Options in Securities Fraud Litigation

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Application of Damages Methodology and Theory of Harm Under Rule 10B-5

I. Executive Summary

Measuring the damages caused by a violation of the federal securities laws is a crucial question at multiple stages of the federal securities class action. Our paper analyzes the distinctive issues faced where properly considering the damages suffered by investors in options contracts, in addition to those suffered by investors in traditional securities. Understanding these distinctions is important because options contracts do not fit neatly into the controlling framework for calculating investor losses established in the Supreme Court's *Dura Pharms., Inc. v. Broudo* decision, with its assumption of a traditional stockholder class.[1]

The "*Dura* method" looks only at the end of a class period, or the point at which a securities defendant's culpable misstatement or omission is corrected. The method disregards the possibility that investors may suffer damages earlier as a result of the defendant's wrongdoing, including through intra-period "in-and-out" transactions.[2]

Recent cases show options traders' special disadvantage under the *Dura* method. In *Co-Diagnostics*, the district court only considered damages to options investors whose contracts straddled the date of the corrective disclosure. Options investors who held intra-period contracts and lost money were not considered.[3] In *Vrakas*, the district court blurred the distinction between options and other equities at the class certification stage by accepting plaintiff's "out-of-pocket" methodology for calculating damages, based on the stock price's reaction to the corrective disclosure. This approach did not consider confounding disclosures or time-varying price inflation faced by options traders.[4]

These analytical idiosyncrasies are coupled with conceptual questions about the causal link between firm conduct and damages to option holders. For example, purchasers of "put" options (discussed below) profit when stock prices fall, rather than when

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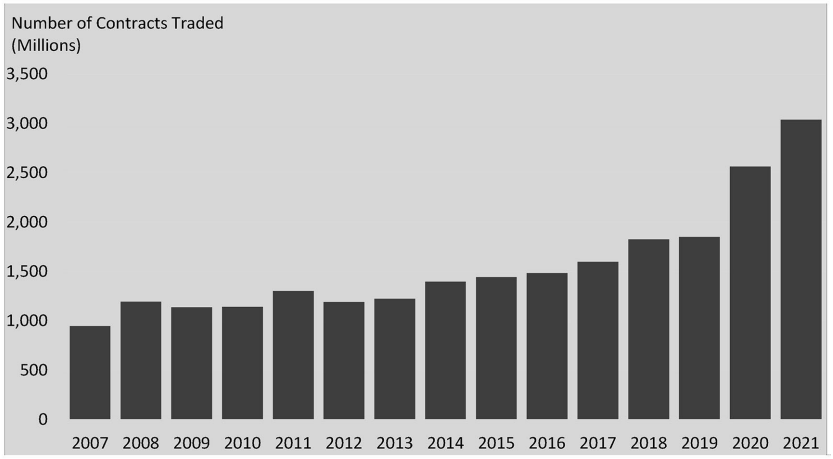
they increase. Investors routinely use options trades to hedge their risk exposure, which in the context of securities litigation may have the effect of an investor's losses in equity investments being offset by their gains from options.[5] Layered on top of these issues is a long running debate over whether options traders may be said to rely on the efficiency of the equity market or to claim reliance on at-issue statements or omissions.[6]

Recognizing some of these issues, there is no consensus between courts as to whether options traders may satisfy the Rule 23's typicality requirement and represent an all-investor class, or whether the factual issues concerning option contracts' strike price, holding duration, maturity, and relationship to volatility and interest rates outweigh the option holders' and traditional security holders' common interest in remedying losses.[7] Despite some courts' hesitancy to appoint options holders as lead plaintiffs, subclasses for options investors are rare, and most common only where particularly strong, and case specific, legal arguments distinguish options holders from other class members.[8]

Recently, in *Apple Securities Litigation*, the judge denied class certification for optionholders on the basis that a common damages methodology had not been established.[9] This article discusses the theory of harm and inflationary damages calculation commonly applied in rule 10b-5 litigation. We show that this theory can be reliably and consistently applied to classes of holders of publicly traded options.[10]

