we calculate the change in implied volatility for the date the certiorari decision is announced and the date the final decision is announced. For both the call and the put options, we take the difference between the implied volatility of the closing price on the day of the event and the implied volatility of the day before. We also calculate the implied volatility spread as the difference between the implied volatility of each matched (on strike price and ex-date) call and put option, as well as the change in the implied volatility spread. We partition the certiorari date results by petitioner and respondent, and also by future win and loss. For each group we perform a t-test of the mean of each of the aforementioned metrics. We do the same for the final decision date, partitioned by win and loss.

2.6 Results

2.6.1 Descriptive Statistics

Fig. 4 shows the distribution of final decisions by year in our sample. Our total sample includes 509 observations (cases), with 218 wins and 291 losses. It spans a 73-year period from 1946 to 2018, which is the most comprehensive dataset researched to date. As a benchmark, Katz, Bommarito, Soellinger, et al. (2017) use a sample of 211 cases, which is limited to cases that the authors considered likely to have affected market prices of publicly traded firms.[8] There is a marked decrease in the number of cases the SC agrees to review, starting from the 1990s. Owens and Simon (2011) discuss this decline, and cite the Supreme Court Case Selections Act of 1988, which eliminated almost all cases that the SC was formerly mandated to hear, and an ideologically fractured Court as the primary reasons for the SC caseload reduction.

Insert Fig. 4 here

Table 1 gives an overview of the frequency of wins and losses to public firms in our sample for each Chief Justice term. The data we have meshes well with Epstein et al.'s (2012) conjecture that the Warren Court (1953–1969) was anti-business, whereas the Roberts Court (starting 2005) is more business friendly, since in our sample, during the Warren Court, public firms win only 28% of the cases, as opposed to the Roberts Court, where the win rate is 58%.

Insert Table 1 here

[8] As mentioned earlier, this introduces a selection bias.

Table 2 presents the statistics for our sample partitioned by petitioner and respondent, and further split into subcategories by the jurisdiction, the case issue, the opponent type, the industry, and the Chief Justice. Our sample is well-balanced between parties, with 259 petitioners and 250 respondents. About 80% of the cases in our sample are accepted by the SC via the certiorari process. As can be seen from Panel A, the most common cases concern economic issues. This is not surprising, since our sample consists only of cases involving business entities. In Panel B we can see that about 70% of the cases that arrive under the appeals jurisdiction have the government as the counterparty. This is consistent with the fact that cases involving the government are more likely to be constitutionally mandated to be heard by the SC.

In Panel C, the sample is presented by the Chief Justice at the time the case is decided, and by the industry that the firm is part of. In the interest of conciseness, we show only the five most frequent industries that appear before a particular Chief Justice. It is interesting to note that in the earlier years in the sample, railroads were the most common industry among the SC cases that involved publicly traded firms. However, in the later years they practically disappeared, probably because of their declining importance, and because the railroad rules and regulations were already well litigated and in place. For a more detailed presentation of the frequency of different industries over the years in our sample, see Fig. 5.

Insert Fig. 5 here

Epstein et al. (2012) present some evidence that the Warren court demonstrated an anti-business attitude, whereas the Roberts court is pro-business. Our data further supports their findings. Panel C shows that while the overall frequency of cases taken by the SC has declined, firms were far more likely to be a respondent in the Warren court (91 respondents to 57 petitioners) than in the Roberts court (22 respondents to 31 petitioners). This seems to indicate that firms are more likely to petition the

SC when it is more business-friendly because the SC is more likely to accept the case. Additionally, firms may be expecting that they are more likely to win a case under a friendlier SC regime.

Insert Table 2 here

Table 3 presents the statistics for the SC wins and losses for final decision events. A notable finding in Panel A is that the trend for the SC to more likely rule in favor of the petitioner is clearly seen, with petitioners having more wins than losses (145 to 114 respectively), and respondents having far fewer (73 to 177 respectively). In Panel C, we can once again see the stark contrast between the Warren court and the Roberts court. Under Warren, firms suffer 107 losses to only 41 wins, whereas under Roberts, it is 22 losses to 31 wins. This table includes an additional panel (Panel D) that divides the sample by press coverage in the Wall Street Journal (WSJ) or the New York Times (NYT) or both. Since the press dataset is only available until 2011, the sample size decreases slightly. In our sample, 79 out of 442 observations have press coverage either in the WSJ or the NYT or in both.

Insert Table 3 here

2.6.2 Cumulative Abnormal Returns at SC Announcement Dates

In Table 4, we provide aggregate, univariate statistics for the 3 different SC event dates, namely granting of writ of certiorari, argument date, and decision date in Panels A, B, and C, respectively. Panel A shows that both petitioners and respondents have negative mean CARs for the date when of writ of certiorari is granted. For petitioners, the mean CAR is -0.686%, and for respondents it is -0.739%, both significant at the 5% level. This is consistent with the prior literature (and of course, does not support our null hypothesis of no reaction) that shows a negative market reaction to both parties in a lawsuit filing (Bhagat et al., 1998), and supports the conjecture that the market finds the projected legal battle in the SC costly for all parties. We also find evidence that the negative CAR for petitioners is driven primarily by civil rights cases; and cases where the counterparty is the government. This is further discussed below. The significant negative reaction lends support for the hypothesis that stock market has not fully anticipated the actions of the SC.

Panel B indicates that there is no market reaction for the argument date, suggesting that either (i) the arguments of the petitioner and respondent have already been anticipated by the stock market, or (ii) the arguments do not, on average, provide information useful for predicting the outcome of the case. The strongest results are to be found for the decision event in Panel C. The winning firms have a mean (median) AR of 0.554% (0.157%), significant at the 1% level, and the losing firms have a mean (median) AR of −0.370% (−0.129%), significant at 5%. Based on these results, a firm that wins (loses) in the SC can expect an abnormal return of approximately 0.55% (−0.37%) on the announcement date. This supports the hypothesis that the stock market does not anticipate the decisions of the SC. This certainly suggest that the decisions of the SC are hard to predict, even for the wisdom of sophisticated investors and institutions that operate in the stock market.[9]

Insert Table 4 here

In Fig. 6, we further confirm the market reaction to the SC decision announcement. To create the figure, we split the final decision sample into wins and losses. For each group, we calculate the mean abnormal return for each day in event time. The graphs show the cumulated mean abnormal return for each group over the event window of $[-20, 10]$. In Fig. 6, a positive jump for wins and a negative jump for losses is evident on the day of the decision, and does not appear to reverse. These results further

[9] This result is certainly a comforting finding and speaks for the independence and unbiasedness of the SC.

support our findings that firms experience significant positive (negative) returns on the date of a win (loss) announcement.

Insert Fig. 6 here

Next, we examine different factors that play a role in the market reaction to the certiorari and decision events. In Table 5, we present the mean CAR for groups of stocks partitioned on legal issue and opponent type, separately for firms that are petitioners (Panels A and B) and respondents (Panels C and D). Panel A shows that cases that relate to civil rights (−3.11%) and economic issues (−0.91%) are both significantly negative at the 5% level. With regard to Civil Rights, it appears that most of these cases are related to discrimination. The strong negative reaction, which recurs throughout our study, seems to indicate that the stock market investors disapprove when firms litigate cases related to this issue. Economic issues are the types of cases that likely lead to economically significant losses. As an example, in Mobil Oil Corp. v. Federal Power Commission (417 U.S. 283), the Federal Power Commission set maximum gas prices for certain areas and was ordering Mobil Oil Corp. to refund any excess from sales made at higher rates prior to the establishment of the maximum. Mobil fought this all the way to the SC. In the 5-day window around the certiorari grant date of January 14, 1974, Mobil experienced a cumulative abnormal return of −5.67%.

In terms of opponent type, Panel B indicates that the negative reaction for petitioner-firms appears to stem mostly from the cases in which the government is the counterparty (CAR of −2.70%, statistically significant at the 1% level). When it comes to fighting the government, it seems that the market feels this is an uphill battle, perhaps due to the deep pockets and long lives that most government bodies have.

For the respondents, Panel C shows that respondents in cases related to economic issues and judicial power both have significant negative CARs. When it comes to the opponent type, Panel D shows negative, albeit insignificant, CARs across all categories.

Insert Table 5 here

Table 6 provides a similar analysis for the final decision date, with the added partitioning by media coverage. Panel A shows that the primary drivers of the positive AR for wins comes from cases relating to economic issues (AR of 0.85%). In Panel B, we can see that AR is consistently positive for winning firms regardless of their opponent, although it is statistically significant only for cases in which the government is the counterparty and the Other category. This suggests that a win decision is received in a subtly nuanced fashion by the stock market. Perhaps the markets view a win against the government as truly of consequence. In Panel C, the ARs are all positive, regardless of whether or not the case had press coverage, and while the only statistically significant result is for firms without press coverage, the mean ARs are higher for the cases with press coverage.

