

ARTICLES

ECONOMIC CRISIS AND THE INTEGRATION OF LAW AND FINANCE: THE IMPACT OF VOLATILITY SPIKES

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The 2008 financial crisis raised puzzles important for understanding how the capital market prices common stocks and in turn, for the intersection between law and finance. During the crisis, there was a dramatic five-fold spike, across all industries, in “idiosyncratic risk”—the volatility of individual-firm share prices after adjustment for movements in the market as a whole.

This phenomenon is not limited to the most recent financial crisis. This Article uses an empirical review to show that a dramatic spike in idiosyncratic risk has occurred with every major downturn from the 1920s through the recent financial crisis. It canvasses three possible explanations for this phenomenon. Thereafter, this Article explores the implications of these crisis-induced volatility spikes for certain legal issues that depend analytically on valuation methodology and hence are affected by volatility: using event studies to determine materiality and loss causation in fraud-on-the-market securities litigation, determining materiality in cases involving claims of both insider trading and misstatements or omissions in registered public offerings, and determining the extent of deference given to a corporate board that rejects an acquisition offer at a premium above the pre-offer market price.

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This analysis shows that the conventional use of event studies during periods of economic-crisis-induced volatility spikes results in understating the number of occasions when a corporate misstatement can be shown to have had a meaningful impact on a firm's stock price. Relatedly, the analysis suggests that during crisis times, insiders have substantially more opportunities to profit from trading on the nonpublic information that they possess and issuers conducting offerings have more opportunities to sell securities at an inflated price. Analysis shows that trying to cure this problem by lowering the standard of what is considered statistically significant is as likely to be socially harmful as socially beneficial. These conclusions counsel that the best response to the reduced effectiveness of private litigation as a deterrent to securities law violations during crisis times is to provide additional resources to SEC enforcement. Lastly, with respect to Delaware courts' recognition of "substantive coercion" as a justification for target-corporation deployment of takeover defenses—arguably a dubious justification in normal times—crisis-induced idiosyncratic-risk spikes provide an unusually plausible claim that target shareholders may indeed make a mistake in tendering into a hostile offer. Analysis of the timing of the spikes in recent cases, however, shows that the claim is tenuous even in these circumstances.

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INTRODUCTION

Financial economics has become ever more integrated into corporate and securities law, a trend that started decades prior to the financial crisis of 2008 to 2009.¹ This is as it should be. Corporate and securities law is, at its core, about valuation. Investors provide to a corporation the funds with which it acquires real assets. The investors

1. The interaction of corporate law and finance began in earnest with Michael Jensen and William Meckling's seminal article on the agency costs at the heart of public corporations. Michael C. Jensen & William H. Meckling, *Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure*, 3 *J. Fin. Econ.* 305 (1976); see also Henry Hansmann & Reinier Kraakman, *Agency Problems and Legal Strategies*, in *The Anatomy of Corporate Law 21* (R. Kraakman et al., eds. 2004) (discussing centrality of agency theory to structure of corporate law). A series of influential articles linking the legal system to corporate finance and the structure of capital markets further evidences how law and finance came to be linked. See, e.g., Rafael La Porta, Florencio Lopez-de-Silanes, Andrei Shliefer & Robert W. Vishny, *Law and Finance*, 106 *J. Pol. Econ.* 1113, 1114–16 (1998) (presenting cross-country study of links between investor legal protection and development of strong capital markets). For an example of current scholarship that is shaped by the intersection of law and finance, see Ronald J. Gilson & Alan Schwartz, *Corporate Control and Credible Commitment*, 43 *Int'l Rev. L. & Econ.* 119, 121 (2015) (analyzing controlling shareholders' extraction of private benefits of control in corporate-finance terms).

receive in return financial claims (securities) on the corporation's future cash flows. The size of these future cash flows then depends importantly on management's choice of what real assets to acquire and how well these assets are managed over time. The capital market's pricing of the financial claims acquired by investors is in effect a valuation of these future cash flows.² Corporate law provides a framework within which a firm's managers make these investment and operating decisions. Properly designed, this legal framework helps spur management to choose and deploy assets in ways that maximize the value of the firm's expected future cash flows. The framework's effectiveness, however, depends in part on the precision with which the capital market prices these financial assets.³ Securities law can enhance price accuracy, for example, by mandating that corporations disclose certain information and by regulating the workings of the securities markets and the behavior of those who trade in them.⁴ The better corporate and securities law perform these tasks, the more valuable the corporation's underlying business and correspondingly, the financial claims that the corporation issues.⁵

The 2008 financial crisis raised many questions for financial economics and financial regulation.⁶ Relatively unappreciated so far, however, are the puzzles the crisis poses for understanding how the capital market prices common stocks and in turn, for the intersection between law and finance. During the crisis, there was a dramatic spike,

2. See Richard A. Brealey, Stewart C. Myers & Franklin Allen, *Principles of Corporate Finance* 80 (11th ed. 2014) (defining market value of debt and equity securities as discounted present value of those securities' future cash flows).

3. See Merritt B. Fox, *Civil Liability and Mandatory Disclosure*, 109 *Colum. L. Rev.* 237, 252–60, 264–67 (2009) [hereinafter Fox, *Civil Liability*] (“More information, with the resulting increase in price accuracy, improves the control market's effectiveness in limiting the agency costs of management.”).

4. Consistent with this view, the growing law and finance literature finds that effective corporate and securities law is a precondition for the sophisticated capital markets and corporate ownership structures that appear most closely associated with economic growth. See, e.g., La Porta et al., *supra* note 1, at 1152 (examining evidence and concluding strong investor-protection laws correlate with economic growth). Securities law also can improve pricing accuracy by facilitating the efficiency of capital market microstructure through regulation. We need not address this function here.

5. See Jesse H. Choper, John C. Coffee, Jr. & Ronald J. Gilson, *Cases and Materials on Corporations* 177–78 (8th ed. 2013) (discussing valuation of financial assets).

6. See, e.g., Gary Gorton, *Misunderstanding Financial Crises: Why We Don't See Them Coming* 221 (2012) (reviewing past misunderstandings of financial crises); Robert E. Hall, *The High Sensitivity of Economic Activity to Financial Frictions*, 121 *Econ. J.* 351, 371 (2011) (arguing standard macroeconomic theory does not explain why drops in output and employment persist for significant periods after financial crisis is resolved); Robert E. Hall, *Why Does the Economy Fall to Pieces After a Financial Crisis?*, *J. Econ. Persp.*, Fall 2010, at 3, 3 (2010) (same); see also Andrew W. Lo, *Reading About the Financial Crisis: A Twenty-One-Book Review*, 50 *J. Econ. Literature* 151, 154–55 (2012) (presenting useful reviews of twenty-one books drawn from postcrisis deluge of works analyzing crisis and appropriate responses).

across all industries, in “idiosyncratic risk”⁷—that is, in the volatility of individual firm’s share prices after adjustment for movements in the market as a whole.⁸ This phenomenon, it turns out, is not limited to just the most recent economic crisis. We show here for the first time that a dramatic spike in idiosyncratic risk has occurred with every major downturn since the 1920s.⁹ This association—between economic crisis and a spike in idiosyncratic risk—is important to the law for two important reasons. First, the spike is caused by a crisis-induced sharp increase in the importance of new information specifically concerning individual firms. Information—its value and its disclosure—is at the center of much of corporate and securities law. Second, idiosyncratic price changes are important because they are at the core of event studies, an econometric technique that, over the last few decades, has moved from an academic tool to assess the impact on stock price of particular corporate actions to providing the central means by which corporate and securities law is applied to specific cases.¹⁰ For example, the Supreme Court recently confirmed the centrality of event studies in securities fraud class actions,¹¹ the predominant form of private securities litigation today.¹²

Now consider the 2008 to 2009 financial crisis’s impact on the stock prices of individual firms. The volatility of individual stock prices increased sharply during the crisis.¹³ A portion of this increase is explained by economy-wide factors like changes in general economic conditions that affect share prices of all stocks. But much more than this was going on. The larger part of the increase in each firm’s overall share price volatility was due to a dramatic rise—five-fold as measured by variance—in idiosyncratic risk, the portion of the volatility that cannot be explained by changes in factors that affect all firms. Rather, there was a large increase, relative to noncrisis times, in the extent to which an individual firm’s share price deviated independently from the change in the market as a whole.

This crisis-related spike in idiosyncratic risk presents a puzzle that is important to understanding how law and finance interact. A firm’s share price moves because there is news: a bit of information that changes expectations about the firm’s future cash flow and hence the value of the

7. See *infra* section I.A (discussing spike in idiosyncratic risk during crisis).

8. See Brealey, Myers & Allen, *supra* note 2, at 174 (defining and comparing “[firm-] specific risk” and “market risk”).

9. See *infra* section I.B (presenting empirical data on crises since 1920s).

10. See *infra* Part III (discussing use of event studies in securities litigation).

11. See *Halliburton Co. v. Erica P. John Fund, Inc.*, 134 S. Ct. 2398, 2415 (2014) (discussing event studies in securities litigation).

12. See Merritt B. Fox, *Securities Class Actions Against Foreign Issuers*, 64 *Stan. L. Rev.* 1173, 1176 (2012) [hereinafter Fox, *Securities Class Actions*] (noting fraud-on-the-market class actions “give rise to the bulk of all the damages paid out in settlements and judgments pursuant to private litigation under the U.S. securities laws”).

13. See *infra* section I.A (presenting empirical data from 2008–2009 financial crisis).

firm's shares.¹⁴ So for example, the announcement that a defense firm received a profitable government contract that was previously thought possible, but not certain, is news: The chance that the contract would not be received is eliminated. In an efficient market, as soon as a bit of news is revealed, it is promptly and fully reflected in price.¹⁵ News is thus by definition unpredictable—to be news it cannot be anticipated and thus already incorporated in the firm's stock price—with its importance determined by how much the news changes expectations of a firm's future cash flows. Future price changes are the result of subsequent news.

Some news affects expectations about the future cash flows of most or all firms because it concerns the overall state of economy—for example, the future rate of economic growth, employment levels, interest rates, or inflation. For any given firm's stock, the portion of the total variability in its share price due to such generally applicable news is referred to as the stock's "systematic" risk, or volatility. The remaining variability in the firm's share price is due to news that affects expectations about its particular cash flows and not about the cash flows of most or all other firms in the market—for example news of a labor strike,¹⁶ an R&D breakthrough,¹⁷ or a regulatory development.¹⁸ The literature variously refers to this as "idiosyncratic," "unsystematic," "firm-specific," or "unique" risk, or volatility.¹⁹ Thus, the five-fold increase in idiosyncratic volatility during the 2008 to 2009 financial crisis tells us that each bit of news

14. See Brealey, Myers & Allen, *supra* note 2, at 365 ("[S]tock prices and company values summarize investors' collective assessment of how well a company is doing, both its current performance and its future prospects.").

15. See, e.g., *id.* at 324–25 (noting large body of accumulated empirical evidence that publicly traded issuer shares listed on exchanges such as NYSE and NASDAQ show immediate reactions to revelations of news, after which prices follow random walk).

16. See John Dinardo & Kevin F. Hallock, 'When Unions Mattered': The Impact of Strikes on Financial Markets, 1925–1937, 55 *Indus. & Lab. Rel. Rev.* 219, 226–32 (2002) (employing event study methodology to find significant negative impacts of labor-strike news on affected firms' share prices).

17. See, e.g., Marta Falconi & Neil Maclucas, Novartis Boosted by Heart Drug Trials, *Wall St. J.* (Mar. 31, 2014), <http://www.wsj.com/articles/SB10001424052702304157204579473051376848032> (on file with the *Columbia Law Review*) ("Novartis AG said Monday it would seek approval for an experimental heart failure treatment sooner than it had expected The news helped bolster shares of Novartis, which surged 3.31% in late morning trading").

18. See, e.g., Matthew Curtin, Volkswagen Shares Tumble Following Emissions Allegations, *Wall St. J.* (Sept. 21, 2015), <http://www.wsj.com/articles/volkswagen-shares-driven-lower-1442826436> (on file with the *Columbia Law Review*) ("The auto maker's nonvoting shares . . . were down 21% in morning trading amid fears of a huge fine in the U.S. as well as long-term damage to the reputation of Europe's biggest auto maker by sales."). Stock prices are also affected by background noise in the securities markets—movements that are uncorrelated with any new information. Thus, idiosyncratic risk will at all times include this background noise. For purposes of this Article, we focus on information-based idiosyncratic risk.

19. See Brealey, Myers & Allen, *supra* note 2, at 174 n.25 ("Specific risk may be called *unsystematic risk*, *residual risk*, *unique risk*, or *diversifiable risk*.").

affecting only a particular firm altered, much more than in normal times, expectations concerning that firm's future cash flows. In essence, during a crisis, all firms share an increased sensitivity to bits of news that, for each, will not affect most other firms. As a consequence, for example, on any good day for the market as a whole, there are far more big losers than in normal times and on any bad day, far more big winners.

The puzzle is why. An economic crisis concerns problems in the economy as a whole. Why would a crisis suddenly increase the importance of new information that is independent of the effect on the company of news about the overall economy? In this Article, we take up both the causes of this large, crisis-induced increase in idiosyncratic risk and its implications for how the legal system uses finance, topics yet to be addressed in either the financial-economics or legal literature.

Part I begins by documenting more fully the link between economic turmoil and idiosyncratic risk. Expanding on earlier work by Campbell et al.,²⁰ we conduct an empirical review, extending back to 1926 and forward to the present. This review shows, for the first time, that *every* major economic downturn in this eighty-five-year period has been accompanied by a substantial spike in idiosyncratic volatility.

Part II seeks to explain why difficult economic times, which are defined in terms of market-wide phenomena, make the future of individual firms more difficult to predict and so make individual stock prices more volatile, independent of the crisis making the overall economy's future performance harder to predict. We canvass several complementary answers. One is that, compared to ordinary times, information about a firm contained in *current* news may become more important in predicting its future cash flows *relative to* the role of the *already existing* stock of knowledge in making such predictions. A second explanation is that the quality of management becomes more important in crisis times. Consequently, the ordinary flow of new information about this subject can cause bigger movements in price because each bit tells the market about something—the quality of management—that the market now regards as more important than it did in ordinary times. A third is that crisis creates uncertainty as to what factors, and hence what information, are important to valuation. Because of this uncertainty, a broader range of information has valuation implications and therefore stock prices move more frequently.

Parts III and IV turn to the implications of our empirical results and of their possible explanations for a number of legal issues that depend analytically on valuation methodology: determining materiality and loss

20. John Y. Campbell, Martin Lettau, Burton G. Malkiel & Yexiao Xu, Have Individual Stocks Become More Volatile? An Empirical Exploration of Idiosyncratic Risk, 56 J. Fin. 1, 3 (2001) [hereinafter Campbell et al., Empirical Exploration] (finding market-, industry-, and firm-level volatility all “increase substantially in economic downturns and tend to lead recessions”).

causation in fraud-on-the-market securities litigation, determining materiality in cases involving claims of insider trading or of misstatements or omissions in registered public offerings, and determining the extent of deference that should be paid to a corporate board that rejects an acquisition offer at a premium above the pre-offer market price. Litigation with respect to each of these matters has, over the last few decades, increasingly involved the empirical analysis—through the use of event studies—of the idiosyncratic portion of share returns of the companies involved.

The analysis in Part IV yields a number of important insights, starting with ones relating to the use of event studies in fraud-on-the-market class actions, the actions that give rise to the bulk of damages and settlements paid out as the result of private securities litigation. We show that the conventional use of event studies during periods of economic-crisis-induced increased volatility results in understating the number of occasions when a corporate misstatement can be shown to have had a meaningful impact on a firm's stock price. Lowering the standard for statistical significance in crisis times would help to correct for this problem but causes an offsetting problem: With a lower standard, liability is imposed more frequently where the misstatement in fact did not have a sufficient impact on price to justify the costs associated with imposing liability. In the end, this analysis shows that lowering the standard in times of crisis is, on balance, no more likely to improve than to harm social welfare. This suggests that during crisis times, Securities Exchange Commission (SEC) enforcement actions are especially important because they offset the reduced effectiveness of private litigation.

We reach a similar conclusion with respect to insider trading and public offerings of securities. This has particular significance because the information-based explanations that we find most persuasive for why economic crises lead to spikes in idiosyncratic risk suggest that, in crisis times, insiders have substantially more opportunities to profit from trading on the nonpublic information that they possess and issuers have more opportunities to sell securities at an inflated price.

Finally, “substantive coercion” is rarely a serious justification for target corporation deployment of takeover defenses, but crisis-induced increases in idiosyncratic risk provide an unusually plausible claim that target shareholders may make a mistake in tendering into a hostile offer. However, the example of two cases that raise the issue close in time to financial crises—*Quickturn*²¹ and *Airgas*²²—shows that even a substantive coercion claim based on a crisis-induced spike in idiosyncratic risk is very difficult to demonstrate.²³

21. *Quickturn Design Sys., Inc. v. Shapiro*, 721 A.2d 1281 (Del. 1998).

22. *Air Prods. & Chems., Inc. v. Airgas, Inc.*, 16 A.3d 48 (Del. Ch. 2011).

23. We refer occasionally to an online appendix that contains additional technical information, further empirical results, and demonstrations of the robustness of our

I. THE EMPIRICAL RECORD

In this Part, we demonstrate empirically both that there was a sharp increase in idiosyncratic risk during the 2008 to 2009 financial crisis and that this is not an isolated incident. An increase in idiosyncratic risk is associated with poor macroeconomic performance throughout an eighty-five-year period going back to 1926. We show as well that the increase was felt by firms across all industries. Moreover, while some of the increase in idiosyncratic risk is due to the simple fact that the share prices of most firms fell dramatically during the crisis, thereby increasing risk because of the resulting higher firm debt–equity ratios, much of it is not.

A. *The 2008 to 2009 Financial Crisis*

The 2008 to 2009 financial crisis illustrates starkly the spike in idiosyncratic risk associated with economic crises. From July 1, 2008, to June 30, 2009, firms in the S&P 100 experienced a five-fold increase in the average idiosyncratic volatility, as measured by variance, compared to 2006 to 2007 and a three-fold increase compared to 2007 to 2008. While 2008 to 2009 was a period of enormous general economic turmoil²⁴—recall that Lehman Brothers failed²⁵ and AIG was essentially nationalized within seven days in September 2008²⁶—this increase in idiosyncratic

findings. See Edward G. Fox, Merritt B. Fox & Ronald J. Gilson, *Economic Crises and the Integration of Law and Finance: The Impact of Volatility Spikes* app. (2015), <https://sites.google.com/site/volatilityspikesappendix/> (on file with the *Columbia Law Review*) [hereinafter Appendix] (providing technical information and further results and demonstrating robustness).

24. See Bureau of Econ. Analysis, U.S. Dep't of Commerce, BEA 09-29, *Gross Domestic Product, 1st Quarter 2009 (Final), Corporate Profits, 1st Quarter 2009 (Revised)* (2009), <http://www.bea.gov/newsreleases/national/gdp/2009/gdp109f.htm> [<http://perma.cc/533U-PYGV>] (“Real gross domestic product—the output of goods and services produced by labor and property located in the United States—decreased at an annual rate of 5.5 percent in the first quarter of 2009”); Bureau of Econ. Analysis, U.S. Dep't of Commerce, BEA 09-11, *Gross Domestic Product: Fourth Quarter 2008 (Final), Corporate Profits, Fourth Quarter 2008* (2009), <http://www.bea.gov/newsreleases/national/gdp/2009/gdp408f.htm> [<http://perma.cc/9B73-7NWA>] (“Real gross domestic product . . . decreased at an annual rate of 6.3 percent in the fourth quarter of 2008”); David M. Herszenhorn, *Bailout Plan Wins Approval; Democrats Vow Tighter Rules*, *N.Y. Times* (Oct. 4, 2008), <http://nytimes.com/2008/10/04/business/economy/04bailout.html?pagewanted=all> (on file with the *Columbia Law Review*) (noting former Treasury Secretary Henry Paulson in 2008 urged “emergency bailout legislation with a warning that the American economy was at risk of the worst economic collapse since the Depression”).

25. See *Lehman Makes It Official in Overnight Chapter 11 Filing*, *Wall St. J.: Crisis on Wall St. Blog* (Sept. 15, 2008, 7:40 AM), <http://blogs.wsj.com/wallstreetcrisis/2008/09/15/lehman-makes-it-official/> (on file with the *Columbia Law Review*) (“Lehman Brothers filed for Chapter 11 bankruptcy Monday in New York, as expected”).

26. See Edmund L. Andrews, Michael J. de la Merced & Mary Williams Walsh, *Fed's \$85 Billion Loan Rescues Insurer*, *N.Y. Times* (Sept. 17, 2008), <http://www.nytimes.com/2008/09/17/business/17insure.html?pagewanted=all> (on file with the *Columbia Law Review*) (“Fearing a financial crisis worldwide, the Federal Reserve reversed course on Tuesday and agreed to an \$85 billion bailout that would give the government control of

volatility reflects movement in individual firm prices that cannot be explained by the direct impact of general economic conditions. While the most extraordinary increases were among financial firms in the index—forty-fold during the crisis relative to 2006 to 2007—nonfinancial firms increased volatility almost four-fold themselves.²⁷ Just as dramatically, idiosyncratic risk then returned to approximately normal levels by June 30, 2010. Thus, we see a spike-like pattern of crisis-induced increase in idiosyncratic risk. Over a one-year period idiosyncratic risk increases sharply and then, just as sharply, returns to precrisis levels. These results are depicted graphically in Figure 1 and are reported in Table 1 below.²⁸

the troubled insurance giant American International Group.”). See generally Andrew Ross Sorkin, *Too Big to Fail* (2009) (providing detailed narrative account of 2008 crisis at Lehman Brothers and AIG).

27. These were firms in the S&P 100 as of March 9, 2009. Our analysis of all firms traded on the NYSE, NASDAQ, and AMEX yielded similar results.

28. Figure 1 is calculated by first estimating the company-specific volatility for each firm that trades on the NYSE, AMEX, or NASDAQ on each day in 2004 to 2010. This volatility is found using the variance of the error term in a CAPM regression over the last year. So the volatility on January 1, 2005, represents what happened from January 1, 2004, to December 31, 2004. Likewise January 2, 2005, represents what happened from January 2, 2004, to January 1, 2005. We then average the results for each day, weighting by market capitalization of the firm. Table 1 uses the same method, but only for S&P 100 firms. In each case, this company-specific volatility is measured by using the variance of the error term in a market model regression of the firm’s daily returns (percentage changes in stock price) over the last year. This regression estimates the firm’s β , which captures how, on average over the year, the firm’s daily stock price responds to price changes in the market as a whole. See generally Brealey, Myers & Allen, *supra* note 2, at 178–82 (“If you want to know the contribution of an individual security to the risk of a well-diversified portfolio . . . you need to measure its *market risk*, and that boils down to measuring how sensitive it is to market movements. This sensitivity is called beta (β).”). On any given day, this β can be used to estimate a predicted return for the firm based only on market performance. The error term for the day is the difference between the firm’s actual return and this predicted term. The variance of this error term over all the trading days of the year is thus a measure of how much the firm’s share price is being moved around by news that is independent of the news that moves the market as a whole around each day.

FIGURE 1: IDIOSYNCRATIC RISK 2004–2010

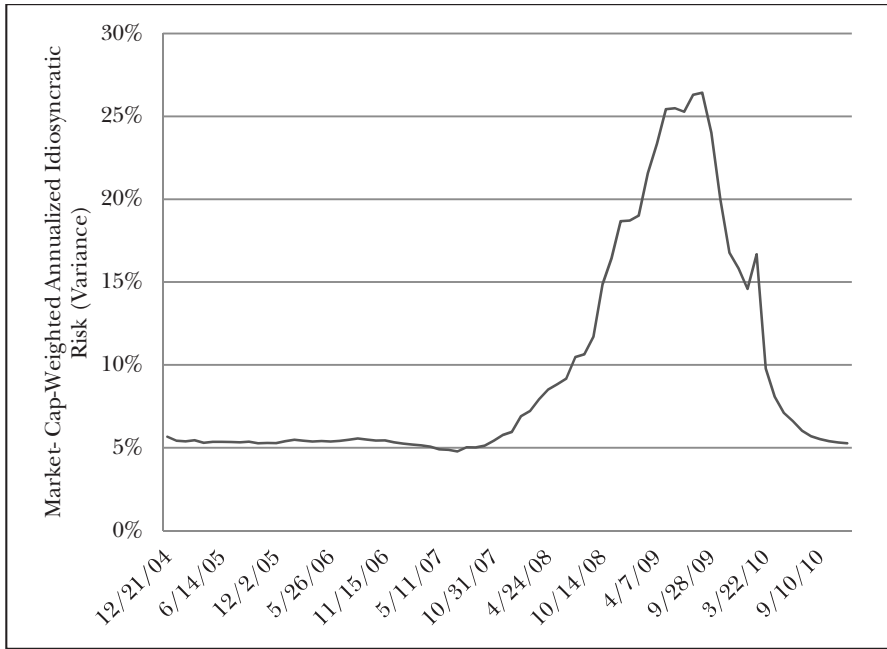


TABLE 1: IDIOSYNCRATIC RISK OF S&P 100 FIRMS, 2005–2009

Period	Market-Cap-Weighted Annual Idiosyncratic Risk		
	All	Financial ²⁹	Nonfinancial
July 1, 2005–June 30, 2006	3.5%	1.8%	3.8%
July 1, 2006–June 30, 2007	3.3%	1.7%	3.6%
July 1, 2007–June 30, 2008	5.7%	8.9%	5.4%
July 1, 2008–June 30, 2009	18.2%	74.0%	13.3%

B. Looking Back over Eight Decades

A relationship between downturns in GDP and idiosyncratic risk was first noted by Campbell et al. in 2001.³⁰ They found that over the thirty-five-year period from 1962 to 1997, a sharp increase in idiosyncratic risk was associated with the 1970, 1974, 1980, 1982, and 1991 recessions as

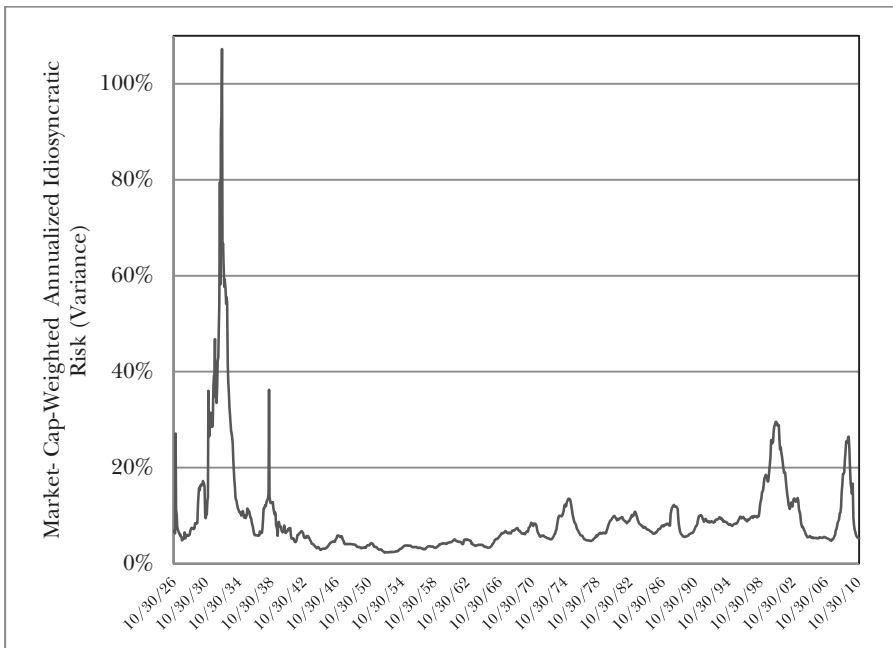
29. The companies analyzed in Table 1 were part of the S&P 100 as of March 2, 2009. By that point, the financial firms in the index were the ones who had weathered the crisis relatively well. Therefore, the exponential increase in volatility for financial firms is not attributable to companies like AIG, Bear Stearns, and Lehman.