Further underscoring the timeliness of investigating the treatment of optionholders in securities litigation, such as the recent high-profile securities litigation involving Elon Musk's "take-private" tweet, which went to trial in early 2023.[11] In that case, questions arose regarding the typicality of option investors to serve as lead plaintiffs,[12] although the question of damages to optionholders was ultimately obviated by the jury's finding that Musk did not commit securities fraud. The treatment of optionholders will likely persist as a question to be faced in future securities litigation due to increased prevalence of options trading. Figure 1 below shows the total volume of options traded on CBOE exchanges between 2007 and 2021. The figure shows a general increase in option trading, with a notable increase in volumes coinciding with the onset of the COVID-19 pandemic in 2020. The spike in options trading volume has been attributed to retail investors trading via Robinhood and other brokerage apps.[13] The increase in retail trading is especially relevant to class-action securities litigation; while institutional investors can bring their own actions, smaller and less sophisticated investors can realistically only achieve recovery by participating in class actions.

FIGURE 1: TOTAL VOLUME OF OPTIONS TRADED ON CBOE EXCHANGES: 2007 TO 2021



Source: CBOE, available at https://www.cboe.com/us/options/market_statistics/historical_data/

If Plaintiffs' counsel in securities class actions are working with the goal of maximizing recovery for the class, then inclusion of option holders is an important consideration to avoid "leaving money on the table." However, optionholders have received relatively little attention in analyses of securities class actions. For example, the Stanford Securities Class Action Clearinghouse,[14] a repository of information on securities class action filings, does not even track the inclusion of optionholders.

Our article adds to the conversation about optionholders in securities class actions, the theory of harm to optionholders, and approaches to calculate damages. In Section II, we describe the fundamentals of option contracts and options valuation. In Section III, we discuss the but-for world and damages as applied to option contracts. We describe how the standard Dura framework does not necessarily apply to options. We show that optionholders may suffer damages from artificial inflation without holding a position through an alleged corrective disclosure event; nonetheless, a standard damages framework can be applied classwide to estimate aggregate damages.

II. Introduction to Options and Factors Affecting Option Value

An option is a contract made between two investors, in which the option holder has the right (but not the obligation) to buy or sell a share of stock at a pre-agreed-upon price, on a specific future expiration date.[15] For the right to enter into this contract, the option buyer pays the option seller a fee (called the "***premium***" or sometimes just the option "price").

Option contracts have two basic forms:

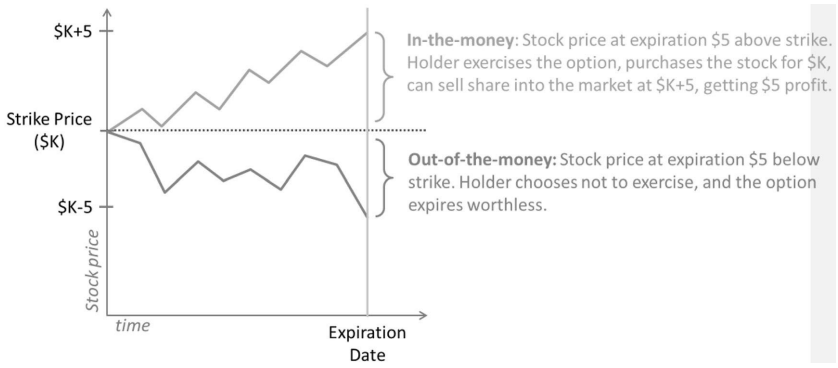
- **Call options**, which give the option holder the right, but not the obligation, to **purchase** a share of stock at an agreed-upon price (called the "***strike***" price) on the expiration date.
- **Put options**, which give the option holder the right, but not the obligation, to **sell** a share of stock at the strike price on the expiration date.

At expiration, if the option holder chooses to go through with the purchase or sale of stock, this is referred to as "exercising their option." Figure 2 below illustrates the decision-making process at expiration for the holder of a call option.[16] The diagram plots the stock's price over time, with a dotted horizontal line indicating the strike price of the option (denoted $K). The figure contains two alternate scenarios: a green line illustrating a case where the stock price increases above the strike price (when the option is referred to as "in the money"), and a red line illustrating a case where the stock price decreases below the strike price

(when the option is referred to as "out of the money").