On the loss side, Panel D shows that economic issues (−0.52%) and issues relating to judicial power (−0.67%) have significant negative reactions. Split by the opponent type, Panel E indicates that losses against the government result in significantly negative abnormal returns of −0.45%. Here again, we see how there are economically significant negative returns to legal battles with the government, further supporting the idea that the market views them in a very negative light. Lastly, in Panel F we can see that both groups of media coverage are much more negative than the group without coverage, and both are statistically significant at the 10% level.

Insert Table 6 here

2.6.3 Regression Analysis

We now extend our analysis from the univariate to multivariate linear regressions. We split the certiorari granted sample into petitioners and respondents, and the final decision sample into wins and losses. For each group, we test different specifications of Eq. (2.1), with the results reported in Tables 7 to 10. Overall, the regression results support our findings in the univariate tests.

Table 7 displays the results for petitioners on the certiorari granted date. In both columns, the Civil Rights indicator is negative and significant, so it appears that the market takes a negative view of firms that litigate these types of cases. In column 2, the Government indicator is also negative and significant. This further supports our earlier findings that market views a legal battle against a government to be worse than a legal battle against any other party.

Insert Table 7 here

For the respondents, Table 8 shows that once again, the coefficient on Civil Rights is negative, albeit significant only in column 2, supporting our previous findings. Cases under the category of Economic Issue or Judicial Power are also part of the driving force behind the negative CAR in the univariate results, as both coefficients are negative and significant in column 1. Cases involving economic issues would seemingly have more of a financial impact on a firm, so this result is unsurprising. Many cases that fall under the category of judicial power revolve around the validity of a lower court's decision to certify or not certify a class action lawsuit (e.g. Wal-Mart v. Dukes, 564 U.S. 338, 2011 and Microsoft Corp. v. Baker, 2017). Losing such a case would presumably lead to a class action lawsuit, which explains the more negative reaction to these cases. Firm size is positive and significant in both columns, which is indicative of investors' belief of an increased likelihood of winning for larger firms.

Insert Table 8 here

Table 9 has the results for firms that receive a favorable decision. In all columns, the Economic Issue and Judicial Power indicators are positive and significant. As mentioned earlier, economic issues are more likely to have a larger impact on a firm's value, and judicial power issues often involve class action certification. The results indicate that investors are treating these wins more positively than wins in other categories. The dummies for cases in which the counterparty is a firm or an individual both have negative and significant coefficients, so these wins are probably considered less valuable in the eyes of investors, especially given the costs incurred for litigation. In columns 3 and 4, the media dummies load positive and significant, increasing the positive reaction to a win. This supports previous findings in the literature (Bushee et al., 2010; Twedt, 2016) that media enhances the response to firm-related events. Lastly, firm size loads negative but insignificant in all four columns.

Insert Table 9 here

Table 10 reports the results for the firms that lose in the SC. The Judicial Power indicator has negative and significant coefficients in columns 3 and 4. This provides further support for the rationale presented above. The opposing party does not seem to have any effect on the abnormal returns for the losing firms. Mirroring the winning-firm sample, both media indicators are significantly negative, giving further credence to our interpretation above. Firm size is positive and significant in columns 1, 3, and 4, which might indicate that larger firms are considered to be less affected by a loss in the SC.

Insert Table 10 here

2.6.4 Leakage and Drift Tests

In order to rule out the possibility of a leakage of information before the certiorari decision and final decision, we divide the certiorari sample into petitioners and respondents and the final decision sample into winning and losing firms, and calculate the mean CAR for each group in a window from 10 trading days before the event until the day before the event (three days before for the certiorari sample). The t-test results are reported in Table 11 Panel A. None of the CARs are significant, which leads us to conclude that information is not leaking out prior to the event.

Since there is also a possibility that the market prices continue to drift for a period of time after the events, we compute the mean CAR for each group in a window from the day after the event (three days after for certiorari sample) until 10 trading days after the event. The t-test results are reported in Table 11 Panel B, and once again, none of the results is significant. This implies that the market reacts quickly and decisively to the new information that is released by the SC.

Insert Table 11 here

2.6.5 Option Market Reaction

Our option market results are presented in Table 12. In Panel A, we partition the certiorari sample into petitioners and respondents. The mean change in implied volatility (IV) for call options is significantly positive, indicating that the option market, in contrast to the stock market, views the granting of certiorari as a net positive event for the petitioners. For the respondents, the change in IV for call (put) options, along with the IV spread and change in IV spread are all negative (positive) and strongly significant. These results are all consistent with our expectation that the option market takes a negative view of the respondents' need to battle the case anew in the SC.

For Panel B, on the date the certiorari decision is announced, we partition the sample according to the future win or loss. We are looking to ascertain whether or not the option market has the ability to predict, on average, the future outcome of the case. What we find is that firms that ultimately lose have a significant negative (positive) change in IV for call (put) options and negative change in IV spread, indicating that the option market appears to be predicting losses from the day the case is accepted in the SC. For the firms that win, the results are mixed, with a positive change in IV for call options, but a negative change in IV spread, and the other results insignificant.

Lastly, in Panel C we split the final decision sample by wins and losses in order to determine whether the option market is surprised by the final decision or has already predicted the outcome. For the wins, there is a significant positive change in IV for call options, and significant positive IV spread and change in IV spread, which is indicative of wins being a surprise to the option market. This result is consistent with our prior results that the option market seems unable to predict the win on the certiorari date. This consistency is further borne out by the lack of reaction to the losses, since the earlier results showed that losses were predicted on the certiorari date.

Overall, the results are consistent with our hypotheses and demonstrate that the option market seems to be where the smart money is invested.

Insert Table 12 here

2.7 Conclusions

In this paper, we have studied the stock market reactions to events at the SC level where at least one party, the petitioner or the respondent, is a publicly traded firm. The three events of interest are the granting of the writ of certiorari (a very rare event), when the public arguments are held, and finally, the date when the SC announces its decision. It is well known that the financial markets and investors are, in general, very efficient in processing information and also unbiasedly anticipating the economic impact of future economic events. Therefore, if the stock market correctly anticipates the future events of the SC, it should not be surprised and should not react.

However, we find that there is a negative reaction in the stock market for a firm, whether petitioner or respondent, when the writ of certiorari is granted. This suggests that the market has not fully anticipated this event. At first glance, it is a bit counter-intuitive and surprising that the petitioner suffers a negative effect, given that the petition has been given a rare chance to be heard in the SC.[10] We attribute this to the fact that the stock market views litigation as a costly process for any firm, no matter whether it is a petitioner or a respondent (see for example, Govindaraj et al., 2007), with an additional cost to firms litigating in civil rights cases and in cases where the government is the counterparty. The oral argument event evokes no market response. This is consistent with the fact that since the cases are so well known even before they arrive at the SC, the arguments are rarely a surprise. The decision of the SC is truly a positive stock market event for the winner and negative stock market event for the loser. This result is consistent with the expectation that a win has a huge positive reward, and a loss entails future economic losses for the firm. Perhaps more important, is the fact that this suggests that the stock market does not seem to be able to predict the decision of the SC and appears to be surprised by the decision. This finding is of particular interest because it suggests that it is hard for even the stock market, with its collective wisdom of sophisticated investors, to predict the actions of the SC.

In the option market, however, we find evidence that losses are predicted on the date certiorari is granted, since there is a negative reaction on the certiorari date to the firms that lose in the future, and there is no reaction to the loss when the final decision is announced. Our results suggest that the while the SC may be unbiased and independent, a glimpse of the final decision could be seen in option market—a market that is known to invite smart money.

[10]This result is particularly pronounced for cases concerning civil rights issues, or cases where the government is involved.

Appendix A

Variable Definitions

Variable	Definition
AR	Abnormal return on the decision announcement date, calculated as the buy-and-hold return on a stock minus the expected return over the same interval. We calculate the expected return using the Fama-French-Carhart 4-factor model. The Fama-French-Carhart factors are estimated over a 120-day trading window ending 20 days before the event.
CAR	Cumulative abnormal return in the interval $[-2, +2]$, where day 0 is the event date (certiorari or arguments), calculated as the sum of the daily buy-and-hold returns on a stock minus the expected returns over the same interval. We calculate the expected return using the Fama-French-Carhart 4-factor model. The Fama-French-Carhart factors are estimated over a 120-day trading window ending 20 days before the event.
Civil Rights	Dummy variable equal to one if a Supreme Court case dealt with a civil rights issue and zero otherwise. We obtain the issue classification from the 2018 Supreme Court Database (Spaeth et al., 2018). According to the database, Civil Rights includes non-First Amendment freedom cases which pertain to classifications based on race, age, indigency, voting, residency, military or handicapped status, gender, and alienage.
Economic Activity	Dummy variable equal to one if a Supreme Court case dealt with an economic issue and zero otherwise. We obtain the issue classification from the 2018 Supreme Court Database (Spaeth et al., 2018). According to the database, Economic Activity is largely commercial and business related; it includes tort actions and employee actions vis-a-vis employers.