30. Campbell et al., Empirical Exploration, *supra* note 20, at 3.

well as with the October 1987 market break.³¹ Campbell et al. did not, however, consider earlier crises, including the stock market crash of 1929 and the period of the Great Depression. Nor, of course, could they have considered the dot-com boom and bust in the early 2000s or the Great Recession of 2008 to 2009.

We have performed a study similar to Campbell et al. but extended the period covered from 1926 to the present. As depicted in Figure 2 below, the results indicate that this pattern of increased idiosyncratic risk associated with poor macroeconomic performance repeats itself throughout the much longer eighty-five-year period, with particularly high levels of idiosyncratic risk at the time of the stock market crash of 1929, the early years of the Great Depression in the early 1930s, the economy's retreat into deep recession in 1937, and the financial crisis of 2008 to 2009.³² We also find that idiosyncratic risk increases at times of market boom as well, although the relationship is weaker—a point to which Part III will return.

FIGURE 2: IDIOSYNCRATIC RISK 1925–2010



31. See *id.* at 13 fig.4 (showing “[a]nnualized firm-level volatility”).

32. The results depicted in Figure 2 are obtained in the same manner as those in Figure 1. See *supra* note 28 (describing analysis). Our method is slightly different than that used by Campbell et al., but our results for the period that our study and theirs overlap are very similar. Appendix, *supra* note 23, at fig.A-2.

C. Sectoral Analysis

As shown in Table 1, the increase in financial-sector volatility during the 2008 to 2009 crisis dramatically outpaced that in the nonfinancial sector. It is therefore reasonable to ask whether the average increase among nonfinancial firms during the crisis was simply the shadow of the crisis in finance falling on a few adjacent industries such as construction. The answer is no. There was a substantial increase in average idiosyncratic volatility in each of the sixty-two-digit Standard Industrial Classification (SIC) industries surveyed.³³ Every industry saw its idiosyncratic volatility, as measured by variance, increase more than 50%, and in fifty-eight of sixty sectors it more than doubled.³⁴

Although firms in every industry experienced significant increases in idiosyncratic risk, what distinguishes those industries that experienced the greatest increase? Interestingly, the sectors whose firms would typically be seen as the riskiest prior to the crisis—those whose stock prices were most sensitive to changes in general economic conditions (i.e. those firms with the highest precrisis β (beta))³⁵—were not the sectors in which idiosyncratic risk increased the most. Rather, it was those sectors with relatively *low* precrisis β s that saw the largest increases in their idiosyncratic risk.

While a high absolute level of β prior to the crisis does not explain the impact of an economic crisis on a company's idiosyncratic risk, there is a significant relationship between crisis period *increases* in β and the industries that showed the largest increases in idiosyncratic risk.³⁶ That is, those firms whose stock prices became more sensitive during the crisis to changes in the overall economy, even though they had a low precrisis β , also tended to have the greatest increase in idiosyncratic risk.³⁷ This

33. Appendix, *supra* note 23, at tbl.A-2.

34. Codes 60–67 are financial. The largest increases among nonfinancial firms were in hotels, amusement services, lumber, and social services. As Figure A-3 in the online appendix shows, controlling for industry-specific factors, along with those of the overall market, does not alter the results. Appendix, *supra* note 23, at fig.A-3.

35. See Brealey, Myers & Allen, *supra* note 2, at 178–82 (defining “beta” as measure of “how sensitive” particular asset “is to market movements”).

36. The results noted in this paragraph are robust to the inclusion or exclusion of financial firms.

37. One question about this finding should be addressed. We measure a firm's idiosyncratic volatility by running a market model, see John Y. Campbell, Andrew W. Lo & A. Craig MacKinlay, *The Econometrics of Financial Markets* 149–80 (1997) [hereinafter Campbell, Lo & MacKinlay, *Econometrics*], to net out the impact of the broader market on the individual stock. In so doing, we estimate the firm's β , which captures how the firm's stock responds to changes in the market. *Supra* note 28. Using this β allows one to estimate a predicted return for the firm based only on market performance. The idiosyncratic risk is derived from how much the actual return varies from the predicted return. If the estimated β departs from the “true” β , the predicted return will be less accurate. This will increase measured idiosyncratic risk regardless of whether the estimated β is too large (in which case when the market goes up, the predicted return will

finding supports the first of our possible explanations for the reported crisis-related increase in unsystematic risk: When a firm is subject to a structural change in the economy, as reflected by an increase in the firm's β , each new bit of firm-specific information will take on greater significance and hence move price more.

D. *The Effects of Leverage*

An alternative explanation for all or part of our reported increase in firm-specific volatility during economic crises is that the increase is caused by an increase in firms' leverage. Because the value of most firms' equity decreases during crises, their debt–equity ratio increases correspondingly. The 2008 to 2009 financial crisis illustrates the phenomenon: From peak to trough, the market capitalization of all firms in the Center for Research in Security Prices (CRSP) database declined 55%. It is well understood that an increase in a firm's debt–equity ratio increases the variability of both the systematic and, of particular interest to us, the idiosyncratic portions of a firm's returns.³⁸ This is because debt is paid

be too positive and if the market goes down, too negative) or whether β is too small (in which case when the market goes up, the predicted return will not be positive enough and when the market goes down, it will not be negative enough).

As detailed in section I.D and in the online appendix, for the typical firm this estimate of β , though unbiased, is less accurate during crisis times than in normal times because the actual value of β over the period of the year is likely to change more in crisis times due to changes in the firm's leverage triggered by sharp changes in the value of its equity. Appendix, *supra* note 23, at 8–11. Thus, one might speculate that the reported result—that firms in sectors whose β s, as we estimated them, increased the most also had the largest increases in idiosyncratic risk—might be an artifact of this less accurate assessment of their β s rather than evidence of a positive relationship between an increase in a firm's true β during crisis and firm-specific risk. The underlying intuition would be that most of the firms whose β s appeared to have experienced the greatest increases might in fact be those whose estimated β s, by chance, deviated the most on the upside from their actual β s. If this is correct, then our assessments of their idiosyncratic risk would also be more inflated than firms where the estimated β was closer to the true value.

This concern, however, appears to be unwarranted. If it were correct, we should, for the same reasons of chance, also see an increase in firm-specific risk in sectors whose estimated β s dropped dramatically during the crisis because they would have a concentration of firms whose estimated β s deviated the most on the downside from their true values. In fact, sectors whose estimated β s dropped during the crisis were no more likely to see a relatively large increase in firm-specific risk than those whose estimated β s were unchanged.

As a further sensitivity check, we also measured firm-specific risk using very short periods (twenty trading days) to minimize the possible impact of the decline in the accuracy of our β estimates compared to those based on a full year, during which the value of the true β may have shifted much more substantially than in a month. The results, reported in the appendix, are very similar to those presented in the text, again suggesting that the decline in the accuracy of our β estimates does not explain the results presented in the text. *Id.* at 12.

38. See Brealey, Myers & Allen, *supra* note 2, at 434–35 (“The expected rate of return on the common stock of a levered firm increases in proportion to the debt–equity ratio . . .”); Franco Modigliani & Merton H. Miller, *The Cost of Capital, Corporation*

first from the firm's underlying cash flows, with equity receiving whatever residuals there are. Absent insolvency, the residual going to equity thus bears all the variability in the firm's cash flow. When the total value of the equity in a firm is reduced, this variability will be concentrated on fewer dollars of equity and so the return on each such dollar varies more.

Perhaps, then, the crisis-related spikes in idiosyncratic risk simply reflect the effect of the crisis-related decreases in equity value.³⁹ Then there is no puzzle to explain, and the focus can turn directly to the legal implications of these findings. To address this possibility, we added explicit controls for the effect on idiosyncratic risk of the increase in leverage.⁴⁰ As depicted in Figure 3, however, no more than one-quarter of the observed increase in idiosyncratic volatility in the most recent crisis was due to the leverage effect that arises from depressed share prices.⁴¹

Thus, the puzzle with which this Part began still remains: Why, during periods of economic crisis, are large increases in idiosyncratic risk consistently associated with a company's stock? We address this puzzle in the next Part.

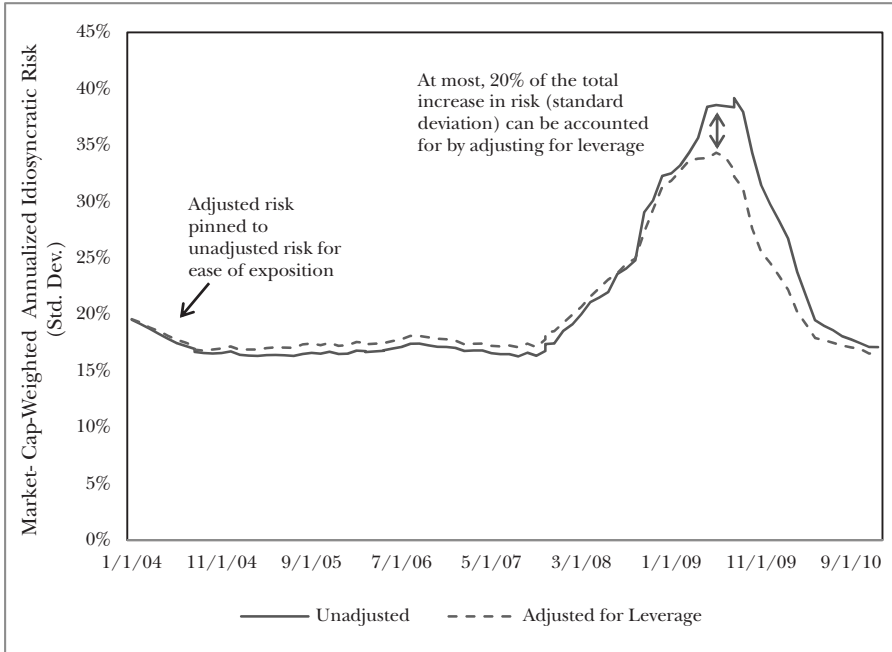
Finance and the Theory of Investment, 48 Am. Econ. Rev. 261, 267–72 (1958) (“[T]he expected yield of a share of stock is equal to the appropriate capitalization rate ρk for a pure equity stream in the class, plus a premium related to financial risk equal to the debt-to-equity ratio times the spread between ρk and r .” (emphasis omitted)).

39. We are grateful to Mark Weinstein for raising this point.

40. For each firm, we adjust for the effect of leverage by deflating the unadjusted daily volatility by multiplying it by the firm's Equity/(Debt+Equity) on that day. For more details, see Appendix, *supra* note 23, at 10 (explaining mathematical computation of unlevered β based on firm's ratio of debt to equity).

41. The online appendix also discusses and seeks to control for a second leverage-related impact on our measure of idiosyncratic risk, a changing (“unstable”) β during the observation period. *Id.* at 11. This too will increase the level of idiosyncratic risk measured for the typical firm. We find, however, that the second effect is in fact even less important than the first and so explains relatively little of the crisis-induced increase in idiosyncratic risk that we have observed.

FIGURE 3: IDIOSYNCRATIC RISK OF S&P 100 FIRMS
ADJUSTED FOR LEVERAGE



II. POSSIBLE EXPLANATIONS

As noted above, Campbell et al. first reported that idiosyncratic risk increases during crisis periods.⁴² Their focus, however, was not on explaining this link, but on explaining what they saw as a secular increase in idiosyncratic volatility from 1962 through 1997. We focus here on the puzzle presented by extending their observation period to the eighty-five years from 1926 through 2010. From the lead up to the Great Depression through what has come to be called the Great Recession, economic downturns repeatedly coincide with spikes in idiosyncratic volatility. Why should a crisis be associated with an increase in risk unrelated to the general economic disorder? We consider three possible explanations. One, explored in section II.A is that, compared to ordinary times, information about a firm contained in current news may become more important in predicting its future cash flows relative to the role of the already existing stock of knowledge in making such predictions. A second explanation, explored in section II.B, is that the quality of management becomes more important in crisis times. Consequently, the ordinary flow of new information about this subject can cause bigger movements in price because each bit tells the market about something—the quality of management—that the market now regards as more

42. Campbell et al., *Empirical Exploration*, *supra* note 20, at 3.

important than it did in ordinary times. A third explanation, explored in section II.C, is that crisis creates uncertainty as to what factors, and hence what information, are important to valuation. Because of this uncertainty, a broader range of information has valuation implications and therefore stock prices move more frequently. These three explanations share a common theme: Economic crises increase both the frequency and the impact of news with valuation consequences for an individual company's stock. New information becomes more valuable and more information is likely to be new, with the consequence of increased idiosyncratic volatility.

A. *Current News Becomes Relatively More Important*

In a rational market, share price at any given moment reflects the aggregate of investors' predictions of an issuer's future net cash flows.⁴³ These predictions are based on a large collection of bits of information, much of it accumulated over a period of years, but some of which at any time is new. In an informationally efficient market, the new information in each bit is by definition unpredictable before it is received. This new information is what causes the issuer's share price to fluctuate in a random walk: If new information cannot be predicted, then neither can the direction of its impact on price. How much a stock's price moves one way or the other depends on the predictive importance of the new bit of information relative to the predictive value of the previously accumulated information concerning that stock.

A first explanation for the association between economic crises and spikes in idiosyncratic volatility is that during an economic crisis, each bit of new information is likely to be more important relative to the existing stock of information for predicting the future. This should be true not only for information relevant to predicting the economy's overall performance but also for information that is relevant to predicting the future cash flows of only a single firm.

One reason that the predictive importance of firm-specific new information increases in an economic downturn is that investors expect structural changes in the economy to accompany a downturn. This is at least in part true because major downturns are usually the result of imbalances in the economy: in the case of the recent financial crisis, an unsustainable level of resources going into construction of residential and commercial buildings and into the financial industry. But the exact nature of this structural change and its implications, good or bad, for any particular firm might not yet be fully understood, as the deluge of books seeking to explain the Great Recession strikingly demonstrates.⁴⁴ In

43. See Brealey, Myers & Allen, *supra* note 2, at 80 (noting present value of share of stock equals expected future dividends per share, discounted to present value).

44. See Gary Gorton & Andrew Metrick, *Getting up to Speed on the Financial Crisis: A One-Weekend-Reader's Guide*, 50 *J. Econ. Literature* 128, 128–29 (2012) (proposing

essence, an economic crisis “shakes the box.” Everyone knows that when things settle down, the relations among firms, and those between each firm and its suppliers and customers, are likely to be different than before the crisis. Relative to each other, some firms will gain and others will lose from these changed relations. But no one is yet sure exactly what pattern these new relations will take and hence what companies will be the winners or losers. A new bit of firm-specific information can have a bigger price impact than in normal times because the bit may disclose something about this new pattern of relations.

Consider, for example, a not-fully-anticipated quarterly earnings announcement that is 10% lower than would have been predicted by the earnings path over the previous few years. This shortfall could be due to random firm-specific factors not likely to repeat themselves, or it could be due to a more enduring change in the fundamental factors shaping the environment in which the firm operates—the costs of its inputs, the market for its outputs, or the technology that the firm uses to transform one into the other—that will continue to influence the firm’s cash flows for many periods to come. A not-fully-anticipated quarterly earnings shortfall typically would have some impact on investor predictions about a firm’s future cash flows and hence on its share price. In making these predictions in normal times, however, investors might assign much more weight to the firm’s longer-term history of earnings because they are indicative of the environment within which the firm had been operating and there would be little reason to believe that the environment had changed radically during this most recent quarter.

During an economic crisis, in contrast, changes in the structure of the economy that significantly impact the firm are much more likely. However, there will at first be no clear understanding of the nature of these changes. The new piece of information concerning the quarterly earnings shortfall thus takes on more importance because there is a greater likelihood that the change in earnings is due to changes in more enduring factors affecting the long-run success of the firm, rather than to fluke factors unlikely to repeat themselves. Put differently, in such times, new information takes on greater importance because the economic crisis degrades the value of the old stock of information in helping to predict the future.⁴⁵

This explanation is consistent with a second feature of our results. As shown in Figure 1, the crisis-induced increase in idiosyncratic risk is truly

“reading list” of sixteen key documents for understanding crisis); Lo, *supra* note 6, at 154 (reviewing twenty-one books about crisis).

45. It should be noted that, even in normal times, a relatively small earnings shortfall from what was expected can have a significant effect on price. The earnings miss may indicate that despite all efforts to massage the numbers, the company still could not make the estimate, which suggests that something more important than a small miss has occurred. In crisis times, though, the shortfall would still, for the reasons discussed in the text, be expected to lead to an even bigger price decline.

spike-like: The increased volatility disappears as quickly as it appears. This suggests that once the market figures out the new shape of the postcrisis structural relationships, idiosyncratic risk returns to historical levels. In this explanation, new information is important to understanding the crisis-induced change in the structure of relationships among firms, and the volatility spike is the artifact of that importance. Once it is understood, the cause of increased idiosyncratic volatility disappears because new information no longer carries the extra, crisis-related capacity to cause large changes in predictions.

The structural change explanation for the increase in idiosyncratic volatility during crisis periods is also supported by the finding that firms in sectors that experienced the largest increase in their β s during the recent financial crisis—that is, ones that relative to other firms became more sensitive to factors that affect the market as a whole—also displayed the greatest increases in idiosyncratic risk.⁴⁶ It is reasonable to think that firms that were most affected by crisis-induced changes in the structure of the economy would tend to experience the biggest changes in their β s. These are the firms for whom, during a crisis, new bits of information would have the most predictive power relative to the prior stock of knowledge. In accordance with our first explanation, these are the firms that would display the greatest increases in idiosyncratic volatility.

A period where the market is rising rapidly, for example during the Internet boom, also may signal disruption and structural change, where again new information takes on more importance. Our findings are consistent with this circumstance as well—idiosyncratic risk goes up in sharp market upturns.⁴⁷ The increase is not as great as in market downturns, but the smaller impact is likely at least in part due to the deleveraging effect of rising stock prices, the opposite of the leverage effect we analyzed in section I.D.

The following hypothetical demonstrates the first explanation. Imagine that you have a barrel with 200 colored balls in it, divided in a ratio between red and green that you are trying to estimate. Each period, you randomly draw one ball, note its color, and put the ball back in the barrel. After, say, twenty periods, you will have a pretty good sense of the ratio in the barrel, and you will not change your estimate very much based on whether the twenty-first ball drawn is red or green. Now suppose that of the 200, 100 randomly selected balls are taken out of the barrel and 100 new balls are substituted for them. The newly substituted balls have an unknown ratio of red to green that might be quite different than the ratio of the 200 original balls. When you take out the twenty-second ball, the outcome (that is, the new bit of information)—whether it is red or green—will change your estimate of the ratio in the barrel much more than it would have absent the substitution.

46. See *supra* section I.C (presenting sectoral-analysis findings).

47. *Supra* Figure 2.

B. *Information Concerning Quality of Management Becomes More Important*

The phenomenon of crisis-enhanced new information has a special role when the information concerns the quality of management. When troubled times sharply change the overall business environment, the importance of an established firm's management becomes more like the importance of a startup's management in normal times. Management confronts more, and more important, decisions than in normal times.

It is well recognized that startup management has special importance because the company's value is primarily comprised of future growth options, as opposed to being based on the cash flows from an existing business.⁴⁸ At this early stage, management needs to make more choices of the kind that shape the fundamental direction of the firm. Moreover, the consequences of these choices are less obvious than they are with an established firm in normal times because there is no history of the consequences of making similar decisions in the past. Having high-quality managers—persons who are better at predicting the consequences of their more difficult choices despite the lack of such history—will thus have a larger impact on expected performance. Crisis thus can put the managers of even mature firms in a situation closer to that of a startup. The sharp change in the mature firm's business environment may force managers to make more fundamental choices, and history will be a less reliable guide as to their consequences. As a result, the quality of management has a larger impact on the firm's future cash flows.

In addition to the extent to which each bit of crisis-related information newly reveals something about the quality of a mature firm's management, the subject that bit of new information concerns—management quality—also has greater implications for the firm's future cash flows. Therefore, the significance of the bit in predicting these future cash flows becomes more important. As a consequence, the revelation of new information concerning management quality causes a bigger share price change and therefore, greater volatility than in noncrisis times.

C. *Model Failure: Ignorance Concerning What Facts Are Initially Relevant*

Investors' expectations about a company's future cash flows are typically based on an implicit model that tells them something about the meaning and importance of new information about the company. In essence, investors have a model that tells them what information is important for predicting future cash flows. In an economic crisis, systemic changes may make investors less confident that they still know

48. See, e.g., Ronald J. Gilson, *Engineering a Venture Capital Market: Lessons from the American Experience*, 55 *Stan. L. Rev.* 1067, 1076–77 (2003) (noting at start-up stage, “quality of the company's management . . . takes on heightened importance because so large a portion of the portfolio company's value depends on management's future decisions”).

which facts have valuation implications. Because of that uncertainty, a much wider range of facts potentially matter and so the appearance of more kinds of information will move prices. Moreover, any particular new bit of information can have greater importance. Not only does it directly tell investors something more about the firm's future cash flow, it may also provide information about the shape of a new valuation model that suggests a different range of information that will be relevant to predicting the firm's cash flows in the future. This may put an already existing stock of knowledge in new perspective, in effect, turning old information into new. Thus, new information and more kinds of information can potentially move price a great deal.

This third explanation differs from the first explanation—that current news becomes more relevant—in that the situation in the first explanation could be fully described in terms of risk, while the third explanation resembles more Knightian uncertainty.⁴⁹ Continuing with the analogy of sampling from a barrel of balls, you still need to estimate the ratio of the colors of the balls in the barrel, but you can no longer even be sure that there are only red balls and green balls after the substitution of the 100 new balls. Suppose, after this substitution, the twenty-second ball drawn is yellow, not red or green. The draw tells you not only something about the ratio of balls, it tells you that your old model—a two-color distribution—is no longer accurate. Thus, you get a whole new kind of information relevant to predicting the contents of the barrel.⁵⁰

49. See Frank H. Knight, *Risk, Uncertainty and Profit* 233–34 (1921) (distinguishing between risk, which can be predicted probabilistically, and uncertainty, which cannot).

50. Warren Buffett has famously made a related point. In his terms, “[Y]ou only find out who is swimming naked when the tide goes out.” Letter from Warren E. Buffett, Chairman, Berkshire Hathaway Inc., to Shareholders of Berkshire Hathaway Inc. 10 (Feb. 28, 2002), <http://www.berkshirehathaway.com/letters/2001pdf.pdf> [<http://perma.cc/QUJ7-X8PG>].

Put more precisely, but less amusingly, good times allow a pooling equilibrium concerning firm quality, and the economic crisis results in separation. While Buffett's point covers part of our analysis, it does not address an important aspect of our data. Our measure documenting the idiosyncratic volatility increase involves the variance of daily market-adjusted price changes over a twelve-month period. For most firms in the sample, much of the increased variance in the idiosyncratic portion of the firm's returns comes from an increase in both the upside and the downside. In contrast, Buffett's separating effect of bad economic times—revealing which are the bad firms and which are the good ones—would, for any given firm, work in just one direction. Moreover, if the large declines in share price associated with the revelation of dishonest or incompetent management drove a significant portion of the crisis-times increase in idiosyncratic risk, then, compared to normal times, the largest drops should explain a substantially higher portion (relative to what we have observed) of the total amount of such risk during the twelve-month period. As discussed in the online appendix, in crisis and in precrisis times alike, about the same portion of total idiosyncratic risk is explained by the biggest drops, a result inconsistent with the “tide goes out” explanation. See Appendix, *supra* note 23, at 8 fig.A-5 (comparing unadjusted market-cap-weighted volatility with estimates after truncating tails).

III. THE EFFECTS OF CRISIS-INDUCED SPIKES IN IDIOSYNCRATIC VOLATILITY ON EVENT STUDIES

Over the last few decades, financial economics and related econometric tools have become increasingly integrated into corporate and securities law analysis and practice. The synergy is straightforward: Financial economics speaks to how assets are valued and corporate and securities laws provide a structure in which value can be created. This sensible trend has proceeded, however, without an appreciation of the dramatic several-fold increase in idiosyncratic volatility accompanying economic bad times that we have documented here and sought to explain. Yet the sharp price drops that accompany bad times make these times precisely when there are more plaintiffs' suits, more governmental enforcement actions, and more calls for regulatory change. This Part and Part IV take a fresh look at the link between financial economics and corporate and securities law in light of what we have shown is the predictable spike in idiosyncratic volatility that accompanies each major economic downturn. Sections IV.A and IV.B consider the impact of crisis-related spikes in idiosyncratic volatility on the use of event studies in connection with a number of issues that arise in securities litigation. Section IV.C then turns to the impact of these spikes on the extent to which incumbent management's valuation of a target company should receive deference in the context of a contest for corporate control.

Financial economics focuses centrally on what factors influence the price of a security. The inquiry can be framed by identifying an event that may influence a security's price and then seeking to measure the impact of that event on the price of the security in question. Measuring the price impact of a particular event, however, requires isolating the effect of a single item of information—the occurrence of the event under study—from the cacophony of information constantly reaching the capital markets. This is the province of an event study.⁵¹ Over the last few decades courts have come, as a practical (and probably as a legal) matter, to require plaintiffs to conduct an event study for many securities fraud class actions to proceed.⁵² As we will see, the level of idiosyncratic

51. See, e.g., Sanjai Bhagat & Roberta Romano, *Event Studies and the Law Part I: Technique and Corporate Litigation*, 4 *Am. L. & Econ. Rev.* 141, 142 (2002) (explaining methodology of event studies focuses on movement of stock prices due to specific events); Sanjai Bhagat & Roberta Romano, *Event Studies and the Law Part II: Empirical Studies of Corporate Law*, 4 *Am. L. & Econ. Rev.* 380, 380 (2002) (“[E]vent studies provide a metric for measurement of the impact upon stock prices of policy decisions.”).

