

Economic Crises and the Integration of Law and Finance: The Impact of Volatility Spikes

Edward G. Fox

Ph.D. student in Economics, University of Michigan

Merritt B. Fox

Michael E. Patterson Professor of Law, NASDAQ Professor for the Law
and Economics of Capital Markets,
Columbia Law School

Ronald J. Gilson

Stern Professor of Law and Business, Columbia Law School, Meyers
Professor of Law and Business, Stanford Law School and European
Corporate Governance Institute

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

Edward G. Fox*, Merritt B. Fox** & Ronald J. Gilson****

Financial economics has become ever more integrated into corporate and securities law, a trend that started decades prior to the financial crisis of 2008-09. 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 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. 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,

* Respectively, *Ph.D. student in Economics, University of Michigan; Michael E. Patterson Professor of Law, NASDAQ Professor for the Law and Economics of Capital Markets, Columbia Law School; and Stern Professor of Law and Business, Columbia Law School, Meyers Professor of Law and Business, Stanford Law School and European Corporate Governance Institute

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however, depends in part on the precision with which the capital market prices these financial assets.¹ 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.² The better corporate and securities law perform these tasks, the more valuable is the corporation's underlying business and, correspondingly, the financial claims that the corporation issues.³

The 2008 Financial Crisis raised many questions for financial economics and our approach to financial regulation.⁴ 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, across all industries, in “idiosyncratic risk,” i.e., in the volatility of individual firm share prices after adjustment for movements in the market as a whole. 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.⁵ This association – between economic crisis and a spike in idiosyncratic risk -- is important to the law for two important reasons. First, as we show, the spike is caused by a crisis-induced sharp

¹ Merritt B. Fox, *Civil Liability and Mandatory Disclosure*, 109 COLUM. L. REV. 237, 252-260, 264-67 (2009).

² 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., Rafael La Porta, Florencio Lopez-de-Silanes, Andrei Shleifer, & Robert Vishny, *Law and Finance*, 106 J. POL. ECON. 1113 (1998). Securities law also can improve pricing accuracy by facilitating through regulation the efficiency of capital market microstructure. We need not address this function here.

³ See JESSE H. CHOPER, JOHN C. COFFEE, JR & RONALD GILSON, CASES AND MATERIALS ON CORPORATIONS, 177-78 (7th ed. 2008).

⁴ See, e.g., GARY GORTON, MISUNDERSTANDING FINANCIAL CRISES: WHY WE DON'T SEE THEM COMING 221 (2012)(review of misunderstandings of financial crisis)Robert E. Hall, *Why Does the Economy Fall to Pieces After a Financial Crisis*, 24 J. ECON. PERSPECTIVES 3 (2010); Robert E. Hall, *The High Sensitivity of Economic Activity to Financial Frictions*, 121 ECON. J. 351 (2011) (standard macroeconomic theory does not explain why drops in output and employment persist for significant periods after a financial crisis is resolved); Andrew Lo, *Reading About the Financial Crisis: A 21-Book Review*, 50 J. ECON. LIT. 151 (2012) (useful survey of post-crisis deluge of books analysing the crisis and appropriate responses).

⁵ See Part II *infra*.

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. The Supreme Court in *Halliburton II* recently confirmed for example, the centrality of event studies in securities fraud class actions, the predominate form of private securities litigation today.⁶

Now consider the 2008-09 financial crisis' impact on the stock prices of individual firms. As we show, the volatility of individual stock prices increased sharply during the crisis. 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 non-crisis 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 firm's financial assets. 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,

⁶See *Halliburton Co. v. Erica P. John Fund*, 134 S. Ct. 2398 (2014)

as soon as a bit of news is revealed, it is promptly and fully reflected in price.⁷ 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 they concern 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 or an R&D breakthrough.⁸ This is variously referred to as “idiosyncratic,” “unsystematic,” “firm-specific” or “unique” risk or volatility. Thus, the five-fold increase in idiosyncratic volatility during the 2008 Financial Crisis tells us that each bit of news affecting only a particular firm altered, much more than in normal times, expectations concerning that firm’s future cash flows.

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 the

⁷ A large body of empirical evidence has accumulated over the last few decades showing that, with respect to a wide range of kinds of information, the share prices of established, publicly traded issuers listed on exchanges such as the NYSE or NASDAQ are efficient in the sense of showing an immediate reaction to the revelation of the news after which prices follow a random walk. See, e.g., RICHARD A. BREALEY, STEWART C. MYERS & FRANKLIN ALLEN, *PRINCIPLES OF CORPORATE FINANCE* 324-25 (11th ed. 2014).

⁸ 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 our purpose here, we focus on information-based idiosyncratic risk.

use of finance by the legal system, topics yet to be addressed in either the financial economics or legal literature.

We begin in Part II by documenting more fully the link between economic turmoil and idiosyncratic risk. Expanding on earlier work by Campbell et al.,⁹ 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 85-year period has been accompanied by a substantial spike in idiosyncratic volatility.

In Part III, we seek 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 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.

We turn in Part IV to explore the implications of our empirical results and of their possible explanations for a number of legal issues that depend analytically on valuation

⁹ 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 (2001).

methodology: determining materiality and loss causation in fraud-on-the-market securities litigation, determining materiality in cases involving claims both of insider trading and of misstatements or omissions in registered public offerings, and 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 of the idiosyncratic portion of share returns of the companies involved through the use of event studies.

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 had no impact on price. In the end, our 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, 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 non-

public information that they possess and issuers have more opportunities to sell securities at an inflated price.

Finally, with respect to substantive coercion as a justification for target corporation deployment of takeover defenses, we show that 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, through the example of two cases that raise the issue close in time to financial crises – *Quickturn*¹⁰ and *Airgas*¹¹ – we also show that even a substantive coercion claim based on a crisis-induced spike in idiosyncratic risk is very difficult to demonstrate.

We refer occasionally to an online Appendix which contains additional technical information, further empirical results, and demonstrations of the robustness of our findings.¹²

II. THE EMPIRICAL RECORD

A. The Recent Financial Crisis

The 2008-2009 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 2006-07 and a three-fold increase compared to 2007-08. While 2008-2009 was a period of enormous general economic turmoil – recall that Lehman Brothers failed and AIG was essentially nationalized within seven days in September 2008 – this increase in idiosyncratic volatility reflects movement in individual firm prices that cannot be explained by the impact of general economic conditions. While the most extraordinary increases were among financial firms in the index – forty-fold during the crisis relative to 2006-07 – non-financial firms

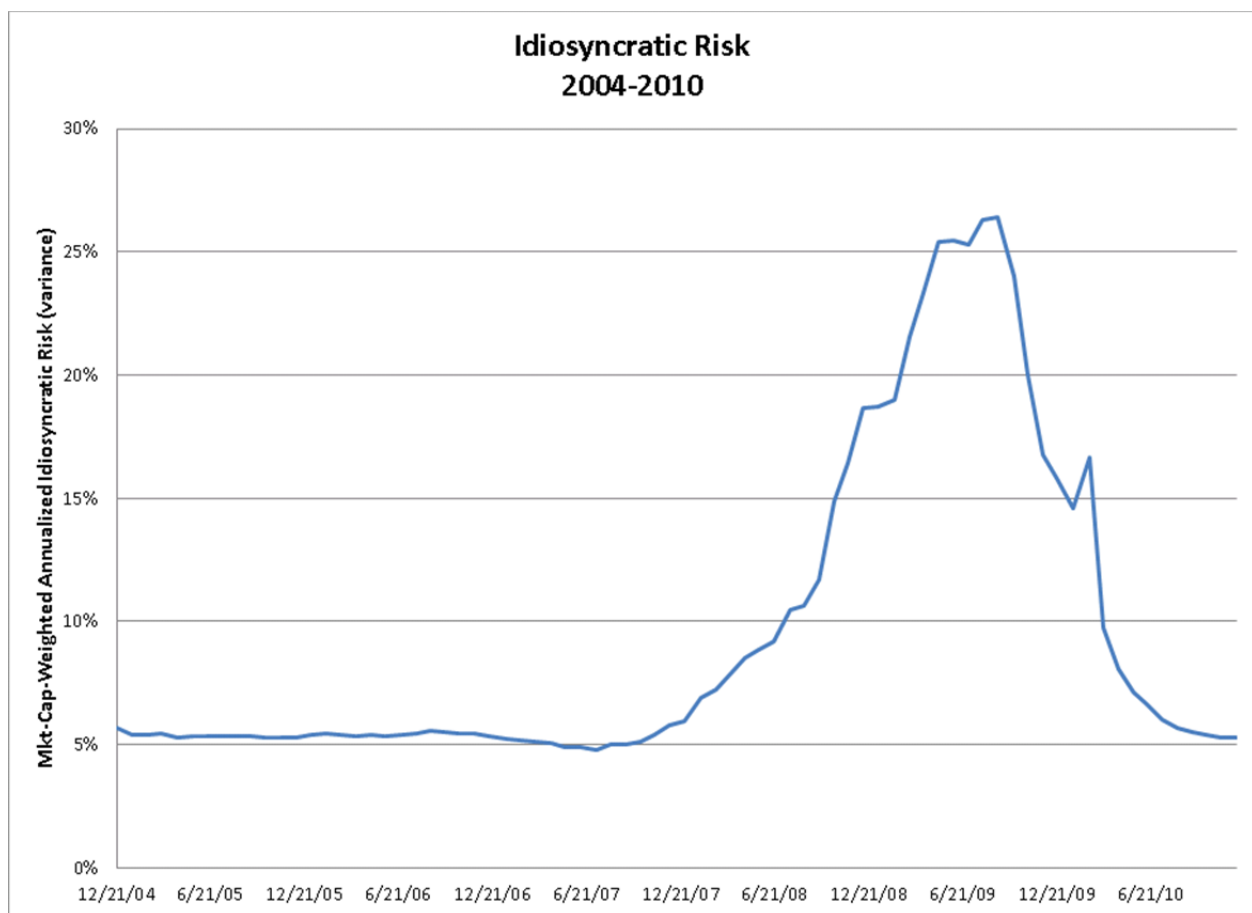
¹⁰ 721 A.2d 1281 (Del. Ch. 1998)

¹¹ 16 A.3d 48 (Del. Ch. 2011).

¹² <https://sites.google.com/site/volatilityspikesappendix/>

increased almost four-fold themselves.¹³ 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 pre-crisis levels. These results are depicted graphically in Figure 1 and are reported in Table 1 below.¹⁴

Figure 1



¹³ 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.

¹⁴ Figure 1 is calculated by first estimating the company specific volatility for each firm that trades NYSE, AMEX or NASDAQ on each day in 2004-2010. 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.

Table 1**Average Annual Company-Specific Volatility****(Var)**

Period	All	Financial	Non-Financial
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. 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 well as with the October 1987 market break.¹⁵ 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 2008-09.