Variable	Definition
Judicial Power	Dummy variable equal to one if a Supreme Court case dealt with a judicial power issue and zero otherwise. We obtain the issue classification from the 2018 Supreme Court Database (Spaeth et al., 2018). According to the database, Judicial Power concerns the exercise of the judiciary's own power.
Federalism	Dummy variable equal to one if a Supreme Court case dealt with an issue related to federalism and zero otherwise. We obtain the issue classification from the 2018 Supreme Court Database (Spaeth et al., 2018). According to the database, Federalism pertains to conflicts and other relationships between the federal government and the states, except for those between the federal and state courts.
Government	Dummy variable equal to one if the opponent in the Supreme Court case was a government body and zero otherwise. We obtain the opponent classification from the 2018 Supreme Court Database (Spaeth et al., 2018).
Firm	Dummy variable equal to one if the opponent in the Supreme Court case was a firm and zero otherwise. We obtain the opponent classification from the 2018 Supreme Court Database (Spaeth et al., 2018).
Individual	Dummy variable equal to one if the opponent in the Supreme Court case was an individual and zero otherwise. We obtain the opponent classification from the 2018 Supreme Court Database (Spaeth et al., 2018).
WSJ	Dummy variable equal to one if the WSJ published an article mentioning the Court's decision and zero otherwise. We obtain this variable from the Epstein dataset (Epstein et al., 2012).
NYT	Dummy variable equal to one if the New York Times published a story about the Court's decision on the front page and zero otherwise. We obtain this variable from the Epstein dataset (Epstein et al., 2012).
MVAL	The natural log of the market value of a firm, calculated as shares outstanding multiplied by the price of a share as of 5 days before the first event.

Variable	Definition
Change in implied volatility	The difference between the implied volatility of an option based on the closing price on the day of the event and the implied volatility of the day before the event, using the implied volatility data from OptionMetrics. We exclude closed contracts and non-standard settlements, and we require the ex-date to be at least 10 days and not more than 60 days into the future. For call options, we require the delta to be between 0.4 and 0.7, and for put options between −0.45 and −0.15.
Volatility spread	The difference between the implied volatility of a matched (on strike price and ex-date) call and put option on the day of the event.
Change in volatility spread	The difference between the volatility spread on the day of the event and the volatility spread the day before the event.

Appendix B

Supreme Court Journal Data Extraction

The SC Journals are available in PDF format. Up until 1993, the Journals are scanned images that were converted to text using optical character recognition (OCR), a process that often introduces errors into the converted text. From 1993 onward, the Journals contain the actual text, so there should be no OCR issues. Using regular expression search, we search each year's journal for entries that state that writ of certiorari was granted. Here is an example of such an entry from the 2017 journal:

> No. **17–2.** United States, Petitioner *v.* Microsoft Corporation. Petition for a writ of certiorari to the United States Court of Appeals for the Second Circuit granted.

and another one from the 1944 journal:

> No. **806.** Alma Motor Company, petitioner, *v.* The Timken-Detroit Axle Company et al. Petition for writ of certiorari to the Circuit Court of Appeals for the Third Circuit granted.

For each entry that we find, we extract the names of the parties and the date. The entries themselves are not dated; instead, the date is printed on each page as a header. Therefore, we extract the date that is at the top of the page. The date can also contain errors and extra spaces from the OCR process. If the OCR incorrectly identifies a digit in the date, any observations from that page would have the wrong date. To mitigate this problem, we verify that the day of the week is a match to the parsed date. Surprisingly, our manual checks confirmed that the journal itself often gets the day of the week wrong, as is evident from the following example of contradictory headers:

(JOURNAL)	THURSDAY, OCTOBER 31, 1990	219
(JOURNAL)	THURSDAY, NOVEMBER 1, 1990	221

If we find multiple consecutive dates with the same incorrect weekday, we consider the weekday to be a journal error and we use the actual date.

Appendix C

United States Circuit Courts of Appeals Analysis

This appendix contains a discussion of the analysis of the stock price reaction to appeals that were decided in one of the United States Circuit Courts of Appeals. We found no significant reaction, so this discussion is relegated to an appendix.

The data comes from the Appeals Data in the Federal Judicial Center's Integrated Database[1] (IDB). This data includes 2,099,026 cases spanning the years 1971–2018 from the 12 Circuit Courts of Appeals, not including the Federal Circuit. For each case, the IDB contains the name of the appellant (the party that filed the appeal) and the appellee, along with the outcome of the case and the date of the judgment. It also includes the circuit court and docket number, which when taken together can uniquely identify a case.

We consider the appellant to have won if the decision of the lower court is reversed or vacated, and we consider the appellee to have won if the lower court's decision is affirmed or the appeal is dismissed. Any cases that are flagged in the database as reopened are dropped, since these might be remanded from the Supreme Court, and are therefore predictable. Some appeals cases have multiple observations in the

[1] This can be accessed at https://www.fjc.gov/research/idb

database, so we identify these cases and keep only one observation per case.

Unfortunately, the party names in IDB are truncated at 20 characters, so there are numerous firms that would not match to CRSP. In order to get the full names of the firms, we downloaded the dockets data from the CourtListener (CL) website.[2] This data contains the circuit court, docket number, and case name. We merge this data with the IDB using the circuit court and docket number. The CL data has just the case name, and does not have data on which party is the appellant and which party is the appellee. Although the case name is supposed to list the appellant first, this was verified to not be the case for a large portion of the cases that we manually checked. To rectify this, for each case, we use the Stata utility `matchit` (Raffo, 2019) to compare each of the party names from the CL data to each of the parties from the IDB data using a bigram vectorial decomposition algorithm (see, for example, Christen, 2006; Pfeifer et al., 1996; Phua et al., 2009), and score the similarity as the number of matched bigrams divided by the number of bigrams in the shorter string. We then keep the pairing with the higher total matching score.

We remove some standard words from the end of the party names (e.g. "et al.") and keep only the actual party name. Using the Stata utility `stdn_compname` (Wasi & Flaaen, 2015), we standardize the firm names in this dataset and in CRSP, and then merge the dataset with CRSP daily returns data using the standardized firm name. We drop any firm with multiple share classes. We retrieve earning announcement dates from Compustat and dividend declaration dates from CRSP, and we drop any observation that is confounded by these events. We require 7 months (140 trading days) of returns data prior to the decision date. Our final sample contains 9,715 cases, of which 6,763 are wins and 2,952 are losses.

In order to study the stock market reaction to the Appeals Courts decisions, we calculate abnormal returns using the Fama-French-Carhart 4-factor model (Carhart, 1997; Fama & French, 1993), using a 6-month (120 trading days) estimation window

[2]https://www.courtlistener.com/

that ends one month (20 trading days) before the decision. Looking at the mean abnormal returns (AR) on the decision date and performing a univariate t-test against a mean of zero, we find no significant positive returns to the winning firm and no significant negative returns to the losing firm. The results remain qualitatively unchanged even if we use different CAR-window specifications. While in some windows the winning firms have a significant positive reaction, the result does not appear to be consistent. We also partitioned the data by court and tested each court's cases separately, but the results remained insignificant.

There are a few possible explanations for the lack of significant results. First, it is possible that, on average, the market does not follow cases in the Appeals Courts since they are generally of less significance than SC cases. Furthermore, the outcome in the Appeals Court can potentially be overturned in the SC.

Second, the IDB appeals database is a conglomeration of over 2 million case-observations reported from 12 different courts over a long period of time, which implies a high probability of data error. By contrast, the SCDB covers only one court, and is carefully maintained by Spaeth et al. (2018).

Tables

Table 1: Supreme Court Decisions Summary by Chief Justice

This table provides a summary of Supreme Court decisions partitioned by Chief Justice. The sample consists of all publicly traded firms in the 2018 Supreme Court Database (Spaeth et al., 2018) during the period 1946–2018. For each Chief Justice term, the number of wins and losses for public firms is reported, with percentages in parentheses.

		Public Firm		
Chief Justice	Term	Wins	Loses	All
Vinson	1946–1953	25 (49%)	26 (51%)	51
Warren	1953–1969	41 (28%)	107 (72%)	148
Burger	1969–1986	80 (46%)	94 (54%)	174
Rehnquist	1986–2005	41 (49%)	42 (51%)	83
Roberts	2005–2018	31 (58%)	22 (42%)	53
Total		218 (43%)	291 (57%)	509

Table 2: Descriptive Statistics for Accepted (via certiorari or direct appeal) Supreme Court Cases

This table provides descriptive statistics for the legal cases that were accepted by the Supreme Court via either the grant of certiorari or the direct appeal process. The sample consists of all publicly traded firms in the 2018 Supreme Court Database (Spaeth et al., 2018) during the period 1946–2018. The data is presented for petitioners and respondents by legal issue (Panel A), opponent type (Panel B), and Chief Justice and industry (Panel C).

