

The Smart Crash of October 19th

by AVNER ARBEL, STEVEN CARVELL, and ERIK POSTNIEKS



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Like a spanking to a misbehaving child, the crash returned rationality to an out-of-control market.

The Smart Crash of October 19th

by AVNER ARBEL, STEVEN CARVELL,
and ERIK POSTNIEKS

The tumultuous stock market crash of October 19, 1987 was almost nothing of what so many analysts, investors, and observers believe it was. Instead of a panic, it was the restoration of sobriety and rationality. Instead of destroying confidence, it restored credibility in the market pricing mechanism. The steep market descent that the world witnessed actually prevented a long, gradual descent. By ending unjustified good times, the crash prevented bad times.

Further, portfolio insurance and program trading did not worsen the crash, they kept it from lasting longer. In the language of statistics, they increased its amplitude and compressed its duration.

With sudden swiftness, the crash imposed the rational rules of a remarkable exercise of analytic intelligence. None of the most active participants in the market's regular activities foresaw the depth, suddenness, or brevity of the correction. Everybody was caught off guard. And everybody was wrong.

A Method to the Madness

The magnitude of the collapse provides a unique opportunity to test various stock market theories about investor behavior, market pricing mechanisms, valuation, risk, rational markets, and fluctuations. These theories have been tested in the past, but mostly under more-or-less normal ranges of market

conditions and fluctuations. None has been tested under extreme or catastrophic conditions.

Our studies found that theories of investor rationality, which have reigned periodically over many years—and also have been vilified and rejected by many scholars over those years—held up reasonably well during the October debacle. To understand the reality of what happened, we must consider—with more insightfulness than other studies have demonstrated—a broad range of factors leading up to and affecting the crash.

Pre-crash Price Gains. According to an observation made many years ago by Benjamin Graham, the father of fundamental value analysis, investors lose their sense of proportion during bull markets, paying excessive prices that appear to have no relation to a

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company's fundamentals. "It is characteristic of all bull markets," Graham and his coauthors wrote in the famous book, *Security Analysis: Principles and Technique*, "that speculative optimism increases with the price level and the price level with the optimism."¹

This observation is consistent with the action of the market before October 19. During the early stages of the crash, it seems, the market recognized that this "bigger fool" pricing mechanism was about to melt down. Once it was apparent that the bull market was over, investors put an abrupt end to the cycle of irrationality with a correction that was proportionate to the degree of overpricing that preceded the crash. To be succinct, stocks that had gone up the most before the crash went down the most during the crash.

The table entitled "Price Behavior Before and During the Crash" supports this conclusion. Quintile one contains those companies whose stocks appreciated the most (more than 57.3%) during the 12 months before the crisis. Quintile five represents those companies that had the worst precrash stock performance (–3.6% and below). The pattern during the crash is inverse: quintile one companies' stock plummeted an average 32.8%, while quintile five's fell "just" 24%. Our 2,000-stock sample fell an average of 28%.

The quintile results are strongly supported by univariate regression analysis. A T-value measures the significance of a variable. A T-value of 2 or more (or

Everybody was caught off guard. And everybody was wrong.

–2 and below) is usually accepted as statistically significant. Here, the T-value is –10.78, showing a high degree of significance. A similar pattern, though less clear, can be observed for one-month and three-month precrash price performance, with T-values of –2.0 and –5.5 respectively.

Industry Groups. Industry groups also played a large role in determining what stocks would be sold off. To determine the impact of industry classification on price performance, we separated our sample into 123 industry subgroups. Our point is best made through contrast. The table entitled "Industry Performance" shows data for the 20 best performing industry groups, those surrounding the median, and

Price Behavior Before and During the Crash

Quintile	Precrash 12-Month Price Performance (%)	October 1-19 Price Decline (%)
1 High	57.4% through 371.5%	–32.8%
2	32.8 through 57.3	–29.2
3	14.6 through 32.7	–26.9
4	–3.5 through 14.5	–24.0
5	–77.8 through –3.6	–24.0

Univariate Regression Results

Constant	–25.5
Standard Error of Y Estimate	11.3
R-Square	0.064
Coefficient of X	–0.062
Standard Error of X Coefficient	0.006
T-Value	–10.78

those that performed the worst during the study period (October 1-19).