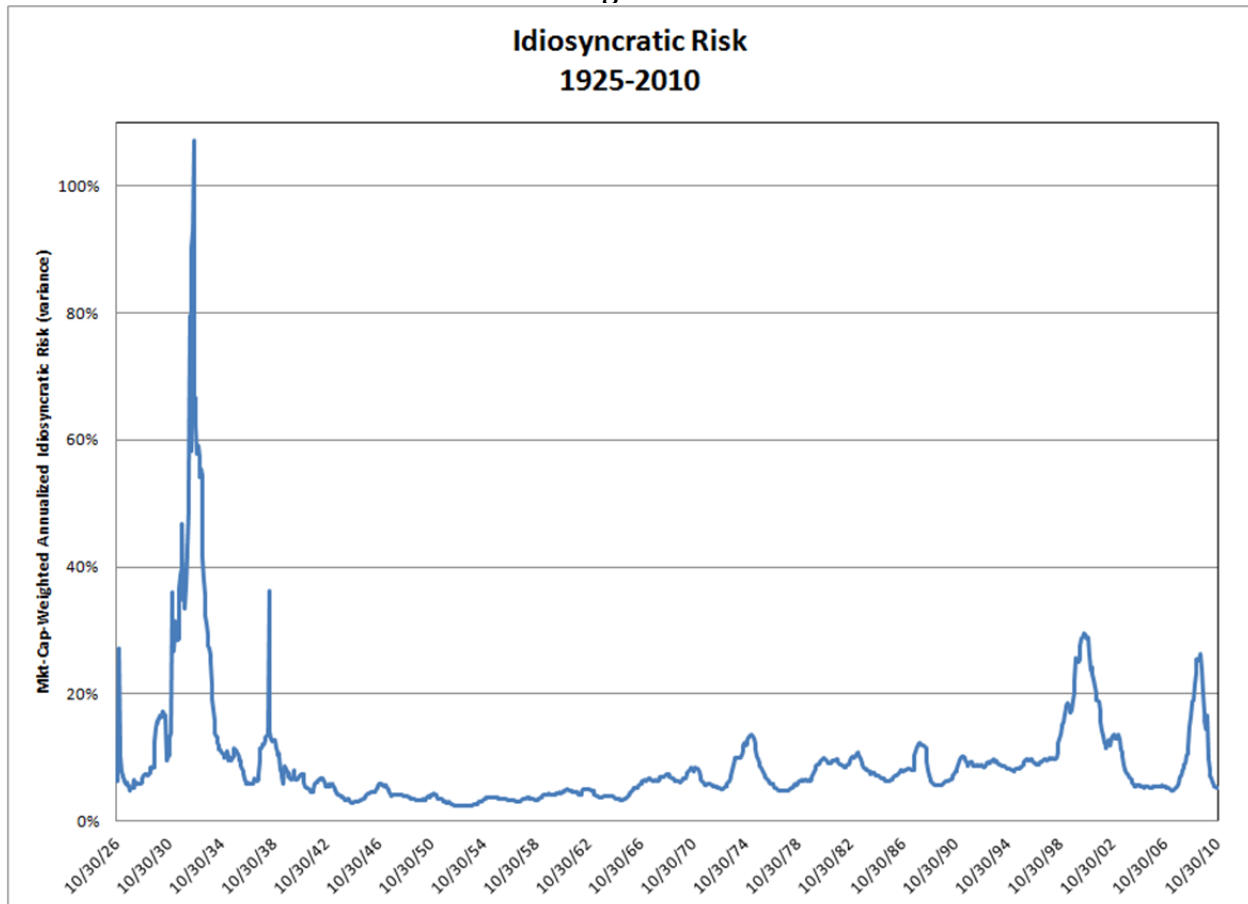
We have performed a study similar to Campbell et al., but extended the period covered from 1926 to the present. As depicted in Figure 2 below, we find that this pattern of increased idiosyncratic risk associated with poor macroeconomic performance repeats itself throughout the much longer 85-year period, 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

¹⁵ Campbell et al., *supra* note 9, at 13 (Figure 4).

economy's retreat into deep recession in 1937 and during the recent financial crisis.¹⁶ We also find that idiosyncratic risk increases at times of market boom as well, although the relationship is weaker, a point to which we will return in Part III.

Figure 2

**Idiosyncratic Risk
1925-2010**



¹⁶ The results depicted in Figure 2 are obtained in the same manner as those in Figure 1. *See supra* note 14. 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, however. *See* Figure A-2 in the online Appendix, available at <https://sites.google.com/site/volatilityspikesappendix/>.

C. Sectoral Analysis

As shown in Table 1, the increase in financial sector volatility during the 2008-09 crisis dramatically outpaced that in the non-financial sector. It is therefore reasonable to ask whether the average increase among non-financial firms 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 60 two-digit SIC industries surveyed.¹⁷ Every industry saw its idiosyncratic volatility, as measured by variance, increase more than 50%, and, in 58 of 60 sectors, it more than doubled.¹⁸

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 pre-crisis β) – were not the sectors in which idiosyncratic risk increased the most. Rather, it was those sectors with relatively low pre-crisis 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.¹⁹ 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 pre-crisis β , also tended to have the greatest

¹⁷See Appendix Table A-1, available at <https://sites.google.com/site/volatilityspikesappendix/>.

¹⁸ Codes 60-67 are financial. The largest increases among non-financial firms were hotels, amusement services, lumber and social services. As Figure A-3 in the Appendix shows, controlling for industry-specific factors, along with those of the overall market, does not alter the results.

¹⁹ The results noted in this paragraph are robust to the inclusion or exclusion of financial firms.

increase in idiosyncratic risk.²⁰ This 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 2008-2009 financial crisis illustrates the phenomenon: from peak to trough, the market capitalization of all firms in the CRSP database declined 55 percent. It is well

²⁰ One question about this finding should be addressed. We obtain our measure of a firm's idiosyncratic volatility by running a market model (see JOHN Y. CAMPBELL, ANDREW LO & ARCHIE CRAIG MACKINLAY, *THE ECONOMETRICS OF FINANCIAL MARKETS* 149-180 (1997)) 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. Using this β allows us 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 that we use 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 be too positive and if the market goes down, too negative) or if 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 II.D and in the 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. 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 as well – 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, 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 (20 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 do not explain the results presented in the text.

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. This is because debt is paid first out of the firm's safest underlying cash flows, with equity receiving the residuals. 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.

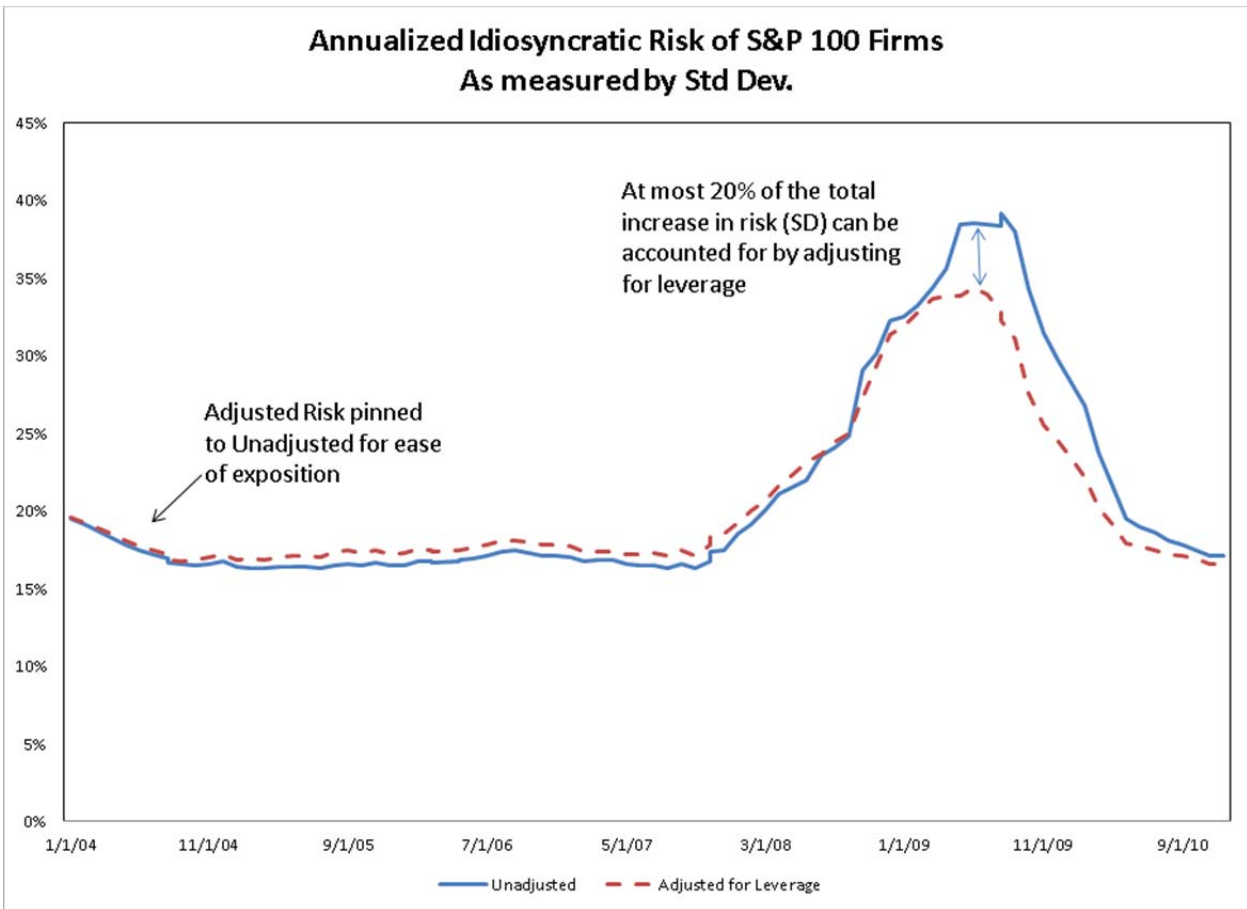
Perhaps, then, the crisis-related spikes in idiosyncratic risk simply reflect the effect of the crisis-related decrease in equity value.²¹ Then we have no puzzle to explain, and can turn directly to the legal implications of our findings. To address this possibility, we added explicit controls for the effect on idiosyncratic risk of the increase in leverage. 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.²²

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

²¹ We are grateful to Mark Weinstein for raising this point.

²² In the Appendix, we also discuss and seek to control for a second leverage-related impact on our measure of idiosyncratic risk, a changing ("unstable") β during the observation period. This too will increase the level of idiosyncratic risk that we measure 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



III. POSSIBLE EXPLANATIONS

As noted above, Campbell et al. first reported that idiosyncratic risk increased during crisis periods.²³ 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 our extending their observation period to the 85 years from 1926 through 2010. From the lead up to the Great Depression through what has come to be called the Great Recession we see a repeated coincidence of economic downturns and spikes in idiosyncratic volatility. Why should a crisis be associated with an increase in risk unrelated to the general economic disorder? Our analysis suggests three explanations that share a common

²³ Campbell, *supra* note 9.

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. 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. It is this new information that 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 a downturn can be expected to be accompanied by structural changes in the economy. This is at least in part true because major downturns are usually the result of economic 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 demonstrate.²⁴ In 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 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 percent 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

²⁴See Gary Gorton & Andrew Metrick, *Getting up to Speed on the Financial Crisis: A One-Weekend-Reader’s Guide*, 50 J. FIN. ECON. 128 (2012); Lo, *supra* note 4.