Panel A. Supreme Court Cases by Type of Legal Issue

		Public Firm is a		
Jurisdiction	Legal Issue	Petitioner	Respondent	Total
Certiorari	Civil Rights	13	16	29
	Economic Issue	92	102	194
	Judicial Power	39	42	81
	Federalism	13	6	19
	Other	46	34	80
	Subtotal	203	200	403
Appeal	Civil Rights	0	1	1
	Economic Issue	38	25	63
	Judicial Power	4	11	15
	Federalism	5	6	11
	Other	9	5	14
	Subtotal	56	48	104
	Total	259	250	509

Panel B. Supreme Court Cases by Opponent Type

		Public Firm is a		
Jurisdiction	Opponent	Petitioner	Respondent	Total
Certiorari	Government	22	27	49
	Firm	49	38	87
	Individual	84	78	162
	Other	48	57	105
	Subtotal	203	200	403
Appeal	Government	39	32	71
	Firm	8	9	17
	Individual	3	3	6
	Other	6	4	10
	Subtotal	56	48	104
	Total	259	250	509

Panel C. Supreme Court Cases by Chief Justice and Industry				
		Public Firm is a		
Chief Justice	Industry (2-digit SIC)	Petitioner	Respondent	Total
Vinson	Railroads	2	10	12
(1946–1953)	Petroleum Refining	5	3	8
	Electric/Gas Services	2	2	4
	Food Products	1	2	3
	Chemicals	2	1	3
	Other	5	16	21
	Subtotal	17	34	51
Warren	Railroads	9	19	28
(1953–1969)	Petroleum Refining	4	10	14
	Food Products	4	8	12
	Chemicals	4	8	12
	Electric/Gas Services	2	10	12
	Other	34	36	70
	Subtotal	57	91	148
Burger	Electric/Gas Services	16	6	22
(1969–1986)	Petroleum Refining	13	8	21
	Electrical Equipment	7	6	13
	Transport. Equipment	5	8	13
	Chemicals	5	6	11
	Other	55	39	94
	Subtotal	101	73	174
Rehnquist	Transport. Equipment	6	5	11
(1986–2005)	Petroleum Refining	7	2	9
	Machinery/Computers	7	1	8
	Electrical Equipment	4	2	6
	Measuring Goods	2	4	6
	Other	27	16	43
	Subtotal	53	30	83
Roberts	Chemicals	6	4	10
(2005–2018)	Business Services	5	2	7
	Electrical Equipment	2	3	5
	Oil/Gas Extraction	1	2	3
	Machinery/Computers	2	1	3
	Other	15	10	25
	Subtotal	31	22	53
	Total	259	250	509

Table 3: Descriptive Statistics for Supreme Court Decisions

This table provides descriptive statistics for the Supreme Court decisions. The sample consists of all publicly traded firms in the 2018 Supreme Court Database (Spaeth et al., 2018) during the period 1946–2018. The data is presented for wins and losses by legal issue (Panel A), opponent type (Panel B), Chief Justice and industry (Panel C), and press coverage (Panel D).

Panel A. Supreme Court Decisions by Type of Legal Issue

		Public Firm		
Public Firm	Legal Issue	Wins	Loses	Total
Petitioner	Civil Rights	9	4	13
	Economic Issue	76	54	130
	Judicial Power	30	13	43
	Federalism	6	12	18
	Other	24	31	55
	Subtotal	145	114	259
Respondent	Civil Rights	3	14	17
	Economic Issue	37	92	129
	Judicial Power	18	35	53
	Federalism	4	8	12
	Other	11	28	39
	Subtotal	73	177	250
	Total	218	291	509

Panel B. Supreme Court Decisions by Opponent Type

		Public Firm		
Public Firm	Opponent	Wins	Loses	Total
Petitioner	Government	28	33	61
	Firm	36	21	57
	Individual	56	31	87
	Other	25	29	54
	Subtotal	145	114	259
Respondent	Government	14	46	60
	Firm	15	32	47
	Individual	31	51	82
	Other	13	48	61
	Subtotal	73	177	250
	Total	218	291	509

Panel C. Supreme Court Decisions by Chief Justice and Industry				
		Public Firm		
Chief Justice	Industry (2-digit SIC)	Wins	Loses	Total
Vinson	Railroads	6	6	12
(1946–1953)	Petroleum Refining	4	4	8
	Electric/Gas Services	1	3	4
	Food Products	0	3	3
	Chemicals	2	1	3
	Other	12	9	21
	Subtotal	25	26	51
Warren	Railroads	8	20	28
(1953–1969)	Petroleum Refining	1	13	14
	Food Products	4	8	12
	Chemicals	1	11	12
	Electric/Gas Services	3	9	12
	Other	24	46	70
	Subtotal	41	107	148
Burger	Electric/Gas Services	10	12	22
(1969–1986)	Petroleum Refining	8	13	21
	Electrical Equipment	5	8	13
	Transport. Equipment	6	7	13
	Chemicals	4	7	11
	Other	47	47	94
	Subtotal	80	94	174
Rehnquist	Transport. Equipment	4	7	11
(1986–2005)	Petroleum Refining	3	6	9
	Machinery/Computers	4	4	8
	Electrical Equipment	4	2	6
	Measuring Goods	2	4	6
	Other	24	19	43
	Subtotal	41	42	83
Roberts	Chemicals	3	7	10
(2005–2018)	Business Services	4	3	7
	Electrical Equipment	2	3	5
	Oil/Gas Extraction	1	2	3
	Machinery/Computers	2	1	3
	Other	19	6	25
	Subtotal	31	22	53
	Total	218	291	509

Panel D. Press Coverage of Supreme Court Decisions involving a Public Firm				
		Public Firm		
Public Firm	Press Coverage	Wins	Loses	Total
Petitioner	WSJ Coverage	10	9	19
	NYT Coverage	15	14	29
	None	100	85	185
Respondent	WSJ Coverage	7	21	28
	NYT Coverage	5	18	23
	None	54	119	173

Table 4: Cumulative Abnormal Returns for Supreme Court Cases

This table reports cumulative abnormal stock returns around the three dates: the date the Supreme Court announces its decision to grant certiorari (Panel A, 5-day window), the date when a case is argued in the Supreme Court (Panel B, 5-day window), and the date when the Supreme Court announces its decision (Panel C, 1-day window). Our sample consists of all publicly traded firms in the 2018 Supreme Court Database (Spaeth et al., 2018) during the period 1946–2018. Individual variable definitions are outlined in Appendix A. Significance level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Panel A. Certiorari Granted Date		
	Petitioners	Respondents
Mean $CAR_{[-2,2]}$	−0.686**	−0.739**
t-statistic	−2.382	−2.081
Median $CAR_{[-2,2]}$	−0.542	−0.357
Wilcoxon Signed-Rank p-value	0.004	0.128
Number Positive/Negative	69/106	77/94
Observations	175	171
Panel B. Supreme Court Argument Date		
	Wins	Losses
Mean $CAR_{[-2,2]}$	0.205	−0.181
t-statistic	0.613	−0.751
Median $CAR_{[-2,2]}$	−0.265	−0.267
Wilcoxon Signed-Rank p-value	0.509	0.182
Number Positive/Negative	90/103	123/138
Observations	193	261
Panel C. Supreme Court Decision Announcement Date		
	Wins	Losses
Mean AR_0	0.554***	−0.370**
t-statistic	2.892	−2.104
Median AR_0	0.157	−0.129
Wilcoxon Signed-Rank p-value	0.010	0.020
Number Positive/Negative	129/89	131/160
Observations	218	291

Table 5: Cumulative Abnormal Returns t-tests for Certiorari Date by Subsample

This table reports the cumulative abnormal stock returns in the 5-day window around the certiorari announcement date for petitioners (Panels A and B) and respondents (Panels C and D). We examine CAR by legal issue (Panels A and C) and by opposing party (Panels B and D). Our sample consists of all publicly traded firms in the 2018 Supreme Court Database (Spaeth et al., 2018) during the period 1946–2018. Individual variable definitions are outlined in Appendix A. Significance level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Panel A. Abnormal Returns on Certiorari Date for Petitioners by Legal Issue

Legal Issue	$CAR_{[-2,2]}$ (%)	t-statistic	Wilcoxon Signed-Rank p-value	Observations
Civil Rights	-3.112^{**}	−2.332	0.034	12
Economic Issue	-0.908^{**}	−2.556	0.009	78
Judicial Power	−0.078	−0.131	0.813	30
Federalism	−1.101	−1.403	0.158	12
Other	0.084	0.111	0.923	43