- In the **in-the-money** scenario, the call option holder chooses to exercise. They buy a share of stock from the option seller at $K. They have bought the share at $5 less than it is worth, a discount. To realize this cash profit immediately, they can sell their share into the market at $K+5, resulting in a **profit of $5** (minus the premium they originally paid to purchase the option).
- In the **out-of-the-money** scenario, the call option holder chooses not to exercise; even if they wanted a share of stock, they would be over-paying by $5 if they purchased it for the strike price $K. In this case, the option expires worthless and the holder has **profit of $0** (minus the premium they originally paid).

FIGURE 2: CALL OPTION HOLDER'S DECISION WHETHER TO EXERCISE



A call option is similar to an insurance contract. As an analogy, when a homeowner buys insurance, they pay an upfront premium, but the insurance only pays out in certain scenarios (such as a house fire). Just like an insurance company, the option seller will only agree to enter into a risky situation if they are compensated via the option premium.[17]

The amount of an insurance premium is going to be calibrated on the likely amount the insurance company will have to pay out, based on the expected dollar amount of the potential payout as well as the risk. Analogous factors affect the premium of an option, as summarized in Figure 3 below.

FIGURE 3: SUMMARY OF FACTORS AFFECTING OPTION PRICES

Factor	Effect on Value of Call Option (All Else Equal)
Time to expiration	Longer time to expiration increases option price. Over time, option price decreases.
Current price of stock	Higher stock price increases call option price, since expected payout will be higher.
Strike price	Higher strike price decreases call option price, since option will be less likely to expire in-the-money.
Volatility of stock	Higher volatility increases option price.
Time value of money	Higher interest rates increase option price.

In the next section, we discuss how each of these option pricing model components are affected by the fraud-on-the-market theory of harm.

III. But-For World and Damages

Because so few cases litigate the damages question for the class of plaintiffs, questions remain about how damages for atypical traders would be netted or calculated.[18] In the reminder of this paper, we explore the implications of artificial inflation on the value of an option, and the resulting damages to optionholders.

First, we argue that because options may expire prior to a corrective disclosure, the traditional Dura principle on common stock—whereby equity investors are only damaged if they hold through an alleged corrective disclosure—does not directly apply to traded options. Justice Breyer's Opinion in *Dura* holds that an inflated purchase price does not itself constitute economic harm. However, a given option contract may not exist at the time of the corrective disclosure, yet its purchase price could still be inflated

relative to the but-for purchase price; thus the option holder would have suffered economic harm at the time of purchase. We will explain the mechanics of this conclusion in detail below.[19]

Finally, there is one remaining component of option value that could be affected by the fraud-on-the-market theory (but which is not part of the investment decision): **stock price volatility**. Damages experts typically assume to hold stock volatility constant in the but-for world. As we discuss above, more volatile stock increases the value of a call option. Company news—especially negative news—tends to increase volatility.[20] Therefore, it is likely that failure to account for alternate but-for volatility results in a downward bias of the but-for option value (that is to say, properly accounting for potentially higher but-for volatility would result in a higher estimate of but-for option value and thus implied damages).

Before we compute damages, we need to determine the investment decision in the but-for world. 10b-5 damages involve comparing the investor's outcome in the actual world against their outcome in the but-for world. For stock investors, it is assumed that in the but-for world, investors would have purchased and sold the same number of shares, on the same dates, as they did in the actual world. In other words, the investment decision is held constant.

Similarly, for optionholders, the natural assumption is to hold many aspects of the transaction constant: the date of the transaction, whether to buy or sell the option, whether a put or call option, and the expiration date of the contract. For the but-for option strike price, there are two potential assumptions:

- **Constant moneyness:** assumes the relative distance between the stock price and strike price (referred to as "moneyness") is held constant. This is the main assumption we explore in the body of the paper.
- **Constant strike:** assumes the dollar level of the strike price is exactly the same in the but-for world. In the appendix, we explore the implication on damages.