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, there are much more likely to be changes in the structure of the economy that significantly impact the firm. 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.²⁵

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 spike-like: the increased volatility disappears as quickly as it appears. This suggests that once the market figures out the new shape of the post-crisis structural relationships, idiosyncratic risk returns to historical levels. In this explanation, the spike is the artifact of the importance of new information to understanding the crisis-induced change in the structure of relationships among firms. 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 our finding that firms in sectors that experienced the largest increase in their β s during the recent financial crisis – i.e., ones that, relative to other firms, became more

²⁵ 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.

sensitive to factors that affect the market as a whole – also displayed the greatest increases in idiosyncratic risk.²⁶ 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.²⁷ 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 Part II.D.

Statistically, our first explanation can be viewed as follows. 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, 20 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 21st ball drawn is red or green. Now suppose that 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 22nd ball,

²⁶ See *supra* Part II.C.

²⁷ See *supra* Figure 2.

the outcome – 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.

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.²⁸ 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. So 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

²⁸ See, e.g., Ronald J. Gilson, *Engineering a Venture Capital Market: Lessons from the American Experience*, 55 STAN. L. REV. 1067 (2003).

information concerns – management quality – has also has greater implications for the firm's future cash flows. So, 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 non-crisis times.

C. Model Failure: Ignorance Concerning Even What Facts are 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 the extent to which information is important for predicting future cash flows. In an economic crisis, systemic changes may make investors less confident that they still know 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 our 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. 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 after the crisis 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 22nd 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.²⁹

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

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 increased. 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 bad times are precisely when dropping share prices are likely to give rise to more plaintiffs' suits, more governmental enforcement actions and more calls for regulatory change. In this Part, we 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

²⁹ Warren Buffet has famously made a related point. In his terms, "you only find out who's swimming naked when the tide goes out." Warren Buffet, Chairman's Letter, Berkshire Hathaway Inc., 2001 Annual Report, (Feb 2002). Put more precisely but less amusingly, good times allow a pooling equilibrium concerning firm quality and economic crisis results in separation. While Buffet'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, it appears that 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, Buffet'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 than we have observed of the total such risk during the twelve-month period. As discussed in the Appendix, we in fact find that, in crisis and in pre-crisis 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 Figure A-5, available at <https://sites.google.com/site/volatil提高ityspikesappendix/>.

volatility that accompanies each major economic downturn. We first 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. We then turn 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.

A. The Effects on Event Studies of Crisis-Induced Spikes in Idiosyncratic Volatility

A central focus of financial economics is on what factors influence the price of a security.³⁰ The inquiry can be framed by identifying an event that may be thought to 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. 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.³¹ As we will see, the level of idiosyncratic 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.

1. *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

³⁰ See, e.g., Sanjai Bhagat & Roberta Romano, *Event Studies and the Law Part I: Technique and Corporate Litigation*, 4 AM. L. & ECON. REV. 141 (2002); Sanjai Bhagat & Roberta Romano, *Event Studies and the Law Part II: Empirical Studies of Corporate Law*, 4 AM. L. & ECON. REV. 380 (2002)..

³¹ See, e.g., *Bricklayers & Travel Trades Int'l Pension funds v. Credit Suisse First Boston*, 853 F. Supp 181,186 (D. Mass. 2012)(“An event study is an accepted method of measuring the impact of alleged securities fraud on a stock price and 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.”); *In re Williams Sec. Litig.*, 496 F. Supp 2d 1195, 1272 (N.D. Okla. 2007)(same).

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 be able 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.³²

a. 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 revelation 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 portion of the observed change in price that is due to firm specific

³² Those familiar with event studies will recognize a fundamental difference between events 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. In the financial economics approach, the effect of all of the other events affecting a company's stock price regress out by using a sample of all companies that experienced the event in question. If the number of companies in the same is large enough, the other events affecting particular companies cancel each other out. See JOHN Y. CAMPBELL, LO & MACKINLAY, *supra* note 20, at 149-180.

. 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.

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.³³

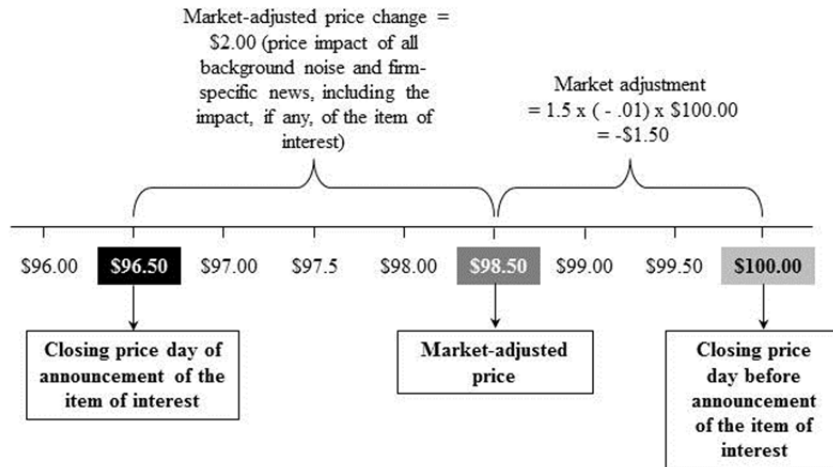
To give an example, suppose that the share price of the issuer under study was \$100.00 at the end of the trading day immediately preceding the item of interest's disclosure and is \$96.50 by the end of the day of the item of interest's disclosure. Suppose as well that the market as a whole went down 1% on the day of the item of interest and that the issuer's Beta (the standard measure of an issuer's share price sensitivity to movements in the market as a whole) is 1.5. thus, 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.³⁴

³³ Courts recognize the need to separate systematic from unsystematic movements in stock price 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 *In re Imperial Credit Indus., Inc. Sec. Litig.*, 252 F.Supp.2d 1005, 1015-16 (C.D. Cal. 2003) *aff'd subnom. Mortensen v Snavely*, 145 F App'x 218 (9th cir. 2005) (rejecting testimony of plaintiff's expert for failure to include "An event study of 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 Northern Telecom Sec. Litig.*, 116 F. Supp. 2d 446, 460 (S.D.N.Y. 2000) ("[Plaintiff's expert] Torkelson'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...").

³⁴ See CAMPBELL, LO & MACKINLAY, *supra* note 20, at 149-180

FIGURE 4.

Isolation of Firm-Specific News Through Market-Adjustment



b. 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.³⁵ The conventional event study assumes that the same probability 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. The standard deviation of the observation period's approximately 250 market-adjusted price changes is, because of the size of the sample, 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 1.96 standard deviations of the mean, plus or minus, 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 that is this large, we can reject with at least 95% confidence the null hypothesis the item of interest

³⁵ 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 (1985). This had led some commentators to call for using another technique for conducting event studies in securities litigation situations. *See, e.g.,* Jonah B. Gelbach, Eric Helland & Jonathan Klick, *Valid Inference in Single-Firm, Single-Event Studies*, 15 AM. L. & ECON. REV. 495 (2013). The overall analysis in this Article would apply equally to these other techniques, however.

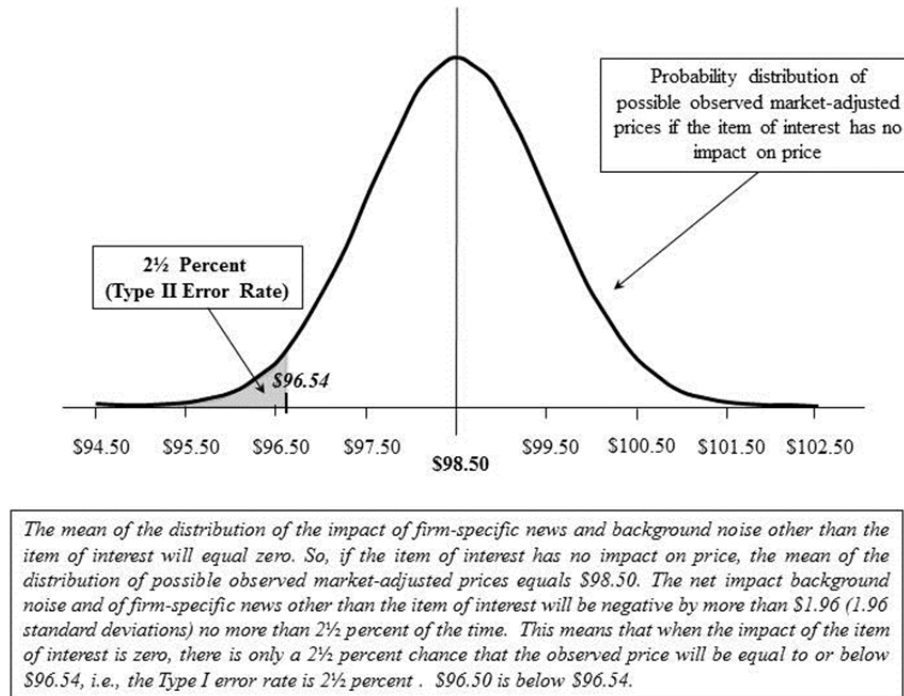
had no impact on price. Accordingly, observed market-adjusted price changes that are large enough to pass this test are often referred as being “statistically significant at the 95% level.”³⁶

These points may be most easily understood by continuing from 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 be, as illustrated in Figure 5, somewhere between +1.96% and -1.96%, with it being 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 a financial economist would conclude that the price change was statistically significant at the 95% level.

³⁶ See JOHN Y. CAMPBELL, LO & MACKINLAY, *supra* note 20, at 149-180.

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 ½ Percent 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 measuring period is large enough to pass this test of statistical significance and there are no other important bits of firm-specific information that 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.³⁷

³⁷ 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

2. *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, the purchaser of a security claiming 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, would seek to prove that the corrective disclosure had a negative effect on price.³⁸

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 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 false negatives ("Type II errors"). Type I errors are where 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 are where the item of interest

measured is longer than one day. In addition, often the baseline one year observation period used to determine the standard deviation has removed from it days on which 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 of 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 (2007). None of these elaborations of event study methodology affect the points that we seek to make, however.

³⁸ 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.

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 kinds of error 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, the Type I error rate depends solely on the level of statistical confidence required by the test, in this discussion is 95%. 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 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%.³⁹ Observed market-adjusted negative price changes more negative than this -- in our example, the observed change of -\$2.00 or -2.00% -- pass this 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* this 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 issuer's item of interest in fact had a -1.00% market-adjusted impact on price and that, as before, the standard deviation of market-adjusted price changes for this issuer was

³⁹The 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.

1.00%. Recall again that the market-adjusted price change observed on the day the item of interest is disclosed 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.⁴⁰ The relevant question is what is the likelihood that the observed market-adjusted price change that occurs on the day of the item of interest 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 background noise on that day is at least negative .96% (which, when combined with the -1.00% impact of the item of interest, would in total be at least 1.96% negative).