Panel B. Abnormal Returns on Certiorari Date for Petitioners by Opponent Type

Opponent	$CAR_{[-2,2]}$ (%)	t-statistic	Wilcoxon Signed-Rank p-value	Observations
Government	-2.703^{***}	−3.841	0.000	22
Firm	−0.639	−1.444	0.105	39
Individual	−0.514	−1.061	0.133	72
Other	0.030	0.047	0.915	42

Panel C. Abnormal Returns on Certiorari Date for Respondents by Legal Issue				
Legal Issue	$CAR_{[-2,2]}$ (%)	t-statistic	Wilcoxon Signed-Rank p-value	Observations
Civil Rights	−2.784	−1.664	0.124	14
Economic Issue	−0.895*	−1.740	0.144	86
Judicial Power	−1.154**	−2.220	0.023	37
Federalism	−1.810	−0.768	0.593	3
Other	1.218	1.469	0.020	31

Panel D. Abnormal Returns on Certiorari Date for Respondents by Opponent Type				
Opponent	$CAR_{[-2,2]}$ (%)	t-statistic	Wilcoxon Signed-Rank p-value	Observations
Government	−0.532	−0.777	0.455	21
Firm	−0.719	−1.186	0.346	36
Individual	−0.687	−1.123	0.260	66
Other	−0.915	−1.163	0.926	48

Table 6: Abnormal Returns t-tests for Decision Date by Subsample

This table reports the 1-day abnormal stock returns on the decision announcement date for wins (Panels A–C) and losses (Panels D–F). We examine AR by legal issue (Panels A and D), by opposing party (Panels B and E), and by presence/absence of press coverage (Panels C and F). Our sample consists of all publicly traded firms in the 2018 Supreme Court Database (Spaeth et al., 2018) during the period 1946–2018. Individual variable definitions are outlined in Appendix A. Significance level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Panel A. Abnormal Returns for Supreme Court Wins by Legal Issue

Legal Issue	AR_0 (%)	t-statistic	Wilcoxon Signed-Rank p-value	Observations
Civil Rights	−0.802	−1.052	0.209	12
Economic Issue	0.848***	2.655	0.032	113
Judicial Power	0.346	1.257	0.230	48
Federalism	0.348	1.086	0.241	10
Other	0.414	1.154	0.196	35

Panel B. Abnormal Returns for Supreme Court Wins by Opponent Type

Opponent	AR_0 (%)	t-statistic	Wilcoxon Signed-Rank p-value	Observations
Government	0.639*	1.917	0.129	42
Firm	0.240	0.698	0.448	51
Individual	0.240	1.172	0.290	87
Other	1.599**	2.031	0.045	38

Panel C. Abnormal Returns for Supreme Court Wins by Press Coverage

Press Coverage	AR_0 (%)	t-statistic	Wilcoxon Signed-Rank p-value	Observations
WSJ Coverage	0.765	1.298	0.356	17
NYT Coverage	0.830	1.401	0.263	20
None	0.501**	2.022	0.080	154

Panel D. Abnormal Returns for Supreme Court Losses by Legal Issue				
Legal Issue	AR_0 (%)	t-statistic	Wilcoxon Signed-Rank p-value	Observations
Civil Rights	−0.132	−0.359	0.112	18
Economic Issue	−0.523*	−1.826	0.425	146
Judicial Power	−0.667**	−2.131	0.063	48
Federalism	0.231	0.566	1.000	20
Other	−0.029	−0.073	0.177	59

Panel E. Abnormal Returns for Supreme Court Losses by Opponent Type				
Opponent	AR_0 (%)	t-statistic	Wilcoxon Signed-Rank p-value	Observations
Government	−0.454*	−1.821	0.041	79
Firm	−0.636	−1.293	0.815	53
Individual	−0.227	−1.157	0.009	82
Other	−0.255	−0.539	0.845	77

Panel F. Abnormal Returns for Supreme Court Losses by Press Coverage				
Press Coverage	AR_0 (%)	t-statistic	Wilcoxon Signed-Rank p-value	Observations
WSJ Coverage	−1.239*	−2.043	0.159	30
NYT Coverage	−1.113*	−1.928	0.145	32
None	−0.217	−0.994	0.208	204

Table 7: Regression Results for Petitioner-Firm Regressions

The table reports the results from regressions of the 5-day CAR for petitioner firms around the certiorari date on the type of legal issue (column 1) and the type of opponent (column 2). Our sample consists of all publicly traded firms in the 2018 Supreme Court Database (Spaeth et al., 2018) during the period 1946–2018. Individual variable definitions are outlined in Appendix A. For simplicity, industry and chief justice dummies are included in the regression, but not reported in the table. Industry fixed effect is at 2-digit code SIC classification. t-statistics are reported in parentheses. Significance level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

	Dependent Variable: Petitioner CAR$_{[-2,2]}$ When Certiorari Is Granted	
Independent Variable	(1)	(2)
Dummy for Legal Issue		
Civil Rights	-4.259^{***}	-4.936^{***}
	(−3.12)	(−3.45)
Economic Issue	0.344	−0.001
	(0.42)	(−0.00)
Judicial Power	1.481	1.057
	(1.49)	(0.98)
Federalism	1.412	0.832
	(0.91)	(0.52)
Dummy for Opponent		
Government		-2.544^{**}
		(−2.35)
Firm		−0.169
		(−0.16)
Individual		0.250
		(0.26)
MVAL	0.313^{*}	0.371^{*}
	(1.68)	(1.90)
FE: Industry	Yes	Yes
FE: Chief Justice	Yes	Yes
Number of Observations	161	156
Adjusted R^2	0.166	0.212

Table 8: Regression Results for Respondent-Firm Regressions

The table reports the results from regressions of the 5-day CAR for respondent firms around the certiorari date on the type of legal issue (column 1) and the type of opponent (column 2). Our sample consists of all publicly traded firms in the 2018 Supreme Court Database (Spaeth et al., 2018) during the period 1946–2018. Individual variable definitions are outlined in Appendix A. For simplicity, industry and chief justice dummies are included in the regression, but not reported in the table. Industry fixed effect is at 2-digit code SIC classification. *t*-statistics are reported in parentheses. Significance level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

	Dependent Variable: Respondent CAR$_{[-2,2]}$ When Certiorari Is Granted	
Independent Variable	(1)	(2)
Dummy for Legal Issue		
Civil Rights	−2.887	−3.398**
	(−1.64)	(−2.15)
Economic Issue	−2.661**	−1.679
	(−2.18)	(−1.46)
Judicial Power	−2.606*	−1.959
	(−1.89)	(−1.52)
Federalism	−2.933	−2.749
	(−0.98)	(−1.01)
Dummy for Opponent		
Government		1.001
		(0.80)
Firm		−0.269
		(−0.25)
Individual		1.289
		(1.26)
MVAL	0.751***	0.503**
	(3.27)	(2.37)
FE: Industry	Yes	Yes
FE: Chief Justice	Yes	Yes
Number of Observations	167	162
Adjusted R^2	0.104	0.110

Table 9: Regression Results for Winning-Firm Regressions

The table reports the results from regressions of the 1-day AR for the winning firms around the Supreme Court announcement date on the type of legal issue (column 1), the type of opponent (column 2), and press coverage dummies (columns 3 and 4). Our sample consists of all publicly traded firms in the 2018 Supreme Court Database (Spaeth et al., 2018) during the period 1946–2018. Individual variable definitions are outlined in Appendix A. For simplicity, industry and chief justice dummies are included in the regression, but not reported in the table. Industry fixed effect is at 2-digit code SIC classification. t-statistics are reported in parentheses. Significance level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

	Dependent Variable: Winning-Firm AR_0 When Case Decision Is Announced			
Independent Variable	(1)	(2)	(3)	(4)
Dummy for Legal Issue				
Civil Rights	−0.648	−0.969	−0.724	−0.793
	(−0.55)	(−0.97)	(−0.66)	(−0.73)
Economic Issue	2.434***	1.752***	2.114***	2.082***
	(3.45)	(2.80)	(2.94)	(2.96)
Judicial Power	1.810**	1.223*	1.527*	1.655**
	(2.28)	(1.80)	(1.94)	(2.14)
Federalism	1.814	0.975	1.349	1.319
	(1.56)	(1.03)	(1.26)	(1.25)
Dummy for Opponent				
Government		−0.782	−0.749	−0.603
		(−1.20)	(−1.10)	(−0.91)
Firm		−1.583**	−1.622**	−1.654**
		(−2.48)	(−2.39)	(−2.49)
Individual		−1.073*	−1.141*	−1.380**
		(−1.77)	(−1.77)	(−2.19)
Dummy for Media				
WSJ			1.298*	
			(1.78)	
NYT				1.875**
				(2.52)
MVAL	−0.194	−0.143	−0.112	−0.085
	(−1.54)	(−1.39)	(−0.95)	(−0.74)
FE: Industry	Yes	Yes	Yes	Yes
FE: Chief Justice	Yes	Yes	Yes	Yes
Number of Observations	206	195	167	170
Adjusted R^2	0.066	0.010	0.005	0.022