Assuming constant strike is appealing, as this keeps all parameters of the option contract the same in the but-for world. However, this assumption may elide the relevance of the current stock price to the investor's decision.

The intuition behind the constant moneyness assumption is the idea that investors make investment decisions relative to the current price of the stock. The investor can use options to operationalize trading decisions such as "I would like to make money if the stock price rises by more than 10% in the next month," or "I want to protect myself in case the stock price falls by more than 20% in the next year." Assuming constant money-

ness can preserve the animus of these decisions in the but-for world relative to the current stock price.

Figure 4 illustrates an option investment in the actual world compared to the but-for world.[21] In this hypothetical example, we assume artificial inflation of $25 (row [a]). Under the assumption of constant moneyness, the table shows the strike price of a call option purchased in the actual and but-for world (row [b]), and the premium the investor would have paid for such an option (row [d]).[22] The table illustrates the damages the investor incurs at the time of purchase, due to the difference in the premium paid in the actual versus but-for world (row [e]). The investor is damaged because they paid too high of a premium relative to what they would have paid in the but-for world.

FIGURE 4: HYPOTHETICAL EXAMPLE OF CALL OPTION PURCHASE IN ACTUAL AND BUT-FOR WORLD

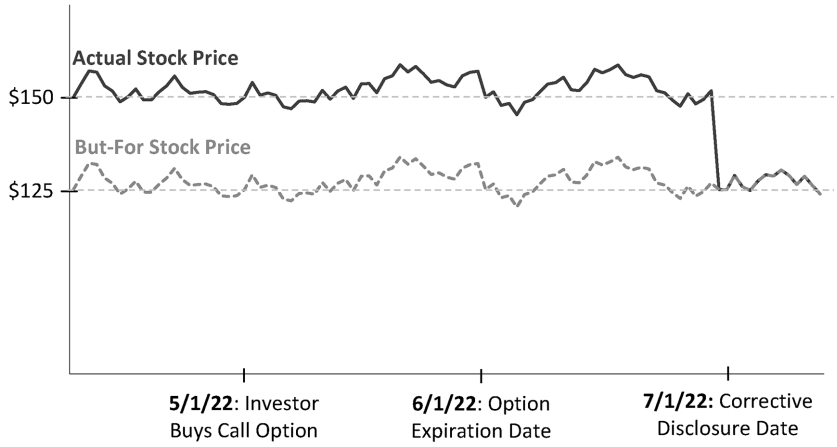
		Actual World [1]	But-For World [2]	Damages [3] = [1] - [2]
[a]	Stock price on purchase date	$150	$125	
[b]	Strike price of option	$170	$145	
[c]	Moneyness (difference between [a] and [b])	out-of-the-money by $20	out-of-the-money by $20	
[d]	Call option premium	$0.52	$0.24	$0.28

Note: option premium is calculated assuming purchase date of 5/1/22 and expiration date of 6/1/22.

We next explore what happens to an option after the date of purchase.

This requires extending our simple inflationary scenario forward in time. **Figure 5** below illustrates an inflationary scenario with constant dollar inflation of $25 during the whole class period, and a single corrective disclosure.[23]

FIGURE 5: HYPOTHETICAL EXAMPLE OF ARTIFICIALLY INFLATED STOCK PRICE AND CORRESPONDING BUT-FOR STOCK PRICE



Situating the example from Figure 4 into this timeline: imagine that the investor buys the call option on 5/1/22, and the expiration is 6/1/22. Because the option expires prior to the corrective disclosure date, the investor cannot hold the contract through a corrective disclosure. Moreover, by construction, the actual stock price is $150 on *both* 5/1/22 and 6/1/22; in other words, the stock price has a net change of $0 during the time the investor held the option contract. At expiration, the option is out-of-the-money and expires worthless, both in the actual world and in the but-for world.[24] Nevertheless, the option holder is damaged by this transaction, as we showed in Figure 4.