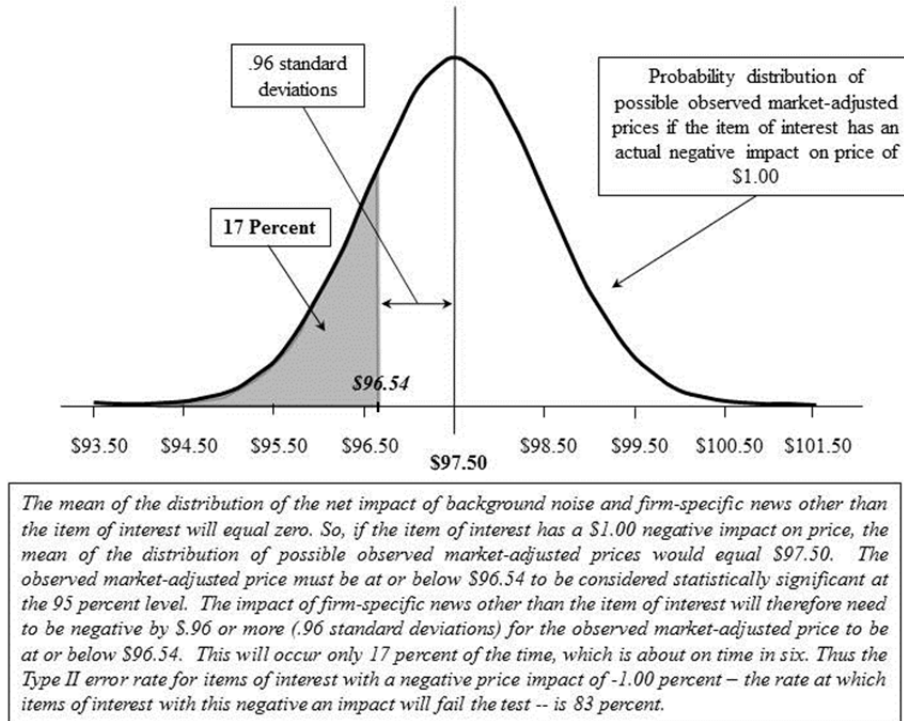
As depicted in Figure 6, this will be the case only about 17% of the time, i.e., only about one time in six.⁴¹ Thus, one cannot necessarily infer from an observed market-adjusted price change failing the test a failure of the test that it is likely it had no effect on price. Indeed, for an issuer with 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.

⁴⁰ 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 negatively affected price by 5%.

⁴¹ 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), available at <http://ssrn.com/abstract=2314058>.

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 percent)



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 brings us 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.

3. *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 considering 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 observation period absent the item of interest's disclosure..⁴² 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 just as we have calculated it above: 2-1/2%.

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% .⁴³ 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 percent. 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 negative to pass the test of statistical significance.

⁴² A visual review of Figures 1 and 2 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.

⁴³ 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 note 86 *infra* and accompanying text.

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, we see that 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 6-10% during non-crisis years, with an average of approximately 8%. This annualized variance translates to a daily standard deviation of 1.78%.⁴⁴ 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 will 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.⁴⁵ This is the Type II error rate – the

⁴⁴ Since our calculations are based on daily data, it is our annual variances that are interpolated using the following mathematical formula: $Var(\sum_{i=1}^{252} \mathcal{E}_i) = 252 * Var(\mathcal{E}_i)$ where $\sum_{i=1}^{252} \mathcal{E}_i$ 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 non-linearity of variance, this is not the exact figure that we yield after market cap weighting the standard deviations of the individual firms but this difference is relatively minor.

⁴⁵ 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 .85 standard deviations above -5% and so, based on the normal distribution, there is a 80.2% chance that

likelihood that this item of interest that actually negatively affected price by 5% would not be accompanied by a market-adjusted price change sufficiently negative to be statistically significant. As we will see, 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.⁴⁶

We 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,.

4. 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 should have failed. While more advanced techniques address this underestimation, they raise other problems.⁴⁷ 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

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 more detail the general approach to calculating Type II errors. Fox, Fox, & Gilson, *supra* note 41, 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 because it is used in virtually all event studies for testing statistical significance. The points outlined above and below are only strengthened if returns are “fat tailed,” because for a given level of Type I errors, if returns are fat tailed, we must set an even more stringent cutoff for statistical significance than we would under the normal distribution, which would induce more Type II errors.

⁴⁶ 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 non-empirically grounded opinions where the error term is likely both greater and completely impossible to estimate with any precision.

⁴⁷ See notes 52-53 *infra*.

rate at 2.5%, 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 the increase in idiosyncratic volatility being recent. 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 becoming apparent.⁴⁸ This 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.

Recall that the conventional event study methodology uses the standard deviation of the observation period's approximately 250 market-adjusted price changes as a measure 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. In other words, this 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. 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.

i. 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 we have shown accompanies each

⁴⁸ 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).

crisis. With the cutoff for what is considered statistically significant then incorrectly based on a standard deviation smaller than what actually prevails 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 - June 30, 2008 period). Assume as well that the idiosyncratic volatility had increased to 2.7% (the standard deviation for such a firm the July 1, 2008 - June 30, 2009 period) and that the event of interest is occurs early in this second period. The observation period is thus the July 1, 2007 - 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 sufficiently negative to be statistically significant.⁴⁹ In effect, we are 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 Part 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, the use of a conventionally designed event

⁴⁹ -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.

study to determine loss causation would increased six-fold the likelihood of liability being incorrectly imposed in such a situation.

ii. 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)⁵⁰ and of the level of idiosyncratic risk. These less precise estimates ameliorate Type I error but only by increasing Type II error.⁵¹

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.⁵² The additional complexity of these techniques makes them harder for a court, let alone a jury, to

⁵⁰ See Appendix at 11, <https://sites.google.com/site/volatil提高spikesappendix/>, as to how this will increase idiosyncratic risk.

⁵¹ One way to counter this problem of an abbreviated observation period is to extend the period forward beyond date the tested item of news becomes public, but omit from the sample the price change on that date to avoid the event whose effect the study is trying to determine influencing 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.

⁵² One method for dealing with shifting volatility is to use a Generalized Auto Regressive Conditional Heteroskedasticity (GARCH) model which makes current volatility a function of past volatility and net-of-market returns (see Appendix for a 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 (1996). However, its use in litigation remains relatively rare. Other possibly useful methods flow from the literature identifying structural breaks in the data. See, e.g., Jushan Bai & Pierre Perron, *Estimating and Testing Linear Models with Multiple Structural Breaks*, 66 ECONOMETRICA, 47 (1998).

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.⁵³ 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.

b. 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 discussed just above by assuming 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 negative enough to meet the required level of statistical confidence.⁵⁴ As a consequence, 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

⁵³ 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 52.

⁵⁴ For a formal demonstration of this point, see Fox, Fox & Gilson, *supra* note 41

greater the volatility, the greater the number of Type II errors for any given allowable number of Type I errors.⁵⁵ In essence, the same level of price effect is harder to detect when more is going on in the background.

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.⁵⁶ Now consider an event with the same actual price impact of -5%, but which occurs during *crisis* times with a spike in idiosyncratic risk of the magnitude observed during the recent financial crisis.⁵⁷ 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%.⁵⁸ So, in such high volatility times, about only one in three items of interest whose disclosure in fact affect 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

⁵⁵ *Id.*

⁵⁶ See *supra* Part IV.B.3.

⁵⁷ For this example, we assume that the standard deviation increases from the normal-times level of 1.78%, see note 44 *supra*, to 3.23%, approximately equal to the daily idiosyncratic volatility of the market capitalization-weighted average firm in the S&P 100 during the peak of the financial crisis.

⁵⁸ Similarly to note 45 *supra*, 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 a 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 move the issuer's share price around 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 after imposition of the requirement will be of that magnitude? The required negative change, -6.33%, is .41 standard deviations beyond -5% and so, based on standard statistical tables for the normal distribution, there is only a 34% chance that the observed change in market-adjusted prices will be a decrease of at least 6.33% and hence considered 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, *supra* note 41 at 10-11.

whatever the actual impact of a misstatement on price, higher volatility results in a higher level of Type II errors – in a higher number of valid securities class actions suits failing.⁵⁹

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

Fraud-on-the-market class actions allow buyers in secondary securities markets to recover from the issuer losses that they incur because they purchased at prices inflated by the issuing corporation's misstatements and without individual class members having to prove that they actually relied upon (or even knew about) the misstatement giving rise to their claim.⁶⁰ These actions, based on alleged violations of §10(b) of the Securities and Exchange Act of 1934 (the "Exchange Act") and Rule 10b-5 promulgated thereunder,⁶¹ currently produce the bulk of all the damages paid out in settlements and judgments pursuant to private litigation under the U.S. securities laws.⁶²

The centrality of securities fraud class actions dates to the Supreme Court's decision in *Basic v. Levinson*.⁶³ Prior to that decision, each plaintiff was required to prove that a misrepresentation was "a substantial factor in determining the *course of conduct* which results in the (recipient's) loss."⁶⁴ Under the traditional 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 claims is not feasible for all

⁵⁹ See *Id.* at 7-9.

⁶⁰ *Basic Inc. v. Levinson*, 485 U.S. 224 (1988).

⁶¹ A fraud-on-the-market action is a form of an implied right of action for civil damages based on a misstatement made in violation of Securities Exchange Act of 1934 (the "Exchange Act", Pub. L. No. 73-291, 48 Stat. 881 (codified as amended at 15 U.S.C. §§ 77a-78lll)) §10(b) and Rule 10b-5, 15 U.S.C. § 78j(b), promulgated thereunder. Rule 10b-5 provides in relevant part: that "it shall be unlawful for any person, directly or indirectly, ... to 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 a security." 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. Texas Gulf Sulphur Co.*, 401 F.2d 833, 859–61 (2d Cir. 1968).

⁶² Merritt B. Fox, *Securities Class Actions Against Foreign Issuers*, 64 STAN. L. REV. 1173, 1176 (2012).

⁶³ *Basic*, 485 U.S. 224.

⁶⁴ *List v. Fashion Park*, 340 F.2d 457, 462 (2nd Cir 1965)(emphasis added).

but the largest traders. But a class action requires that common issues of fact and law predominate, a requirement that cannot be met if each plaintiff must individually prove reliance and causation.⁶⁵

Basic fundamentally changed the manner in which causation could be proved. Under its 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.⁶⁶ 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 to prove reliance by each purchaser. 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.⁶⁷

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, i.e., that the issuer misstatement in fact inflated the prices that they paid for their shares.⁶⁸ Absent crisis-induced increases in idiosyncratic volatility, this methodology works reasonably well. However, our finding of very large spikes in idiosyncratic

⁶⁵ 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 at issue.”).

⁶⁶ *Basic*, 485 U.S. at 243.

⁶⁷ 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 author). By the early 2000s, the total amount of such settlements had increased dramatically. Indeed, the value of settlements paid from January 2002 through December 2004, including the disclosed value of any noncash components, totaled over \$9.6 billion. ELLEN M. RYAN & LAURA E. SIMMONS, CORNERSTONE RESEARCH, SECURITIES CLASS ACTION SETTLEMENTS: 2011 REVIEW AND ANALYSIS 1 fig. 1 (2012), available at http://securities.stanford.edu/Settlements/REVIEW_1995-2011/Settlements_Through_12_2011.pdf. This figure decreased slightly to \$8.47 billion for the three-years beginning January 2009 and ending December 2011. *Id.*

⁶⁸ 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 Wunderlich, *Regressing: The Troubling Dispositive Role of Event Studies in Fraud Litigation*, 15 STAN. J. LAW, BUS. & FIN. 183 (2009).

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 potentially 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 causes of action 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, beyond the plaintiff's need to establish the existence of 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.⁶⁹ 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.⁷⁰ For our purposes here, however, these issues reduce to two: did the misstatement inflate the price paid by more than a de minimus 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.⁷¹ An investor who purchases shares of the issuer while the

⁶⁹ *Dura Pharmaceuticals, Inc. v. Broudo*, 544 U.S. 336, 341–42 (2005).