Table 10: Regression Results for Losing-Firm Regressions

The table reports the results from regressions of the 1-day AR for the losing firms around the Supreme Court announcement date on the type of legal issue (column 1), the type of opponent (column 2), and press coverage dummies (columns 3 and 4). Our sample consists of all publicly traded firms in the 2018 Supreme Court Database (Spaeth et al., 2018) during the period 1946–2018. Individual variable definitions are outlined in Appendix A. For simplicity, industry and chief justice dummies are included in the regression, but not reported in the table. Industry fixed effect is at 2-digit code SIC classification. t-statistics are reported in parentheses. Significance level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

	Dependent Variable: Losing-Firm AR_0 When Case Decision Is Announced			
Independent Variable	(1)	(2)	(3)	(4)
Dummy for Legal Issue				
Civil Rights	−0.053	−0.267	−0.117	−0.107
	(−0.06)	(−0.37)	(−0.15)	(−0.14)
Economic Issue	−0.715	−0.397	−0.586	−0.646
	(−1.43)	(−0.92)	(−1.28)	(−1.43)
Judicial Power	−0.911	−0.663	−1.015*	−1.046*
	(−1.52)	(−1.25)	(−1.73)	(−1.82)
Federalism	0.332	0.683	0.645	0.698
	(0.38)	(0.91)	(0.82)	(0.90)
Dummy for Opponent				
Government		−0.554	−0.576	−0.570
		(−1.28)	(−1.24)	(−1.25)
Firm		−0.200	−0.172	−0.320
		(−0.40)	(−0.31)	(−0.59)
Individual		−0.510	−0.499	−0.548
		(−1.12)	(−1.00)	(−1.11)
Dummy for Media				
WSJ			−1.313**	
			(−2.32)	
NYT				−1.379***
				(−2.79)
MVAL	0.282***	0.118	0.208*	0.202*
	(2.65)	(1.27)	(1.95)	(1.94)
FE: Industry	Yes	Yes	Yes	Yes
FE: Chief Justice	Yes	Yes	Yes	Yes
Number of Observations	282	274	242	245
Adjusted R^2	0.170	0.247	0.260	0.270

Table 11: Leakage and Drift Tests

This table reports the results of tests for information leakage before our dates of interest (Panel A) and tests for drift after our dates of interest (Panel B). Our sample consists of all publicly traded firms in the 2018 Supreme Court Database (Spaeth et al., 2018) during the period 1946–2018. Significance level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Panel A. Leakage Tests				
Group	Window	Mean CAR	p-value	Observations
Certiorari				
Petitioners	[-10,-3]	0.747	0.108	153
Respondents	[-10,-3]	−0.363	0.344	157
Decision				
Wins	[-10,-1]	−0.123	0.784	182
Losses	[-10,-1]	−0.093	0.771	262
Panel B. Drift Tests				
Group	Window	Mean CAR	p-value	Observations
Certiorari				
Petitioners	[3,10]	0.111	0.746	139
Respondents	[3,10]	0.177	0.679	146
Decision				
Wins	[1,10]	−0.009	0.983	186
Losses	[1,10]	−0.448	0.174	250

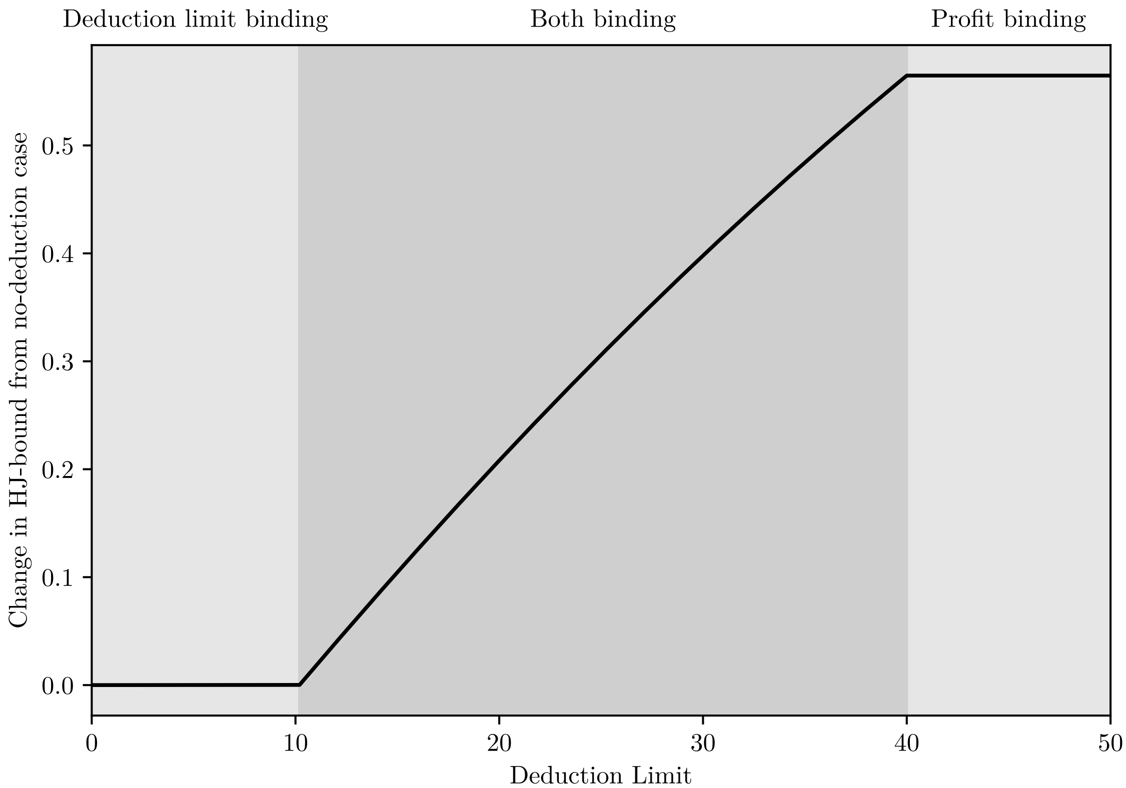
Table 12: Options Implied Volatility Analysis

This table reports the mean change in implied volatility for both call and put options, as well as the mean implied volatility spread (difference between matched call and put options) and change in implied volatility spread, on the day certiorari is announced and the day the final decision is announced for firms involved in Supreme Court cases. The certiorari date results are partitioned by petitioner and respondent (Panel A), and also by the future wins and losses (Panel B). The final decision date results are partitioned by wins and losses (Panel C). Our sample consists of all publicly traded firms in the 2018 Supreme Court Database (Spaeth et al., 2018) during the period 1946–2018 that matched to OptionMetrics. Individual variable definitions are outlined in Appendix A. t-statistics are reported in parentheses, with the number of observations underneath. Significance level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Panel A. Certiorari Decision Split by Petitioners and Respondents				
	Change in Implied Volatility		Volatility Spread	Change in
	Call Options	Put Options		Volatility Spread
Petitioners	0.008*	−0.002	0.010	−0.007
	(1.88)	(−1.26)	(1.65)	(−1.53)
	138	194	70	48
Respondents	−0.004***	0.004***	−0.003**	−0.005***
	(−3.41)	(5.48)	(−2.54)	(−3.14)
	167	238	74	59
Panel B. Certiorari Decision Split by Wins and Losses				
	Change in Implied Volatility		Volatility Spread	Change in
	Call Options	Put Options		Volatility Spread
Wins	0.007**	0.000	0.006	−0.008**
	(1.98)	(0.03)	(1.13)	(−2.06)
	158	222	78	60
Losses	−0.005***	0.002**	−0.000	−0.004*
	(−3.79)	(2.01)	(−0.32)	(−1.93)
	147	210	66	47
Panel C. Final Decision Split by Wins and Losses				
	Change in Implied Volatility		Volatility Spread	Change in
	Call Options	Put Options		Volatility Spread
Wins	0.007***	0.001	0.005***	0.008*
	(5.34)	(1.05)	(3.37)	(1.97)
	152	223	69	42
Losses	−0.006	−0.005	−0.000	0.001
	(−1.64)	(−1.64)	(−0.08)	(0.23)
	111	143	51	26