The foregoing illustrates that option holders can be damaged purely at the point of purchase without any additional action taken, and without any underlying change in the artificial inflation or stock price. By construction, we selected an example where the option expired worthless, and the investor chose not to sell prior to the corrective disclosure. We will next illustrate what happens if the option holder sells prior to expiration, or if the option expires in-the-money.

Figure 6 illustrates an example of an **in-the-money option** that is **purchased and sold** during the class period. The table shows the investor's harm on the date of purchase, due to paying too high of a premium (row [d]).[25] In this example, on the date of sale, the investor experiences *gains* from the artificial inflation, since they received a higher sale price than they would have in the but-for world (row [e]).[26] Damages form the inflated purchase price are netted against gains from the inflated sale price (row [f]).

FIGURE 6: HYPOTHETICAL EXAMPLE OF CALL OPTION PURCHASE AND SALE IN ACTUAL AND BUT-FOR WORLD

		Actual World [1]	But-For World [2]	Difference [3] = [1] - [2]	
[a]	Stock price on purchase date (5/1/22)	$150	$125		
[b]	Stock price on sale date (5/15/22)	$150	$125		
[c]	Strike price of option	$130	$105		
[d]	Call option premium on purchase date (5/1/22)	$20.49	$20.27	$0.22	*Damages at purchase*
[e]	Call option premium on sale date (5/15/22)	$20.17	$20.11	$0.06	*Gains at sale*
[f]	Net loss on transaction (= [d] - [e])	$0.32	$0.16	$0.16	*Net damage on transaction*

Due to our assumption of constant but-for moneyness, damages for optionholders come entirely from the difference in the *premium* in the but-for world, both on the day of purchase and on the date of sale (if sold). The value of the option at expiration—whether exercised for a profit or expired worthless—will be the same in the actual and but-for world.[27]

Figure 7 explores what would happen if the investor **held the contract through expiration**. The table shows the exercise value of the option (row [e]). Because the option is in-the-money on the expiration date, the investor will exercise the option and receive value of $20 (by construction, this is the same in the actual and but-for world). The investor's inflationary damage is due to over-paying for the premium at purchase (rows [d] and [f]).

FIGURE 7: HYPOTHETICAL EXAMPLE OF CALL OPTION PURCHASE AND EXERCISE IN ACTUAL AND BUT-FOR WORLD

		Actual World [1]	But-For World [2]	Difference [3] = [1] - [2]	
[a]	Stock price on purchase date (5/1/22)	$150	$125		
[b]	Stock price on expiration date (6/1/22)	$150	$125		
[c]	Strike price of option	$130	$105		
[d]	Call option premium on purchase date (5/1/22)	$20.49	$20.27	$0.22	*Damages at purchase*
[e]	Exercise value (= [b] - [c])	$20.00	$20.00	$0.00	*No difference at expiration*
[f]	Net loss on transaction (= [d] - [e])	$0.49	$0.27	$0.22	*Net damage on transaction*

Appendix: But-For World and Damages Assuming Constant Strike

In this appendix, we provide examples of damages under an alternate assumption regarding the investment decision in the but-for world. In the main body of the paper, we assume the investor buys an option contract with the same moneyness (i.e. relative distance between the stock price and the strike price). In this appendix, we instead assume the investor buys the exact same contract in the but-for world, with the same strike price.

As we will show, this assumption can lead to either higher or lower damages in different scenarios. In particular, the assumption of constant strike leads to higher damages for options expiring after the corrective disclosure date.

On a classwide basis, which assumption leads to higher damages would depend on the specific option contracts investors actually traded, on the evolution of the stock price and of inflation, and whether losses are netted against gains for different options transactions made by the same investor.

We will continue our hypothetical scenario with constant $25 inflation during the class period. First, in **Figure 8** below, we show damages at purchase for an **out-of-the-money option that expires worthless**. Column [1] shows the actual world and is identical to Figure 4 in the main body. Column [2] shows the but-for world assuming a constant strike price. In the but-for world, a call option with strike price of $170 is even farther out-of-the-money, reflected by the extremely small premium of $0.001. Column [3] shows the investor's damages in this scenario due to overpayment of the premium, which are higher than the damages under the equivalent scenario assuming constant moneyness.