52. See, e.g., *Bricklayers & Trowel Trades Int'l Pension Fund v. Credit Suisse First Bos.*, 853 F. Supp. 2d 181, 186 (D. Mass. 2012) (“An event study . . . often plays a ‘pivotal’ role in proving loss causation and damages in a securities fraud case. Given the difficulty inherent in proving the effect, if any, of a single news item on the price of a stock, many courts require them in such cases.” (citation omitted)); *In re Williams Sec. Litig.*, 496 F. Supp. 2d 1195, 1272–73 (N.D. Okla. 2007) (“[A] number of courts have rejected or refused to admit . . . damages reports or testimony by damages experts in securities cases

volatility associated with a company's stock is central to the event study methodology and the sharp spikes in such volatility that accompany economic crises cause problems. To see why, we need to start with a brief account of how an event study is conducted.

A. *Event Study Basics*

It would be very useful to be able to identify the impact of a particular event on a stock's price. For example, on the day that any particular item of news relating to a specific issuer becomes public, say the announcement of an acquisition, other bits of news concerning the company also may affect its share price. So the mere fact that the share price moved up or down that day does not show that the price movement was caused by the acquisition. In assessing whether the acquisition will increase a firm's value, it would be helpful to observe just the effect of the acquisition announcement—to separate the effect of the “event” from that of any other bits of news relevant to the company's future cash flows and of random noise. An event study helps distinguish between the different possible influences on stock price in order to assess the extent to which a particular item of information affected price.⁵³

1. *Determining the Market-Adjusted Price Change.* — Conducting an event study begins with measuring the market-adjusted change in the issuer's share price when the item of interest becomes public. The market-adjusted change is the difference between the observed price change and what the change in overall stock market prices predicts would have been the issuer's price change. This prediction is based on the historical relationship (usually over a one-year observation period ending shortly before disclosure of the item of interest) between price changes in the overall market and price changes of the issuer's stock.

Making this market adjustment removes the influence on the stock's price of news that affects the price of all firms' stock, i.e., bits of systematic news. What is left—the market-adjusted price change—is the

which fail to include event studies or something similar.” (quoting *In re Imperial Credit Indus., Inc. Sec. Litig.*, 252 F. Supp. 2d 1005, 1015 (C.D. Cal. 2003)).

53. Those familiar with event studies will recognize a fundamental difference between event studies as originally developed in financial economics and event studies as they are used in securities litigation. In financial economics, the key to an event study is that the task is to measure the effect of an event in general—does it affect stock price over a sample of companies that experienced the event?—not the effect of an event on a particular company's stock price. The financial economics approach uses a sample of all companies that experienced the event in question to regress out the effect of all the other events affecting a company's stock price. If the number of companies in the sample is large enough, the other events affecting particular companies cancel each other out. See Campbell, Lo & MacKinlay, *Econometrics*, supra note 37, at 149–80 (explaining event study methodology).

A single-company event study, as used in the securities litigation context, must address the problem of other events occurring close in time to the event under study in other ways. The text is concerned with single-firm event studies.

portion of the observed change in price that is due to firm-specific news or background noise. Because in securities litigation, the news item of interest relates specifically to the issuer, eliminating the impact of systematic news is critical.⁵⁴

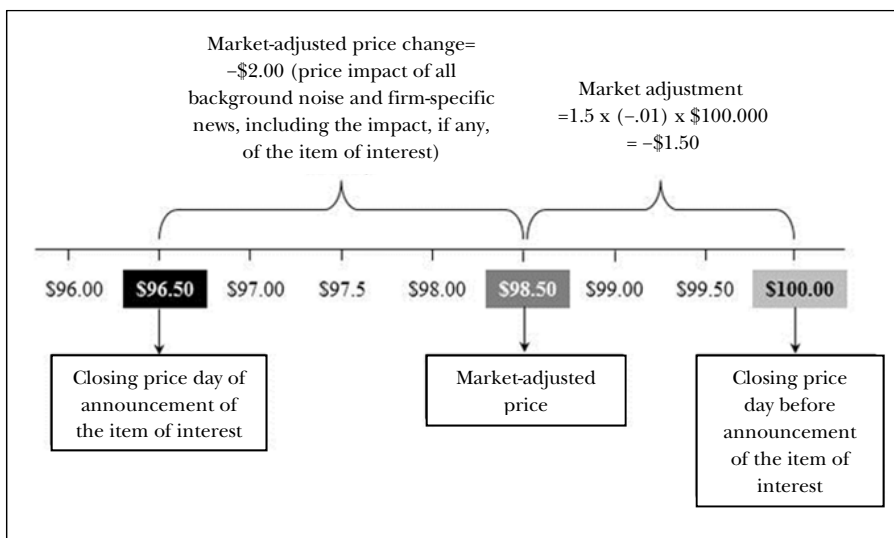
To give an example, suppose that the share price of the issuer under study was \$100.00 at the end of the trading day immediately preceding the item of interest's disclosure and is \$96.50 by the end of the day on which the item of interest is disclosed. Suppose as well that the market as a whole went down 1% on the day of the item of interest and that the issuer's β is 1.5.⁵⁵ Based on this historical relationship between day-to-day changes in the issuer's share price and the corresponding market-wide price changes, we would predict that if firm-specific news, including the item of interest, had on a net basis no effect on the issuer's share price, the issuer's price would have dropped to \$98.50. But in fact it dropped to \$96.50. So the remainder of the observed price change—referred to as the market-adjusted price change—would be $-\$2.00$, or -2.00% . As depicted in Figure 4, this is the portion of the total observed price change that can be attributed to firm-specific news.⁵⁶

54. Courts recognize the need to separate systematic from unsystematic movements in stock price based on the utility of single-firm event studies in accomplishing this. For examples of courts requiring the use of event studies to strip away any movement in price caused by market-wide trends for plaintiffs to establish loss causation, see *Imperial Credit Indus., Inc.*, 252 F. Supp. 2d at 1015–16 (rejecting testimony of plaintiff's expert for failure to include "event study or similar analysis . . . [to] eliminate that portion of the price decline . . . which is unrelated to the alleged wrong," but attributable to "market events for which Defendants cannot be held responsible" (citations omitted)); *In re N. Telecom Ltd. Sec. Litig.*, 116 F. Supp. 2d 446, 460 (S.D.N.Y. 2000) ("[Plaintiff's expert's] testimony is fatally deficient in that he did not perform an event study or similar analysis to remove the effects on stock price of market and industry information . . .").

55. See *supra* note 28 (explaining concept of β).

56. See Campbell, Lo & MacKinlay, *Econometrics*, *supra* note 37, at 149–80 (discussing methodology of event studies).

FIGURE 4: ISOLATION OF FIRM-SPECIFIC NEWS THROUGH MARKET-ADJUSTMENT



2. *Judging the Market-Adjusted Price Change Against Its Historical Volatility.* — The next step in an event study determines the likelihood that at least part of the observed market-adjusted price change results from the item of interest. In essence we are asking the following question: How likely is it that we would observe a market-adjusted price change of the magnitude that was observed on the day the item of interest was announced if in fact the change results solely from the day's other bits of firm-specific news and background noise? This can be answered by comparing the issuer's market-adjusted price change on the relevant date with the historical record of the daily, market-adjusted ups and downs in the issuer's share price, typically over the approximately 250 trading days in a one-year observation period ending on a day shortly before the item of interest's disclosure, i.e., by comparing the magnitude of the market-adjusted price change on the day of the announcement with the issuer's historical idiosyncratic volatility.

As a general matter, market-adjusted price changes, up and down, are distributed in a pattern closely resembling what would be produced by a normal (bell-shaped curve) probability distribution with a zero mean.⁵⁷ The conventional event study assumes that the same probability

57. While the event studies used by experts in securities litigation cases almost universally assume that these price changes are normally distributed, it has been recognized for some time that the actual distribution of these changes is not perfectly normal. See, e.g., Stephen J. Brown & Jerold B. Warner, *Using Daily Stock Returns: The Case of Event Studies*, 14 J. Fin. Econ. 3, 4-5 (1985) (discussing non-normal distribution in daily stock returns). This has led some commentators to call for using another technique for conducting event studies in securities litigation situations. See, e.g., Jonah B.

distribution generates the market-adjusted price change on each of the approximately 250 trading days during the observation period *and* the net price impact of all ordinary, day-to-day firm-specific news and background noise other than any impact from the item of interest on the day that it is announced. Because of the size of the sample, the standard deviation of the observation period's approximately 250 market-adjusted price changes is a fairly precise estimate of the standard deviation of this probability distribution.

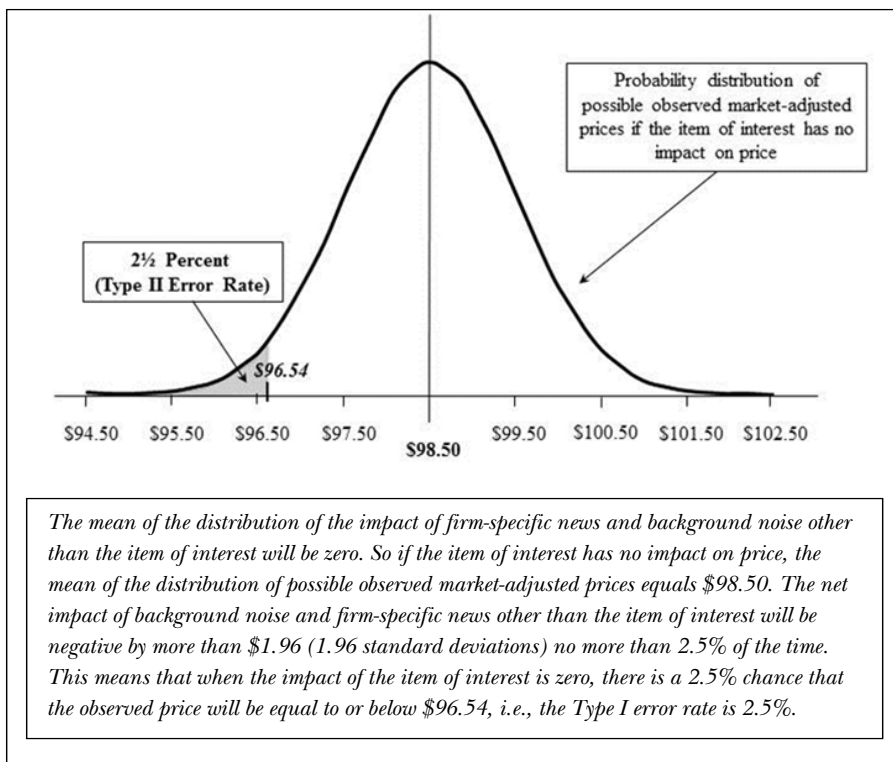
Because this probability function is a normal distribution, the net price impact of all the other firm-specific news of the day and background noise will be within plus or minus 1.96 standard deviations of the mean, 95% of the time. From this, we can see that if the item of interest in fact had no impact on price, there is less than a 5% chance that we would observe a market-adjusted price change on the day it was announced that is plus or minus, more than 1.96 standard deviations from the mean. Therefore, if we observe a market-adjusted price change this large, we can reject with at least 95% confidence the null hypothesis that the item of interest had no impact on price. Accordingly, observed market-adjusted price changes that are large enough to pass this test are often referred to as being statistically significant at the 95% level.⁵⁸

These points may be most easily understood by extending our example above. Suppose, for purpose of illustration, that the standard deviation of the market-adjusted price changes during the observation period was 1%. This would mean that on the day the item of interest is announced, the net price impact of the other firm-specific news and background noise would 95% of the time be somewhere between +1.96% and -1.96%, as illustrated in Figure 5. It would be outside this range on the positive side 2.5% of the time and on the negative side 2.5% of the time. In our example, the observed market-adjusted price change on the day of the announcement of the item of interest was -\$2.00 or -2.00%. This is more than 1.96 times the standard deviation of the day-to-day ups and downs in the market-adjusted price during the observation period, and so the price change was statistically significant at the 95% level.

Gelbach, Eric Helland & Jonathan Klick, Valid Inference in Single-Firm, Single-Event Studies, 15 *Am. L. & Econ. Rev.* 495, 496-99 (2013) (explaining flaws of standard approach and proposing alternative test). The overall analysis in this Article would apply equally to these other techniques.

58. See generally Campbell, Lo & MacKinlay, *Econometrics*, supra note 37, at 149-80 (explaining history and methodology of event study analysis). As a technical matter, saying that we can reject the null hypothesis with "95% confidence" is the province of Bayesian statistics. Our terminology, however, is commonly used with event studies and shall be thought of as shorthand for saying there is a less than 5% chance of observing a result this extreme if the null hypothesis is true.

FIGURE 5: DEMONSTRATION THAT AN ANNOUNCEMENT OF AN ITEM OF INTEREST WITH NO NEGATIVE IMPACT ON PRICE WOULD BE ACCOMPANIED BY A MARKET-ADJUSTED PRICE CHANGE AS NEGATIVE AS $-\$2.00$ LESS THAN 2.5% OF THE TIME



If the difference between the issuer's market-adjusted price change when the event of interest is disclosed and its historic market-adjusted price change over the observation period is large enough to pass this test of statistical significance and no other important bits of firm-specific information become public close in time to the event of interest, we can, with at least 95% confidence, reject the null hypothesis that the observed market-adjusted price change was due entirely to factors other than disclosure of the item of interest. In other words, the observer can reject with this level of confidence the proposition that the item of interest had no effect on price.⁵⁹

59. The foregoing discussion presents a somewhat simplified version of the event studies that are typically conducted by experts giving testimony in securities actions. For example, there is usually a control for industry-specific pieces of information as well as for systematic information, which will entail some complications concerning the proper definition of the industry. Also, sometimes the event window in which the market-adjusted price change is measured is longer than one day. In addition, often the baseline one-year observation period used to determine the standard deviation has removed days on which

B. *Type I and Type II Errors in the Use of Event Studies for Securities Litigation*

A securities fraud class action typically is based on the theory that a corporate disclosure caused the issuer's stock price to move in a particular direction. An event study is used to test that theory. For example, if the purchaser of a security claimed that a corporate misstatement inflated the price she paid and that she suffered a loss when the stock price dropped in response to the truth coming out, she would seek to prove that the corrective disclosure negatively affected the price.⁶⁰

As just discussed, because there are potentially many other bits of firm-specific news and general background noise affecting an issuer's share price on the same day that the item of interest is announced, we cannot determine with certainty whether the item of interest had any negative impact on price. We instead use an event study to make a probabilistic assessment of whether the item in fact had an effect on the company's share price. An event study addresses this question by providing a probabilistic assessment of whether the corrective disclosure had a negative effect on the company's share price. As the question is usually put, did the issuer's stock price decline by a statistically significant amount? For our purposes here, the critical fact is that this test will generate a certain rate of false positives (Type I errors) and of false negatives (Type II errors). Type I errors occur when the item of interest did *not* in fact have an impact on price but the observed market-adjusted price change on the day it was announced was sufficiently negative to nonetheless *pass* this test. Type II errors occur when the item of interest *did* in fact have an impact on price but the observed market-adjusted price change on the day it was announced *was not statistically significant*.

Again, these two types of errors are most easily understood by going back to our example. When the standard deviation is properly specified, as will be the case in normal economic times,⁶¹ the Type I error rate depends solely on the level of statistical confidence required by the test (for

there are identifiable, obviously important bits of firm-specific news and in parallel, there is an attempt to remove the impact of any other identifiable, obviously important bits of firm-specific news on the day that the item of interest is disclosed. For a discussion of these elaborations on the simple model presented here, see, e.g., Allen Ferrell & Atanu Saha, *The Loss Causation Requirement for Rule 10b-5 Causes of Action: The Implications of Dura Pharmaceuticals, Inc. v. Broudo*, 63 Bus. Law. 163, 166–67 (2007). None of these elaborations of event-study methodology affect the points that we seek to make.

60. For purposes of illustration, we will assume throughout this Article that the legally relevant question is whether an item of news had a negative effect on price, but a symmetrical version of the discussion would be equally valid where the legally relevant question is whether the item had a positive effect on price—for example, in a case claiming that a proposed acquisition was favorable to shareholders.

61. See *infra* section III.B.1 (identifying magnitude of Type I and Type II errors in normal economic times).

purposes of this discussion, 95%⁶²). To pass the test, the observed market-adjusted price change on the day of the item of interest must be at least -\$1.96. As depicted in Figure 5, there is only a 2.5% chance that the other firm-specific news and background noise had a net price impact this negative. Thus, there is only a 2.5% chance that we would observe a market-adjusted price change this negative if the item of interest in fact had no negative impact on price: The Type I error rate is 2.5%.⁶³ Observed market-adjusted negative price changes more negative than this—in our example, the observed change of -\$2.00 or -2.00%—pass the test.

The Type II error rate—where the item of interest *did* in fact have a negative impact on price but the observed market-adjusted price change on the day it was announced *failed* the confidence test—is a bit more complicated. The Type II error rate depends not only on the level of statistical confidence required by the test, again 95% for this discussion, but also on the magnitude of the actual negative price impact of the item of interest and the issuer's idiosyncratic volatility as measured by its standard deviation.

To see how this works, modify our continuing example slightly. Suppose, as depicted in Figure 6, that an item of interest in fact had a -1.00% market-adjusted impact on the issuer's stock price and that, as before, the standard deviation of market-adjusted price changes for this issuer was 1.00% over the measuring period. Recall again that the market-adjusted price change observed on the disclosure day is the combination of the item of interest's price impact and the net price impact of all the other firm-specific bits of news and background noise on that day.⁶⁴ The relevant question is: What is the likelihood that the observed market-adjusted price change on the disclosure day will be sufficiently negative to pass the 95% confidence standard, (i.e., more negative than -1.96%)? This will only happen if the net impact of all the other bits of firm-specific news and back-

62. Cf. Shari Seidman Diamond, Reference Guide on Survey Research, *in* Reference Manual on Scientific Evidence 359, 381 (3d. ed. 2011) [hereinafter Manual on Scientific Evidence] (“Traditionally, scientists adopt the 95% level of confidence”); David H. Kaye & David A. Freedman, Reference Guide on Statistics, *in* Manual on Scientific Evidence, supra, 211, 245 (noting 95% is confidence level “most popular” in scientific literature).

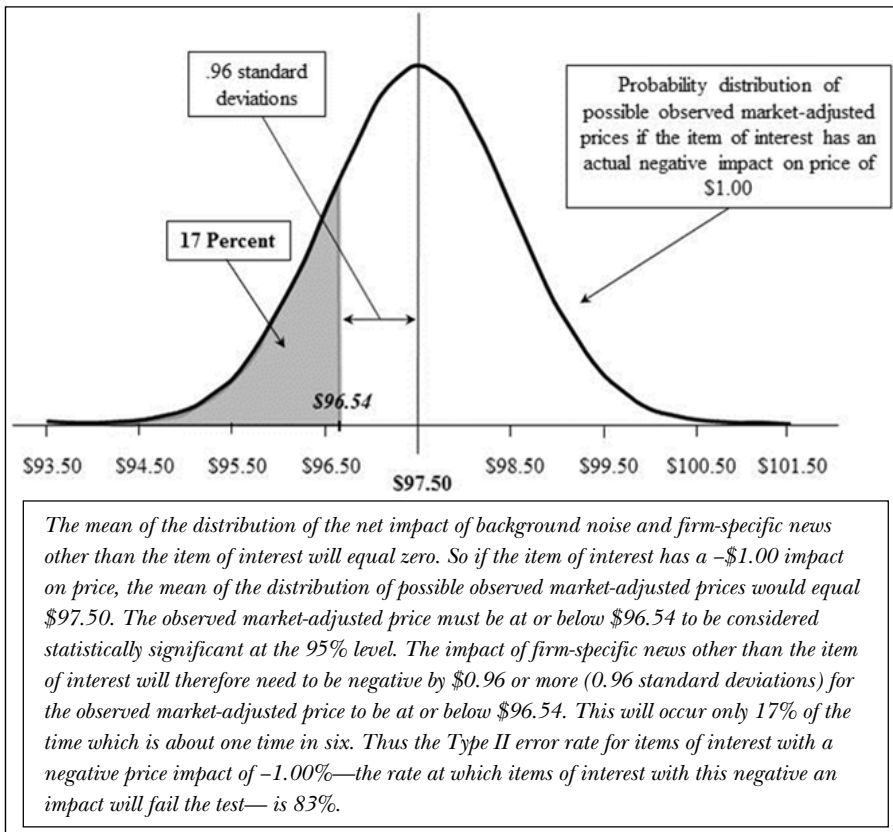
63. The standard methodology is to use a “two-tailed” test, which looks only at the magnitude of the price change. The result is considered statistically significant at the 95% level if the observed price change is greater than 1.96 times the standard deviation, whether positive or negative. The observed price change being statistically significant and negative implies that if the item of interest had no effect on price, there is no more than a 2.5% chance that we would observe a change this negative.

64. The expected value of the effect on share price of these other factors is zero, but that only means that they are as likely to add to as to subtract from the negative effect on share price of the item of interest. As a highly simplified example, suppose there is one other piece of firm-specific information revealed to the market the same day. This other bit of news is unrelated to the news items of interest and if it were the only piece of firm-specific information revealed that day, would result in a positive price change of +3%. The observed market-adjusted change in price will be 2%, even if, as posited, the news item of interest itself affected price by -1%.

ground noise on that day is at least -0.96% (which, when combined with the -1.00% impact of the item of interest, would in total be at least -1.96%).

As depicted in Figure 6, this will be the case only about 17% of the time, or only about one time in six.⁶⁵ Thus, one cannot necessarily infer from an observed market-adjusted price change failing the test that it likely did not affect price. Indeed, for an issuer with a standard deviation of 1%, an item of interest with an actual impact on price of -1.00% will fail the test most of the time.

FIGURE 6: DEMONSTRATION THAT WITH AN ITEM OF INTEREST HAVING AN ACTUAL NEGATIVE IMPACT OF \$1.00, THE OBSERVED MARKET PRICE WILL BE NEGATIVE ENOUGH TO BE CONSIDERED STATISTICALLY SIGNIFICANT ONLY ONE TIME IN SIX (A TYPE II ERROR RATE OF 83%)



65. For a more detailed discussion of the general approach to calculating the chances of this kind of error, see Edward G. Fox, Merritt B. Fox & Ronald J. Gilson, *Idiosyncratic Risk During Economic Downturns: Implications for the Use of Event Studies in Securities Litigation* 7–11 (Columbia Law & Econ., Working Paper No. 453, 2013) [hereinafter Fox, Fox & Gilson, *Idiosyncratic Risk*], <http://ssrn.com/abstract=2314058> [<http://perma.cc/7K5A-NGS3>] (expressing calculations mathematically).

More generally, the odds of an item of interest that actually had a negative effect on price passing a test based on any given level of confidence depends on the size of the actual effect relative to the standard deviation of past day-to-day market-adjusted price changes. Also, the higher the required confidence level, the lower the rate of false positives (Type I errors) and the higher the rate of false negatives (Type II errors). As we will see, each kind of error can have negative social consequences when event studies are used in securities litigation. That assessment leads to the matter of special concern here: Economic crisis-related idiosyncratic volatility spikes make the problem of Type I and Type II errors significantly worse.

1. *The Magnitude of Type I and Type II Errors in Normal Times Using a 95% Confidence Level.* — Our analysis starts by identifying the magnitude of Type I and Type II errors in normal times. This sets the baseline for our consideration of the impact of crisis-related volatility spikes.

a. *Type I Errors.* — In normal economic times, it is conventionally assumed that the same probability distribution generates the market-adjusted price changes on each of the approximately 250 trading days during the typical one-year observation period prior to the item of interest's disclosure.⁶⁶ Thus, the standard deviation of the observation period's approximately 250 market-adjusted price changes is a fairly precise estimate of the standard deviation of the probability distribution generating the net price impact of background noise and firm-specific information other than the item of interest on the day of its announcement. Under these circumstances, with a 95% confidence standard, the Type I error for a test of whether the item of interest had a negative impact on price is as calculated above: 2.5%.

b. *Type II Errors.* — Now consider what in normal times would be the Type II error rate associated with using the 95% confidence level if an item of interest in fact negatively affects the price by 5%.⁶⁷ Again, background noise and firm-specific information other than the item of interest will simultaneously affect the issuer's market-adjusted price. Thus, the observed market-adjusted price change in any given instance may differ, one way or the other, from 5%. Type II error occurs when the observed market-adjusted price change—the combination of the price impact of the item of interest and these other impacts—is not sufficiently

66. A visual review of Figures 1 and 2, *supra*, provides an empirical verification of the reasonableness of the assumption. In these Figures, each moment's measure of idiosyncratic risk is the standard deviation of market-adjusted price changes over the previous twelve months. In other words it is a day-by-day look back over the prior twelve months. One can see that during normal times this measure stays quite steady from one day to the next.

67. Securities lawyers often use 5% as a crude rule-of-thumb threshold percentage as a starting point for determining how much income or assets need to be misreported to be considered material. See *infra* note 122 and accompanying text (describing prevalence of 5% in securities litigation contexts).

negative to pass the test of statistical significance. The starting point is to calculate how negative the market-adjusted price change accompanying the item of interest's announcement needs to be to pass the test, just as was done in the example above concerning Type II error depicted in Figure 6. In Figure 2 above, market-cap-weighted average firm-specific volatility, as measured by variance, from the 1970s until the advent of the financial crisis, was in the range of 6% to 10% during noncrisis years, with an average of approximately 8%. This annualized variance translates to a daily standard deviation of 1.78%.⁶⁸ Again, for the observed market-adjusted price change to be considered statistically significant at the 95% level, the observed market-adjusted price change must be at least as negative as 1.96 times the standard deviation—it must be $-1.96 \times 1.78\% = -3.49\%$.

The Type II error question is then how likely it is that the observed market-adjusted price be at least this negative when the actual price impact of the item of interest is -5% . The observed price change will be this negative unless the net impact of the other firm-specific news and background noise that day is $+1.51\%$ or more (so that, when added to the -5% impact of the item of interest, the combined impact is less negative than -3.49%). These other factors would have a net impact of $+1.51\%$ or more only about 20% of the time.⁶⁹ This is the Type II error rate—the

68. Since our calculations are based on daily data, it is our annual variances that are interpolated using the following mathematical formula: $Var \sum_{i=1}^{252} \varepsilon_i = 252 * Var(\varepsilon_i)$ where $\sum_{i=1}^{252} \varepsilon_i$ is the sum of the market-adjusted returns on each of the 252 trading days each year, and thus the left-hand side is the annual variance of market-adjusted returns. The equality flows because the market-adjusted returns will be independent of one another in an efficient market. A reader can back out the daily variance by dividing the annualized numbers in Figure 2 by 252. The daily standard deviation is the square root of the daily variance. Due to the nonlinearity of variance, this is not the exact figure that we yield after marketcap weighting the standard deviations of the individual firms, but this difference is relatively minor.