We found a logical pattern in the cross-industry performance. With few exceptions, the industries that performed the worst were concentrated in products and services that are perceived to have a high degree of discretionary spending: photographic equipment, toys and games, hotels and casinos, movies and entertainment, book and magazine publishers, pollution control, and (perhaps for obvious reasons) securities brokers. Least hard hit were generally the perceived necessities: utilities, natural gas, telephone communication, paperboard containers, and farming machinery. The industry groups around the median largely represent mid-cases in this respect, like industrial fasteners, furniture, and shoe manufacturers.

Corporate Restructuring. Perhaps nothing typifies the impact of the bursting speculative bubble on Black Monday better than the stock price performance of companies that had been engaged in mergers and acquisitions, leveraged buyouts, or initial public offerings. One reason often cited for the market's precrash departure from traditional forms of fundamental valuation was the seemingly unbounded potential that investment bankers found in the arena of corporate restructuring.

Apparently there was no price too high to pay for a company as long as it could be broken up or refinanced. Infusions of foreign capital from Europe and Japan fueled the notion of unlimited price horizons until almost no one doubted its veracity.

1. Benjamin Graham, David L. Dodd, and Sidney Cottle, *Security Analysis: Principles and Technique* (New York: McGraw-Hill, 1962).

To be sure, some merger and acquisition (M&A) activity did produce value. Unfortunately, the restructuring craze that hit Wall Street late in 1986 and continued until the crash seemed to ignore the reasoning behind M&A activity as much as the market had been ignoring fundamental value. In many cases, prices rose astronomically from day to day based on rumors, as if the market were in a feeding frenzy.

In an effort to determine the effect on the stock of businesses involved in corporate restructuring before or during the crash, we studied the price performance of a portfolio of the 50 most widely followed restructuring companies. Graph One shows the portfolio's price performance from August 18 (just before the market's peak) through November 4 compared with the Dow Jones Industrial Average.

The two groups of stocks run in unison from August 18 until October 19, which indicates that corporate restructuring was to a large extent fueling the market's movement. All stocks took on higher prices because of the ripple effect that these restructurings were causing.

While during the crash the two groups moved largely together, it is strikingly apparent that after October 19, stocks of companies undergoing restruc-

turing lost much more than the market as a whole and continued to underperform the market thereafter. Some of the largest losses occurred five days after the crash, probably not coincidentally, that is when margin calls were made. Why the plunge? We think the premium afforded these stocks before the collapse was no longer perceived to be valid. Once the stocks were stripped of the speculative veil, their intrinsic value revealed that the market had overpriced the shares and a correction was now in order.

Company-Specific Variables. To determine the degree to which investors considered fundamental value, risk, and uncertainty when choosing stocks to sell, we looked at the relationship between those factors and price performance from October 1-19. The table, "The Risk-Averse Logic of Investors, October 1-19," summarizes the results of our analysis. Each variable is broken into quintiles, with quintile one representing a portfolio of stocks containing securities with the highest value of the factor in question, and quintile five representing stocks with the lowest factor value. At the bottom of each column we provide the T-statistic, R-square, and several other important statistical measures.

Industry Performance

(October 1-19, 1987)