FIGURE 8: HYPOTHETICAL EXAMPLE OF CALL OPTION PURCHASE IN ACTUAL AND BUT-FOR WORLD

		Actual World [1]	But-For World Assuming Constant Strike [2]	Damages Assuming Constant Strike [3] = [1] - [2]
[a]	Stock price on purchase date	$150	$125	
[b]	Strike price of option	$170	$170	
[c]	Moneyness (difference between [a] and [b])	out-of-the-money by $20	out-of-the-money by $45	
[d]	Call option premium	$0.52	$0.001	$0.52

Figure 9 shows an example of the **purchase and sale** of a contract with strike $130. Column [1] is taken directly from Figure 6 in the main body, while Column [2] shows the but-for world assuming constant strike. While an option with strike of $130 is in-the-money in the actual world, it would be out-of-the-money by $5 in the but-for world (row [d]). Here, as in Figure 6, the investor experiences inflationary damages at the time of purchase (from paying too high of a premium) and inflationary gains at the itme of sale (from reciving too high of a sale price). However, in Figure 9 the investor has **net inflationary gains** from the transaction because they would have lost more money on the transaction in the but-for world (row [g]).

FIGURE 9: HYPOTHETICAL EXAMPLE OF CALL OPTION PURCHASE AND SALE IN ACTUAL AND BUT-FOR WORLD

		Actual World [1]	But-For World Assuming Constant Strike [2]	Difference [3] = [1] - [2]	
[a]	Stock price on purchase date (5/1/22)	$150	$125		
[b]	Stock price on sale date (5/15/22)	$150	$125		
[c]	Strike price of option	$130	$130		
[d]	Moneyness (difference between [a] and [b])	in-the-money by $20	out-of-the-money by $5		
[e]	Call option premium on purchase date (5/1/22)	$20.49	$2.50	$17.99	*Damages at purchase*
[f]	Call option premium on sale date (5/15/22)	$20.17	$1.44	$18.73	*Gains at sale*
[g]	Net loss on transaction (= [d] - [e])	$0.32	$1.06	($0.74)	*Net **gains** on transaction*

Figure 10 shows what would happen to this option contract **when exercised**. Row [d] is the same as in the prior table, showing damages at purchase. Row [e] shows the exercise value of the contract. In the actual world, the investor exercises the contract and receives a value of $20 (they purchased the share of stock cheaply at $130 and sold for a value of $150). In the but-for world, the contract is out-of-the-money and expires worthless ($0 exercise value). Thus the investor has **gains of $20 at expiration** compared to the but-for world.[28] In this example, the investor has net inflationary gains, as they had lower losses in the actual world versus the but-for world. In contrast, under the but-for moneyness assumption (Figure 7), this transaction resulted in damages.

FIGURE 10: HYPOTHETICAL EXAMPLE OF CALL OPTION PURCHASE AND EXERCISE IN ACTUAL AND BUT-FOR WORLD

		Actual World [1]	But-For World [2]	Difference [3] = [1] - [2]	
[a]	Stock price on purchase date (5/1/22)	$150	$125		
[b]	Stock price on expiration date (6/1/22)	$150	$125		
[c]	Strike price of option	$130	$130		
[d]	Call option premium on purchase date (5/1/22)	$20.49	$2.50	$17.99	*Damages at purchase*
[e]	Exercise value (= max {[b] - [c], 0})	$20.00	$0.00	$20.00	*Gains at expiration*
[f]	Net loss on transaction (= [d] - [e])	$0.49	$2.50	($2.01)	*Net **gains** on transaction*

In our final example, **Figure 11**, we show an example of an option **expiring after the corrective disclosure date**. This scenario leads to high damages because the purchase premium is inflated, but at exercise there is no longer a difference between the actual and but-for world. Thus, the high damages at purchase are not offset by high gains at exercise, leading to overall high damages.