⁷⁰ *Id.*

⁷¹ This observation parallels an insight of Daniel Fischel in an early seminal article, published prior to *Basic*, 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 (1982). Fischel suggested that the adoption of the cause of action reflected an underlying view of the market that most investors were price takers. As a consequence, they are hurt by a misstatement by its effect on price, not by its

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).⁷² The amount of this loss is her damages, thereby satisfying the damages requirement.⁷³ As for the materiality requirement, the Supreme Court has ruled 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.⁷⁴ Anytime a misstatement meaningfully inflates the price of a security trading in an efficient market, it has obviously had

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 article was cited by the Supreme Court in *Basic*, 485 U.S. at []. For an example of a judicial opinion explicitly endorsing this conflation of the three traditionally separate doctrinal elements, see *Verifone Sec. Litig.*, 784 F.Supp. 1471, 1479 (N.D. Cal. 1994) *aff'd* 11 F.3d 865 (9th cir. 1993) (the fraud-on-the-market theory "subsumes" into a single analysis the inquiry into reliance, materiality, causation and damages).

⁷² In the pre-fraud-on-the-market years preceding *Basic*, the courts refined their causation analysis to require two showings: transaction causation and loss causation. Transaction causation was a showing that the plaintiff would not have purchased but for the misstatement. Loss causation was a showing that the untruth was in some reasonably direct or proximate way responsible for the loss. See Merritt B. Fox, *After Dura: Causation in Fraud-on-the-Market Actions*, 31 J. CORP. LAW, 829, 834-36 (2006). These concepts do not fit well 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: i.e., where there is a material misstatement by an issuer whose shares trade in an efficient market. See, e.g., *Semerenco v. Cendant Corp.*, 223 F.3d. 165, 178-83. A showing of loss causation requires a showing 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 Pharms. v. Broudo*, 125 S. Ct. 1627, 1634-35 (2005). Thus the basic causal inquiry in the fraud-on-the-market theory is framed in terms of loss causation.

⁷³ This corresponds to the "out of pocket" measure of damages that is the standard measure in Rule 10b-5 cases. See *Green v. Occidental Petroleum Corp.*, 541 F.2d 1335, 1341-46 (9th Cir. 1976).

⁷⁴ In *TSC v. Northway*, the Supreme Court found that a fact is material "if there is a substantial likelihood that a reasonable investor would consider it important in deciding how to vote." 426 U.S. 438, 449 (1970). *Northway* involved the materiality of an omitted fact in a proxy statement in connection with a suit under §14(a) of the Exchange Act and Rules 14a-3 and 14a-9 thereunder. 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 goes 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.* *Basic v. Levinson*, 485 U.S. 224 (1988), applies the *Northway* standard to materiality under Rule 10b-5.

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.⁷⁵

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 issuer misstatements are of this kind, 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.

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

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

⁷⁵ See, e.g., *In re Merck & Co., Inc. Securities Litigation*, 432 F3d 261, 273-74 (3rd Cir. 2005) ("reasonable investors are the market" and in an efficient market information is reflected in price, and so when information changes price, it must be important to reasonable investors).

causation.⁷⁶ Indeed, some courts explicitly require the plaintiff to present, through expert testimony, an event study in order to make a showing of loss causation.⁷⁷

Conforming to the usual social science convention, 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.⁷⁸ 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

⁷⁶ See, e.g., *In re REMEC Inc. Sec. Litig.*, 702 F. Supp. 2d 1202, 1266, 1275 (S.D. Cal. 2010) (on the basis of the standards that "a plaintiff must show that an economic loss occurred after the truth behind the misrepresentation or omission became known to the market" and "the decline in stock price caused by the revelation of that truth must be statistically significant," the court grants defendant's motion for summary judgment with respect to loss causation where the plaintiff's expert testimony on the subject is struck on *Daubert* grounds) (citations omitted); *In re Imperial Credit Indus., Inc. Sec. Litig.*, 252 F. Supp. 2d 1005, 1015–16 (C.D. Cal. 2003) *aff'd sub nom. Mortensen v. Snavelly*, 145 F. App'x 218 (9th Cir. 2005) (granting defendant issuer's motion for summary judgment because plaintiff failed to provide "an 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.") Simply showing that the misstatement inflated price is not sufficient to establish loss causation. *Dura Pharmaceuticals, Inc. v. Broudo*, 544 U.S. 336, 346 (2005).

⁷⁷ See, e.g., *Fener v. Operating Engineers 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). With respect to materiality, see *In re Gaming Lottery Securities Litigation*, 2000 WL 193125 (S.D.N.Y.) (event studies are "an 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, 874-883 (2005) (collecting cases).

⁷⁸ See, e.g., *In re REMEC Inc. Sec. Litig.*, 702 F. Supp. 2d 1202, 1266 (S.D. Cal. 2010) (citations omitted) (to establish loss causation, an event study must show that the "decline in stock price caused by the revelation of that truth [is] statistically significant.").

the correct, social-welfare-maximizing standard, at least in normal times.⁷⁹ For our purposes, the assumption that 95% is the correct standard in normal times forms a useful baseline that conforms to current practice. Our ultimate concern here, however, is whether an economic crisis-induced spike in idiosyncratic risk might change the appropriate 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 test involves inevitable tradeoffs between Type I error and Type II error. As we saw in Part IV.A, the terms of this tradeoff are determined by the test's chosen level of statistical confidence. 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 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 saw, for a corrective disclosure with a -5% negative 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%.

⁷⁹ Although beyond our task here, this assumption is itself worthy of further consideration. See, e.g., Leslie A. Demers, *Lost in Translation: Erroneous Conflation of Statistical Certainty with Evidentiary Standards*, available at <http://ssrn.com/abstract=2225998>.

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 is 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. One can see, therefore, that 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. Moreover, if idiosyncratic risk increases, the terms of this tradeoff worsen. So, for a given chosen level of confidence and Type I error rate, the Type II 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 liability on an issuer for making, with scienter, a misstatement that inflates an issuer's share price and how 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.⁸⁰ The increased share price accuracy and issuer transparency that results from greater compliance with this disclosure system increases social welfare by enhancing the efficiency with which resources are allocated in our economy.⁸¹

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.⁸² The amount of resources consumed by 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.⁸³ 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)

⁸⁰ See, e.g., John C. Coffee, Jr., *Law and the Market: The Impact of Private Enforcement*, 156 U. PENN. L. REV. 229 (2007).

⁸¹ Greater issuer transparency and more accurate prices in the secondary market signal when an issuer's management is doing a poor job in terms of utilizing the firm's current assets and of investing in new projects. They help align the interests of managers with those of shareholders by assisting in the effectiveness of share price based compensation, block holder activism and the 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 Merritt B. Fox, *Civil Liability and Mandatory Disclosure*, 109 COLUM. L. REV. 237, 252-260, 264-67. (2009).

⁸² A reasonable estimate of the litigation costs for the legal and expert fees of both sides is \$2.5 billion annually. *Id.* at 247-48 n. 18. 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 do they 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. PENN. L. REV. PENNUMBRA 87 (2011). The figure also does not include efficiency losses from the decision of managers, out of fear of such liability, not to voluntarily disclose true information before disclosure is otherwise required.

⁸³ 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 thoughtful commentators on the issue. See, e.g., John C. Coffee, Jr., *Reforming the Class Action*, 106 COLUM. L. REV. 1534, 1556—66 (2006); Paul Mahoney, *Precaution Costs and the Law of Fraud in Impersonal Markets*, 78 VA. L. REV. 623, 632 (1992). The inadequacy of these rationales is explored in detail in Merritt B. Fox, *Securities Class Actions Against Foreign Issuers*, 64 STAN. L. REV. 1173, 1192-99 (2012).

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.⁸⁴

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.

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

⁸⁴What level the materiality threshold should be set at is subject to difference 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 recent decision in *Halliburton Co. v. Erica P. John Fund*, 134 S. Ct. 2398 (2014).

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 in normal times, i.e. that social welfare will be lower if the confidence level chosen were either stricter or less strict than 95%. It means that the net social welfare impact of making the standard *stricter* – the gain from the decrease in Type I error, the loss from the increase in Type II error with respect to misstatements having price impacts greater than the materiality threshold, and the gain from the increase in Type II error with respect to misstatements having price impacts less than the materiality threshold – is *negative*. And it means that the net social welfare impact of making the standard *less strict* – the loss from the increase in Type I error, the gain from the decrease in Type II error with respect to misstatements having price impacts greater than the materiality threshold, and the loss from the decrease in Type II error with respect to misstatements having price impacts less than the materiality threshold – is *also negative*.

3. The implications of increased idiosyncratic risk for the use of event studies in fraud-on-the-market suits. As we have seen, 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 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.⁸⁵ We saw 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.⁸⁶

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.

⁸⁵ See Part III.A.4 *supra*.

⁸⁶ 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. *United States v. Nacchio*, 519 F.3d 1140, 1162 (10th Cir. 2008), *vacated in part on other grounds on reh'g en banc*, 555 F.3d 1234 (10th Cir. 2009) (“[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 misstatement material.”). See also U.S. Sec. Exch. Comm’n, SEC Staff Accounting Bulletin No. 99 – Materiality, 17 C.F.R. § 211 (Aug. 12, 1999), available at <http://www.sec.gov/interp/account/sab99.htm>. (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 would, 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.

So, for a given chosen level of confidence and hence given Type I error rate, the Type II error will be higher for any possible 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 changes of law or policy. We start by exploring whether the apparent problem is in fact self-correcting. We argue that some kinds of corrective disclosures will cause larger price drops during crises than normal times, thus keeping pace as the cutoff for statistical significance grows during crises. For these types of disclosures 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, wouldn't it 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, we show that the welfare effects are in fact ambiguous. In one knife-edge case we can show that 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 both 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, news about the quality of management becoming more important, and increased ignorance concerning what facts are relevant.⁸⁷ To the extent that any one or more of these explanations is correct, 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% confidence level (-3.49% in our example) 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 economic-crisis-times cutoff (-6.33% in our example). For such misstatements, we need not worry about a policy response to the worsening of the terms of tradeoff between Type I and Type II errors because the effect is erased by the corresponding magnification of the actual negative price impacts of their corrective disclosures.

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. The absolute level of the distortion and how it

⁸⁷ See Parts III.A, III.B and III.C *supra*.

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 mechanism described here could be expected 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 threshold, 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 volatility 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.⁸⁸ 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 such a statement will increase. The social benefit from deterring these kinds of misstatements, however, will still be as great as in normal times.

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 in normal times. In crisis times,

⁸⁸ Many disclosures will contain aspects that are "self-correcting" and others that are not. For example if a company misses earnings 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 as in regular and crisis periods.

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 may result in too large an 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. We will see that we cannot 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 that follows 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 relaxed in crisis times than in ordinary times. This is because the corresponding accompanying 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 by chance equals the materiality threshold (the minimum size of price drops from corrective disclosures which it is beneficial to deter with liability) 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 reducing it in ordinary times. This is because there will be a range of negative price 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 where either 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 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. So 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 be welfare enhancing in crisis-induced high idiosyncratic volatility times only if, contrary to normal times, the social gain from a decrease in Type II error as a result of a small relaxation of the confidence level 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, the lowering the confidence level will have the same impact on Type I errors and the same negative effect on social welfare in both times.⁸⁹ *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.*

In sum:

1. Given the assumption that the 95% confidence level is socially optimal, and 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 increase Type I errors from reducing 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 normal times, then the social gain from the reduction in Type II errors is greater than the social cost from the increase

⁸⁹ 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.

in Type I errors. This would mean that reducing 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. 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, however. We have presented a rigorous proof of this proposition in a different paper,⁹⁰ but the discussion that follows summarizes the reasoning.