69. This calculation involves the distribution of possible observed values of the market-adjusted price change if the actual market-adjusted price impact of the tested item of news is -5% . The distribution of observed market-adjusted price changes accompanying tested items of news with an actual impact of -5% will approximate a normal distribution with a mean of -5% and a standard deviation equal to the standard error of 1.78%, representing the effect, plus or minus, of the other ordinary bits of firm-specific information that move the issuer's share price around every day. Since the observed change in prices will be considered statistically significant at the 95% level and have the right sign only if it is a decrease of greater than -3.49% , the question becomes: What are the chances that the observed change after imposition of the requirement will be at least this negative? The required negative change, -3.49% , is 0.85 standard deviations above -5% , and so, based on the normal distribution, there is then an 80.2% chance that the observed market-adjusted change in price will be a decrease greater than 3.49% and hence considered statistically significant at the 95% level in a two-tailed test. Thus, there is a 19.8% chance that the observed change will yield a false negative. In a related, more technical paper, we discuss in greater detail the general approach to calculating Type II errors. Fox, Fox & Gilson, *Idiosyncratic Risk*, *supra* note 65, at 7–11.

In fact, market-adjusted stock returns do not appear to converge exactly to a normal distribution (they are “fatter” tailed, i.e., they exhibit more extreme returns than if they followed a normal distribution). We use the normal distribution because it is used in

likelihood that this item of interest, which actually negatively affected price by 5%, would not be accompanied by a market-adjusted price change sufficiently negative to be statistically significant. In these circumstances, a securities fraud claim will fail despite the fact that the disclosure did in fact have a 5% impact on stock price.⁷⁰

Discussion can now move to the impact of crisis-induced increases in idiosyncratic volatility on event study methodology and hence on the conduct of securities litigation.

2. *Type I and II Errors in Periods of Crisis-Induced, High Idiosyncratic Risk.* — A spike in idiosyncratic volatility has two implications for Type I and Type II errors. First, if the spike recently occurred and conventional event study methodology is employed, the test of statistical significance that identifies the size of a price change large enough to meet the 95% confidence level can drastically underestimate the actual extent of Type I error. Put simply, the standard deviation used for determining the statistical significance of the price change will understate the real standard deviation because of the crisis-induced increase in idiosyncratic risk—that is, securities fraud claims will succeed when they would otherwise have failed. While more advanced techniques address this underestimation, they raise other problems.⁷¹ Second, more generally, even where the cutoff for statistical significance properly takes into account the crisis-induced spike in idiosyncratic risk and is set at the appropriate point to maintain the Type I error rate at 2.5%, a spike nonetheless can result in a several-fold increase in Type II error—that is, securities fraud claims will fail when they should have succeeded.

a. *The Effect of a Recent Increase in Idiosyncratic Volatility.* — Consider the situation where there has recently been a large increase in idiosyncratic volatility, as was the case in the fall of 2008 as the full dimensions of the financial crisis were just becoming apparent.⁷² This

virtually all event studies for testing statistical significance. The points outlined above and below are only strengthened if returns are “fat tailed” because, if returns are fat tailed for a given level of Type I error, one must set an even more stringent cutoff for statistical significance than one would under the normal distribution, which would induce more Type II errors.

70. A first impression is that the likelihood of a mistake is too high to provide the foundation for the litigation of securities fraud cases. While that assessment is beyond the scope of our effort here, it is worth keeping in mind the alternative: two expert financial analysts offering nonempirically grounded opinions where the error term is likely both greater and completely impossible to estimate with any precision.

71. See *infra* notes 78–79 and accompanying text (explaining advanced Generalized Auto Regressive Conditional Heteroskedasticity (GARCH) model).

72. For example, during seven days in September 2008, Lehman Brothers failed and the federal government effectively nationalized AIG. Ronald J. Gilson & Reinier Kraakman, *Market Efficiency After the Financial Crisis: It’s Still a Matter of Information Costs*, 100 Va. L. Rev. 313, 375 (2014) (noting full effect of capital market crisis had not been fully realized by dates of Lehman Brothers failure and federal government’s intervention in AIG).

special situation poses problems for the conventional strategy for testing whether an item of interest in fact affected price. In particular, it undermines the use of a one-year measuring period before the occurrence of the event in question as a proxy for the forces generating idiosyncratic volatility at the time the item of interest is announced.

The conventional event-study methodology assumes that the volatility in the company's market-adjusted stock price at the time of the announcement is the same as during the preceding one-year observation period.⁷³ In the special situation of a recent crisis-induced increase in idiosyncratic volatility, this assumption fails radically, resulting in an insufficiently negative cutoff and securities fraud actions succeeding when they should not.

b. *Potential Understatement of Type I Errors.* — In this special situation, the standard deviation of market-adjusted price changes during the one-year observation period will underestimate the daily net price fluctuation by the time of the item of interest's announcement. This is because of the sharp increase in idiosyncratic risk that accompanies each crisis.⁷⁴ With the cutoff for what is considered statistically significant then incorrectly based on a standard deviation smaller than what actually prevailed at the time of the event, more than 2.5% of the tested news items that in fact had no effect on price will be accompanied by market-adjusted price changes that satisfy this erroneous cutoff. Thus, the Type I error rate will be understated to the benefit of plaintiffs in securities fraud actions.

A hypothetical provides a sense of the extent of the understatement of Type I errors. Assume that the standard deviation of firm-specific price changes during the observation period was 1.5% (the standard deviation for the average S&P 100 firm for the July 1, 2007, to June 30, 2008, period). Assume as well that the idiosyncratic volatility had increased to 2.7% (the standard deviation for such a firm in the July 1, 2008, to June 30, 2009, period) and that the event of interest occurs early in this second period. The observation period is thus July 1, 2007, to June 30, 2008. Using the conventional methodology (a one-year pre-event estimation period), any observed market-adjusted price drop of 2.95% ($1.96 \times 1.5\%$) or more on the date the item of interest is disclosed would be statistically significant at the 95% confidence level. But by the date of disclosure the standard deviation of idiosyncratic volatility has risen to 2.7%. The result is that about 14% of the time, items of interest with no effect on price will be accompanied by market-adjusted price changes

73. See *supra* section III.A.2 (describing conventional method of using standard deviation of observation period's approximately 250 market-adjusted price changes as measure of the probability distribution generating the net price impact of background noise and firm-specific information other than the item of interest).

74. See *supra* Part I (summarizing empirical findings).

sufficiently negative to be statistically significant.⁷⁵ In effect, our event study is comparing apples and oranges: the current higher volatility with a cutoff based on the older lower volatility level. *Thus, the Type I error rate would be almost six times the supposed 2.5% level.* As will be discussed in section IV.B.2, liability clearly should not be imposed on an issuer in a securities fraud claim where the misstatement in fact had no impact on price. Yet, with a recent increase in idiosyncratic volatility of this sort, using a conventionally designed event study to determine loss causation would increase six-fold the likelihood of liability being incorrectly imposed in such a situation.

c. *Correcting for Understated Type I Errors and the Resulting Increase in Type II Errors.* — One approach to addressing the problem of increased Type I error caused by the increase in idiosyncratic volatility after the estimation period ends is to begin the estimation period only after the idiosyncratic risk increases. Where the tested item of news occurs relatively soon after the increase in volatility, however, an estimation period beginning with the volatility increase and ending immediately before the item of interest will be shorter, possibly much shorter, than the conventional one-year period. This will result in less precise estimates of the relationship between the issuer's stock price and the ups and downs of the market as a whole (i.e., the issuer's β)⁷⁶ and of the level of idiosyncratic risk. These less precise estimates ameliorate Type I error, but only by increasing Type II error.⁷⁷

Another approach to addressing the conventional strategy's significant understatement of Type I error when there is a recent increase in idiosyncratic volatility is to use a full one-year observation period that ends before the tested item of news becomes public, but to use more advanced econometrics that take into account the midstream change in idiosyncratic volatility.⁷⁸ The additional complexity of these

75. This percentage reflects that -2.95% is 1.09 times the actual standard deviation of 2.70% . Based on standard statistical tables for the normal distribution, 14% of all outcomes are more negative than 1.09 standard deviations below the mean.

76. See Appendix, *supra* note 23, at 11 (showing how this will increase idiosyncratic risk).

77. One way to counter this problem of an abbreviated observation period is to extend the period forward beyond the date the tested item of news becomes public, but omit from the sample the price change on that date to avoid having the event whose effect the study is trying to determine influence the measure. The downside is that the volatility induced by the tested item of news may seep into other days in the observation period, thus again increasing Type II error.

78. One method for dealing with shifting volatility is to use a GARCH model, which makes current volatility a function of past volatility and net-of-market returns. See Appendix, *supra* note 23, at 15 (providing more detailed explanation and analysis using GARCH). GARCH is used frequently in academic studies of stock price volatility. See, e.g., A. Corhay & A. Tourani Rad, Conditional Heteroskedasticity Adjusted Market Model and an Event Study, 36 Q. Rev. Econ. & Fin. 529, 530 (1996) (applying GARCH in event study of divestitures). However, its use in litigation remains relatively rare. Other possibly useful methods flow from the literature identifying structural breaks in the data. See generally,

techniques makes them harder for a court, let alone a jury, to evaluate. In particular, these models offer the expert performing the analysis relatively wider scope for important choices—that is, choices that importantly affect whether the securities fraud claim will succeed.⁷⁹ In such circumstances, it is predictable that the plaintiff's and defendant's experts will disagree. The court may be ill-equipped to determine which expert to believe, and a jury will likely be utterly confused by what is a very sophisticated econometric debate.

d. *The Effect of an Increase in Idiosyncratic Volatility More Generally.* — If disclosure of the item of interest occurs at a time when idiosyncratic risk is sharply elevated by economic crisis, the Type II error rate for any maximum acceptable rate of Type I error will be much higher than it would be in normal times. While this problem begins as soon as there is an increase in idiosyncratic risk, for expository simplicity, we will disentangle it from the problem just discussed above by assuming that idiosyncratic risk has remained stable for more than a year before the item of interest occurs. This treatment controls for the mismatch between volatility levels during the estimation period and at the time the event occurs.

Higher idiosyncratic volatility during the estimation period results in a larger standard deviation of the issuer's past market-adjusted share price changes and consequently, a larger standard deviation with which to evaluate the price effect of the item of interest's disclosure. As a result, the cutoff for an observed price change to be considered statistically significant must be more negative. Thus, for any given maximum acceptable level of Type I error, the *observed* change in market-adjusted price accompanying the particular event must be more negative for the change to be sufficiently negative to meet the required level of statistical confidence.⁸⁰ Consequently, the chance that an *actual* negative price effect of any given size will be accompanied by an observed price change that meets this standard is reduced. In other words, the greater the volatility, the greater the number of Type II errors for any given allowable number of Type I errors.⁸¹ In essence, the same level of price effect is harder to detect when more is going on in the background.⁸²

e.g., Jushan Bai & Pierre Perron, Estimating and Testing Linear Models with Multiple Structural Breaks, 66 *Econometrica* 47 (1998).

79. For example, the expert must choose how many autoregressive terms to include in GARCH or how to identify the structural break. See Corhay & Rad, *supra* note 78, at 531–32 (providing model for estimating structural break).

80. For a formal demonstration of this point, see Fox, Fox & Gilson, *Idiosyncratic Risk*, *supra* note 65, at 7–11.

81. *Id.* at 11 (showing mathematically that “if the Type I error rate is maintained at 2.5%, the Type II error rate jumps in crisis times from 19.8% to 66%”).

82. See *id.* (“[I]n high volatility times resembling the 2008–09 financial crisis, only a bit more than one in three disclosures that actually affected an issuer's price by 5% would pass the test of being considered statistically significant at the 95% level, compared with . . . [over] four out of five . . . in normal times.”).

The spike in idiosyncratic risk accompanying the recent financial crisis provides a dramatic illustration of this point. Recall the hypothetical discussed above that considered the level of Type II errors in *normal* times when an event in fact has a -5% impact on price.⁸³ Now consider an event with the same actual price impact of -5% but that occurs during *crisis* times with a spike in idiosyncratic risk of the magnitude observed during the recent financial crisis.⁸⁴ Then the market-adjusted price change needed to meet the 95% confidence level standard jumps from -3.49% to -6.33%. This implies an increase in Type II error rate from 20% to 66%.⁸⁵ So, in such high volatility times, about only one in three items of interest whose disclosure in fact affects an issuer's share price by -5% would be accompanied by observed price changes considered statistically significant at the 95% level, compared with four out of five passing the test in normal times. More generally, whatever the level of maximum allowable Type I errors and whatever the actual impact of a misstatement on price, higher volatility results in a higher level of Type II errors.⁸⁶

IV. LEGAL IMPLICATIONS OF CRISIS-INDUCED SPIKES IN IDIOSYNCRATIC RISK

Crisis-induced spikes in idiosyncratic risk can have important implications for corporate and securities law both through their effect on event studies and more generally. In this Part, we examine three

83. See *supra* section II.B.1.b (presenting hypothetical scenario).

84. For this example, we assume that the standard deviation increases from the normal-times level of 1.78%, see *supra* note 68, to 3.23%, approximately equal to the daily idiosyncratic volatility of the market cap-weighted average firm in the S&P 100 during the peak of the financial crisis.

85. Similarly to the calculations in *supra* note 69, this calculation involves the distribution of possible observed values of the market-adjusted price changes if the actual market-adjusted price impact of the corrective disclosure is -5%. The distribution of observed market-adjusted price changes accompanying corrective disclosures with an actual impact of -5% will approximate a normal distribution with a mean of -5% and a standard deviation equal to the standard deviation of 3.23%, representing the effect, plus or minus, of the ordinary bits of firm-specific information and background noise that affects the issuer's share price every day during this period of high volatility. Since the observed change in prices will be considered statistically significant at the 95% level and have the right sign only if it is a decrease of 6.33%, the question becomes: What are the chances that the observed change will be of that magnitude? The required negative change, -6.33%, is 0.41 standard deviations beyond -5%. Based on standard statistical tables for the normal distribution, there is then only a 34% chance that the observed change in market-adjusted prices will be a decrease of at least 6.33% and hence statistically significant at the 95% level. Thus, there is a 66% chance that the observed change will yield a false negative. For a more detailed discussion of these points, see Fox, Fox & Gilson, *Idiosyncratic Risk*, *supra* note 65, at 10-11.

86. Fox, Fox & Gilson, *Idiosyncratic Risk*, *supra* note 65, at 7-9 ("The greater SD [standard deviation], for any given [actual impact on price], the greater the likelihood of Type II error.").

examples: In section IV.A, establishing causation and materiality in fraud-on-the-market securities class actions; in section IV.B, establishing materiality in other securities law contexts; and in section IV.C, judicial deference to board rejections of premium acquisition offers and the substantive coercion defense.

A. *Fraud-on-the-Market Shareholder Class Actions: Establishing Causation and Materiality*

The spike in idiosyncratic risk that occurs during financial crises causes a very substantial decline in the usefulness of fraud-on-the-market class actions in crisis times.⁸⁷ These actions allow buyers in secondary securities markets to recover from the issuer losses that they incurred by purchasing at prices inflated by the issuer's misstatements, without individual class members having to prove that they actually relied upon (or even knew about) the misstatement giving rise to their claim.⁸⁸ These fraud-on-the-market actions, based on alleged violations of section 10(b) of the Securities and Exchange Act of 1934 (Exchange Act) and Rule 10b-5 promulgated thereunder, currently produce the bulk of all the damages paid out in settlements and judgments pursuant to private litigation under the U.S. securities laws.⁸⁹ Plaintiffs in these fraud-on-the-market actions depend on the reliability of event studies. Idiosyncratic-risk spikes diminish that reliability for studies conducted during economic-crisis periods.

The centrality of securities fraud class actions dates to the Supreme Court's decision in *Basic Inc. v. Levinson*.⁹⁰ Prior to that decision, courts required each plaintiff to prove that a misrepresentation was "a substantial factor in determining the *course of conduct* which results in [the

87. A fraud-on-the-market action is an implied right of action for civil damages based on a misstatement made in violation of the Securities Exchange Act of 1934, Pub. L. No. 73-291, 48 Stat. 881 (codified as amended at 15 U.S.C. §§ 78a-78pp (2012)), 15 U.S.C. § 10(b) and Rule 10b-5, 17 C.F.R. § 240.10b-5 (2015), and 15 U.S.C. § 78j(b), promulgated thereunder. Rule 10b-5 provides in relevant part:

It shall be unlawful for any person, directly or indirectly, . . . [t]o make any untrue statement of a material fact or to omit to state a material fact necessary in order to make the statements made, in the light of the circumstances under which they were made, not misleading . . . in connection with the purchase or sale of any security.

17 C.F.R. § 240.10b-5. Any statement made by an issuer that is "reasonably calculated to influence the investing public," for example by being made to the media, satisfies Rule 10b-5's requirement that it be "in connection with the purchase or sale of a security," even though neither the issuer nor its officials buy or sell shares themselves. *SEC v. Tex. Gulf Sulphur Co.*, 401 F.2d 833, 862 (2d Cir. 1968) (en banc).

88. See *Basic Inc. v. Levinson*, 485 U.S. 224, 241-42, 250 (1988) (holding lower courts may apply fraud-on-the-market presumption on rebuttable basis).

89. See Fox, *Securities Class Actions*, supra note 12, at 1176 & n.2 (citing interviews with practitioners and quantitative data about initial complaints).

90. 485 U.S. 224.

recipient's] loss."⁹¹ Under this traditional, pre-*Basic* rule, securities fraud class actions were extremely difficult to prosecute. Absent the aggregation of claims (and associated economies of scale in litigation costs) that a class action allows, pursuing a securities fraud claim is infeasible for all but the largest traders. But certification of a shareholder class action seeking money damages requires that common issues of fact and law predominate,⁹² a requirement that cannot be met if each plaintiff must individually prove reliance and causation.⁹³

Basic fundamentally changed the manner in which causation could be proved. Under its then-new "fraud-on-the-market" theory, a material misstatement by an issuer whose shares trade in an efficient market is expected to affect the issuer's share price.⁹⁴ The Court said that because such misrepresentations will have an impact on the security's price and because all traders rely on the price, individual reliance can be presumed rather than proven, thereby eliminating the need for proof of individual reliance.⁹⁵ This presumption makes class actions economically feasible, with the concomitant large potential exposure to issuers. The result was an enormous growth in securities fraud class action litigation.⁹⁶

This is where event studies come in. They are the predominant way that class action plaintiffs establish both the materiality of the misstatement and the causal link between that misstatement and their losses—that the issuer's misstatement in fact inflated the prices the plaintiffs paid

91. *List v. Fashion Park, Inc.*, 340 F.2d 457, 462 (2d. Cir. 1965) (emphasis added) (internal quotation marks omitted) (quoting Restatement of Torts § 546 (Am. Law Inst. 1938)).

92. Fed. R. Civ. P. 23(b)(3).

93. See *Castano v. Am. Tobacco Co.*, 84 F.3d 734, 745 (5th Cir. 1996) ("[A] fraud class action cannot be certified when individual reliance will be an issue.").

94. See *Basic*, 485 U.S. at 246–47 (endorsing presumption that "market price of shares traded on well-developed markets reflects all publicly available information, and, hence, any material misrepresentations").

95. *Id.* at 247 ("Because most publicly available information is reflected in market price, an investor's reliance on any public material misrepresentations, therefore, may be presumed for purposes of a Rule 10b-5 action.").

96. In the five-year period beginning April 1988, shortly after the Supreme Court's decision in *Basic*, and ending March 1993, the total cash amount paid to settle federal class actions alleging that issuer misstatements distorted share price was \$2.5 billion. Vincent E. O'Brien & Richard W. Hodges, A Study of Class Action Securities Fraud Cases 1988–1993 I-5 (1993) (unpublished study) (on file with the *Columbia Law Review*). By the early 2000s, the total amount of such settlements had increased dramatically. Indeed, the value of settlements paid from January 2005 through December 2007 (a period that includes the three blockbuster cases of WorldCom, Enron, and Tyco), including the disclosed value of any noncash components, totaled over \$39.5 billion. Laarni T. Bulan, Ellen M. Ryan & Laura E. Simmons, Cornerstone Research, Securities Class Action Settlements: 2014 Review and Analysis 3 fig.2 (2015), <http://securities.stanford.edu/research-reports/1996-2014/Settlements-Through-12-2014.pdf> [<http://perma.cc/UAH6-SJPM>]. This figure decreased to \$9.2 billion for the three years beginning January 2012 and ending December 2014. *Id.*

for their shares.⁹⁷ Absent crisis-induced increases in idiosyncratic volatility, this methodology works reasonably well. But our finding of very large spikes in idiosyncratic volatility at times of economic crisis shows that it works less well during these periods, precisely the time when large price movements in individual stocks are likely to give rise to an increase in securities fraud actions. This reduced effectiveness of event studies during such periods raises important issues, discussed below, concerning both how courts should administer fraud-on-the-market suits in such times and how these suits should fit into the larger framework of securities law enforcement.

1. *Fraud-on-the-Market Actions and the Importance of the Misstatement's Effect on Price.* — The first step in understanding the issues raised by our empirical results for fraud-on-the-market actions is to examine how such an action works.

a. *The Stripped-Down Model of Fraud-on-the-Market Litigation.* — Analyzed doctrinally, the legal issues in a fraud-on-the-market securities action (assuming the plaintiff establishes at the outset a public misstatement made with scienter by an issuer whose shares trade in an efficient market) are the materiality of the misstatement, loss causation, transaction causation, and damages.⁹⁸ The litigation of such a claim can be described in terms of the allocation, between the parties, of the burdens of proof and persuasion on each of these issues at each stage of the litigation and the allowable forms of evidence.⁹⁹ For our purposes here, however, these issues reduce to two: Did the misstatement inflate the price paid by more than a de minimis amount, and if so, did the plaintiff suffer a loss as a result?

Where both these questions can be answered affirmatively, all the doctrinal elements for the cause of action will be satisfied.¹⁰⁰ An investor

97. A recent article sympathetic to plaintiffs explains the conclusion that an event study is mandatory for a securities class action case to proceed. See Michael J. Kaufman & John M. Wunderlich, *Regressing: The Troubling Dispositive Role of Event Studies in Fraud Litigation*, 15 *Stan. J.L., Bus. & Fin.* 183, 187 (2009) (“The interrelated questions of materiality, reliance, loss causation, and damages all require an event study for their resolution. The overriding substantive issue in securities fraud cases has become whether an expert has proffered an opinion based on a reliable event study.”).

98. See, e.g., *Dura Pharm., Inc. v. Broudo*, 544 U.S. 336, 341–42 (2005) (“[T]he action’s basic elements include: (1) a material misrepresentation (or omission); (2) scienter . . . ; (3) a connection with the purchase or sale of a security; (4) reliance [or] ‘transaction causation’; (5) economic loss; and (6) ‘loss causation’” (emphasis omitted) (internal citations omitted)).

99. See *id.* at 342–43 (noting plaintiff must independently establish causation and “an inflated purchase price will not itself constitute or proximately cause the relevant economic loss” because of “tangle of factors affecting price”).

100. This observation parallels Daniel Fischel’s insight in a seminal pre-*Basic* article that commented on lower court cases that were the origin of the fraud-on-the-market cause of action. Daniel R. Fischel, *Use of Modern Finance Theory in Securities Fraud Cases Involving Actively Traded Securities*, 38 *Bus. Law.* 1, 12–13 (1982). Fischel suggested that the adoption of the cause of action reflected an underlying view of the market that

who purchases shares of the issuer while the price is inflated by the misstatement, and who still holds the shares at the time the truth is revealed, has suffered a loss. She paid too much as a result of the misstatement, and because revelation of the truth dissipates this inflation, she has not been able to recoup her loss by selling into a still-inflated market. Her loss thus satisfies the loss causation requirement (with transaction causation being satisfied as well by the mere fact that the situation receives the fraud-on-the-market presumption).¹⁰¹ The amount of this loss is her damages, thereby satisfying the damages requirement.¹⁰² As for the materiality requirement, the Supreme Court has held that a fact is material if there is a substantial likelihood that a reasonable investor would consider it important in a decision whether to purchase or sell a security.¹⁰³ Anytime a misstatement meaningfully

most investors were price takers. As a consequence, they are hurt by a misstatement because of its effect on price, not its effect on their decisions to buy or sell. Fischel observed that for an action based on this view, the traditional doctrinal issues of materiality, reliance, and damages reduce to a single inquiry: Did the misstatement affect price and if so by how much? *Id.* at 13. The Supreme Court cited Fischel's article in *Basic*. 485 U.S. at 246 n.24.

For an example of a judicial opinion explicitly endorsing this collapsing of the three traditionally separate doctrinal elements into a single empirical test, see *In re Verifone Sec. Litig.*, 784 F. Supp. 1471, 1479 (N.D. Cal. 1992) (noting fraud-on-the-market theory "subsumes" reliance, materiality, causation, and damages inquiries into single analysis), *aff'd*, 11 F.3d 865 (9th Cir. 1993).

101. In the pre-fraud-on-the-market years before *Basic*, the courts refined their causation analysis to require two showings: transaction causation and loss causation. Transaction causation required the plaintiff to show she would not have purchased but for the misstatement. Loss causation required the plaintiff to show that the untruth was responsible for the loss in some reasonably direct or proximate way. See Merritt B. Fox, *After Dura: Causation in Fraud-on-the-Market Actions*, 31 J. Corp. L. 829, 834-36 (2006) [hereinafter Fox, *After Dura*] (discussing pre-*Basic* framework). These concepts do not fit well with the alternative causal connection allowed in the fraud-on-the-market actions, but the courts have maintained the two requirements. Transaction causation is presumed in any situation where the fraud-on-the-market presumption is allowed: where there is a material misstatement by an issuer whose shares trade in an efficient market. See, e.g., *Semerenko v. Cendant Corp.*, 223 F.3d 165, 178-83 (3d Cir. 2000) ("[A] plaintiff in a securities action is generally entitled to a rebuttable presumption of reliance if he or she purchased or sold securities in an efficient market."). A showing of loss causation requires not only that the misstatement inflated the issuer's share price but also that there was a causal connection between this inflation and a loss by the plaintiff. *Dura Pharm.*, 544 U.S. at 346-48 (2005) (holding plaintiffs did not adequately allege "proximate causation and economic loss"). Thus, the basic causal inquiry in the fraud-on-the-market theory is framed in terms of loss causation.