Again in this example, the purchase premium for the call option is inflated in the actual world (row [d]). The option in this example expires worthless after the corrective disclosure. There are no longer two states of the world, so the investor does not have inflationary gains or losses at expiration (row [e]), leaving the investor with net inflationary damages (row [f]).

FIGURE 11: HYPOTHETICAL EXAMPLE OF CALL OPTION PURCHASE AND POST-CORRECTIVE-DISCLOSURE EXERCISE, IN ACTUAL AND BUT-FOR WORLD

		Actual World [1]	But-For World [2]	Difference [3] = [1] - [2]	
[a]	Stock price on purchase date (5/1/22)	$150	$125		
[b]	Stock price on expiration date (7/2/22)	$125			*After corrective disclosure*
[c]	Strike price of option	$130	$130		
[d]	Call option premium on purchase date (5/1/22)	$21.49	$4.33	$17.16	*Damages at purchase*
[e]	Exercise value on 7/2/22 (= max {[b] - [c], 0})	$0		$0	*No difference at expiration*
[f]	Net loss on transaction (= [d] - [e])	$21.49	$4.33	$17.16	*Net damages on transaction*

NOTES:

[1]*Dura Pharms., Inc. v. Broudo*, 544 U.S. 336, 125 S. Ct. 1627, 161 L. Ed. 2d 577 (2005).

[2]*Cook v. Allergn PLC, No. 18 CIV. 12089 (CM)*, 2019 WL 1510894, at *2 (S.D.N.Y. Mar. 21, 2019).

[3]*Gelt Trading, Ltd. v. Co-Diagnostics, Inc., No. 220CV00368JNPDBP*, 2021 WL 913934, at *4 (D. Utah Mar. 10, 2021).

[4]*Vrakas v. United States Steel Corp., No. CV 17-579*, 2019 WL 7372041, at *7, *9 (W.D. Pa. Dec. 31, 2019).

[5]See *City of Sunrise Firefighter's Pension Fund v. Citigroup Inc., No. 20-CV-10360 (AJN)*, 2021 WL 396343, at *4 (S.D.N.Y. Feb. 4, 2021). The question of offsets across different assets is not unique to options investors; note that this decision also discusses offsets to equity damages coming from bond investments.

[6]*In re Fed. Nat. Mortg. Ass'n Sec., Derivative & "ERISA" Litig.*, 247 F.R.D. 32, 42 (D.D.C. 2008).

[7]Compare *Hall v. Medicis Pharm. Corp., No. CV08-1821PHX-GMS*, 2009 WL 648626, at *4 (D. Ariz. Mar. 11, 2009) (collecting cases); with *Cook v. Allergn PLC, No. 18 CIV. 12089 (CM)*, 2019 WL 1510894, at *2 (S.D.N.Y. Mar. 21, 2019) (options trader as lead plaintiff "would introduce factual issues irrelevant to stockholder class members, like strike price, duration, maturity, volatility, and interest rates, and . . . could subject the class to unique defenses").

[8]"[C}ourts have granted options purchasers certification as a sub-class only when there is concern that the named plaintiff 'must have standing to pursue each claim alleged.' *Averdick v. Hutchinson Tech. Inc.*, 2006 U.S. Dist. LEXIS 47445, at *18 (D.Minn. Feb. 9, 2006) (internal citations omitted) . . . While there is merit to [the] argument that options purchasers, who do not have a stake in the equity of the company, might perhaps seek a different litigation strategy to maximize their recovery, this argument has been rejected by courts as a basis for creating a subclass of purchases of call option contracts." *In re XM Satellite Radio Holdings Sec. Litig.*, 237 F.R.D. 13, 20 (D.D.C. 2006).

[9]*In re Apple Sec. Litig., No. 4:19-cv-2033-YGR*, 2022 U.S. Dist. LEXIS 23771 (N.D. Cal. Feb. 4, 2022).

[10]This article only examines publicly traded options contracts on underlying stock, where the company issuing the stock is facing securities fraud litigation. We do not examine other types of options issued by the company such as stock purchase options or warrants issued to employees. We additionally note that, similarly to common stock, options traded by executives or directors of a company are typically excluded from damages.