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 0. 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 to as to disguise

⁹⁰ See Fox, Fox & Gilson, *supra* note 41, at 11-19.

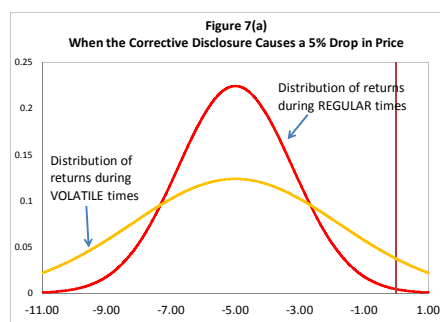
the actual 20% drop: the assumed 1% normal-times standard deviation of idiosyncratic risk tells us that the net impact of these other items will rarely move the price more than a few percent. So the Type II error rate with the 95% standard is almost 0. If the standard is lowered to 90%, the Type II error rate will be even closer to 0, 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 larger reduction in Type II error in crisis times than it would in normal times.

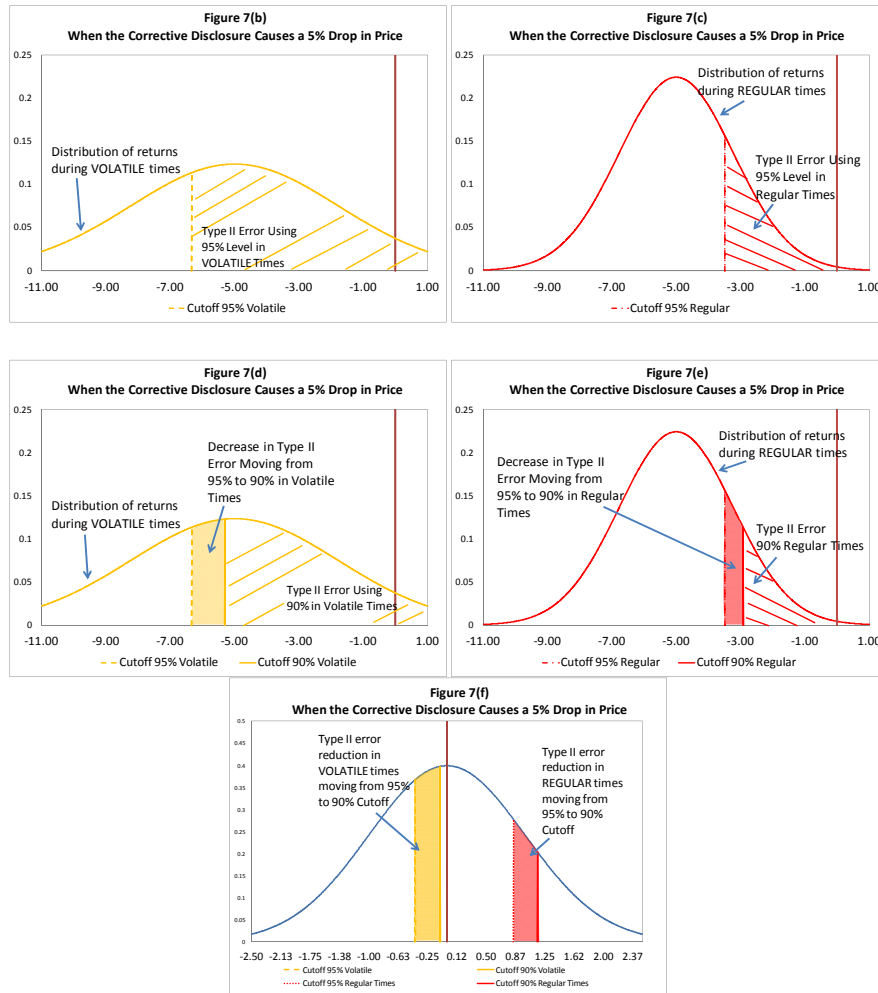
Where the negative price impact of the corrective disclosure is a much smaller 2%, the opposite will be the case. In normal times, the standard deviation of 1% tells us that other firm specific news and background noise will move price much more relative to an actual 2% negative price impact than to 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 we expect from the net impact of other firm specific news and background noise. A 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, 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.⁹¹ The net impact of these other items is, on average, 0. 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 is 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.



⁹¹ See Part IV.A.2 and Figure 6 *supra*.



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. The cutoff is $-1.96 \times$ (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: any observed market-adjusted price to the right of the applicable cutoff fails the test. For example in 7(b) because -5% is less negative than the 95% cutoff for crisis periods (–

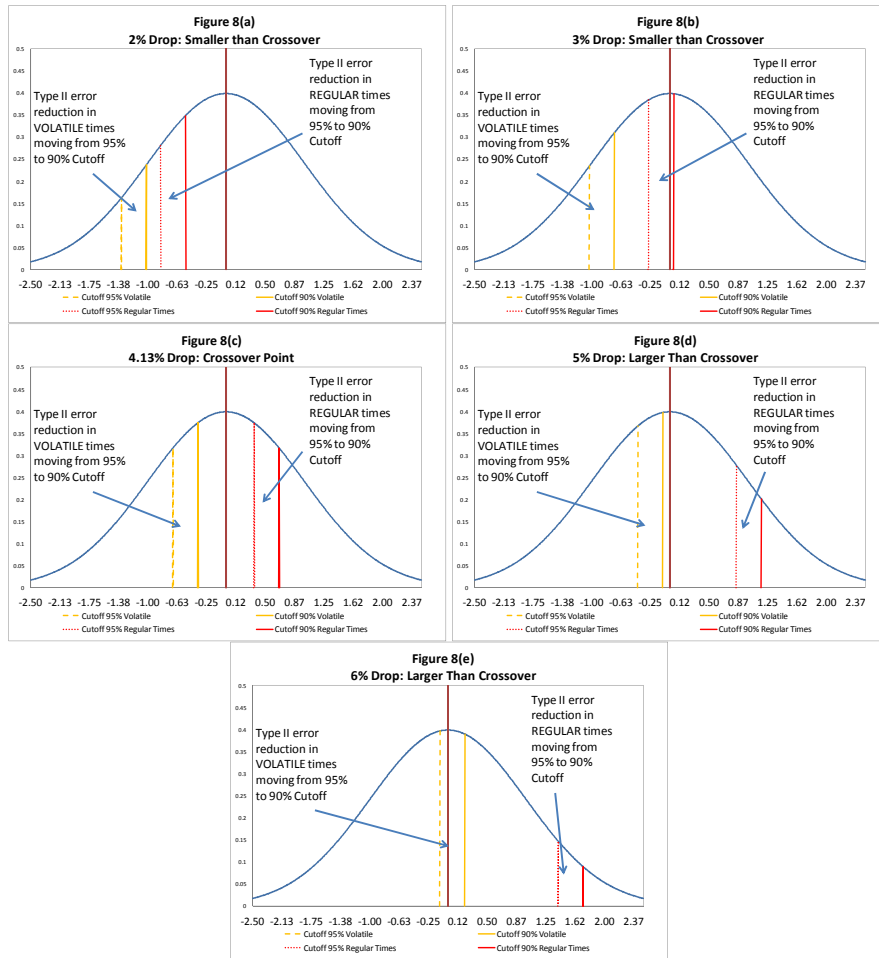
6.33%), the corrective disclosure in our example will only pass the test if the net impact of other bits of firm specific news and background noise drives the price down by at least another 1.33%. This is .41 standard deviations below the mean of the distribution (which is -5%). For a normal distribution, this will happen only about 1/3 of the time, so the observed price will only be negative enough to pass the test 1/3 of the time. As a result, Type II error in crisis times 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 .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%). So in normal times 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. It can be seen that 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 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, which is centered at 0 and has a standard deviation of 1. The math, though a bit difficult, is not important here. Rather, observe two things. First, this transformation

preserves the standard deviations we noted above, so that the threshold for 95% in crisis times starts .41 standard deviations below the mean and the 95% threshold in normal times starts .84 standard deviations above the mean. Also observe that the interval between the 95% and 90% threshold is the same length (.32) in both regular and volatile periods. This means comparing the reduction in Type II errors is easy: whichever period's interval is closer to 0 (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 0.

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 8(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. -.32, is the same. For actual impacts (Figures 8(d) and 8(e)) more negative than the crossover point of -4.13, 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 this point (Figures 8(a) and 8(b), the opposite is the case.



iii. *The special case where the crossover point just 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 just 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 a 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. 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 in high idiosyncratic volatility 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 materiality threshold, lowering the confidence level in high idiosyncratic volatility times will decrease false negatives 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 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 where the crossover point is just to equal the materiality threshold would be pure coincidence because the factors determining each are independent. In this ordinary case they would not be not equal. Then 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 will have a less positive, or a more negative, effect on social welfare in crisis 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 volatile 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 volatile times would be less beneficial, or more harmful, than 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 just equals the materiality threshold.

If, as seems likely, the crossover point does not equal the materiality threshold and so 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 increase level of welfare losses, with respect to corrective disclosures with price effects within this range. Answering this question requires knowing the distribution of misstatements in the economy in terms of their price effects (and hence the price effects of their associated corrective disclosures). And it 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 effect versus the costs of such litigation.

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

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

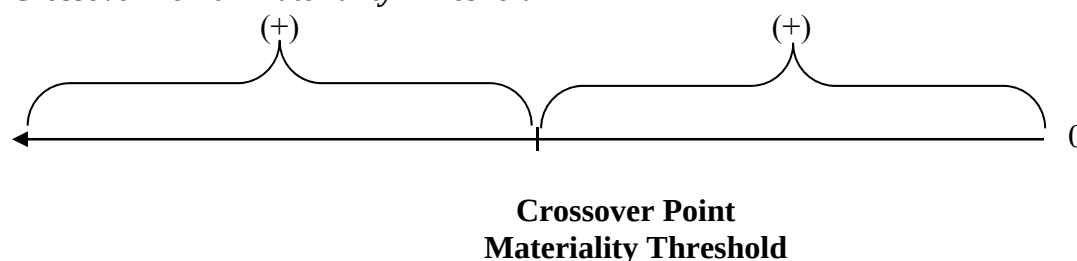
(-) = The welfare gains from reduced Type II error are smaller, or the welfare losses from reduced Type II errors are greater, in crisis times than in normal times.

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. 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.