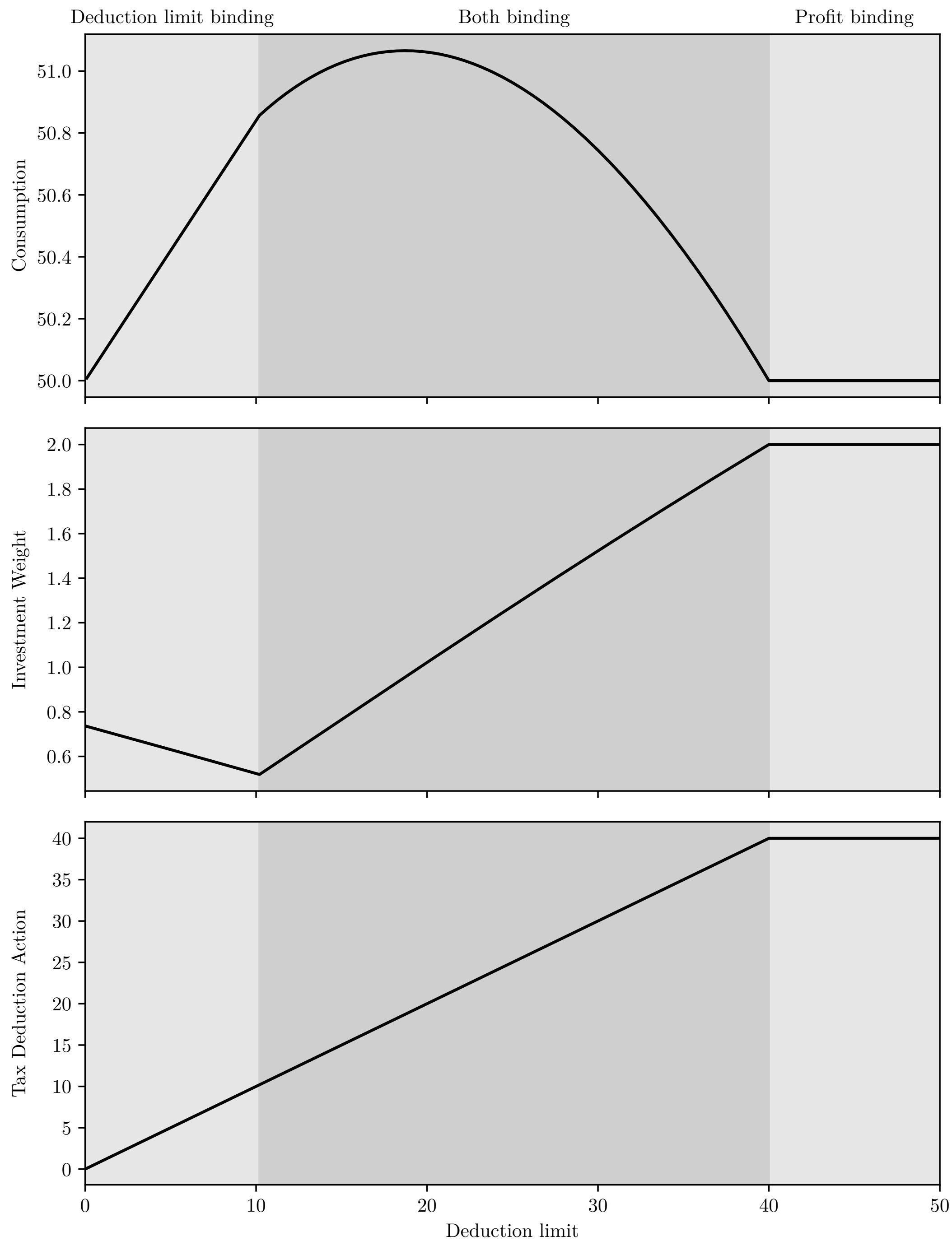
Figures

Figure 1: The effect of tax deductions on the Hansen-Jagannathan bound



$$W_0 \text{ (initial wealth)} = 100$$
$$r^l_{i,1} \text{ (return in the low state)} = -0.1$$
$$r_f \text{ (risk-free rate)} = 0.05$$
$$r^h_{i,1} \text{ (return in the high state)} = 0.4$$
$$p \text{ (probability of the high state)} = 0.5$$
$$\tau \text{ (tax rate on risky-asset return)} = 0.4$$

Figure 2: Optimal solutions



W_0 (initial wealth) $= 100$

$r_{i,1}^{l}$ (return in the low state) $= -0.1$

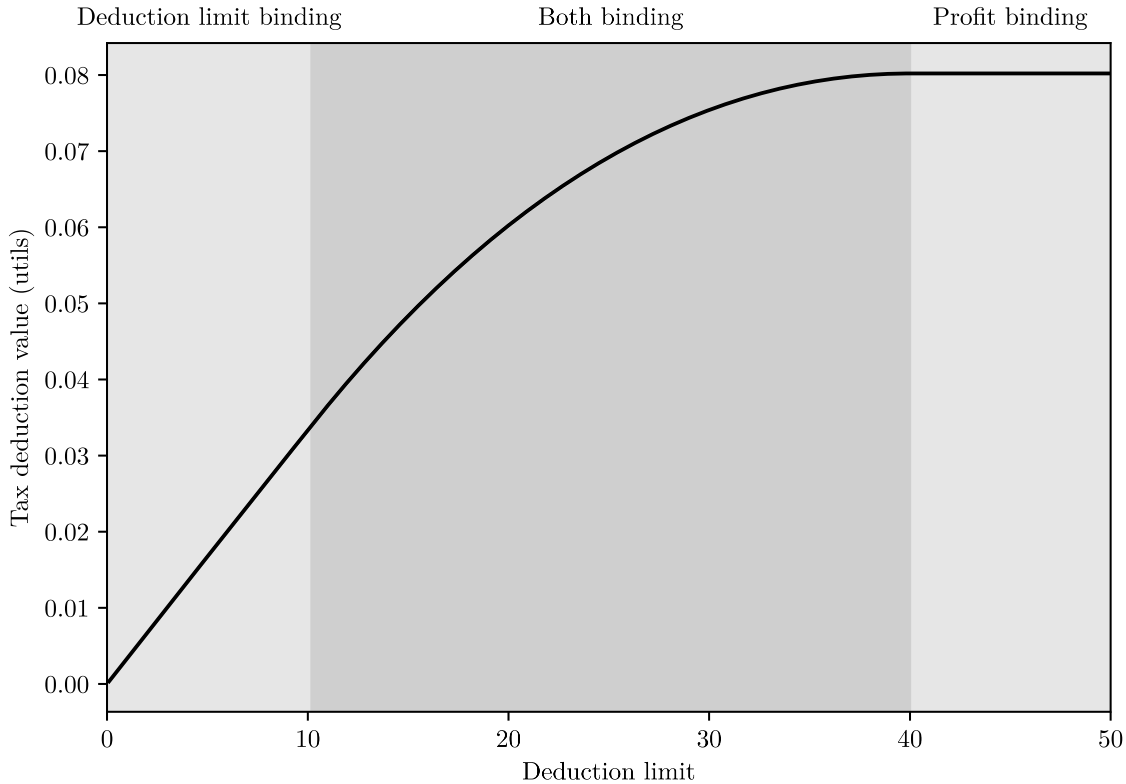
r_f (risk-free rate) $= 0.05$

$r_{i,1}^{h}$ (return in the high state) $= 0.4$

p (probability of the high state) $= 0.5$

τ (tax rate on risky-asset return) $= 0.4$

Figure 3: Tax deduction values



$$W_0 \text{ (initial wealth)} = 100$$
$$r_{i,1}^l \text{ (return in the low state)} = -0.1$$
$$r_f \text{ (risk-free rate)} = 0.05$$
$$r_{i,1}^h \text{ (return in the high state)} = 0.4$$
$$p \text{ (probability of the high state)} = 0.5$$
$$\tau \text{ (tax rate on risky-asset return)} = 0.4$$