102. This corresponds to the "out-of-pocket" measure of damages that is standard in Rule 10b-5 cases. See *Green v. Occidental Petroleum Corp.*, 541 F.2d 1335, 1341-46 (9th Cir. 1976) (Sneed, J., concurring in part and concurring in the result in part) (describing out-of-pocket measure of damages and its application).

103. *Basic*, 485 U.S. at 232 ("We now expressly adopt the *TSC Industries* standard of materiality for the § 10(b) and Rule 10b-5 context."). In *TSC Industries, Inc. v. Northway, Inc.*, the Supreme Court found that a fact is material "if there is a substantial likelihood that a reasonable shareholder would consider it important in deciding how to vote." 426

inflates the price of a security trading in an efficient market, it has obviously had an actual effect on the behavior of investors. This strongly suggests that a reasonable investor, like those actually trading in the market, would have found it important.¹⁰⁴

b. *Focus on the Corrective Disclosure.* — Where an issuer's original misstatement hides a truth that is less favorable than the market's expectations for the issuer at the time the misstatement is made, the misstatement will not increase the issuer's share price. Instead, it just avoids the share-price decline that would have resulted from the truth. Because a substantial portion of all alleged issuer misstatements are of this kind,¹⁰⁵ the inquiry into materiality and causation usually focuses on the market's reaction when the truth (the corrective disclosure) comes out. If the announcement of the truth causes the price to decline, the logic goes, the misstatement must have previously inflated the issuer's share price relative to what it would have been had the misstatement not been made. And in an efficient market, the disclosure of the truth guarantees that the inflation in the stock's price has been dissipated.¹⁰⁶

2. *The Use of an Event Study to Establish that a Corrective Disclosure Has Had a Negative Impact on Price.* — Event studies are commonly used in fraud-on-the-market suits for assessing the likelihood that a corrective

U.S. 438, 449 (1970). Materiality “does not require proof of a substantial likelihood that disclosure of the omitted fact would have caused the reasonable investor to change his vote.” *Id.* Rather, it contemplates “a showing of a substantial likelihood that, under all the circumstances, the omitted fact would have assumed actual significance in the deliberations of the reasonable shareholder.” *Id.* The Court went on to say, “Put another way, there must be a substantial likelihood that the disclosure of the omitted fact would have been viewed by the reasonable investor as having significantly altered the ‘total mix’ of information available.” *Id.*

104. See, e.g., *Teamsters Loc. 445 Freight Div. Pension Fund v. Bombardier Inc.*, 546 F.3d 196, 207–08 (2d Cir. 2008) (noting “it is difficult to presume that the market will integrate the release of material information about a security into its price” absent evidence of efficient market for that security); *In re Merck & Co. Sec. Litig.*, 432 F.3d 261, 273–74 (3d Cir. 2005) (noting “‘reasonable investors’ are the market” and in efficient market, information is reflected in price, so when information changes price, it must be important to reasonable investors).

105. See, e.g., *SEC v. Todd*, 642 F.3d 1207, 1220–21 (9th Cir. 2011) (finding possible “material misrepresentations” where issuer’s CEO “failed to publicly disclose in an analysts’ conference call and an earnings press report that [issuer] Gateway’s ability to meet analysts’ revenue growth expectations was based largely on . . . one-time . . . transactions”); *Chamberlain v. Reddy Ice Holdings, Inc.*, 757 F. Supp. 2d 683, 702–04 (E.D. Mich. 2010) (noting plaintiff-shareholders pled materially false and misleading statements with sufficient particularity by alleging issuer hid violation of antitrust laws).

106. See Brealey, Myers & Allen, *supra* note 2, at 324–25 (summarizing “semistrong market efficiency” hypothesis, according to which “prices reflect . . . all . . . public information”).

disclosure has in fact negatively affected price by more than a de minimis amount.¹⁰⁷

a. *Event Studies as Evidence of Loss Causation and Materiality.* — For investors who purchase an issuer's stock after the issuer's misstatement and still hold the stock at the time of the corrective disclosure, an event study that reveals a statistically significant, market-adjusted decline in price when the truth is revealed provides evidence of both materiality and loss causation.¹⁰⁸ Indeed, some courts explicitly require the plaintiff to present, through expert testimony, an event study in order to make a showing of loss causation.¹⁰⁹

107. See, e.g., *In re Sadia, S.A. Sec. Litig.*, 95 Fed. Sec. L. Rep. 806 (CCH) (S.D.N.Y. 2010) (“Vellrath conducted an event study of the daily movements in the price of Sadia’s ADRs [before and after issuer’s fraud-related corrective disclosure] with the goal of identifying any ‘abnormal returns’, i.e., returns greater than or less than . . . one would expect on the security . . .” (quoting Expert Report of Marc Vellrath, Ph.D., CFA, ¶41, *In re Sadia, S.A. Sec. Litig.*, 95 Fed. Sec. L. Rep. at 806 (No. 1:08-CV-09528 (SAS)), 2009 WL 5164437)); *Gen. Elec. Co. v. Jackson*, 595 F. Supp. 2d 8, 22–24 (D.D.C. 2009) (summarizing litigants’ use of event studies); *In re Seagate Tech. II Sec. Litig.*, 843 F. Supp. 1341, 1368 (N.D. Cal. 1994) (“Defendants’ expert . . . conducted the econometric ‘event study’ by noting the movement of the price of [issuer] Seagate common for each day in the class period and comparing it with an industry index.”); see also Kaufman & Wunderlich, *supra* note 97, at 187 (arguing “properly conducted event study . . . has become a substantive and essential element of a securities fraud claim itself”).

108. See, e.g., *In re REMEC Inc. Sec. Litig.*, 702 F. Supp. 2d 1202, 1266, 1275 (S.D. Cal. 2010) (noting “plaintiff must show . . . economic loss occurred after the truth behind the misrepresentation or omission became known to the market” and “decline in stock price caused by the revelation . . . must be statistically significant”); *In re Imperial Credit Indus., Inc. Sec. Litig.*, 252 F. Supp. 2d 1005, 1015–16 (C.D. Cal. 2003) (granting defendant issuer’s motion for summary judgment because plaintiff failed to provide “event study or similar analysis . . . [to] eliminate that portion of the price decline . . . which is unrelated to the alleged wrong” and is instead attributable to “market events for which Defendants cannot be held responsible”), *aff’d sub nom. Mortensen v. Snavely*, 145 F. App’x 218 (9th Cir. 2005). Simply showing that the misstatement inflated price is not sufficient to establish loss causation. *Dura Pharm., Inc. v. Broudo*, 544 U.S. 336, 342–46 (2005) (holding plaintiffs must prove proximate cause and economic loss caused by misrepresentation).

109. See, e.g., *Fener v. Operating Eng’rs Const. Indus. & Misc. Pension Fund (LOCAL 66)*, 579 F.3d 401, 409 (5th Cir. 2009) (“Although analyst reports and stock prices are helpful in any inquiry, the testimony of an expert—along with some kind of analytical research or event study—is required to show loss causation.”). Plaintiffs must generally provide this evidence at the summary judgment stage. See Mary K. Warren & Sterling P.A. Darling, Jr., *The Expanding Role of Event Studies in Federal Securities Litigation*, 6 No. 6 Sec. Litig. Rep. 19 (2009) (“[A]n event study is commonly the device that creates a triable question of fact . . . The presence or absence of an event study may, therefore, result in summary judgment for the defendant or, in limited circumstances, the plaintiff.”). With respect to materiality, see *In re Gaming Lottery Sec. Litig.*, Fed. Sec. L. Rep. (CCH) ¶90,763, at 93,716, 93,716 (S.D.N.Y. Feb. 16, 2000) (event studies are “accepted method for the evaluation of materiality”); William O. Fisher, *Does the Efficient Market Theory Help Us Do Justice in a Time of Madness?*, 54 *Emory L.J.* 843, 871, 874–83 (2005) (collecting cases).

Conforming to the usual social science convention,¹¹⁰ courts generally have adopted the 95% confidence level as the standard to be used in securities litigation for determining the price effect of a corrective disclosure.¹¹¹ In choosing this standard, the courts are in essence establishing the plaintiff's burden of persuasion concerning whether the corrective disclosure in fact affected the issuer's share price. The "null hypothesis" is that the corrective disclosure had no negative influence on price. If the plaintiff can persuade the fact-finder that the null hypothesis can be rejected with at least 95% confidence, the plaintiff has established both loss causation and materiality.

b. *The Working Assumption that the 95% Standard Maximizes Social Welfare in Normal Times.* — We will assume here that this adoption of the 95% standard in fraud-on-the-market suits is the correct, social-welfare-maximizing standard, at least in normal times.¹¹² For our purposes, the assumption that 95% is the correct standard in normal times forms a useful baseline that conforms to current practice.¹¹³ This, in turn, allows

110. See Michael Cowles & Caroline Davis, On the Origins of the 0.05 Level of Statistical Significance, 37 *Am. Psychol.* 553, 553 (1982) (noting "conventional use of the 5% level as the maximum acceptable probability for determining statistical significance" in the social sciences and exploring convention's origin); Kaye & Freedman, *supra* note 62, at 251 ("In practice, statistical analysts typically use levels of 5% and 1%. The 5% level is most common in social science, and an analyst who speaks of significant results without specifying the threshold probably is using this figure.")

111. See, e.g., *United States v. Hatfield*, 795 F. Supp. 2d 219, 234 (E.D.N.Y. 2011) (recognizing, in criminal securities fraud case, "95% confidence interval is the threshold typically used by academic economists in their work"); *In re REMEC Inc. Sec. Litig.*, 702 F. Supp. 2d at 1266 (to establish loss causation, event study must show "decline in stock price caused by the revelation of that truth [is] statistically significant" (citations omitted)); Cornerstone Research, Estimating Recoverable Damages in Rule 10b-5 Securities Class Actions 9 (2014), <https://www.cornerstone.com/GetAttachment/df483ce3-5fe3-41b8-ad83-f704dc8426f7/Estimating-Recoverable-Damages-in-Rule-10b-5-Securities-Class-Actions.pdf> [<http://perma.cc/8ZR3-EYNK>] (last visited Oct. 23, 2015) ("A confidence interval of 95 percent is often applied in academic event studies and frequently accepted by courts."). Kaye & Freedman, *supra* note 62, at 251 n.101, note that the Supreme Court "implicitly" endorsed the 95% confidence level in two 1977 decisions. See also *Hazelwood Sch. Dist. v. United States*, 433 U.S. 299, 311 n.17 (1977) (finding shortfall of black teachers hired by defendant school district "significant" because it represented "difference of more than three standard deviations"); *Castaneda v. Partida*, 430 U.S. 482, 496 & n.17 (1977) (finding sufficient "proof... to establish a prima facie case of discrimination against... Mexican-Americans in... grand jury selection" where statistical evidence showed the observed number of Mexican American jurors was less than expected number by "greater than two or three standard deviations"). Kaye and Freedman point out that "[a]lthough the Court did not say so," the differences treated as "significant" in *Castaneda* and *Hazelwood School District* "produce p-values of about 5% and 0.3% when the statistic is normally distributed." Kaye & Freedman, *supra* note 62, at 251 n.101.

112. Although beyond the scope of this Article, this assumption is itself worthy of further consideration. See, e.g., Leslie A. Demers, Lost in Transposition: Erroneous Conflation of Statistical Certainty with Evidentiary Standards 3 (Feb. 27, 2013) (unpublished manuscript), <http://ssrn.com/abstract=2225998> (on file with the *Columbia Law Review*) (describing errors courts make with 95% confidence-interval standard).

113. See *supra* note 111 (listing cases that applied 95% confidence-interval standard).

a focus on the ultimate concern here: whether an economic crisis-induced spike in idiosyncratic risk changes the appropriate confidence-interval standard for event studies, regardless of what standard might be optimal in normal times.

i. *The Choice of Confidence Level Sets the Terms of the Tradeoff Between Type I and Type II Error.* — An event study involves inevitable tradeoffs between Type I error and Type II error, with the terms of this tradeoff determined by the test's chosen level of statistical confidence.¹¹⁴ Recall that if the 95% confidence level is chosen, an event study will have a 2.5% Type I error rate, i.e., there is a 2.5% chance that a corrective disclosure that in fact has no effect on price will be accompanied by an observed market-adjusted price change negative enough to pass the significance test (and allow the suit to go forward).

The choice of the 95% confidence level also influences the Type II error rate, i.e., the chance that a corrective disclosure that in fact has a negative impact on price will be accompanied by an observed market-adjusted price that is insufficiently negative to meet the required confidence level (and so will not allow a class action suit to go forward). But an event study's Type II error rate depends as well on how negative the disclosure's actual price impact is and on the level of idiosyncratic volatility associated with the issuer's stock. As we have seen, a corrective disclosure with a -5% price impact made by an issuer with what, in normal times, is the average level of idiosyncratic volatility, the choice of the 95% confidence level implies a Type II error rate of about 20%.

More generally, holding constant the level of idiosyncratic volatility, the choice of the 95% confidence level implies a Type I error rate of 2.5% and a set of Type II error rates that correspond to the magnitude of a corrective disclosure's actual negative impact on price. The more negative the actual impact, the lower the Type II error. In comparison, a confidence level stricter than 95% would imply a lower Type I error rate and a set of Type II error rates that, for each possible magnitude of negative impact on price, would be higher than it would be with the choice of the 95% confidence level. A confidence level less strict than the 95% level would have the opposite effects.

Thus, holding constant the level of idiosyncratic volatility, there is, for any given negative impact on price, a tradeoff between Type I and Type II error rates, with the point on this tradeoff determined by how strict the chosen confidence level is. Thus, the choice of the confidence level is the choice of a set of tradeoff points, each corresponding to a particular magnitude of a corrective disclosure's actual negative impact on price. If idiosyncratic risk increases, the terms of this tradeoff worsen. For a given chosen level of confidence and Type I error rate, the Type II

114. See *supra* section III.B (defining Type I and Type II errors and explaining tradeoffs between them).

error rate corresponding to any particular magnitude of a corrective disclosure's actual negative impact on price will be higher.

ii. *The Social Welfare Effects of Type I and Type II Error and the "Materiality Threshold."* — Assessing the social-welfare effects of these tradeoffs between Type I and Type II error starts with understanding both the social benefits and social costs of imposing section 10(b) and Rule 10b-5 liability on an issuer for making a misstatement that inflates an issuer's share price and how the extent of this distortion affects this calculation. Forcing the issuer to pay damages in response to a fraud-on-the-market action helps deter other issuers from making such misstatements in the future. This penalty is the key private mechanism for enforcing the Exchange Act's comprehensive system of mandatory disclosure applicable to publicly traded issuers—if the disclosure is not accurate, damages are assessed.¹¹⁵ The improved share-price accuracy and issuer transparency that result from greater compliance with this disclosure system increase social welfare by enhancing the efficiency with which resources are allocated in our economy.¹¹⁶

This gain does not come for free; securities litigation uses scarce resources that could otherwise be deployed to other useful purposes. These resources include the lawyers' and experts' time on both sides of such litigation, as well as the time and effort expended by the issuer's executives and by the judiciary.¹¹⁷ The amount of resources consumed by

115. See, e.g., John C. Coffee, Jr., *Law and the Market: The Impact of Enforcement*, 156 U. Pa. L. Rev. 229, 266–74 (2007) (detailing methods and results of private enforcement).

116. Greater issuer transparency and more accurate prices in the secondary market signal when an issuer's management is doing a poor job of utilizing the firm's current assets and investing in new projects. Transparency and price accuracy help align the interests of managers with those of shareholders by boosting the effectiveness of share-price-based compensation, block-holder activism, and hostile-takeover mechanisms for reducing the agency costs of management. Greater transparency, by reducing the opportunities for insider trading, also adds to the value of an issuer's shares by increasing their liquidity. These points are discussed in more detail in Fox, *Civil Liability*, supra note 3, at 252–60, 264–67 (“By reducing the amount of nonpublic information . . . ongoing periodic disclosure should therefore reduce bid/ask spreads, increase liquidity, and, consequently, reduce the cost of capital.”).

117. A reasonable estimate of the litigation costs for the legal and expert fees of both sides is \$2.5 billion annually. See *id.* at 247 n.18 (“[T]his would suggest that the total annual legal expenses associated with these actions averaged about \$2.46 billion . . .”). This figure does not include the value of executive time devoted to defending the litigation or much of the judicial resources consumed by such litigation. Nor does it include the time and resources that honest executives devote to be sure that disclosures that they believe to be true do not, despite the scienter requirement, generate liability because of legal error. See, e.g., Amanda M. Rose, *Fraud on the Market: An Action Without a Cause*, 160 U. Pa. L. Rev. PENNumbra 87, 94 (2011), [https://www.law.upenn.edu/journals/lawreview/articles/volume160/issue1/Rose160U.Pa.L.Rev.87\(2011\).pdf](https://www.law.upenn.edu/journals/lawreview/articles/volume160/issue1/Rose160U.Pa.L.Rev.87(2011).pdf) [<http://perma.cc/R5PU-MABT>] (“[I]t is cheap and easy for corporate officers not to lie, but to avoid being *misjudged* a liar, they may spend excessive corporate resources scrubbing disclosures . . .”). The figure also does not include efficiency losses from the

such litigation is similar whether the original misstatement resulted in a large or small price distortion. Thus, ideally, liability should be imposed only in cases where, at the margin, the improvement in economic welfare from deterring issuer misstatements is at least as great as the social costs arising from prosecuting the action.¹¹⁸ This suggests, in turn, that there is some degree of price distortion (as proxied by the size of the corrective disclosure's actual negative effect on price) below which price distorting misstatements should not be subject to fraud-on-the-market damage liability because the costs of the action would exceed the deterrence achieved. We will call this point the "materiality threshold"—the point at which the price distortion is large enough that deterring misstatements that have so significant an effect is worth the enforcement cost.¹¹⁹

iii. *The Meaning of the Assumption that the 95% Confidence Level Is Socially Optimal in Normal Times.* — With this understanding of the social benefits and social costs associated with imposing liability for misstatements made with scienter and how they relate to the misstatement's *actual* effect on price, we can now explore the meaning of the assumption that, at least in normal times, the 95% standard constitutes the socially optimal set of tradeoff points between Type I and Type II errors.

Type I error—with its resulting imposition of liability where the actual price impact of the corrective disclosure is zero—is the easy case: It unambiguously reduces social welfare. Litigation is costly and there is no gain in deterring misstatements so unimportant that their corrections have no effect on price.

decision of managers, out of fear of such liability, not to voluntarily disclose true information before disclosure is otherwise required.

118. This account of the potential social benefits of fraud-on-the-market litigation does not include providing compensation as a way of correcting for unfair investor losses or for an inefficient allocation of risk if investor losses are left where they originally lie. These compensatory rationales for imposing liability simply do not hold up under close examination, a view widely shared by commentators on the issue. See, e.g., John C. Coffee, Jr., *Reforming the Securities Class Action: An Essay on Deterrence and Its Implementation*, 106 *Colum. L. Rev.* 1534, 1556–66 (2006) (arguing most compelling rationale for imposing securities fraud liability is “impact of fraud on investor confidence and thus the cost of equity capital” throughout economy); Paul G. Mahoney, *Precaution Costs and the Law of Fraud in Impersonal Markets*, 78 *Va. L. Rev.* 623, 632 (1992) (“It is therefore not surprising that Easterbrook and Fischel’s ‘net harm’ analysis reaches only tentative conclusions when applied to secondary-market frauds.”). The inadequacy of these compensatory rationales is explored in detail in Fox, *Securities Class Actions*, *supra* note 12, at 1192–99 (concluding “investor protection arguments for imposing liability on an issuer to deter misstatements are weak”).

119. What level the materiality threshold should be set at is subject to differences in opinion. These differences arise from different assessments of a variety of factors: the power of fraud-on-the-market suits to deter, the importance of finely accurate share prices, and the total social costs of such litigation. The same differences in these assessments lead to different views on the value of fraud-on-the-market suits as recently rehearsed in the various opinions in the Supreme Court’s decision in *Halliburton Co. v. Erica P. John Fund, Inc.*, 134 S. Ct. 2398 (2014).

Assessing the welfare impact of Type II error is slightly more complicated. Consider first a misstatement whose actual impact on price is greater than the materiality threshold. Type II error with respect to whether its corrective disclosure had an actual negative effect on price *reduces* social welfare because the error results in a failure to impose liability in a situation where, by definition, imposing liability would have been socially desirable: The improvement in economic welfare from the issuer misstatements that would have been deterred would have been greater than the social costs of the legal action necessary to impose liability. For a misstatement whose actual impact on price is less than the materiality threshold, however, the opposite is the case. Type II error, by blocking imposition of liability in a situation where the social benefits are less than the social costs actually *increases* social welfare.

The social impact of the chosen level of statistical confidence, therefore, needs to account for three factors: the social harm from its Type I error, the social harm from its Type II error with respect to the corrective disclosures of misstatements having actual price impacts greater than the materiality threshold, and the social gain (or social costs avoided) from its Type II error with respect to the corrective disclosures of misstatements having actual price impacts smaller than the materiality threshold. Given these three factors, consider what is implied by the assumption that the 95% confidence level is socially optimal—that making the confidence standard stricter would reduce social welfare—in normal times.¹²⁰ That is, upon requiring a stricter confidence level, the social-welfare loss from the increase in Type II error with respect to misstatements having price impacts greater than the materiality threshold (factor 2) would exceed the combined social-welfare gain from the decrease in Type I error (factor 1) and the increase in Type II error with respect to misstatements having price impacts less than the materiality threshold (factor 3). And it means that the net social-welfare impact of making the standard less strict would also be negative: The total losses from the increase in Type I error (factor 1) and from the decrease in Type II error with respect to misstatements having price impacts less than the materiality threshold (factor 3) would exceed the gain from the decrease in Type II error with respect to misstatements having price impacts greater than the materiality threshold (factor 2). If 95% is the socially optimal confidence level, requiring either a stricter or a laxer confidence level reduces social welfare.

3. *The Implications of Increased Idiosyncratic Risk for the Use of Event Studies in Fraud-on-the-Market Suits.* — As noted above, an increase in idiosyncratic risk leads to a worsening of the terms of tradeoffs between the Type I and Type II errors. Recall the example where the standard error increases from 1.78%, which was the average standard deviation for

120. That is, assuming social welfare will be lower if the chosen confidence level were either stricter or less strict than 95%.

the idiosyncratic volatility of the typical firm from the 1970s up until the financial crisis, to 3.23%, the average such standard deviation at the height of the financial crisis.¹²¹ Recall that the cutoff—the minimum drop in the market-adjusted price that meets the 95% confidence standard—jumps from -3.5% in normal times to -6.33% in crisis times. Maintaining the 95% standard during a crisis-driven high-volatility period means that for corrective disclosures with an actual price impact of -5%, the Type I error rate remains at 2.5%, but the Type II error rate more than triples from about 20% to 66%. The consequences of this worsening tradeoff for fraud-on-the-market litigation are dramatic: Liability would be imposed in only about one case in three for misstatements whose corrective disclosures have a -5% actual impact on price, compared with four cases out of five in normal times.¹²²

More generally, with idiosyncratic volatility for a firm's stock at a normal level, the choice of the confidence level is the choice of a set of points on the tradeoff between Type I and Type II error, each point corresponding to a particular magnitude of a corrective disclosure's actual negative impact on price. If idiosyncratic risk increases, the terms of this tradeoff worsen. So, for a given chosen level of confidence and hence given Type I error rate, the Type II error will be higher for any given actual negative impact on price.

In the discussion that follows, we consider whether this sharp worsening of the Type I/Type II error tradeoff in high-idiosyncratic-volatility times suggests needed changes of law or policy.

The discussion starts by exploring whether the apparent problem is in fact self-correcting. Some kinds of corrective disclosures will cause larger price drops during crises than normal times, thus keeping pace as

121. See *supra* section III.B.1.b (discussing example); *supra* note 84 and accompanying text (discussing standard deviation at height of 2008 to 2009 financial crisis).

122. Here and elsewhere in our discussions of the effect of idiosyncratic risk on event studies, we use a disclosure event with an actual impact on price of 5% as our example for comparative calculations of Type II error rates in normal and in crisis times. Five percent was chosen because a common rule of thumb used by securities lawyers is that information relating to a change in net income of 5% or more is considered material. See *United States v. Nacchio*, 519 F.3d 1140, 1162 (10th Cir. 2008) (“[A] 5% numerical threshold is a sensible starting place for assessing the materiality of [the alleged misstatements], but it does not end the inquiry. Special factors might make a smaller miss [of reported financial performance] material.”), vacated in part on other grounds on *reh'g en banc*, 555 F.3d 1234 (10th Cir. 2009); see also SEC Staff Accounting Bulletin No. 99, 64 Fed. Reg. 45150, 45151 (Aug. 19, 1999) (stating SEC staff has no objection to registrants using this “rule of thumb” in this fashion). A 5% decrease in the expected value of all future cash flows, discounted to present value at the discount implied in the market price before the decrease in expectations, would, in an efficient market, result in a 5% decrease in price. The policy-derived materiality threshold discussed here actually may well be above or below 5% of net income but in the abstract, most people would agree that a misstatement that causes a 5% change in stock price warrants attention.

the cutoff for statistical significance grows during crises. For these types of disclosures, unambiguously no adjustment is needed.

The market's reaction to other kinds of important corrective disclosures, however, will not grow in crises. Thus, we go on to address directly the question of whether the worsened terms of the tradeoff between Type I and Type II errors warrants reducing the required level of statistical confidence to something below 95%. In other words, would it not make sense to accept a few more Type I errors to (partially) counteract the rapid increase in Type II errors during crises?

While this idea has intuitive appeal, the discussion below shows that the welfare effects are in fact ambiguous. In one knife-edge case, reducing the confidence level will improve welfare. In all other cases, reducing the standard during crises will be helpful for some kinds of disclosures, but harmful for others, as compared to reducing the standard during normal times. Because it is unclear whether moving down from the 95% level will in fact be helpful in crises, we recommend a different kind of solution. In high-idiosyncratic-volatility times, the 95% standard should be maintained but, to compensate for the diminished effectiveness of private fraud-on-the-market type enforcement, reliance on, and resources for, SEC enforcement actions should be increased.

a. *Is the Problem with Increased Idiosyncratic Volatility Self-Correcting?* — Is it possible that the very event—economic crisis—that leads to the increase in idiosyncratic volatility also renders it inconsequential in terms of the worsening tradeoff between Type I and Type II error? The idea is that the crisis raises not only the size of the negative price change necessary to be statistically significant but also the size of the price drop from any corrective disclosure. Such a magnified impact is consistent with our explanations of crisis-induced increased idiosyncratic volatility: current news becoming more important relative to older news,¹²³ news about the quality of management becoming more important,¹²⁴ and increased ignorance concerning what facts are relevant.¹²⁵ To see this, suppose that any one or more of these explanations is correct. Then corrective disclosures with actual negative impacts on price that, in normal times, would usually be accompanied by observed market-adjusted price changes sufficiently negative to meet the normal-times cutoff for the 95% normal-times confidence level (−3.49% in our example¹²⁶) will, in crisis times, have an actual impact on price that is sufficiently more negative that their accompanying observed market-adjusted price changes would be sufficiently negative to meet the 95% confidence level's more restrictive

123. See *supra* section II.A.

124. See *supra* section II.B.

125. See *supra* section II.C.

126. See *supra* section III.B.1.b (discussing Type II errors).

economic-crisis-times cutoff (-6.33% in our example¹²⁷). For such misstatements, there is no need to worry about a policy response to the worsening of the terms of tradeoff between Type I and Type II errors because the corresponding magnification of the actual negative price impacts of their corrective disclosures erases the effect.