20 Top Performing Industries	Price Change (%)	20 Median Performing Industries	Price Change (%)
Electric Utilities	-10.50%	Fertilizers	-28.34%
Malt Beverages	-14.52	Textile Mill Products	-28.51
Truck, Rail Leasing	-14.99	Electrical Equipment Manufacturers	-28.55
Natural Gas Distribution	-17.27	Oil-Canadian Oil and Gas	-28.60
Paperboard Containers	-18.04	Metal Fabricators	-28.74
Property and Casualty Insurance	-18.32	Natural Gas	-28.74
Commodity Companies	-19.08	Heavy Construction	-28.76
Telephone Communications	-19.34	Industrial Fasteners	-28.97
Department Stores	-19.38	Electronics	-28.98
Cable Television	-20.51	Oil Field Machinery and Equipment	-28.98
Multi-line Insurance	-21.00	Specialty Paper and Package	-29.06
Banks-Regional	-21.12	Apparel Manufacturing/Finished Products	-29.14
Oil-International	-21.45	Furniture and Home Furnishings	-29.16
Oil and Gas, Domestic	-21.49	Gas and Oil Pipelines	-29.19
Mortgage Investment	-22.43	Oil Integrated Companies	-29.27
Metals-Precious	-22.74	Shoe Stores and Shoe Manufacturers	-29.28
Soft Drinks	-23.28	Meat and Poultry	-29.31
Machinery-Farming	-23.54	Oil-Refiners	-29.33
Real Estate	-23.65	Catalog Showrooms	-29.41
Small Foods Companies	-23.80	Aluminum	-29.47

The results clearly indicate that what may have appeared to be chaotic and random selling actually resembled an orderly return to a risk-averse fundamental approach to stock valuation. Investors imposed a crisis pricing mechanism that is more consistent with basic financial theory than any pricing mechanism present during the bull market.

■ **Dividends**—Column one shows that dividend yield played an extremely strong role during the sell-off, almost as if the textbook dividend valuation (bird-in-the-hand) approach prevailed. Stocks with high yields lost “only” 21.2%, compared with no-dividend stocks, which lost 32%. This relationship is highly statistically significant with a T-value of 12.9. The importance of dividend policy is often debated in academic papers, but the market apparently made up its mind on the issue. When the market environment is very uncertain, a bird in the hand is worth *more* than two in the bush. We found similar results for dividend payout and dividend per share.

■ **Price-to-book**—Underlying asset value was highly regarded by investors during the market crash. Column two shows the relationship between the price-to-book ratio and market performance. The results

are conclusive: stocks that sold at very low price-to-book ratios lost much less than those that sold well above their price-to-book ratios. Moreover, this relationship was highly significant in the cross-sectional regression with a T-statistic of -5.7 .

In other words, investors sent out a clear message: sell stocks with prices that do not represent solid underlying values. Far from irrational, this approach reflects the most prudent judgment that could have surfaced in any catastrophic situation. Other asset-related measures, like book value per share and five-year return on assets, confirm this conclusion.

■ **Price-earnings ratio**—Before the crash, the stock market had P-E ratios approaching historic highs, which implies very low earnings yields. Further, the prevailing yields were significantly lower than the riskless interest rate. Perhaps not surprisingly, the difference between interest rates and earning yields reached its widest point just before the crash. Ominously, this behavior came despite predictions for only moderate growth in dividends and earnings per share, and expectations for even higher interest rates. In combination, all these imply that stocks had become significantly overvalued.

On October 19, reality caught up. Column three contains the quintile and regression information for P-E ratios and shows a clear pattern: high P/E stocks lost about 55% more than low P/E stocks. Quintile one lost 31.1% compared with a drop of only 20.1% for quintile five. Once again, those stocks that had strayed farthest from the classical value models were hit hardest. The logic of fundamental value, this time as related to earnings multiples, ruled stock selling patterns and the resulting pricing mechanism. The same conclusion holds for other earnings measures like price-to-cash-flow ratio and pretax profit margin.

■ **Company size**—Clearly, stocks of smaller companies with low market values did not fare well either. Large-capitalization stocks lost 25.7% compared to smaller-capitalization stocks, which lost 29%. This relationship is reflected in the significant T-statistic of 2.4 for the cross-sectional regression.

Two factors are probably at work here. First, larger companies are better able to weather an economic storm than smaller companies. If the market free-fall precipitated a recession, small companies would suffer the most. The market merely reflected the worry about a recession and stepped up selling pressure on the smaller stocks. Second, stocks with low market capitalization are also relatively thinly traded, which often leads to greater volatility. No doubt this accentuated the price declines.