Figure 4: Observation frequency by year for case decisions

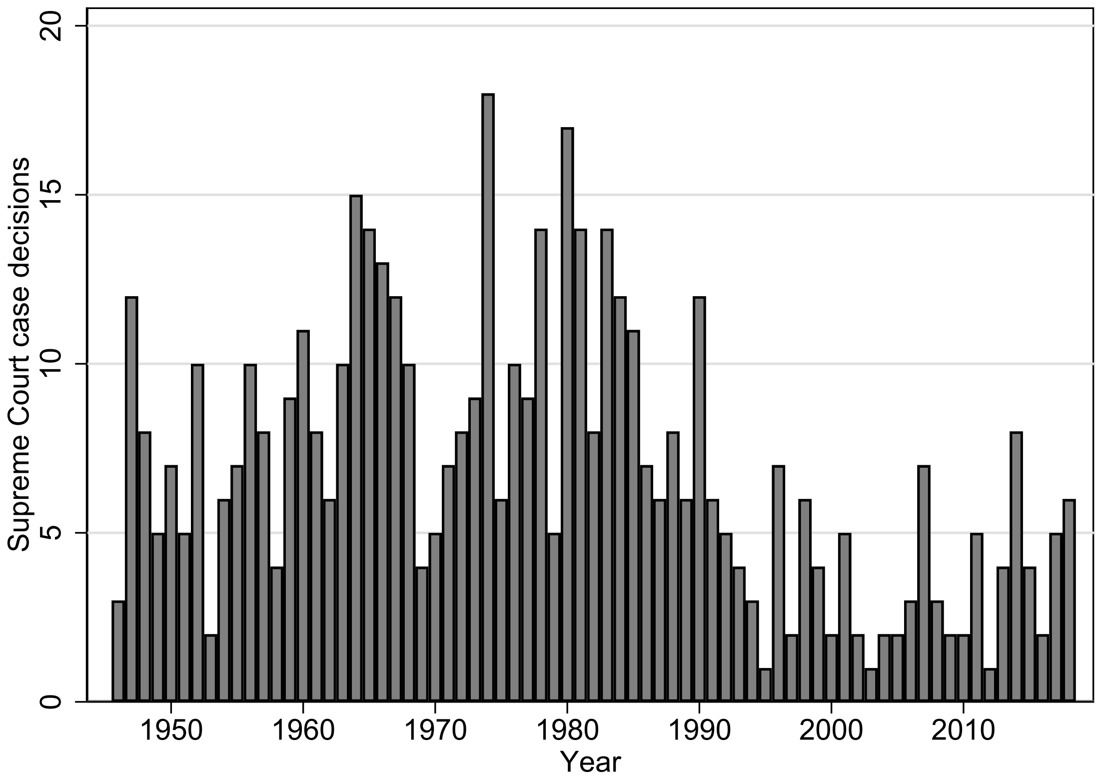


Figure 5: Observation frequency by year and industry

This figure shows the distribution of Supreme Court case decisions by industry, for the 15 most frequent industries. Each dot represents a year with a case decision in that particular industry. The larger the dot, the more case decisions there were in that particular year.

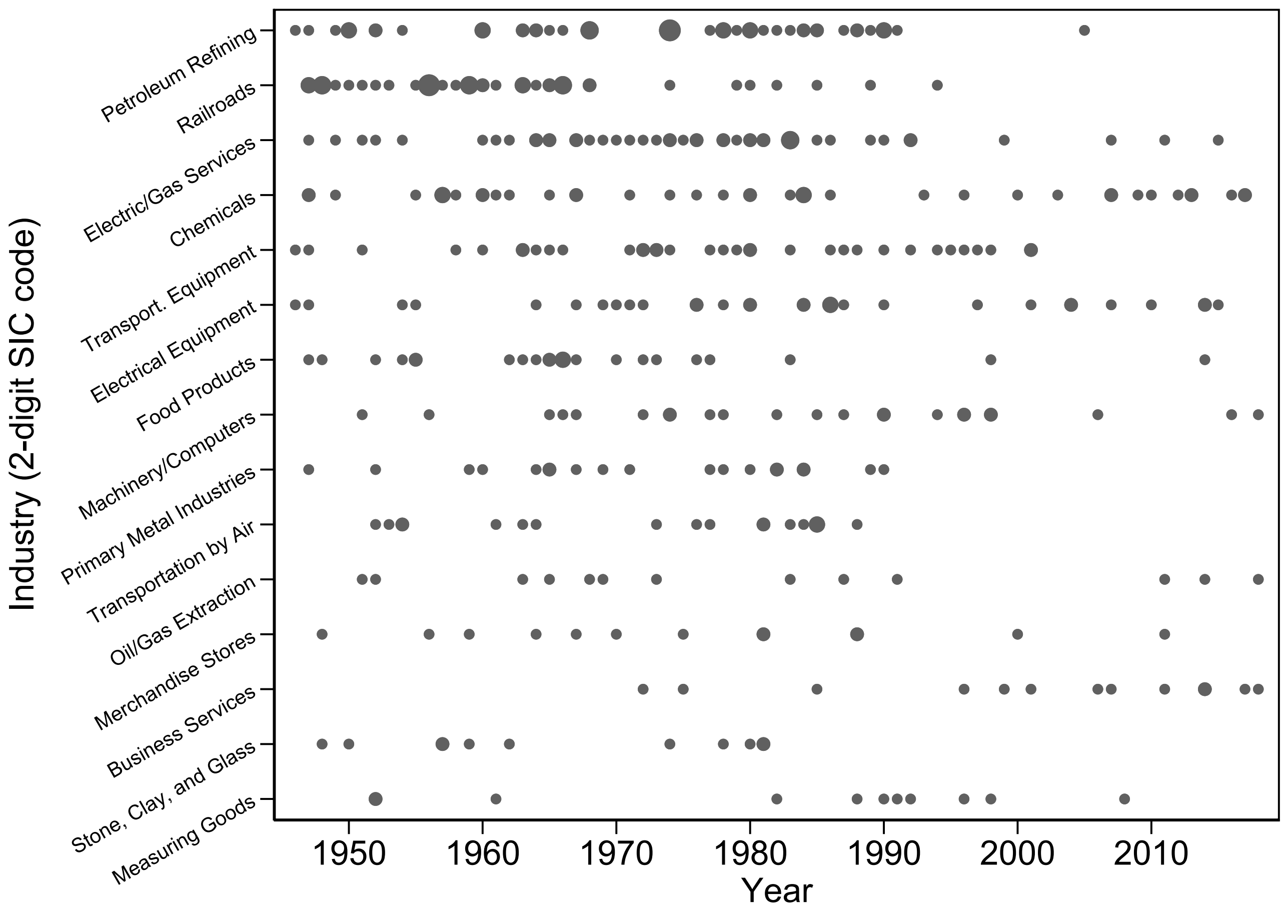
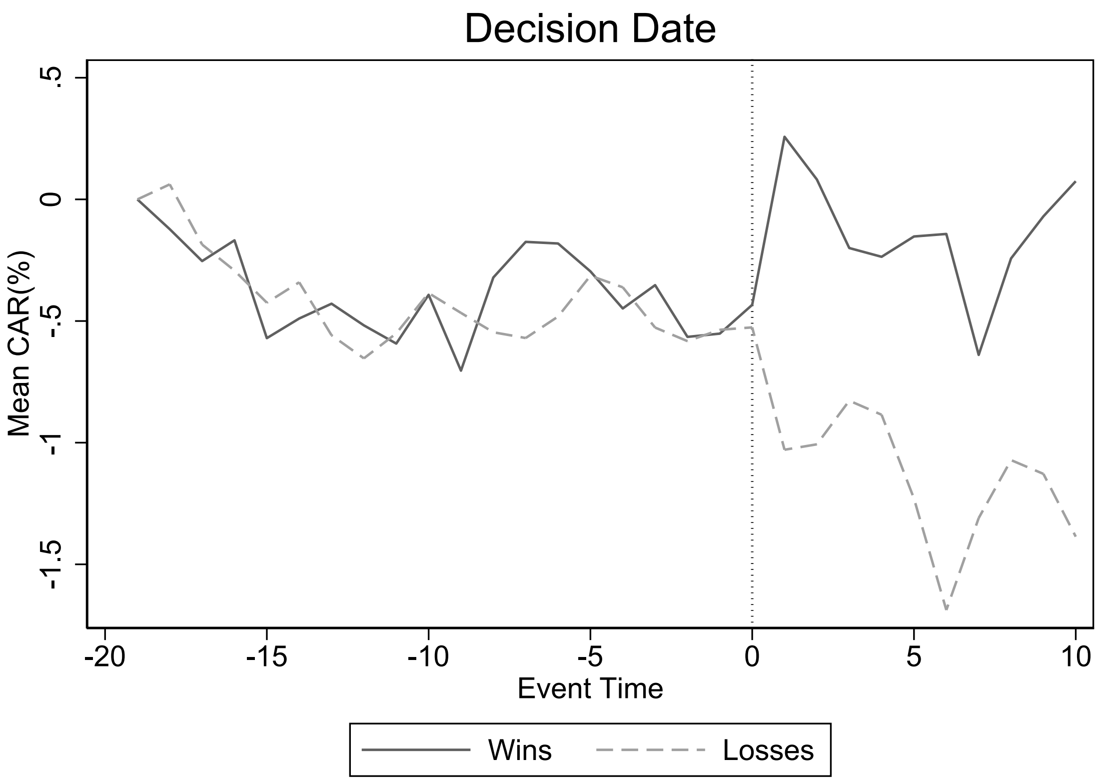


Figure 6: Graph of CAR centered on the case decision announcement date split by wins and losses



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