[11]See, e.g., Eslinger, Bonnie, "Tesla Jury Clears Musk In $12B 'Take Private' Tweet Trial," *Law360*, February 3, 2023, *available at* https://www.law360.com/articles/1572558/tesla-jury-clears-musk-in-12b-take-private-tweet-trial.

[12]*Isaacs v. Musk*, No. 18-CV-04865, 2018 WL 6182753 (N.D. Calif. Nov. 27, 2018). See also Hurt, Christine and Paul Stancil, "Short Sellers, Short Squeezes, and Securities Fraud," *The Journal of Corporation Law*, 47:1, 2021.

[13]See, e.g., Yun Li, "Options trading activity hits record powered by retail investors, but most are playing a losing game," *CNBC*, December 22, 2021, *available at* https://www.cnbc.com/2021/12/22/options-trading-activity-hits-record-powered-by-retail-investors.html.

[14] https://securities.stanford.edu/.

[15]In this paper, we will limit our discussion of common stock options with fixed expiration dates (i.e., European options). However, our framework can be applied to other types of options, such as American options.

[16]The decision-making process is symmetric, but reversed, for the holder of a put option.

[17]In reality, the buying and selling of options-and the resulting purchase or sale of stock, if any-are mediated by brokerages. But for the sake of discussion, it is easier to imagine the transaction as taking place between the option buyer and seller directly.

[18]Christine Hurt and Paul Stancil, Short Sellers, Short Squeezes, and Securities Fraud, The Journal of Corporate Law, Vol. 47:1, Fall 2021, p. 130.

[19]Another distinction in the application of the prevailing damages framework to optionholders is the application of the PSLRA look-back cap which limits shareholder recovery when stock prices increase in the 90 days following a corrective disclosure. Economically, this rule is not directly applicable to optionholders, particularly as the option holder's harm arises at the moment of purchase (as we will describe in greater detail below).

[20]See, e.g., Helinä Laakonen and Markku Lanne, "Asymmetric News Effects on Volatility: Good vs. Bad News in Good vs. Bad Times," Studies in Nonlinear Dynamics & Econometrics, 2009, vol. 14, issue 1, 1-38.

[21]For now, we only discuss the impact at the time of purchase; later in the paper, we will explore the evolution of option value after time of purchase, and the implication for damages.

[22]The premiums are calculated using the Black-Scholes formula, which is one of the most common formulas used to value options. For the purposes of the calculation, we assume a purchase date of 5/1/22 and a contract expiration date of 6/1/22. The formula also requires assumptions regarding interest rates and stock volatility, which we hold constant in the actual and but-for world.

[23]Note that the theory of damages we discuss can be applied to cases involving any number of corrective disclosures as well as varying levels of inflation (such as constant-percentage inflation, among other potential assumptions).

[24]In other words, in the actual world, the investor has no incentive to exercise their option to buy a share of stock at $170, since they could buy it even more cheaply in the market for $150. Similarly, in the but-for world, the investor has no incentive to exercise their option to buy a share of stock at $145, since they could buy in the market for $125.

[25]Note that the dollar amount of the premium is higher in Figure 6 than it was in Figure 4 (over $20 in Figure 6, compared to less than $1 in Figure 4). The difference is because the option is in-the-money. This is illustrative of the effect of moneyness on option premiums.

[26]This is only one example of what could happen at sale. In real life, a different pattern of stock price movement could result in further damages to the investor at sale; these would be added to the damages at purchase rather than netting out.

[27]Under the alternate assumption of keeping strike constant in the but-for world, investors could receive a differing value at exercise in the but-for world. The Appendix provides detailed examples.

[28]When artificial inflation is present at expiration, a call option's exercise value in the actual world will always be higher than the but-for exercise value. Thus, purchasers of call options will have inflationary gains for this component

of the transaction. For put options, the opposite is true: at expiration, the actual exercise value is always higher than the but-for exercise value, meaning that purchasers of put options will have inflationary damages for this component of the transaction. Of course, in both cases, any gains or losses on the exercise value must be netted against gains or losses on the premium.