We further checked the differences in price behavior of different-sized companies by comparing the

<i>20 Worst Performing Industries</i>	<i>Price Change (%)</i>
Air Freight	-32.74%
Cosmetics, Personal Care	-32.93
Airlines—Trunk Carriers	-33.04
Sporting Goods and Vehicles	-33.13
Tools—Small	-33.15
Hotels and Casinos	-33.72
Tire and Rubber	-33.73
Contract Drilling	-34.00
Autos and Trucks	-34.10
Microcomputer Manufacturing	-34.82
Residential Construction	-34.83
Books, Magazines, and Publishing	-35.18
Minicomputer Manufacturing	-35.55
Glass	-37.06
Toys and Games	-37.62
Semiconductors and Related Products	-37.72
Movies and Entertainment	-38.29
Pollution Controls	-40.87
Securities Brokers	-42.70
Photographic Equipment	-43.54

performance of the Dow Jones Industrial Average with that of the broadest based price index, the Wilshire 5000. The Dow measures the price performance of some of the largest and most established companies, but it accounts for less than .5% of all publicly traded companies and only about 2% of their market value. The Wilshire index covers all actively traded stocks—about 7,000 companies—including thousands of medium-sized and smaller companies.

To sharpen the size measure even further, we obtained an unpublished and widely neglected version of the Wilshire index in which its components are weighted equally rather than value weighted, as in the published index. The result of the price comparison for the expanded period October 1 through November 27, and for a parallel period following the 1929 market crash, is shown in Graph Two, "The Market Crashes: 1929 vs. 1987."

Smaller company stocks continued to perform poorly. By the end of November, more than a month after Black Monday, the stock prices of most small and medium-sized companies remained about 10% below the lows they had reached on October 19, indicating a high degree of postcrash investor rejection. Further, the price movement similarities with 1929 are much more apparent than for the Dow compa-

nies. Evidently, as in 1929, investors looked to larger companies for shelter from future market quakes. The same phenomenon has been observed in the bond market, where investors overwhelmingly rejected medium-grade bonds and junk bonds after the collapse.

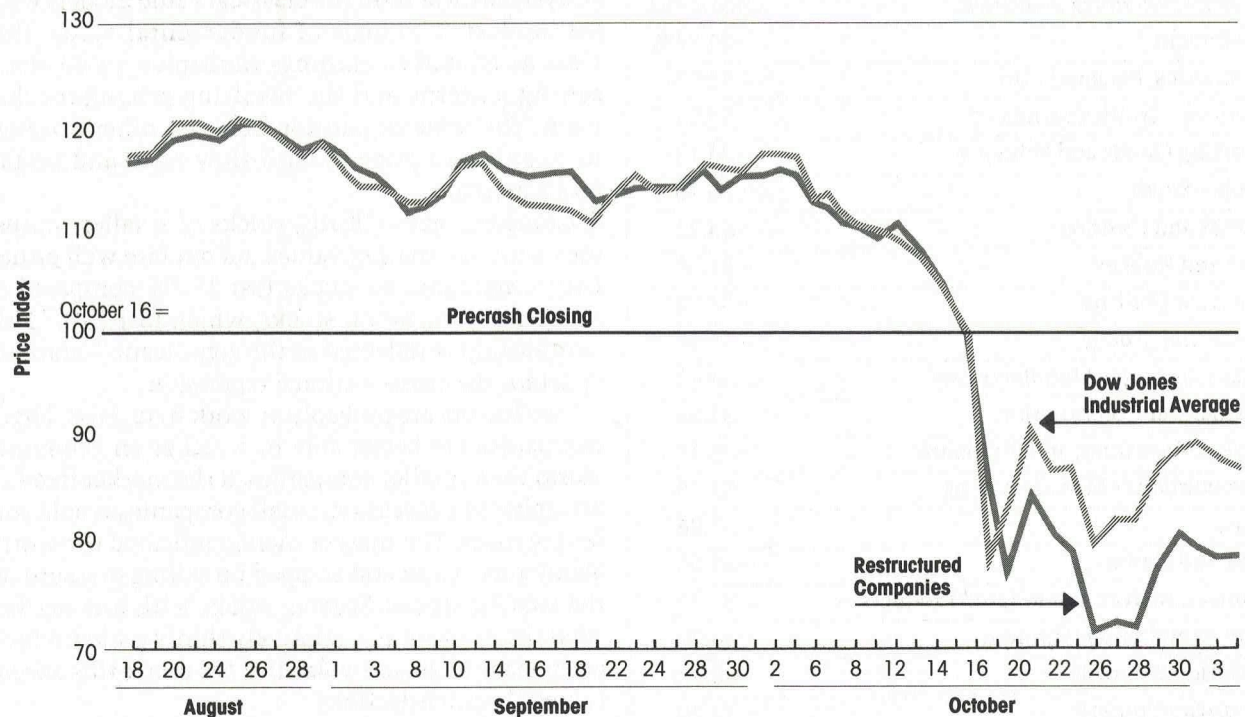
■ **Risk**—As one might expect, risk—especially as measured in the debt-equity ratio—played a key role in the pricing mechanism during the crash. Companies with more leverage in their capital structure lost more than companies with little debt. Although it is not obvious from the quintile analysis, a T-statistic of -2.6 implies that the debt-equity ratio was significant for the sample as a whole; market participants perceive high debt as risky and burdensome. The T-statistic was also significant for other traditional company-related risk measures like the current ratio and free cash flow per share. Once again, the market reacted rationally during the downturn by increasing the selling pressure on financially risky companies.