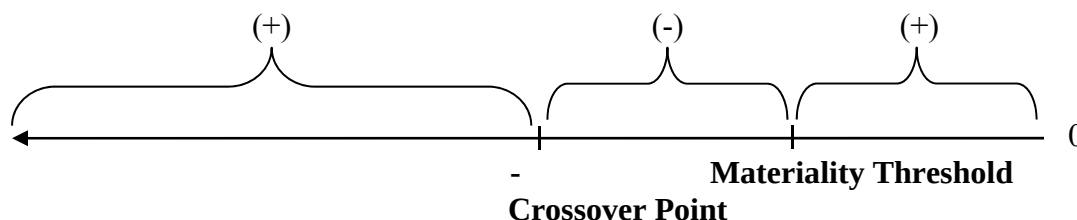
It is socially desirable to impose liability on misstatements made with scienter whose corrective disclosures have actual price impacts more negative than the *materiality threshold* and socially undesirable to impose liability for such misstatements when they have actual price impacts less negative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

The comparative welfare effects of lowering the standard in normal versus volatile times is depicted here with regard to three situations: the crossover point = the materiality threshold, the crossover point is < the materiality threshold, and the crossover point is > the materiality threshold.

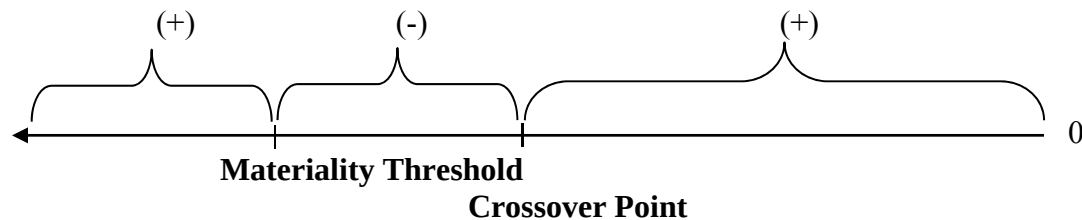
Crossover Point = Materiality Threshold



Crossover Point more negative than the Materiality Threshold



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 have a more favorable welfare effect in terms of its impact on Type II errors than doing so in normal times? 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. 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 case

where the Type II error crossover point just equals the materiality threshold, but this would be a pure coincidence because the factors that determine one are entirely independent of the factors that determine the other.

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. 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 causation in fraud-on-the-market class actions in the face of economic crisis-induced increases in idiosyncratic volatility. What we can say with certainty, however, is 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 more costly way to deter issuer misstatements because 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.⁹² 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. 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 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

⁹² See *supra* notes 60-70 and accompanying text.

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 a market realization of the truth, often gradual, in advance of the full corrective disclosure and thus to a smaller or non-existent observed market-adjusted price change at the time of the disclosure.⁹³

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.⁹⁴ 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.⁹⁵ But we suspect that they are

⁹³ Fox, *supra* note 72, at 850-851; David Tabak & Frederick C. Dunbar, *Materiality and Magnitude: Event Studies In The Courtroom*, in *Litigation Services Handbook: The Role of the Financial Expert*, Ch. 19 at 4 (Roman L. Weil, Peter B. Frank & Michael J. Wagner eds. 2002) (discussing beginning event studies prior to the actual announcement of the news to correct for leakage before that time).

⁹⁴ See, e.g., *In re Imperial Credit Indus., Inc. Sec. Litig.*, 252 F. Supp. 2d 1005, 1014-16 (C.D. Cal. 2003); *In re Executive Telecard, Ltd. Sec. Litig.*, 979 F. Supp. 1021, 1023-28 (S.D.N.Y. 1997).

⁹⁵ 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, 523-525 (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).

relatively more manageable in the hands of an administrative agency that can use prosecutorial discretion in deciding which cases to bring.

C. 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 Securities Act Section 11 litigation based on alleged misstatements or omissions in the registration statements of securities public 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.”⁹⁶ The doctrinal standard for materiality in insider trading cases under Rule 10b-5 is identical to Rule 10b-5 misstatement cases: whether there is a substantial likelihood that a reasonable investor would consider the non-public information on which the insider traded to be important in a decision whether to purchase or sell the security involved.⁹⁷ 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 misrepresentation cases, an event study is the financial economist’s standard tool for determining the likelihood that the disclosure of a previously non-public item of news in fact did change the

⁹⁶ See, e.g., *SEC v. Texas Gulf Sulphur Co.*, 401 F.2d 833, 848 (2d Cir. 1968) (en banc).

⁹⁷ See *supra* note 74.

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.⁹⁸

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, 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 actions⁹⁹ relevant to insider

⁹⁸ *SEC v Berlacher* 2010 WL 3566790 at 9 (E.D. Pa 2010) (an event study ... [is] reliable and the best measure of materiality"). See also Mark L. Mitchell & Jeffrey M. Netter, *The Role of Financial Economics in Securities Fraud Cases: Application at the Securities Exchange Commission*, 49 BUS. LAW. 545, 572-584 (1994)(collecting cases).

⁹⁹ See Part IV.B.3.c *supra*

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.¹⁰⁰

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 in normal times.¹⁰¹ This means that in crisis times, insiders would have many more opportunities to profit from insider trading on non-public 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. Applications: Materiality under Section 11 of the Securities Act

¹⁰⁰ See *supra* Part IV.B.3.c. In a non-jury 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. *SEC v Berlacher*, 2010 WL 3566790 (E.D. Pa 2010). 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.

¹⁰¹ Recall from our earlier examples that the standard error for the typical firm during the recent financial was 3.23%, compared to 1.78% in the average year in normal times. This says, very roughly, that average bit information released by such a firm had almost twice the effect on price in crisis as in normal times.

Section 11(a) of the Securities Act of 1933 (the “Securities Act”)¹⁰² 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 the materiality is the same as under Rule 10b-5.¹⁰³ 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.¹⁰⁴

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. 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 the net effect will be as if the offering was

¹⁰² Pub. L. No. 73-22, 48 Stat. 74 (codified as amended at 15 U.S.C. § 77a *et seq.*, with § 11(a) codified at § 77k(a)).

¹⁰³ See *supra* note 74. The Supreme Court has yet to address the proper standard for materiality under § 11 of the Securities Act, but all the circuit courts that have addressed the question have applied the *Northway* definition of materiality in § 11 actions. See, e.g., *Kronfeld v. Trans World Airlines, Inc.*, 832 F.2d 726, 731 (2d Cir. 1987) (collecting cases).

¹⁰⁴ See, for example, *In re World Access, Inc. Securities Litigation*, 310 F. Supp.2d 1281 (N.D.Ga. 2004)

priced correctly in the first place. Imposing absolute liability also creates incentives to take cost effective steps to avoid such price distorting behavior.¹⁰⁵

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. 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 the price drop was caused by events other than the misrepresentation or omission.

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. Both sides will bear the burden of proving statistical significance with respect to the element on which they bear the burden of proof. The plaintiff will seek to prove materiality through an event study by showing a statistically significant drop in share price when the corrective disclosure was made. In turn, the defendant will use an event study to prove that the

¹⁰⁵ Section 11(a) also imposes absolute liability on other participants in the process: the issuer's top managers, directors and underwriters. However, under Section 11(b), these other participants are granted an affirmative defense: they have no liability if they can show that they engaged in adequate due diligence. 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 Bates, *The Federal Securities Act of 1933*, 43 YALE L.J. 173 (1933); Felix Frankfurter, *The Securities Act: II*, FORTUNE, Aug. 1933, at 54, 108. See also, *Feit v. Lesco Data Processing Equip. Corp.*, 332 F. Supp. 544, 581 (E.D.N.Y. 1971); *Escott v. BarChris Constr. Corp.*, 283 F. Supp. 643, 696 (S.D.N.Y. 1968).

drop in security price was caused by events other than the corrective disclosure. The dueling event studies will be further complicated by the fact that each party can be expected to contest the other's event study. 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.¹⁰⁶ 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, both the plaintiff and defendant will be affected by the higher standard of statistical significance. 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 makes Section 11's shift in the burden of proof to the defendant on this issue significant.

D. 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 securities laws. We turn now to

¹⁰⁶ Again, there are no strong reasons to believe that lowering the standard, with the consequent increase in Type I errors, will increase social welfare.

corporate law, in particular to the legal implications of our findings for what has been the most disputed element in corporate law over the last thirty years: the extent of judicial deference to a board of directors' decision to defend against a hostile takeover. Over this period, Delaware law evolved to give the board wide discretion when it determines there is a risk of "substantive coercion," i.e., a risk that the shareholders may mistakenly accept a tender offer that the board believes undervalues the corporation. In this section we consider whether crisis-induced spikes in idiosyncratic risk may 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.*,¹⁰⁷ and *Quickturn Design Systems, Inc v. Mentor Graphics, Inc.*¹⁰⁸

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.¹⁰⁹ 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."¹¹⁰ 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.

¹⁰⁷ 16 A.3d 48 (Del. Ch. 2011).

¹⁰⁸ 721 A. 2d 1281 (Del. Ch. 1998)

¹⁰⁹ Ronald J. Gilson, *The Fine Art of Judging: William T. Allen*, 22 DEL. J. CORP. L. 914, 914 (1997).

¹¹⁰ See, e.g., *Unocal Corp. v. Mesa Petroleum Co.*, 493 A.2d 946, 954-955 (Del.1985).

The threat that fully informed shareholders would make this mistake is termed, awkwardly, “substantive coercion.”¹¹¹

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 hands. If these prices are thought to be relatively accurate, it is harder to justify the target board’s preventing 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*.¹¹² There the court resolved the conflict between two contending positions over who decided whether a hostile takeover would succeed: should the board be prevented from interfering with the offer so that the shareholders decide whether to accept a hostile bid, or should the board have the power to prevent shareholders from making that choice.¹¹³ In *Unocal*, the 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, and if so, whether the board’s response was proportional to the threat identified.

¹¹¹ As will become apparent, one of the authors bears at least half the responsibility for this very poorly turned phrase. See *infra* note 114 and accompanying text.

¹¹² 439 A.2d 946 (1985).

¹¹³ Compare Ronald J. Gilson, *A Structural Approach to Corporate Law: The Case Against Defensive Tactics in Tender Offers*, 33 STAN. L.REV. 819 (1981), with Martin Lipton, *Takeovers in the Target Boardroom*, 35 Bus. Law. 104 (1979).

Following *Unocal*, a law review article appeared that influenced the further evolution of Delaware takeover law: Gilson and Kraakman's *Delaware's Intermediate Standard for Defensive Tactics: Is there Substance to Proportionality Review*.¹¹⁴ Anticipating the potential 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 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 was lower than the company's fundamental value.¹¹⁵ To make a claim of substantive coercion credible, the authors 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.¹¹⁶ At the least, the discipline imposed by requiring this showing would force

¹¹⁴ Ronald J. Gilson & Reiner Kraakman, *Delaware's Intermediate Standard for Defensive Tactics: Is There Substance to Proportionality Review?* 44 BUS. LAW. 247 (1989). Chancellor Chandler assesses the article's impact on Delaware takeover law in *Air Products and Chemicals, Inc. v. Airgas, Inc.*, 16 A.3d. 48, 96-96 (De. Ch. 2011).

¹¹⁵ Gilson & Kraakman, *supra* note 114, at 267.

¹¹⁶ *Id.* at 268. 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:

'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

management to specify the metric by which their performance going forward should be measured if the offer were defeated.

In *Paramount Communications, Inc. v. Time, Inc.*,¹¹⁷ the “Supreme Court addressed the concept of substantive coercion head on ...”¹¹⁸ As that court put it in a subsequent case, the “board of directors had reasonably determined that inadequate value was not the only threat Paramount’s all cash for all shares presented, but was *also* reasonably concerned that the Time shareholders might tender to Paramount in ignorance or based upon a mistaken belief, i.e., yield to substantive coercion.”¹¹⁹

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 they 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 Supreme Court, to give the concept broad application, watered down what had to be proved to essentially nothing¹²⁰

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.”