While self-correction of this type will indeed help with regard to certain misstatements, a problem remains. Recall that the most convincing social benefit from allowing fraud-on-the-market causes of action is that they deter price-distorting misstatements and so enhance allocative efficiency in the real economy.¹²⁸ The absolute level of the distortion and how it compares to what we call the materiality threshold is what is important here, rather than how the distortion compares with some elevated level of overall idiosyncratic price volatility.

There are two types of misstatements that in crisis times would move prices enough to meet the materiality threshold, but that are not of a nature where the self-correction described here would offset the crisis-elevated cutoff for 95% statistical significance. The first is where the misstatement's actual impact on price in normal times meets the materiality threshold¹²⁹ but this impact is not magnified by crisis. A statement by an issuer that it holds assets, such as oil reserves, that in fact do not exist is an example. The information-based explanations that we find most plausible for crisis-induced spikes in idiosyncratic volatility¹³⁰ do not suggest that the actual price impact of such a misstatement would be magnified during crisis times, and so it would distort price no more in crisis than in normal times.¹³¹ As a result, in crisis times, the price effect of corrective disclosure would be significantly less likely to meet the 95% confidence level's more stringent crisis-period cutoff and so the Type II error rate for this kind of statement will increase. The social benefit from deterring these kinds of misstatements, however, will still be as great as it is in normal times.

127. See *supra* section III.B.2.d (discussing effect of increase in idiosyncratic volatility).

128. See *supra* notes 115–117 and accompanying text.

129. See *supra* note 119 and accompanying text (defining “materiality threshold” as degree of share-price distortion large enough that value of deterring misstatements responsible for distortion exceeds social cost of fraud-on-the-market litigation required to deter it).

130. See *supra* Part II (postulating explanations that current news becomes more relevant during economic crises, information concerning quality of management becomes more relevant during crises, or crises cause uncertainty as to what information is even relevant to begin with).

131. Many disclosures will contain aspects that are “self-correcting” and others that are not. For example, if a company misses its earnings target by \$1 per share, this can be thought of as two pieces of news: (a) shareholders have \$1 less than they expected in assets and (b) earnings may be on a lower trajectory in the future. We expect the reaction to (b) to be amplified during the crisis but that part (a) will be evaluated the same way in both regular and crisis periods.

The second kind of misstatement where self-correction would not suffice is the flip side of the first: a misstatement that, if made in normal times, would not distort prices sufficiently to reach the materiality threshold but if made in crisis times, is magnified in its price impact sufficiently to reach the materiality threshold. With this magnified impact on price, it becomes socially beneficial to impose liability when it would not be socially beneficial in normal times. In crisis times, however, the higher Type II error would reduce the likelihood that such misstatements would trigger liability.

b. *Does Increased Idiosyncratic Risk in Crisis Times Call for Reducing the Standard of Statistical Significance?* — As we have just seen, for many important kinds of misstatements, crises will radically increase the number of Type II errors if we hold the number of Type I errors fixed. For the average firm, more than two-thirds of corrective disclosures causing a 5% drop in the stock price would be missed if we keep the 95% level during the most recent crisis. Even if, as we assume, the 95% confidence level is the socially optimal standard of statistical significance in normal times, maintaining the 95% standard during crisis times will result in a large increase in Type II errors. In essence, the question is whether any social gains from moderating the increase in Type II errors would outweigh the social losses from the increase in Type I errors. As we will see below, it is impossible to even make an educated guess as to the answer. It is just as likely that reducing the standard in crisis times would decrease social welfare as increase it.

The analysis makes three principal points:

1. To determine whether it would be desirable to relax the standard below the 95% confidence level in crisis times, the focus must be on whether, at the margin, the welfare gains from reduced Type II errors are greater when the standard is more relaxed in crisis times than in ordinary times. This is because the corresponding increase in Type I error will be the same in crisis times as in normal times and so the resulting social losses will be the same.

2. Reducing the standard in crisis times will decrease Type II error by more than doing so in normal times for corrective disclosures with actual negative impacts on price greater than a particular magnitude (the “crossover point”), but will decrease Type II error by less than doing so in normal times where the actual negative price impact is less negative than this crossover point.

3. Except in the unlikely event that this crossover point coincidentally equals the materiality threshold,¹³² it will be very difficult to tell whether the welfare gains from reduced Type II errors are greater when the standard is relaxed in crisis times, compared to relaxing it in ordinary times. This is because there will be a range of negative price

132. That is, the minimum size of price drops from corrective disclosures that it is beneficial to deter with liability.

impacts where it is socially desirable to impose liability and where the reduction in Type II error is greater when the standard is relaxed in crisis times than in normal times. But there will also be a range of negative price impacts either where it is socially desirable to impose liability and the reduction in Type II error is instead less when the standard is relaxed in crisis times than in normal times, or where it is socially *undesirable* to impose liability and the reduction in Type II error is greater when the standard is relaxed in crisis times than in normal times.

i. *A Critical Question.* — The assumption that the 95% confidence level is socially optimal in normal times means that, at the margin, the social loss from a small relaxation in the standard, with the resulting tiny increase in Type I error, *just equals* the social gain from the corresponding decrease in Type II error. It also means that the social loss from a more than infinitesimal increase in Type I error must be greater than the increase in social benefits from the corresponding decrease in Type II error. Hence, the assumption implies that in normal times there would be no improvement from a meaningful relaxation of the confidence standard. If an improvement were possible, the 95% standard would not be optimal.

This analysis means that lowering the required confidence level below 95% can enhance welfare in crisis-induced, high-idiosyncratic-volatility times only if—contrary to normal times—the social gain from a decrease in Type II error *is greater* than the social cost from the corresponding increase in Type I error. Because the confidence level is defined in terms of the acceptable level of Type I errors, lowering the standard by a given amount in normal times and in high-idiosyncratic-volatility times results in the same increase in Type I error rate. So lowering the confidence level will have the same impact on Type I errors and the same negative effect on social welfare in both crisis and normal times.¹³³ Thus, the critical question is whether, at the margin, reducing the standard in crisis times will result in greater social welfare gains from reduced Type II errors than reducing the standard in normal times would.

In sum:

1. Given the assumption that the 95% confidence level is socially optimal, if the level is relaxed in normal times, the social gain from the reduced Type II errors at the margin just equals the social cost from the increased Type I errors.

2. The social cost from the increased Type I errors if the standard is relaxed in crisis times equals the social cost from the increased Type I errors from relaxing the standard in normal times.

3. Thus, if the standard is relaxed in crisis times and the social gain from the reduction in Type II errors is greater than if it is relaxed in

133. We are assuming, plausibly, that the costs and benefits of imposing liability for misstatements with any given price impact are the same in crisis and normal times.

normal times, then the social gain from the reduction in Type II errors is greater than the social cost from the increase in Type I errors. This would mean that relaxing the standard in crisis times is a good thing to do.

ii. *The Type II Error Effects from Reducing the Confidence Level in Crisis Times Versus Normal Times and the Crossover Point.* — For corrective disclosures with an actual negative impact on price greater than a particular magnitude (the crossover point), reducing the required confidence level from 95% to some lower level in crisis times will decrease Type II error by *more* than doing so in normal times would. Where the actual negative price impact is less negative than this crossover point, however, doing so in crisis times will decrease Type II error by *less* than doing so in normal times would. The discussion that follows summarizes the reasoning as to why.¹³⁴

The first part of this proposition—relating to price impacts more negative than the crossover point—would seem to make intuitive sense. A crisis-induced increase in idiosyncratic risk increases Type II error for any level of price drop, so one would think that reducing the standard would be more effective at reducing Type II error when there was more Type II error to reduce. For the same reason, the second part of the proposition—relating to price impacts less negative than the crossover point—at first seems counterintuitive.

An extreme example suggests why both parts of the proposition in fact make sense. Imagine that in crisis times, the standard deviation of the typical firm's idiosyncratic volatility is 10%, whereas in normal times, it is 1%. Now compare the reduction in Type II error from lowering the confidence level in normal times versus crisis times where the actual negative price impact of the corrective disclosure is a large 20%. During normal times Type II errors for this kind of disclosure are essentially zero. This is because the net impact of other firm-specific news and background noise on the day of the disclosure is almost never so positive as to disguise the actual 20% drop: The assumed 1% normal-times standard deviation of idiosyncratic risk tells us that the net impact of these other items will rarely move the price more than a few percent. So the Type II error rate with the 95% standard is almost zero. If the standard is lowered to 90%, the Type II error rate will be even closer to zero, but the reduction in Type II error from reducing the standard will be very small.

In contrast, in crisis times, the standard deviation of 10% tells us that the net impact of other firm-specific news and background noise will move price much more relative to this 20% drop. The Type II error rate with the 95% standard would be 48%, whereas if the standard were relaxed to 90%, it would be 36%. Thus, for a corrective disclosure with a large actual price effect, reducing the confidence level results in a much

134. We have presented a rigorous proof of this proposition in a different paper. Fox, Fox & Gilson, *Idiosyncratic Risk*, *supra* note 65, at 11–19.

larger reduction in Type II error in crisis times than it would in normal times.

Where the negative price impact of the corrective disclosure is a much smaller 2%, the opposite will be the case. In normal times, the standard deviation of 1% tells us that other firm-specific news and background noise will move price much more relative to an actual 2% negative price impact than to an actual 20% price impact. In this normal period, the Type II error rate with the 95% standard would be 48% and with the 90% standard it would be 36%. In contrast, in crisis times, an actual negative price impact of 2% is a drop in the bucket compared to the swings expected from the net impact of other firm-specific news and background noise. Type II error thus will be very large whichever confidence level is used. The results of an event study would be statistically significant at the 95% level only if the observed market-adjusted price change was -19.6% or more, and statistically significant at the 90% level only if it was -16.4% or more. To pass these tests, the net impact of other firm-specific news and background noise would have to be at least -17.6% and -14.4%, respectively. The net impact of these other items is slightly more likely to reach -14.4% or -17.6% or more during a crisis, but the difference in likelihood is small. Specifically, the Type II error with the 95% confidence level standard would be 96%. With a 90% confidence level, the Type II error rate would be 92%. Thus, for a corrective disclosure with a small actual price effect, reducing the required confidence level results in a much smaller reduction in Type II error in crisis times than it would in normal times.

Keeping in mind this extreme example, consider a more realistic example. Assume a corrective disclosure with an actual negative price impact of 5%. Recall that the observed market-adjusted price change will be the combination of this 5% drop and the net effect of the other bits of firm-specific news and background noise that affect the issuer's share price the same day.¹³⁵ The net impact of these other items is, on average, zero. So the distribution of possible observed market-adjusted price changes will be centered around -5%. How widely the returns are dispersed around -5%, however, is a function of the firm's idiosyncratic volatility: the higher the volatility, the wider the dispersion. Figure 7(a) depicts two dispersions around -5% of possible observed market-adjusted prices for the corrective disclosure in our example. The shallower curve represents a standard deviation of 3.23%, the standard deviation of the typical firm in the recent financial crisis. The steeper curve represents a standard deviation of 1.78%, the standard deviation of the typical firm in normal times.

135. See *supra* section III.B & fig. 6 (studying statistical causal link between factors such as public firm-specific information and observed price change).

FIGURE 7(A): WHEN THE CORRECTIVE DISCLOSURE CAUSES A 5% DROP IN PRICE—COMPARING REGULAR AND VOLATILE PERIODS

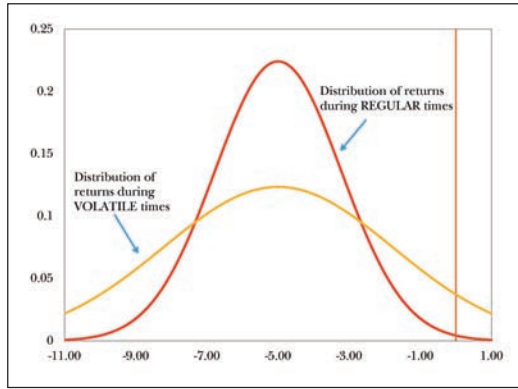


FIGURE 7(B): 5% DROP—TYPE II ERROR USING 95% LEVEL IN VOLATILE PERIODS

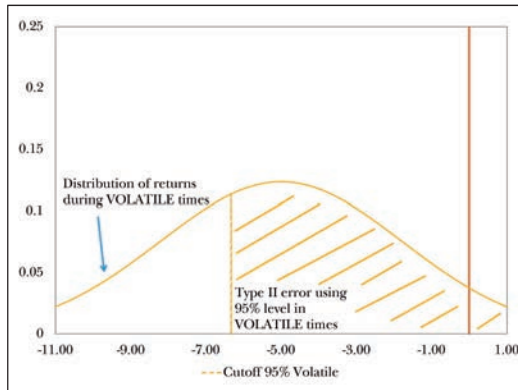


FIGURE 7(C): 5% DROP—TYPE II ERROR USING 95% LEVEL IN NORMAL PERIODS

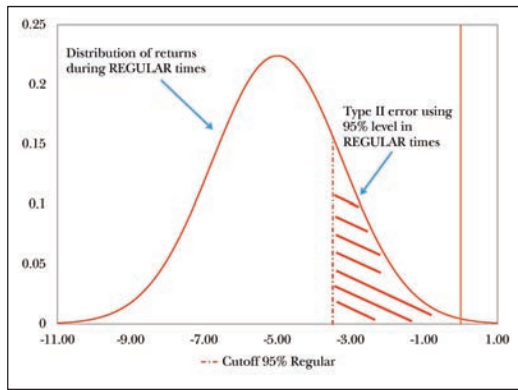


FIGURE 7(D): 5% DROP—REDUCTION IN TYPE II ERROR MOVING TO 90% LEVEL IN VOLATILE PERIODS

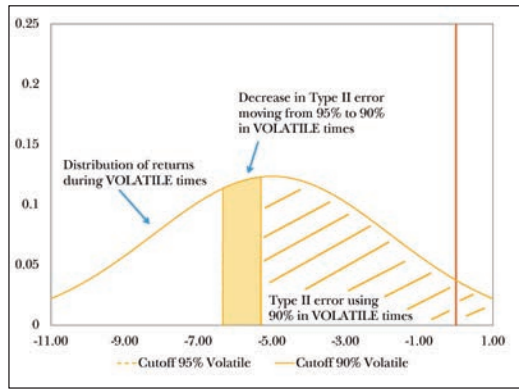


FIGURE 7(E): 5% DROP—REDUCTION IN TYPE II ERROR MOVING TO 90% LEVEL IN REGULAR TIMES

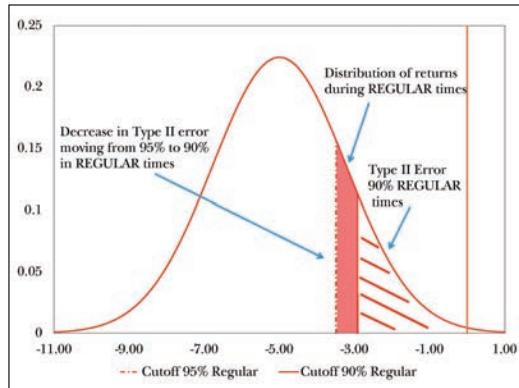
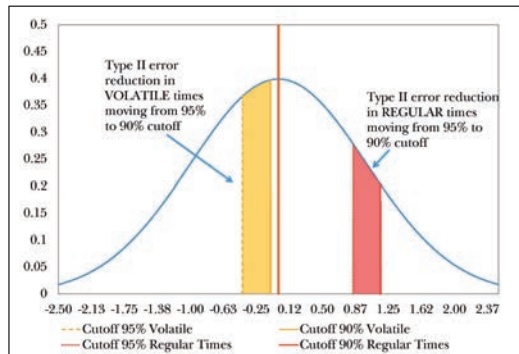


FIGURE 7(F): 5% DROP—COMPARING REDUCTIONS IN TYPE II ERROR MOVING TO 90% LEVEL



Now recall that the firm's idiosyncratic volatility also determines how negative the observed market-adjusted price change must be for it to be considered statistically significant at the 95% confidence level.¹³⁶ The cutoff is -1.96 multiplied by the standard deviation of the idiosyncratic risk of the firm. So for this typical firm, this cutoff in the financial crisis was $-1.96 \times 3.23 = -6.33\%$ and in normal times would be $-1.96 \times 1.78 = -3.49\%$. Type II error—a corrective disclosure with an actual negative impact on price that fails the test—occurs when the observed market-adjusted price change is not sufficiently negative to meet the cutoff.

Figures 7(b) and 7(c) display the Type II error rate using the distributions from 7(a) and the crisis- and normal-period cutoffs, respectively: In the figures, any observed market-adjusted price to the right of the applicable cutoff fails the test. For example, in Figure 7(b), because -5% is less negative than the 95% cutoff for crisis periods (-6.33%), the corrective disclosure in our example will only pass the test if the net impact of other bits of firm-specific news and background noise drives the price down by at least another 1.33% . This is 0.41 standard deviations below the distribution mean (which is -5%). For a normal distribution, this will happen only about one-third of the time, so the observed price will only be negative enough to pass the test about one-third of the time. As a result, Type II error in crisis periods will be about 66% (i.e., the area marked under the curve to the right of the cutoff in Figure 7(b) is 66%).

In contrast, as depicted in Figure 7(c), during normal times, the observed market-adjusted price will pass the test unless the net impact of these other items is sufficiently positive to drive the observed price up by at least 1.51% . This is 0.84 standard deviations above the mean, which with a normal distribution occurs only about 20% of the time (i.e., the marked area in Figure 7(c) under the curve to the right of the cutoff point is 20%). In normal times, then, Type II error would only be 20% .

Figures 7(d) and 7(e) graphically show what happens when we relax the statistical standard to 90% . The cutoffs then drop to -5.30% ($-1.64 \times 3.23\%$) during crisis times and 2.92% ($-1.64 \times 1.78\%$) in normal times. The area under the curves in these two figures between the 95% and 90% thresholds represents the reduction in Type II errors. The area in Figure 7(d) is larger than in Figure 7(e), indicating that a corrective disclosure with an actual negative impact on price of -5% is above the cutoff point: Type II errors decline after reducing the required confidence level by more during crisis times than during regular times.

Figure 7(f) displays the same information as Figures 7(d) and 7(e), except that we have transformed the two distributions so they can be directly compared by turning them both into the standard normal distribution, centered at zero and having a standard deviation of 1 .¹³⁷

136. See *supra* section III.B.1.b (mentioning relevance of firm-specific volatility on observed price change).

137. The math, though a bit difficult, is not important here.

Observe two things. First, this transformation preserves the standard deviations we noted above, so that the threshold for 95% in crisis times starts 0.41 standard deviations below the mean and the 95% threshold in normal times starts 0.84 standard deviations above the mean. Second, observe that the interval between the 95% and 90% cutoff is the same length (.32) in both regular and crisis periods. This means comparing the reduction in Type II errors is easy: Whichever period's interval is closer to zero (with a -5% actual impact, the crisis period) will see the larger reduction in Type II errors, since the normal distribution is at its highest at zero.

This approach, depicted in Figure 7(f), can be used to compare the normal- versus crisis-period reduction in Type II error from reducing the confidence level for corrective disclosures with any magnitude of actual negative impact on price. Figures 8(a), (b), (c), (d), and (e) depict these comparative reductions for actual negative impacts of 2%, 3%, 4.13%, 5%, and 6%, respectively. One can see from these figures that it will also always be the case that the crisis interval falls to the left of the normal-times interval (because the actual price impact relative to the standard deviation is always less negative in crisis times). One can see from Figure 8(c) that the crossover point will be where the two intervals are mirror images of each other, with the crisis-times interval on the negative side and the normal-times interval on the positive side. In all these curves, the distance under the curve from -1.96 to -1.64 (i.e., -0.32) is the same. For actual impacts (Figures 8(d) and 8(e)) that are more negative than the crossover point of -4.13%,¹³⁸ the curve is higher over the interval representing the reduction in a crisis period, representing a larger area and hence a larger reduction in Type II error. For actual impacts below the crossover point (Figures 8(a) and 8(b)), the opposite is the case.

138. The crossover point for relaxing the standard from the 95% confidence level to the 90% confidence level (i.e., allowing up to 5% Type I error instead of only 2.5% Type I error) when volatility increases for the typical company from a standard deviation of 1.78 to 3.23 (the normal times versus the financial crisis) is -4.13%. For the calculations, see Fox, Fox & Gilson, *Idiosyncratic Risk*, supra note 65, at 16–19.

FIGURE 8(A): 2% DROP—SMALLER THAN CROSSOVER

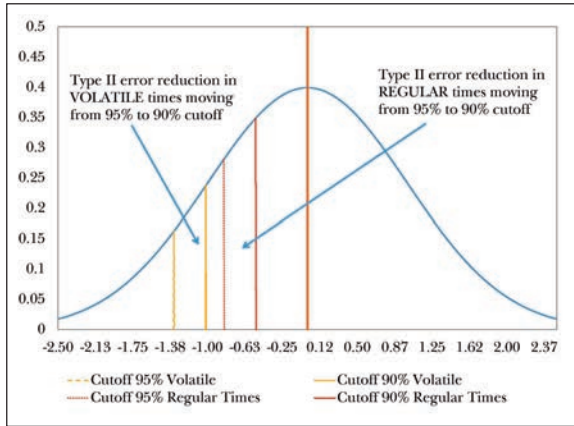


FIGURE 8(B): 3% DROP—SMALLER THAN CROSSOVER

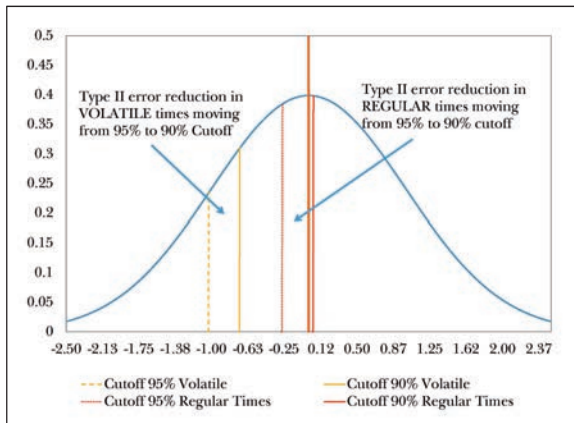


FIGURE 8(C): 4.13% DROP—CROSSOVER POINT

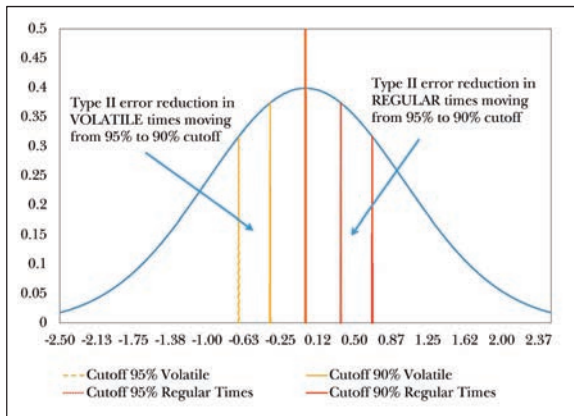


FIGURE 8(D): 5% DROP—LARGER THAN CROSSOVER

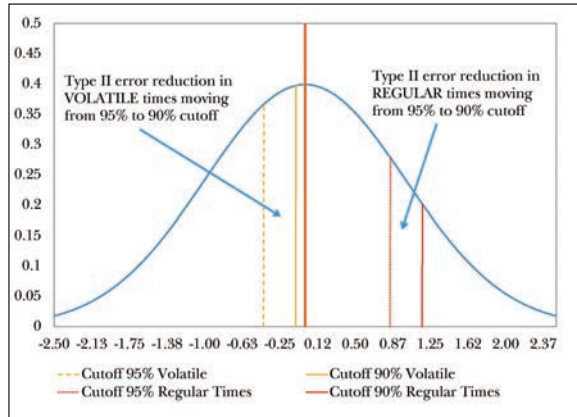
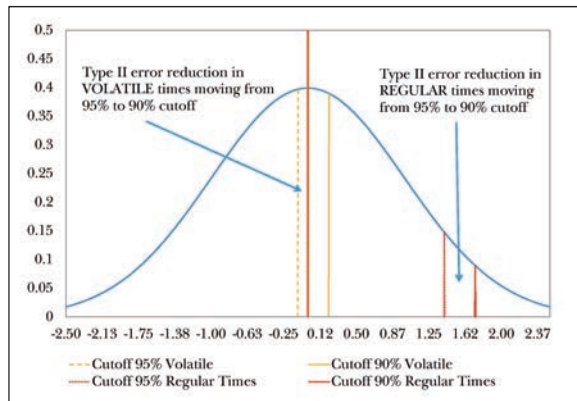


FIGURE 8(E): 6% DROP—LARGER THAN CROSSOVER



iii. *The Special Case Where the Crossover Point Exactly Equals the Materiality Threshold.* — To assess the welfare impact of lowering the confidence level in crisis times, consider first the special case where the Type II error crossover point exactly equals the materiality threshold, as depicted by the first bar in Figure 9. In this special case, the impact on Type II errors from reducing the required statistical confidence would have an unambiguously greater net positive effect on social welfare in a period of crisis-induced high idiosyncratic risk than it would in normal times. To see why, recall that it is socially desirable to impose liability on misstatements made with scienter whose corrective disclosures have actual price impacts more negative than the materiality threshold because the social benefits from the deterrent effects of imposing liability exceed the litigation's social costs.¹³⁹ The converse would be true for misstatements whose corrective disclosures have actual price impacts smaller than the materiality threshold.

For all corrective disclosures with actual price impacts more negative than the crossover point, reducing the confidence level will decrease false negatives more in high-idiosyncratic-volatility times than in normal times. Where the crossover point just equals the materiality threshold, this is exactly the range of price impacts where reducing false negatives is welfare-enhancing. This is because it is desirable for liability to be imposed where the corrective disclosure's price impact is more negative than the materiality threshold.

For all corrective disclosures with actual price impacts less negative than the crossover point, lowering the confidence level in high-idiosyncratic-volatility times will decrease false negatives (Type II errors) by less than in normal times. Reducing false negatives for corrective disclosures with price impacts in this range is welfare-destroying because it is undesirable to impose liability where the corrective disclosure's price impact is less negative than the materiality threshold. So less reduction in false negatives is desirable because false negatives block imposition of liability and imposing liability is not desirable for corrective disclosures with actual negative price impacts this small.