Perhaps the most surprising discovery relates to the role of systematic risk, or beta, in affecting pricing patterns during the crash. (The beta coefficient is a standard index of the volatility of a stock relative to the market. A beta of 1 indicates a stock as volatile as the market. The higher the beta, the more volatile

GRAPH ONE

Restructured Companies* vs. the Dow

(price performance from August 18 through November 4, 1987)



*Mergers and acquisitions, initial public offerings, and leveraged buyouts

The Risk-Averse Logic of Investors, October 1-19

(price decline by certain variables)

	1	2	3	4	5	6	7	8	9
Quintile	Dividend Yield	Price to Book	P/E	Size	Debt to Equity	Beta	Coefficient of Variation in Analysts' Predictions	5-Year Projected Growth Rate	Number of Analysts
1 Highest	-21.2%	-30.3%	-31.1%	-25.7%	-28.7%	-32.6%	-32.3%	-32.7%	-25.0%
2	-27.4	-29.3	-28.3	-27.1	-25.3	-30.2	-29.7	-29.6	-28.9
3	-27.1	-25.5	-28.3	-27.3	-27.9	-26.6	-26.9	-28.5	-29.5
4	-29.4	-24.5	-24.2	-27.7	-27.4	-24.7	-26.0	-28.0	-28.5
5 Lowest	-32.0	-26.5	-20.1	-29.0	-27.4	-22.6	-25.8	-20.6	-26.7

Univariate Regression Results

Constant	-30.6	-25.5	-26.1	-27.6	-26.9	-21.0	-27.7	-25.3	-28.6
Standard Error of Y Estimate	11.1	11.5	11.2	11.6	11.6	11.2	10.7	10.9	11.3
R-Square	.089	.019	.006	.003	.004	.084	.02	.001	.004
Coefficient	1.16	-.72	-.006	.0002	-.005	-8.02	-.009	-.057	.09
Standard Error of Coefficient	.09	.127	.002	.0000	.002	.638	.002	.016	.035
T-Value	12.9	-5.7	-3.0	2.4	-2.6	-12.6	-4.9	-3.5	2.5

the stock vis-à-vis the market.) The beta has come under fierce attack recently for both statistical and theoretical reasons. At best, it is considered a long-term measure of a company's market-related risk. At worst, it is called a statistical artifact that ought to be abandoned in favor of more sophisticated and inclusive measures of risk. Our data clearly indicate, however, that the beta was a significant predictor of price behavior, even during this very short and extremely volatile period.