Chesapeake Corporation v. Shore, 771 A. 293, 327-330 (Del. Ch. 2000) (quoting Gilson & Kraakman, *supra* note 114, at 268-69, 274).

¹¹⁷ 571 A.2d. 1140 (Del. 1990).

¹¹⁸ *Air Products & Chemicals, Inc. v. Airgas, Inc.*, 16 A.3d 48, 98 (Del. Ch. 2011).

¹¹⁹ *Unitrin, Inc. v. American General Corp.*, 651 A.2d 1361, 1384 (Del. 1995)(emphasis in the original).

¹²⁰ 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.” 16 A.3d 48 at 57.

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: both the importance of new information about 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. This crisis-induced gap between management's 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 pre-crisis 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*,¹²¹ and *Air Products and Chemicals, Inc. v. Airgas, Inc.*¹²² Each case took place following a financial crisis. Each involved a sharp decline in the target's share price, which both appears to have prompted the bidder to initiate the hostile offer and

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

¹²² 16 A. 3d 48.

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. Patent litigation brought by Quickturn had by 1997 resulted in an injunction barring Mentor Graphics from selling certain products in the United States. There was an associated damage claim by Quickturn that it said could reach \$225 million. 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 the patent. However, there was a problem over price. Although Mentor Graphics' 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. Mentor Graphics chairman then concluded that "the market outlook being very weak due to the Asian crisis made it [the Quickturn the acquisition] a good opportunity."¹²³ Mentor Graphics then commenced a tender offer at an approximately 50 percent premium to Quickturn's crisis-effected market price, but at more than a 50 percent discount to the pre-crisis 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

¹²³ 721 A. 2d at 1285.

which the Chancery Court ultimately upheld. Quickturn also adopted a “dead hand” poison pill¹²⁴ that it withdrew after similar devices were invalidated in cases involving other litigants, and then a “slow hand” poison pill that the Supreme Court ultimately held violated Delaware law.¹²⁵

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 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 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.¹²⁶

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 pre-crisis volatility levels. As shown in Figure 10, this is exactly what happened to Quickturn. The company’s daily idiosyncratic risk did rise

¹²⁴ 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. If the adopting board is replaced, the pill will remain in place for its full, typically ten year term regardless if the bidder wins a subsequent proxy contest.

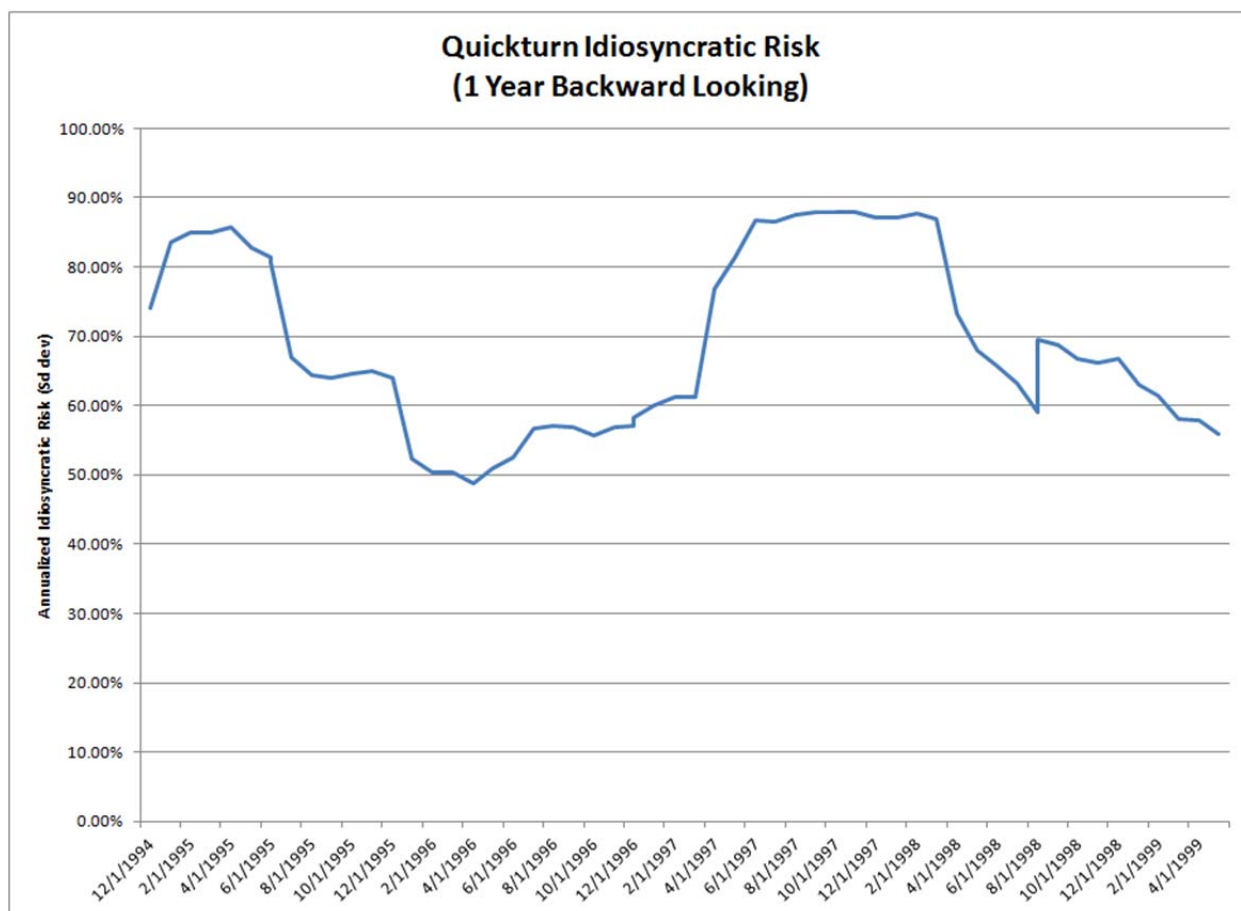
¹²⁵ 721 A. 2d at 1292-93. A slow hand pill imposes a period following a change in a majority of the board during which the board cannot redeem the pill.

¹²⁶ Gilson & Kraakman, *supra* note 114, at 271.

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.¹²⁷ Mentor's offer followed this collapse in price. By this time, however, Quickturn's idiosyncratic risk had returned to pre-crisis 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.

Figure 10

¹²⁷ This release reported an 11 percent 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.



Airgas presents a similar fact pattern, albeit in the context of a different crisis. Prior to the 2008-2009 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’ 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.”¹²⁸ Then the global recession hit, and in the spring or summer of 2009, Air Products interest in Airgas was reignited.”¹²⁹ Following unsuccessful discussions between the two companies, Air Products then made a hostile offer at

¹²⁸ 16 A.3d at 62.

¹²⁹ *Id.* at 63

\$62, at a time when the Airgas share price was still well below its pre-crisis level.¹³⁰

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 Air Gas directors but, 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.”¹³¹

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.

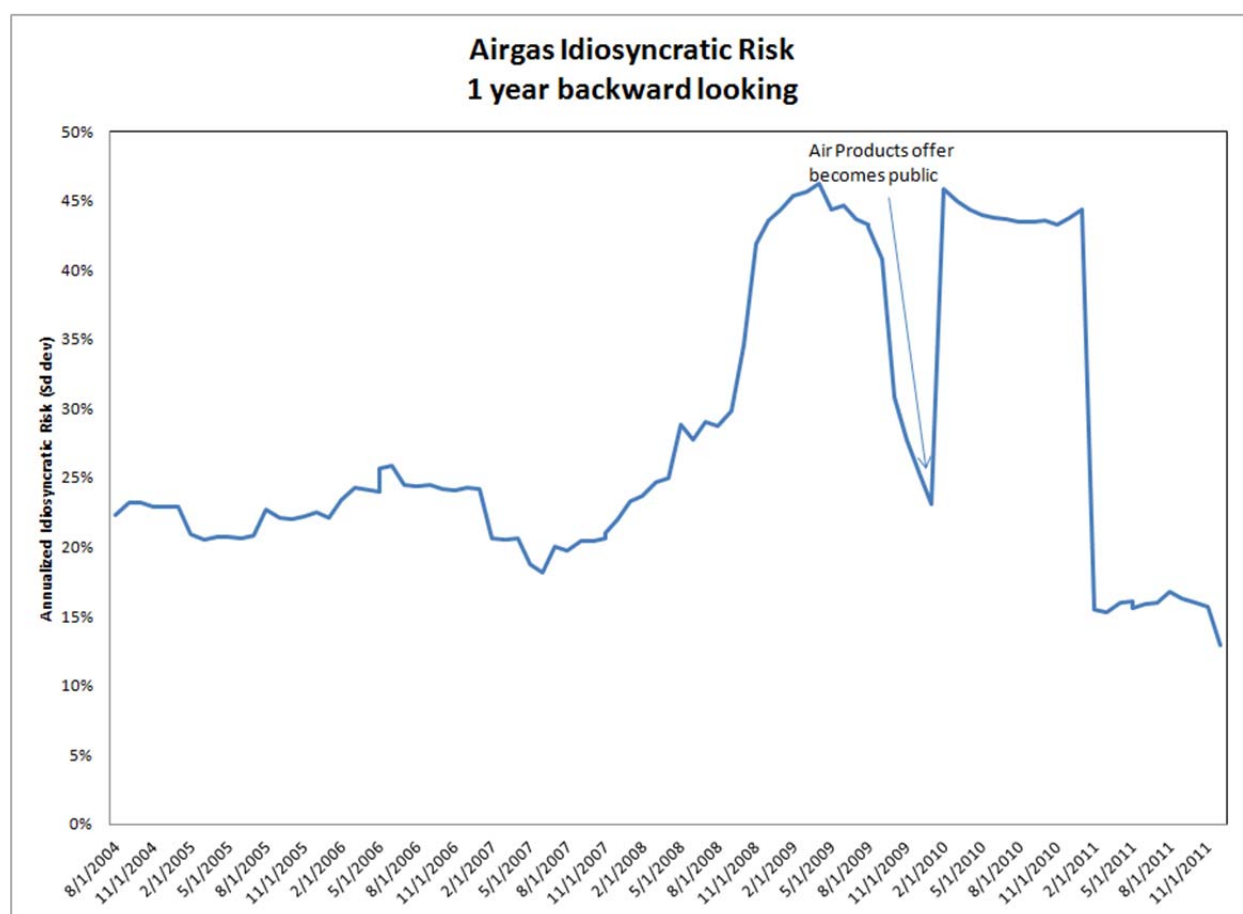
Like *Quickturn*, the timing in *Airgas* makes it difficult to link a crisis-related spike in idiosyncratic volatility to the potential for real substantive coercion. In this respect, the data falsifies the claim that a crisis-induced increase in idiosyncratic volatility might cause

¹³⁰The court quotes the Air Products CEO 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.

¹³¹ *Id.* at 57.

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' idiosyncratic risk preceded the Air Products offer, by which time risk levels had returned to normal levels.¹³² 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.

Figure 11



¹³² Airgas 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.

V. 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 and 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 2008-2009 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 class-based 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.