Now we can put the two cases together. As depicted in the first bar in Figure 9, over the full range of possible actual negative price effects from corrective disclosures, the impact on the Type II error rate from reducing the confidence level would increase social welfare in a period of high idiosyncratic risk. Compared to normal times, reducing the confidence level in crisis times would reduce the Type II error rate by more in the range where Type II errors are undesirable and reduce it by less in the range where Type II errors are desirable. Therefore, in this special

139. See *supra* note 119 and accompanying text (explaining concept of "materiality threshold" as point at which price distortion becomes large enough to justify enforcement costs of deterring misstatements).

situation, lowering the standard in volatile times would unambiguously increase social welfare.

iv. *The Ordinary Case Where the Crossover Point Does Not Equal the Materiality Threshold.* — The special case described above, where the crossover point is exactly equal to the materiality threshold, would be pure coincidence because the factors determining each are independent. In the ordinary case, they would not be equal. As a result, the comparative welfare effects of lowering the confidence level in crisis times versus doing so in normal times become more complicated. If the crossover point is either more or less negative than the materiality threshold, there will be a range of actual negative price effects from corrective disclosures for which the impact on Type II errors from lowering the standard in crisis times will have a less positive, or a more negative, effect on social welfare than in normal times.

First consider the situation, depicted in the second bar in Figure 9, where the crossover point is more negative than the materiality threshold. In this situation, for corrective disclosures with actual price impacts less negative than the crossover point but more negative than the materiality threshold, reducing the standard in high-volatility crisis times will reduce false negatives by less than doing so in normal times. This is a range of actual price impacts where false negatives are undesirable. So for corrective disclosures with price effects in this range, lowering the standard in crisis times is, in terms of its impact on Type II errors, less socially beneficial than doing so in normal times.

Next consider the opposite situation, depicted by the third bar in Figure 9, where the crossover point is less negative than the materiality threshold. For corrective disclosures with actual price impacts more negative than the crossover point but less negative than the materiality threshold, lowering the confidence standard in volatile times will reduce false negatives by more than doing so in normal times. This is a range of actual price impacts, however, where false negatives are desirable because it is undesirable to impose liability. So for corrective disclosures with price effects in this range, lowering the standard is, in terms of its impact on Type II errors, more socially harmful than doing so in ordinary times.

Thus, in each of these two situations, for corrective disclosures with price impacts in the range between the materiality threshold and the crossover point, the welfare effects of reducing the confidence level in high-volatility crisis times would be less beneficial, more harmful, than it would be in normal times. For corrective disclosures that have actual price effects that are on either side of this range, the welfare effects of lowering the standard would be more favorable, or less unfavorable, in crisis times than in normal times, for the same reasons as in the special situation where the crossover point precisely equals the materiality threshold.

If, as seems likely, the crossover point does not equal the materiality threshold—meaning there is a range of corrective disclosure price impacts that fall between these two points—what can we conclude about the social welfare effect of lowering the confidence level during crisis-induced high idiosyncratic volatility times? Recall that the critical question is whether the welfare benefits from the reduction in Type II errors are greater when the confidence level is relaxed in crisis times compared to ordinary times. Thus, we need to know whether the enhanced level of welfare gains with respect to corrective disclosures with price impacts outside this range on one side or the other dominate the reduced level of welfare gains, or increased level of welfare losses, with respect to corrective disclosures with price effects within this range. Answering this question requires knowing two things. First, one must know the distribution of misstatements in the economy in terms of their price effects (and hence the price effects of their associated corrective disclosures). And second, the answer also requires knowing, for corrective disclosures with each such level of price impact, the social gain or loss arising from weighing the deterrence benefits from imposing liability versus the costs of such litigation. We are currently far from knowing either of these things.

FIGURE 9: TYPE II ERROR REDUCTION FROM REDUCING THE CONFIDENCE LEVEL FOR STATISTICAL SIGNIFICANCE IN CRISIS TIMES VERSUS NORMAL TIMES AND THE IMPLICATIONS FOR SOCIAL WELFARE

For corrective disclosures with actual impacts more negative than the crossover point, reducing the standard in crisis times will decrease Type II error by more than doing so in normal times would. For corrective disclosures with actual impacts less negative than this point, reducing the standard in crisis times will decrease Type II error by less than doing so in normal times would.

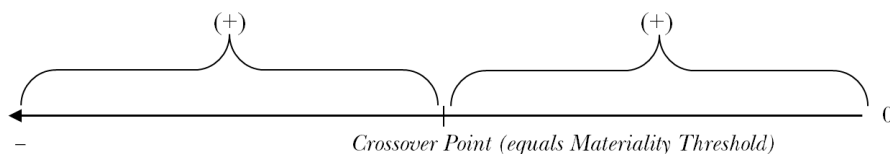
It is socially desirable to impose liability on misstatements made with scienter whose corrective disclosures have actual price impacts more negative than the materiality threshold and socially undesirable to impose liability for such misstatements when they have actual price impacts less negative than this point.

The comparative welfare effects of lowering the standard in normal versus volatile times is depicted here with regard to three situations: (A) where the crossover point equals the materiality threshold, (B) where the crossover point is less than the materiality threshold, and (C) where the crossover point is greater than the materiality threshold.

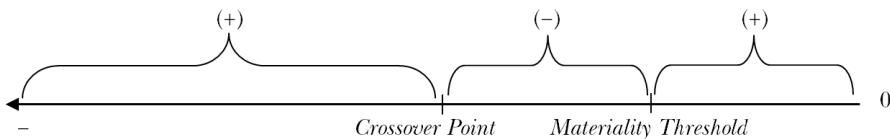
(+) = The welfare gains from reduced Type II errors are greater, or the welfare losses from reduced Type II errors are smaller, in crisis times than in normal times.

(-) = The welfare gains from reduced Type II errors are smaller, or the welfare losses from reduced Type II errors are greater, in crisis times than in normal times.

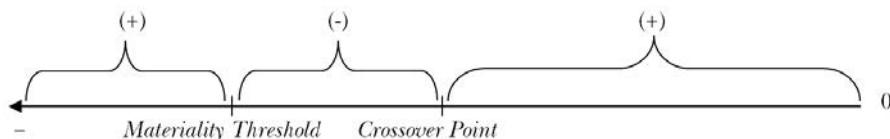
A. Crossover Point equals the Materiality Threshold



B. Crossover Point more negative than the Materiality Threshold



C. Crossover Point less negative than the Materiality Threshold



v. *Summary and Conclusion.* — Whether the steep increase in Type II errors during economic-crisis-induced periods of high idiosyncratic volatility warrants reducing the confidence level used in event studies of corrective disclosures in order to determine loss causation and materiality in fraud-on-the-market suits reduces to the following question: At the margin, does lowering the confidence level in crisis times increase social welfare through the reduction of Type II errors more than doing so in normal times does? This distillation follows logically from two observations. First, the negative welfare effect from a relaxed confidence level's increase in Type I errors will be the same in crisis times as in normal times because, by definition, reducing the standard will increase Type I error by the same amount in each of these two periods. Second, in normal times, this negative welfare effect from a reduced confidence level's increase in Type I errors will, at the margin, just equal the positive welfare effect from the reduced confidence level's decrease in Type II error because this is a necessary condition for our starting assumption that in normal times the 95% standard results in the socially optimal set of points in the tradeoffs between Type I and Type II errors.¹⁴⁰ Thus, reducing the confidence level in crisis times is desirable only if the resulting positive welfare effect from a reduced standard's impact on Type II errors is greater in volatile times than in normal times.

We have seen that it is impossible to determine, without considerably more information than appears to be available, whether this condition is met. The exception is the special—and purely coincidental—case where the Type II error crossover point exactly equals the materiality threshold. That case would be a pure coincidence because the factors determining the crossover point are entirely independent of the factors determining the materiality threshold.

The assumption that the 95% confidence level is the socially optimal point of tradeoff between Type I and Type II errors in normal times may, of course, be incorrect.¹⁴¹ But that would simply suggest that the standard be changed for normal times, an analysis that we do not undertake here (though our discussion identifies the nature of the inquiry). Regardless, the results here are generalizable from any such altered set point. If the optimal standard in normal times is something other than 95%, this analysis still suggests that without more information than we now have, we cannot have strong priors that welfare would be enhanced, rather than compromised, by lowering the required standard of statistical confidence during periods of economic crisis.

c. *Shifting the Mix of Enforcement Mechanisms in Crisis Times.* — The foregoing discussion shows that there are no simple answers to the questions that arise from using event studies to assess materiality and loss

140. See *supra* notes 111–113 and accompanying text (explaining assumption that 95% is socially optimal confidence level).

141. See *supra* note 112 and accompanying text (discussing assumption).

causation in fraud-on-the-market class actions in the face of economic crisis-induced increases in idiosyncratic volatility. We can say with certainty, however, that the dramatic worsening in the tradeoff between Type I and Type II errors makes the threat of fraud-on-the-market actions a comparatively much less useful tool for deterring price-distorting issuer misstatements in crisis times than in normal times. As has just been demonstrated, there is as much reason to believe that lowering the required confidence level in times of economic crisis will decrease social welfare as increase it. And if the required level of statistical confidence is maintained at 95%, the threat of such an action constitutes a considerably less effective deterrent.

This loss of deterrence can be illustrated. Assume that if misstatements made with scienter distort prices by 5%, they surpass the materiality threshold, i.e., they are serious enough to incur the social costs of deterring them through private actions. As we have seen from our examples, crisis times would transform this useful cause of action from one that catches most such misstatements—four out of five—to one that catches many fewer—just one in three. And if the confidence standard is lowered to at least partially compensate for this loss in deterrence, a fraud-on-the-market class action becomes a costlier way to deter issuer misstatements because, among other reasons, of the corresponding increase in Type I errors.

This very substantial decline in the usefulness of fraud-on-the-market class actions in crisis times has not been previously recognized. It suggests that during crisis times, more resources should be devoted to other methods for deterring price-distorting misstatements, for example stepped-up SEC enforcement actions. In contrast to fraud-on-the-market suits, the SEC is not required to establish loss causation in Rule 10b-5 enforcement actions.¹⁴² So in a crisis, the SEC will not have to prove loss causation in times when it is considerably less likely that the corrective disclosure of a misstatement that substantially distorts price will be accompanied by a statistically significant, market-adjusted price drop. The SEC still, of course, needs to establish that the misstatement was material, but unlike with respect to loss causation, the case law permits materiality to be proven other than through an event study.¹⁴³ For example, the SEC could show the facial importance of the issuer's misstatement, the extent to which analysts took note of the misstatement at the time it was made, and any price reaction at the time of the misstatement. Evidence that would suggest that the market-adjusted price

142. See, e.g., *SEC v. Kelly*, 765 F. Supp. 2d 301, 319 (S.D.N.Y. 2011) (“[U]nlike a private plaintiff, the SEC need not allege or prove reliance, causation, or damages in an action under Section 10(b) or Rule 10b-5.”); *supra* notes 88–104 and accompanying text (discussing requirements of fraud-on-the-market shareholder class actions).

143. See, e.g., *SEC v. Lee*, 720 F. Supp. 2d 305, 335 (S.D.N.Y. 2010) (holding SEC sufficiently pleaded materiality by alleging defendant's false statements would have influenced reasonable investor).

drop at the time of any unambiguous issuer announcement of the truth might be smaller than the amount by which the misstatement inflated price also would be relevant. Possible explanations of how this could occur include insider trading based on the truth, rumors of the true situation circulating in the market, and the existence of a series of corporate announcements that dribbled the truth out in small doses in advance of the full corrective disclosure. All of these could lead to the market's realizing the truth, often gradually, in advance of the full corrective disclosure and thus cause a smaller or nonexistent observed market-adjusted price change at the time of the disclosure.¹⁴⁴

Using these other indicia to determine whether a misstatement influenced price is a considerably more subjective exercise than the use of an event study. Indeed much of the event study's appeal for the judiciary derives from its greater objectivity and transparency: Experts may differ in their methodology, but in comparison to, for example, the testimony of a financial analyst, the differences between competing methodologies are readily observable. This appeal is so important that in private suits, some courts will grant the defendant summary judgment on the issue of loss causation if the plaintiff does not introduce an event study showing a statistically significant, market-adjusted negative price change at the time of the corrective disclosure.¹⁴⁵ But when the event study becomes a comparatively less powerful tool, alternative forms of evidence concerning loss causation and materiality become relatively more attractive. At least in theory, courts could give more importance to these other forms of evidence in fraud-on-the-market suits as well as in SEC enforcement actions in times of economic crisis.¹⁴⁶ But it is likely that they are relatively more manageable in the hands of an administrative agency that can use prosecutorial discretion in deciding which cases to bring.

144. See Fox, After *Dura*, supra note 101, at 850–51 (explaining why share price does not necessarily drop immediately after corrective disclosure); David Tabak & Frederick C. Dunbar, Materiality and Magnitude: Event Studies in the Courtroom 7 (Nat'l Econ. Research Assocs., Working Paper No. 34, 1999), www.nera.com/content/dam/nera/publications/archive1/3841.pdf [<http://perma.cc/KUK3-FFLF>] (discussing beginning event studies prior to actual announcement of news to correct for leakage before that time).

145. See, e.g., In re Imperial Credit Indus., Inc. Sec. Litig., 252 F. Supp. 2d 1005, 1014–16 (C.D. Cal. 2003) (finding defendants entitled to summary judgment because plaintiffs failed to produce event study); In re Exec. Telecard, Ltd. Sec. Litig., 979 F. Supp. 1021, 1025–27 (S.D.N.Y. 1997) (rejecting reliability of expert testimony due to failure to perform event study).

146. For a view of one of the authors that as a general matter, some of these factors should, under certain circumstances, be taken into account by courts in fraud-on-the-market actions, see Merritt B. Fox, Demystifying Causation in Fraud-on-the-Market Actions, 60 Bus. Law. 507, 523–25 (2005). For an opposing view that they never should be, see John C. Coffee, Jr., Causation by Presumption? Why the Supreme Court Should Reject Phantom Losses and Reverse *Broudo*, 60 Bus. Law. 533, 537 (2005).

B. *Establishing Materiality in Other Securities Law Contexts*

The concept of “materiality” pervades securities law, reaching far beyond fraud-on-the-market suits. This includes two particularly important areas where event studies are frequently used: insider trading regulation and section 11 of the Securities Act of 1933 (the Securities Act) litigation based on alleged misstatements or omissions in the registration statements of public securities offerings. Use of event studies to establish materiality in each of these important areas raises sufficiently distinct issues from their use in fraud-on-the-market studies to warrant separate discussion.

1. *Insider Trading*. — One of the requirements of the longstanding prohibition under Rule 10b-5 against insider trading is that the information on which the insider trades be “material.”¹⁴⁷ The doctrinal standard for materiality in insider trading cases under Rule 10b-5 is identical to that in Rule 10b-5 misstatement cases: whether there is a substantial likelihood that a reasonable investor would consider the nonpublic information on which the insider traded to be important in a decision whether to purchase or sell the security involved.¹⁴⁸ If the later public disclosure of this information changes the price of this security, it has had an actual effect on the behavior of investors. Again, this change in price strongly suggests that a reasonable investor would have found the information important at the time that the defendant traded on it. As in fraud-on-the-market cases, an event study is the financial economist’s standard tool for determining the likelihood that the disclosure of a previously nonpublic item of news in fact did change the price of a security. Not surprisingly, therefore, the courts in insider trading litigation have accepted event studies as at least one (preferred) way to establish the materiality of information.¹⁴⁹

The social gains from deterring trades based on inside information are somewhat different from the gains from deterring corporate misstatements, as are the costs from imposing liability for insider trading where the importance of the information is below a certain threshold. Still, there will be a point below which, if we knew for certain the impact of the information on price, we would not wish to impose liability—i.e.,

147. See, e.g., *SEC v. Tex. Gulf Sulphur Co.*, 401 F.2d 833, 848 (2d Cir. 1968) (en banc) (“An insider’s duty . . . to abstain from dealing in his company’s securities arises only in ‘those situations . . . which are reasonably certain to have a substantial effect on the market price of the security if . . . disclosed.’” (quoting Arthur Fleischer, Jr., *Securities Trading and Corporate Information Practices: The Implications of the Texas Gulf Sulphur Proceeding*, 51 Va. L. Rev. 1271, 1289 (1965))).

148. See *supra* note 103 (explaining definition of materiality).

149. *SEC v. Berlacher*, No. 07-3800, 2010 WL 3566790, at *8 (E.D. Pa. Sept. 13, 2010) (referring to “event study as reliable and the best measure of materiality”); see also Mark L. Mitchell & Jeffrey M. Netter, *The Role of Financial Economics in Securities Fraud Cases: Applications at the Securities and Exchange Commission*, 49 Bus. Law. 545, 572–84 (1994) (collecting cases).

there is a policy-based materiality threshold. And because the tool that we have to measure that impact—the event study—gives us only probabilistic guidance as to what the actual impact of the information on price was, the issues associated with the tradeoff between Type I and Type II errors are the same as with fraud-on-the-market suits. If the same required confidence level is maintained during periods of economic crisis-induced idiosyncratic risk as during normal times and if event studies are required to establish materiality, Type II errors will rise sharply and many more trades that in fact are based on information sufficiently important to meet the materiality threshold will not be actionable. But again, there are no strong reasons to believe that lowering the required confidence level, with the consequent increase in Type I errors, will increase, rather than decrease, social welfare.

Ultimately, just as with fraud-on-the-market actions during periods of crisis-induced spikes in volatility, event studies are a comparatively less powerful tool in these circumstances for discriminating between information that is and is not material in insider trading cases despite their advantage of being less subjective. This makes our discussion of alternative forms of evidence concerning proof of materiality in fraud-on-the-market class actions¹⁵⁰ relevant to insider trading as well. Again, we suspect that increased permissibility of more subjective kinds of evidence during economic-crisis periods is more suitable in SEC enforcement cases because its capacity to use prosecutorial discretion cabins their inappropriate use in a fashion not present in cases brought by private parties.¹⁵¹

The fact that event studies are, in crisis times, a comparatively less powerful tool for discriminating between information that is and is not material takes on special significance in insider trading cases given our explanations for what causes crisis-induced spikes in idiosyncratic risk. These explanations suggest that more kinds of information that insiders typically possess will be important in crisis times and will have a larger effect on price when they are eventually revealed than they would in normal times.¹⁵² This means that in crisis times, insiders would have

150. See *supra* section IV.A (examining causation and materiality in fraud-on-the-market shareholder class actions).

151. See *supra* section IV.A. In a nonjury trial involving an SEC Rule 10b-5 action against a defendant accused of insider trading, at least one court has ruled that where the defense has introduced expert testimony based on an event study showing no statistically significant price reaction upon the public release of the information on which the defendant traded and the government, to show materiality, only offered the testimony of a financial expert who did not conduct an event study, the government failed to establish materiality. *Berlacher*, 2010 WL 3566790, at *7. We note that this case did not involve a situation where an economic crisis-induced spike in idiosyncratic risk devalued that defendant's use of an event study.

152. Recall from our earlier examples that the standard error for the typical firm during the recent financial crisis was 3.23%, compared to 1.78% in the average year in normal times. *Supra* text accompanying note 121. This says, very roughly, that average bit

many more opportunities to profit from insider trading on nonpublic information that in normal times would not be important enough to warrant deterring by privately imposed liability or governmental sanction. Yet assuming that the required level of statistical confidence is not changed, the very same larger standard error means that this larger number of more important bits of inside information that are now important enough to exceed the materiality threshold will on average be no more likely to be found by an event study to be material than they were in normal times when their price impacts were below this threshold.

2. *Materiality Under Section 11 of the Securities Act.* — Section 11(a) of the Securities Act¹⁵³ imposes liability on the issuer, the underwriters, and certain other persons for misstatements and omissions of required information in a registration statement for a public offering. As with corporate misrepresentations and insider trading under Rule 10b-5, the misstatement or omission is actionable only if it relates to a “material fact.” The doctrinal standard for materiality is the same as under Rule 10b-5.¹⁵⁴ Assume that following their issuance, the offered securities trade in an efficient secondary market. If the registration statement contains a misstatement or omission whose subsequent correction changes the security’s price, the doctrinal standard would be met. As a result, here too the courts have relied heavily on event studies in determining whether the misstatement or omission was material.¹⁵⁵

Assessing the appropriate role of event studies in determining materiality and damages in section 11 cases and the implications of crisis-induced spikes in idiosyncratic risk requires a little background concerning the system of liability and the statutory measure of damages, including the allocation of burdens of proof and persuasion with respect to these elements.

As for liability, section 11(a) imposes absolute liability on the issuer.¹⁵⁶ When an issuer offers equities for sale and makes a price-inflating misstatement or omission, it receives the inflated sales price. Imposing liability simply returns the inflation to the buyer. At least in a transaction-cost-free world (including the absence of judicial error), doing so makes sense whatever the level of the issuer’s culpability, since

information released by such a firm had almost twice the effect on price in crisis as it did in normal times.

153. Pub. L. No. 73-22, 48 Stat. 74 (codified as amended at 15 U.S.C. §§ 77a–77aa (2012)).

154. See supra note 103 (explaining definition of materiality). The Supreme Court has yet to address the proper standard for materiality under section 11 of the Securities Act, but all the circuit courts that have addressed the question have applied the *Northway* definition of materiality in section 11 actions. See, e.g., *Kronfeld v. Trans World Airlines, Inc.*, 832 F.2d 726, 731 (2d Cir. 1987) (collecting cases).

155. See, e.g., *In re World Access, Inc. Sec. Litig.*, 310 F. Supp. 2d 1281, 1298–99 (N.D. Ga. 2004) (using parties’ event studies in determining materiality).

156. See, e.g., *Hutchinson v. Deutsche Bank Sec. Inc.*, 647 F.3d 479, 484 (2d Cir. 2011) (applying section 11’s scheme of absolute liability for issuers).

the net effect will be as if the offering was priced correctly in the first place. Imposing absolute liability also creates incentives to take cost-effective steps to avoid such price distorting behavior.¹⁵⁷

Now consider damages. For a plaintiff still holding her securities at the time of judgment, section 11(e) provides that the prima facie damages measure is the difference between the price paid for the security and its value on the date of suit, with the difference presumed to be caused by the misstatement or omission.¹⁵⁸ But this crude measure and presumption obviously does nothing to correct for market-wide or firm-specific factors other than the misstatement or omission that may have influenced the security's price after the plaintiff's purchase. To address this gap, section 11(e) in effect shifts the burden of proving loss causation from the plaintiff to the defendant by granting the defendant an affirmative defense if it can prove the absence of loss causation; damages are reduced to the extent that defendants can show that events other than the misrepresentation or omission caused the price drop.

The implications of economic-crisis-induced spikes in idiosyncratic volatility on determining materiality and damages/loss causation under section 11 track those under Rule 10b-5. Each side will bear the burden of proving statistical significance with respect to the element on which it bears the burden of proof. The plaintiff, if it seeks to prove materiality through an event study, will succeed at doing so by showing a statistically significant drop in share price when the corrective disclosure was made.

157. Section 11(a) also imposes absolute liability on other participants in the process: the issuer's top managers, directors, and underwriters. However, section 11(b) grants these other participants an affirmative defense: They have no liability if they can show that they engaged in adequate due diligence. 15 U.S.C. § 77k(a), (b)(3). The overall liability scheme for these other participants is designed to motivate each of them, particularly the lead underwriter, to independently investigate the issuer and to participate actively in the drafting of the registration statement. Commentary by persons intimately involved with the creation of the Securities Act confirm that this in *terrorem* arrangement for imposing damages in the absence of adequate investigation was a critical part of the legislative plan to promote full disclosure. See William O. Douglas & George E. Bates, *The Federal Securities Act of 1933*, 43 *Yale L.J.* 171, 173 (1933) (noting penalties are both "compensatory" and "*in terrorem*" in nature and therefore are "set high to guarantee that the risk of their invocation will be effective in assuring that the 'truth about securities' will be told"); Felix Frankfurter, *The Securities Act: II*, *Fortune*, Aug. 1933, at 54, 109 (praising in *terrorem* effects of Act); see also *Feit v. Leasco Data Processing Equip. Corp.*, 332 F. Supp. 544, 581 (E.D.N.Y. 1971) (explaining courts must hold underwriters to high standard of diligence "since they are supposed to assume an opposing posture with respect to management"); *Escott v. BarChris Constr. Corp.*, 283 F. Supp. 643, 696-97 n.48 (S.D.N.Y. 1968) ("The purpose of Section 11 is to protect investors In order to make the underwriters' participation in this enterprise of any value to the investors, the underwriters must make some reasonable attempt to verify the data submitted to them. They may not rely solely on the company's officers or . . . counsel.").

158. § 11(e), 48 Stat. at 83 ("The suit authorized under subsection (a) may be either (1) to recover the consideration paid for such security with interest thereon, less the amount of any income received thereon, upon the tender of such security, or (2) for damages if the person suing no longer owns the security.").

In turn, the defendant will use an event study to prove that the drop in security price was caused by events other than the corrective disclosure. The fact that each party will likely contest the other's event study further complicates this event-study duel. Despite the complications, the analysis remains essentially the same. If the same standard of statistical significance is maintained during highly volatile times as in normal ones, Type II errors will rise sharply.¹⁵⁹ Suppose the plaintiff is required to establish materiality through use of an event study. Crisis times will substantially diminish section 11's capacity to create the situation that would have prevailed if the offering had been priced correctly in the first place and to deter future price-distorting misstatements and omissions in registration statements.

The crisis-induced increase in idiosyncratic volatility has the same impact on the defendant's effort to show that factors other than the corrective disclosure caused all or part of the price drop. Thus, the higher standard of statistical significance will affect both the plaintiff and the defendant. The relative impact will depend on the facts; the defendant's opportunity to disprove loss causation depends on the presence of other events in the relevant period that may have affected the issuer's price. However, the limits on the capacity of event studies to separate the effects of multiple factors make section 11's shift in the burden of proof to the defendant on this issue significant.

C. *Judicial Deference to Board Rejections of Premium Acquisition Offers and Substantive Coercion*

To this point, our discussion of the legal implications of the pattern of, and alternative explanations for, crisis-induced spikes in idiosyncratic risk has focused on issues related to the content and their private and public enforcement of the federal securities laws. We turn now to corporate law and in particular to the legal implications of our findings for what has been the most disputed element in state corporate law over the last thirty years: the extent of judicial deference to a board of directors' decision to defend against a hostile takeover.¹⁶⁰ Over this

159. Again, there are no strong reasons to believe that lowering the standard, with the consequent increase in Type I errors, will increase social welfare.