The results, found in column six of the "Risk-Averse Logic" table, support this conclusion. High beta stocks—expected to lose more than the market—did indeed drop 32.6% in price compared to 28% for the sample as a whole. Stocks with the lowest betas—expected to be less volatile than the market—fell only 22.6%. We also checked the price performance of all stocks having a beta of 1. Amazingly, the average price decline of this portfolio was 28%, equal to the decline of our research universe "market portfolio" of 2,000 stocks, and exactly as suggested by the theory over the long term. Further, the results of the regression analysis indicate a high level of significance for the beta coefficient.

Investors' sale of higher risk stocks in an unsettled market is not surprising. What is surprising is the apparent closeness with which investors followed theory by rejecting the more volatile stocks during the very short period of the crash.

■ **Uncertainty**—The "prudent investor" hypothesis is also apparent in the market's response to uncertainty. Market analysts make earnings forecasts on thousands of companies. These analysts rarely agree, however, about a company's future. We used a measure of the relative dispersion in their forecasts as an approximation of uncertainty.²

For this purpose, we calculated the coefficient of variation in analysts' earnings predictions for each of the companies in our data base using information that was provided by the Finstat data base (a division of Shearson Lehman Hutton). We used this measure (the standard deviation in the forecasts divided by the average forecast) to determine whether company-related uncertainty affected investor trading behavior during the crash.

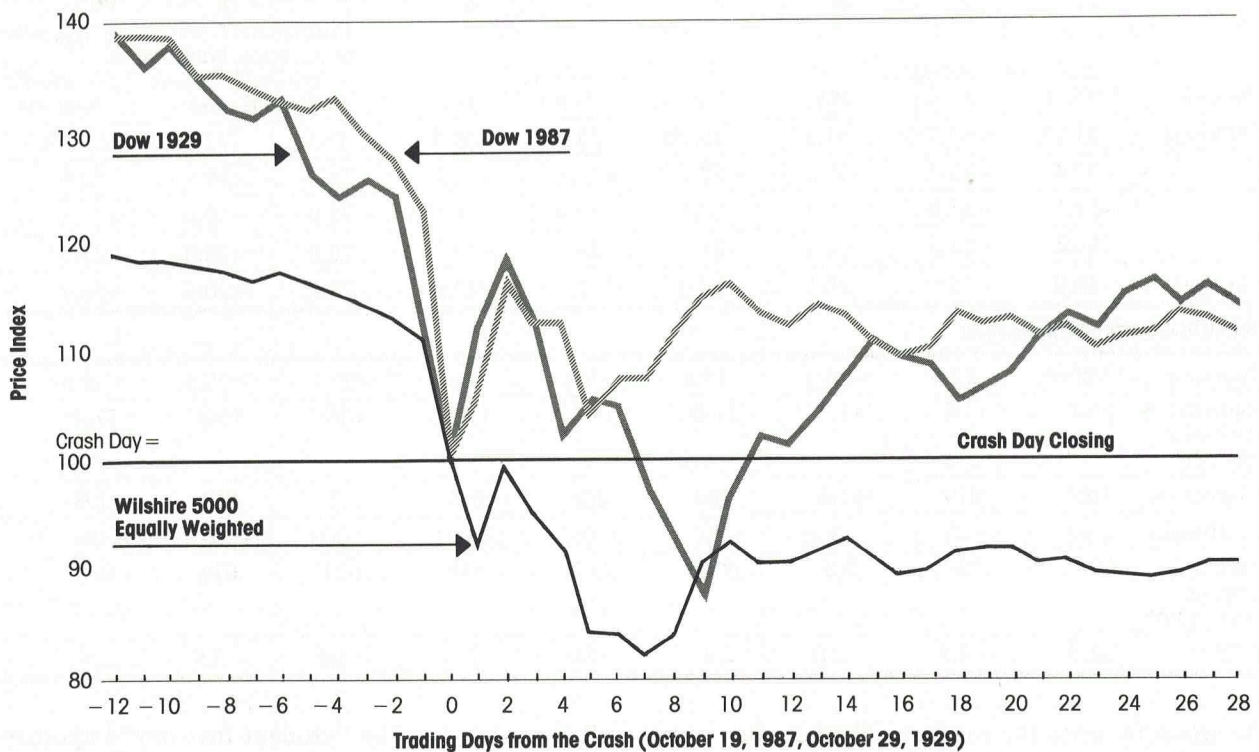
The results, shown in column seven, are highly significant. Stocks with a high degree of uncertainty in their forecasts fell 32.3% in price compared with a loss of only 25.8% for stocks with the least uncertainty. Cross-sectional regression analysis shows a T-statistic of -4.9 for this relationship. Rational investors are expected to retreat from uncertainty (like that reflected here in a low degree of analyst