160. See Jack B. Jacobs, *Fifty Years of Corporate Law Evolution: A Delaware Judge's Retrospective*, 5 Harv. Bus. L. Rev. 141, 154-55 (2015) (arguing rise of hostile takeover litigation contributed to changing legal standards for corporate boards). Justice Jack Jacobs, a recently retired Delaware Supreme Court Justice who sat on the Chancery Court during this period, described the matter as follows:

[The Delaware courts] created an entirely new . . . set of standards [for reviewing boards of director's actions] in the landmark cases of *Unocal*, *Revlon*, and *Blasius* . . . [which] were needed to address new realities and issues arising out of novel legal and financial technologies, in order to solve the problem of whether and how boards should respond to hostile corporate takeovers. That evolution was game-changing. It reshaped the governance of boards and the conduct of all

period, Delaware law evolved to give the board wide discretion when it determines there is a risk of “substantive coercion”—a risk that the shareholders may mistakenly accept a tender offer that the board believes undervalues the corporation. As we will show in this section, the concept of substantive coercion as developed by the Delaware Supreme Court makes little sense in normal times. Here we consider whether there is a circumstance in which the concept might make sense: Can crisis-induced spikes in idiosyncratic risk of the sort discussed in Parts I and II make a substantive coercion claim plausible where it would not be credible in normal times? In particular, we examine two takeover cases where an economic crisis figured centrally in both the bidder’s decision to make the offer and the target board’s decision to oppose it: *Air Products and Chemicals, Inc. v. Airgas, Inc.*¹⁶¹ and *Quickturn Design Systems, Inc. v. Mentor Graphics, Inc.*¹⁶²

1. *A Brief Review of the Evolution of Delaware Takeover Law.* — The emergence of the hostile takeover boom in the 1980s subjected traditional corporate law to the equivalent of a stress test. The largest and most tendentious corporate transactions in history created serious doctrinal cracks, the most important of which was allocating, in the face of a hostile tender offer, final decision rights among directors, shareholders, and courts.¹⁶³ As the law developed, the breadth of the board’s discretion to constrain shareholders from approving a hostile offer came to depend upon the court’s assessment of the board’s professed belief that the offer presented a “threat” to corporate policy.¹⁶⁴ An important element of the potential threat was whether shareholders, even with full information, would mistakenly (in the board’s view) tender their shares to a hostile bidder. The threat that fully informed shareholders would make this mistake is termed, awkwardly, “substantive coercion.”¹⁶⁵

Framing the concept most generously, tolerance of board decisions to block a hostile takeover depends in part on how accurately share prices predict the value of the company in the incumbent management’s

players, including legal and financial advisors, in the area of mergers and acquisitions.

Id.

161. 16 A.3d 48 (Del. Ch. 2011).

162. 721 A.2d 1281 (Del. 1998).

163. Ronald J. Gilson, *The Fine Art of Judging*: William T. Allen, 22 Del. J. Corp. L. 914, 914 (1997).

164. See, e.g., *Unocal Corp. v. Mesa Petroleum Co.*, 493 A.2d 946, 954–55 (Del. 1985) (“[D]irectors must show that they had reasonable grounds for believing that a danger to corporate policy and effectiveness existed because of another person’s stock ownership.”).

165. As will become apparent, one of the authors bears at least half the responsibility for this very poorly turned phrase. See *Unitrin, Inc. v. Am. Gen. Corp.*, 651 A.2d 1361, 1384 (Del. 1995) (citing Ronald J. Gilson & Reinier Kraakman, *Delaware’s Intermediate Standard for Defensive Tactics: Is There Substance to Proportionality Review?*, 44 Bus. Law. 247, 267 (1989) [hereinafter Gilson & Kraakman, *Intermediate Standard*], as origin of term “substantive coercion”).

hands. If these prices are thought to be relatively accurate, it is harder for the target board to justify preventing its shareholders from deciding themselves whether to accept a hostile offer made at a premium over that price. The increase that we have documented in idiosyncratic risk during times of economic distress provides, for the first time, a potentially coherent core to the concept of substantive coercion, a term that has become progressively both more important to Delaware takeover law and more empty of analytic content. Understanding this point, however, requires a short detour along a very long road: the development of Delaware's takeover law.

The modern law of takeovers began with the Delaware Supreme Court's decision in *Unocal v. Mesa Petroleum*.¹⁶⁶ There the court resolved the conflict between two contending positions over who could decide whether a hostile takeover would succeed: Should the board be prevented from interfering with the offer so that shareholders decide whether to accept a hostile bid or should the board have the power to prevent shareholders from making that choice?¹⁶⁷ The *Unocal* court rejected both contending positions in favor of creating for itself what appeared to be a regulatory role: The court would decide whether the hostile offer presented a threat and if so, whether the board's response was proportional to the threat identified.¹⁶⁸

Following *Unocal*, a law review article appeared that influenced the further evolution of Delaware takeover law: Ronald Gilson and Reinier Kraakman's *Delaware's Intermediate Standard for Defensive Tactics: Is There Substance to Proportionality Review?*.¹⁶⁹ Anticipating the possibility that the Delaware Supreme Court might be too sympathetic to a board's claim that it knew better than the shareholders, the authors sought to provide the court with a framework for responding to such claims in a way that would cabin what would meet the test. From this effort came the awful term "substantive coercion": the risk that even in the face of full disclosure, target shareholders still might mistakenly accept a hostile bid that is lower than the company's fundamental value.¹⁷⁰ To make a claim

166. 493 A.2d 946.

167. Compare Gilson & Kraakman, *Intermediate Standard*, supra note 165, at 821, 831–48 (arguing conflict of interest inherent in management defensive tactics "exposes the invalidity of defensive tactics in tender offers and delineates a general principle governing management's appropriate role in the tender offer process"), with Martin Lipton, *Takeover Bids in the Target's Boardroom*, 35 *Bus. Law.* 101, 115–16 (1979) ("There is no reason to remove the decision on a takeover from the reasonable business judgment of the directors.").

168. See *Unocal*, 493 A.2d at 955 ("If a defensive measure is to come within the ambit of the business judgment rule, it must be reasonable in relation to the threat posed.").

169. Gilson & Kraakman, *Intermediate Standard*, supra note 165. Chancellor Chandler assesses the article's impact on Delaware takeover law in *Air Prods. & Chems., Inc. v. Airgas, Inc.*, 16 A.3d 48, 96–98 (Del. Ch. 2011) (citing article and noting adoption of its proposed test into Delaware case law).

170. Gilson & Kraakman, *Intermediate Standard*, supra note 165, at 267.

of substantive coercion credible, the authors would have required a good deal more than just management's predictable claim that the market price undervalued the company's shares. The board also would have to state clearly the source of the mispricing and management's plans for correcting it.¹⁷¹ At the least, the discipline imposed by requiring this showing would force management to specify the metric by which their

171. *Id.* at 268 (arguing substantive coercion allegation “requires a coherent statement of management’s expectations about the future value of the company” and “showing of how—and when—management expects a target’s shareholders to do better”). Then-Vice Chancellor (now Chief Justice) Strine highlighted the problem that an unconstrained claim of substantive coercion would present:

As a starting point, it is important to recognize that substantive coercion can be invoked by a corporate board in almost every situation. There is virtually no CEO in America who does not believe that the market is not valuing her company properly. Moreover, one hopes that directors and officers can always say that they know more about the company than the company’s stockholders—after all, they are paid to know more. Thus, the threat that stockholders will be confused or wrongly eschew management’s advice is omnipresent.

....

... Professors Gilson and Kraakman—from whom our courts adopted the term substantive coercion—emphasized the need for close judicial scrutiny of defensive measures supposedly adopted to address that threat[.]

Chesapeake Corp. v. Shore, 771 A.2d 293, 327, 329 (Del. Ch. 2000). Vice Chancellor Strine then quotes Professors Gilson and Kraakman to show what “close judicial scrutiny” would entail:

To support an allegation of substantive coercion, a meaningful proportionality test requires a coherent statement of management’s expectations about the future value of the company. From the perspective of shareholders, substantive coercion is possible only if management plausibly expects to better the terms of a hostile offer—whether by bargaining with the offeror, by securing a competitive bid, or by managing the company better than the market expects. To make such a claim requires more than the standard statement that a target’s board and its advisers believe the hostile offer to be ‘grossly inadequate.’ In particular, demonstrating the existence of a threat of substantive coercion requires a showing of how—and when—management expects a target’s shareholders to do better.

....

The discipline imposed by requiring management to state clearly just *how* it intends to cause the price of the company’s shares to increase is a critical check on knee-jerk resort to assertions that a hostile offer’s price is inadequate. For example, if management believes that the price of a hostile offer is inadequate because the market undervalues the company[] . . . an acceptable statement of the threat to shareholders would require management to describe the steps that it planned to correct the market’s valuation.

Id. at 329–30 (Del. Ch. 2000) (quoting Gilson & Kraakman, *Defensive Tactics*, *supra* note 169, at 268–69, 274).

performance going forward should be measured if the offer were defeated.

In *Paramount Communications, Inc. v. Time, Inc.*,¹⁷² the Delaware “Supreme Court . . . addressed the concept of substantive coercion head on . . .”¹⁷³ As that court put it in a subsequent case, the “board of directors had reasonably determined that inadequate value was not the only threat that Paramount’s all cash for all shares offer presented, but was *also* reasonably concerned that the Time stockholders might tender to Paramount in ignorance or based upon a mistaken belief, i.e., yield to substantive coercion.”¹⁷⁴

The result, it is fair to say, greatly diminished *Unocal* as a serious restriction on a board’s authority to block a hostile takeover by turning substantive coercion into an assumption rather than a standard of proof. Possibly, the Delaware Supreme Court so sharply diluted the restrictions on proving the presence of substantive coercion because neither the court nor advocates of management discretion could articulate a compelling circumstance when fully informed shareholders reasonably could be expected to make a mistake in accepting a hostile offer. If so, Gilson and Kraakman were too clever by half. In their effort to set the standard of proof high, they created a situation where the Delaware Supreme Court, to give the concept broad application, watered down what had to be proved to essentially nothing.¹⁷⁵

2. *Substantive Coercion and Crisis-Induced Spikes in Idiosyncratic Risk.* — This is where the impact of crisis-induced spikes in idiosyncratic risk comes in. The occurrence of such a spike may present a realistic situation where substantive coercion could occur. In particular, recall our analysis of the potential that the incidence of insider trading would go up as a result of a crisis: The importance of new information about both the company and about its management go up, which may increase the amount and value of insiders’ private information compared to that available to the market.¹⁷⁶ This crisis-induced gap between management’s

172. 571 A.2d 1140 (Del. 1990).

173. *Airgas*, 16 A.3d at 98 (summarizing Delaware Supreme Court’s movement away from *Unocal* in *Paramount*).

174. *Unitrin, Inc. v. Am. Gen. Corp.*, 651 A.2d 1361, 1384 (Del. 1995).

175. Chancellor Chandler reached just this conclusion in *Airgas*:

Inadequate price has become a form of ‘substantive coercion’ as that concept has been developed by the Delaware Supreme Court in its takeover jurisprudence. That is, the idea that *Airgas*’s stockholders will disbelieve the board’s views on value (or in the case of merger arbitrageurs who may have short-term profit goals in mind, they may simply ignore the board’s recommendations), and so they may mistakenly tender into an inadequately priced offer. Substantive coercion has been clearly recognized by our Supreme Court as a valid threat.

Airgas, 16 A.3d at 57.

176. See *supra* section IV.B.1 (arguing kinds of information typically held by insiders are more important in crisis times than in normal times).

information and that available to the market may be difficult to communicate because of the crisis even if, unlike the insider trading situation, management is inclined to close the gap through disclosure. In a period when the continued validity of the market's precrisis valuation model of the company is in question and the range of relevant new information expands precisely because of new competing models, simple disclosure of management's information may not solve the problem. In this circumstance, the information gap may be a measure of substantive coercion: For a period of time, management's knowledge advantage over shareholders concerning facts important for valuing the company is significantly increased. Thus, in a period of crisis when an increase in management's knowledge advantage is signaled by a spike in idiosyncratic risk, there is, in the name of substantive coercion, a case for temporarily giving the board more discretion to impede a takeover.

In this regard, consider the facts of two well-known takeover cases: *Quickturn Design Systems, Inc. v. Mentor Graphics Corp.*,¹⁷⁷ and *Air Products and Chemicals, Inc. v. Airgas, Inc.*¹⁷⁸ Each case took place following a financial crisis. Each involved a sharp decline in the target's share price, which appears to have both prompted the bidder to initiate the hostile offer and provided the target a rationale for resistance. As it turns out, however, in each case, the timing of the crisis-induced increases in idiosyncratic risk do not support an application of the theory of substantive coercion articulated above. This is because the crisis-induced spike in idiosyncratic volatility had already dissipated by the time of the hostile offer.

Quickturn was a technology company with whom Mentor Graphics competed.¹⁷⁹ Patent litigation brought by Quickturn had, by 1997, resulted in an injunction barring Mentor Graphics from selling certain products in the United States.¹⁸⁰ There was an associated damages claim by Quickturn that it said could reach \$225 million.¹⁸¹ These developments led Mentor Graphics to consider a hostile acquisition of Quickturn, motivated in large part by a desire to resolve the dispute by extinguishing the claim through an acquisition of the company holding

177. 721 A.2d 1281 (Del. 1998), aff'g 728 A.2d 25 (Del. Ch. 1998).

178. 16 A.3d 48.

179. See *Quickturn*, 721 A.2d at 1283 (describing Mentor and Quickturn as publicly traded companies on NASDAQ market specializing in electronic design technology and emulation technology, respectively).

180. See *id.* at 1284-85 ("In December 1997, the [International Trade Commission] issued a Permanent Exclusion Order prohibiting Mentor from importing, selling, marketing, advertising, or soliciting in the United States . . . any of the emulation products manufactured by [Mentor-acquisition] Meta outside the United States.").

181. See *id.* at 1285 ("Quickturn is asserting a patent infringement damage claim that, Quickturn contends, is worth approximately \$225 million.").

the patent.¹⁸² There was, however, a problem over price. Although Mentor Graphics's investment banker supported the concept of the acquisition, its view was that Quickturn's stock price, which reached \$15.75 during the first quarter of 1998, was too high to make the acquisition worthwhile.

Things changed abruptly as a result of the Asian financial crisis. By summer 1998 (the second quarter), Quickturn's stock price had dropped to \$6.¹⁸³ Mentor Graphics's chairman then concluded that "the market outlook being very weak due to the Asian crisis made [the Quickturn acquisition] a good opportunity."¹⁸⁴ Mentor Graphics then commenced a tender offer at an approximately 50% premium to Quickturn's crisis-affected market price, but at more than a 20% discount to the precrisis price. In response, and after the requisite investment banking and legal counsel opinions and board meeting discussion, Quickturn took a set of defensive actions, including a delay in holding a shareholder-requested meeting, an action the Chancery Court ultimately upheld. Quickturn also adopted a "dead hand" poison pill¹⁸⁵ that it withdrew after similar devices were invalidated in cases involving other litigants and then a "slow hand" poison pill that the Delaware Supreme Court ultimately held violated Delaware law.¹⁸⁶

At least superficially, this case presents a circumstance where a claim of substantive coercion is plausible under the framework developed here. If a crisis-induced spike in idiosyncratic risk is in fact occurring at the time of the hostile offer, the spike would indicate that the private information possessed by target management is likely of greater significance than it is in normal times. The market price of the target's shares, which did not reflect this private information, thus could more significantly diverge from a fully informed price—just the circumstance

182. *Id.* ("If Mentor owned Quickturn, it would also own the patents, and would be in a position to 'unenforce' them by seeking to vacate Quickturn's injunctive orders against Mentor in the patent litigation.")

183. *Id.* at 1284 n.5.

184. *Id.* at 1285 (quoting Mentor Graphics Executive Vice President Gregory Hinckley).

185. A dead-hand poison pill is one that can be redeemed only by the directors who adopted it or by successor directors nominated by directors who adopted it. See, e.g., *id.* at 1289 (describing "continuing director" provision in which only those directors could redeem rights). If the adopting board is replaced, the pill will remain in place for its full, typically ten-year term regardless of if the bidder wins a subsequent proxy contest.

186. See *id.* at 1289, 1292–93 (invalidating Quickturn's "Delayed Redemption Provision," which prevented newly elected board members from redeeming rights within six months if purpose of redemption was to transact with specified "interested persons"). A slow hand pill imposes a period following a change in a majority of the board during which the board cannot redeem the pill. The same device is sometimes referred to as a "no-hand" pill. See *Mentor Graphics Corp. v. Quickturn Design Sys., Inc.*, 728 A.2d 25, 27 & n.2 (Del. Ch. 1998) ("This case involves . . . a 'no hand' poison pill of limited duration and scope . . . Some practitioners of the art have described this iteration as a 'slow hand' poison pill."), *afford* 721 A.2d 1281.

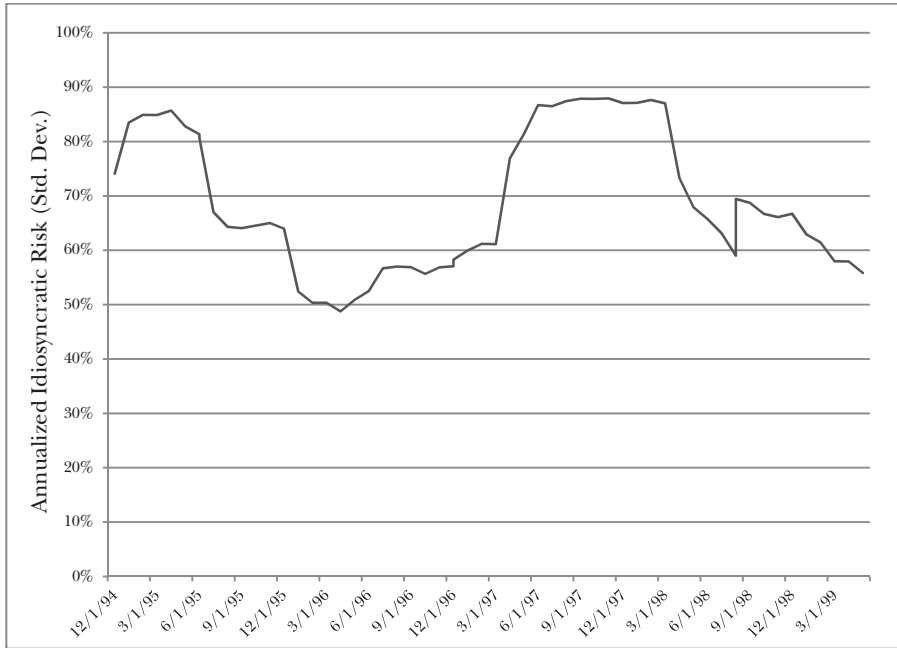
contemplated by substantive coercion. Target shareholders who compare this market price with the hostile bid could be misled into believing that the bid presented an attractive premium when, judged against management's difficult-to-communicate belief concerning the true value of the shares, it did not. Thus, a spike in idiosyncratic risk could provide evidence of the existence of the kind of situation that Gilson and Kraakman contemplated: one where shareholders could be misled and one where subsequent events—whether share price recovered—could prove whether shareholders were in fact misled.¹⁸⁷

The problem with this nice story is that the facts do not support it. Recall from Figure 1 that for the typical issuer during the financial crisis, the pattern of idiosyncratic volatility over time in fact had a spike shape: a rapidly increasing level of idiosyncratic risk followed in approximately one year by a rapid return to precrisis volatility levels. As shown in Figure 10, this is exactly what happened to Quickturn. The company's daily idiosyncratic risk did rise abruptly during the summer of 1997, when the Asian financial crisis surfaced. Although increasingly volatile, its stock price continued a general rise until a peak in the first quarter of 1998, only to collapse following its disappointing second quarter 1998 earnings release.¹⁸⁸ Mentor's offer followed this collapse in price. By this time, however, Quickturn's idiosyncratic risk had returned to precrisis levels. Thus, there is no simple link between a crisis-induced spike in idiosyncratic risk and a story that Quickturn's management had a particularly large, difficult-to-communicate, knowledge advantage at the time the offer was made.

187. Gilson & Kraakman, *Defensive Tactics*, *supra* note 169, at 271.

188. This release reported an 11% drop in revenue from the year-earlier quarter and a quarterly loss of between \$0.12 and \$0.14 per share, compared with a profit of \$0.04 a year earlier.

FIGURE 10: QUICKTURN IDIOSYNCRATIC RISK



Airgas presents a similar fact pattern, albeit in the context of a different crisis. Prior to the 2008 to 2009 financial crisis, *Airgas* stock traded in the \$40s and \$50s with some periods in the \$60s. With the onset of the financial crisis, the stock dropped—in March 2009 as low as \$27—but recovered to the low \$40s by the time of *Air Products*'s hostile offer. Just as with *Quickturn*, *Air Products* had considered a hostile tender offer prior to the crisis, “but did not pursue a transaction at that time because *Airgas*'s stock price was too high. Then the global recession hit, and in the spring or summer of 2009, *Air Products*' interest in *Airgas* was reignited.”¹⁸⁹ Following unsuccessful discussions between the two companies, *Air Products* then made a hostile offer at \$62, at a time when the *Airgas* share price was still well below its precrisis level.¹⁹⁰

There followed a series of improvements in the price of the *Air Products* offer, culminating in a final offer of \$70. A proxy fight led to three *Air Product* nominees being elected minority *Airgas* directors, but

189. *Air Prods. & Chems., Inc. v. Airgas, Inc.*, 16 A.3d 48, 62–63 (Del. Ch. 2011).

190. The court quotes the CEO of *Air Products* as stating:

[N]ow is the time to acquire *Flashback* [the code name for *Airgas*]—their business has yet to recover, the pricing window is favorable, and our ability (should we so choose) to offer an all-cash deal would be viewed very favorably in this market. To take advantage of the situation, we believe we will have to go public with our intentions.

Id. at 68.

surprisingly, the Air Products nominees then concluded that the \$70 offer proffered by their nominator was inadequate. In a related case, the Delaware Supreme Court prevented Air Products from accelerating an election that likely would have resulted in Air Products nominees constituting a majority of the Airgas board. The case then came back to the Chancery Court with the central issue being whether the Airgas board could decline to redeem its poison pill, in light of the fact that the pill had “given Airgas more time than any litigated poison pill in Delaware history—enough time to show stockholders four quarters of improving financial results, demonstrating that Airgas is on track to meet its projected goals.”¹⁹¹

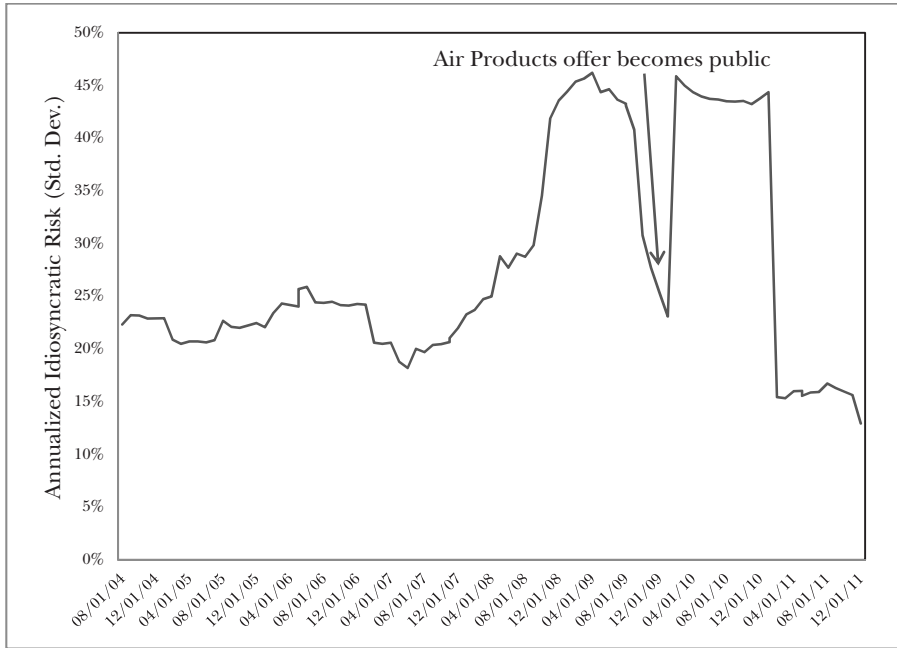
Chancellor Chandler made quite clear that in his view substantive coercion should not, as a policy matter, be treated as a valid rationale for declining to redeem the pill when the hostile offer had already been delayed for over a year and there was no serious claim that the shareholders lacked any necessary information. Nonetheless, he felt constrained by Delaware Supreme Court precedent and concluded that Airgas had met the Supreme Court’s empty standard for substantive coercion.

Like *Quickturn*, the timing in *Airgas* makes it difficult to link a crisis-related spike in idiosyncratic volatility to the potential for real substantive coercion. In this respect, the data falsifies the claim that a crisis-induced increase in idiosyncratic volatility might cause shareholders to err in whether to accept the hostile bid because the board possessed an unusually great knowledge advantage over the market. As in *Quickturn*, Figure 11 shows that the increase in Airgas’s idiosyncratic risk preceded the Air Products offer, by which time risk levels had returned to normal levels.¹⁹² This drop in idiosyncratic risk before the Air Products offer and the further delay in the offer as a result of the litigation, suggests that whatever potential there would have been for a successful substantive coercion claim if the offer had been made earlier, Chancellor Chandler’s instincts were right. Such a claim was no longer appropriate by the time of the Air Products offer and certainly not by the time the court issued its opinion.

191. *Id.* at 57.

192. Airgas’s idiosyncratic risk increased again *after* Air Products made its offer. This presumably represents uncertainty for a considerable period of time concerning how high Air Products was willing to go and concerning the legal wrangling related to the offer.

FIGURE 11: AIRGAS IDIOSYNCRATIC RISK



CONCLUSION

Financial economics and associated econometric techniques have come to play a central role in corporate and securities law. This is hardly surprising since at its core, financial economics is concerned with the valuation of financial assets and at their core, corporate and securities law are concerned with establishing rules that facilitate value maximization. Both corporate law and securities law, in turn, depend on the relationship between market prices and value in formulating causes of action. In this Article, we for the first time document and seek to explain a pattern that existing theory does not predict and existing empirical studies do not reveal: A spike in companies' unsystematic risk has followed every economic crisis from the 1929 stock market crash to the 2008 to 2009 Great Recession. We consider the implications of this pattern for securities law issues, including the proof and measurement of the elements of a cause of action for securities fraud and insider trading claims and for a central corporate law issue—the extent to which a target board of directors can prevent shareholders from accepting a hostile takeover. More generally we show the workings of what is not widely recognized as a tautology: Law and finance cannot operate independently since one seeks to explain the factors that dictate the value of financial assets and the other seeks to establish rules and institutions that facilitate creating that value.