2. For a discussion of the role of uncertainty, see Avner Arbel, *How to Beat the Market with High Performance Generic Stocks* (New York: New American Library, 1986); Paul Strebel and Steven Carvell, *In the Shadows of Wall Street* (Englewood Cliffs, N.J.: Prentice-Hall, 1988); Steven Carvell and Paul Strebel, "A New Beta Incorporating Analysts' Forecasts," *Journal of Portfolio Management*, Fall 1984.

GRAPH TWO

The Market Crashes: 1929 vs. 1987

(The Dow and broader base indices, daily percentage change)



consensus during a period of market volatility). The data suggest that the extreme case of the collapse did not create an exception to the theory.

■ **Predicted earnings growth**—Analysts' estimates of future earnings growth, always important to investors, were especially widely watched before the crash, and projections of higher earnings powered the bull market. At the bull market's end, however, investors lost faith in the analysts' predictions.

Column eight provides some insight into this fact. Five-year growth rates were apparently perceived to be overoptimistic, given the economic conditions. When stock prices began to drop, investors realized that they had capitalized overvalued growth estimates into their valuation models, and they began to apply a cross-market contrarian approach.

One of the strongest relationships revealed by our study is the *inverse* relationship between analysts' precrash earnings predictions and stock price performance during the crash. Clearly, the greater the analyst-predicted earnings-per-share growth, the further the price declined. Companies in quintile one lost 32.7% compared with companies in quintile five, which lost only 20.6% during the same period. This implies that stocks expected by analysts to enjoy the highest growth rate dropped almost 59%

more in value than stocks in the lowest growth-rate group during the market crash. The results in this respect are highly statistically significant. This pattern also prevails in the predictions of short-term growth rates and past five-year sales growth rates—a clear sign that the market had realized its mistake and was correcting it in a rational and logical manner.

■ **Analyst attention**—Stocks getting less analyst attention have historically outperformed the more heavily researched stocks over the long term. This phenomenon, known as the "neglected firm effect," occurs in part as a reward for the greater levels of uncertainty caused by the paucity of information available for neglected stocks.³ Once more, as theory and common sense tell us, higher levels of uncertainty aversion, typical under catastrophic conditions, should translate into greater price drops for the high-uncertainty, no-name, generic stocks followed by only a few analysts.

This conclusion gets support from a significant T-statistic of 2.5 for the cross-sectional regression. It should also be noted, however, that the conclusion is not clearly apparent in the quintiles. The most ne-

3. Avner Arbel, Steven Carvell, and Paul Strebel, "Giraffes, Institutions and Neglected Firms," *Financial Analysts Journal*, May/June 1983; Avner Arbel and Paul Strebel, "The Neglected and Small Firm Effects," *Financial Review*, November 1982.

glected stocks in quintile five, those with fewer than three analysts covering them, performed only slightly worse than the most highly researched group. Although the market in general was selling off the less followed stocks, the most neglected stocks still may have been perceived as having some undisclosed value and thus as better candidates to hold than to sell. This was the case, perhaps, because the neglected stocks were unpopular to start with and therefore were not overpriced before the crash.

As the final step in our analysis of the company-specific variables, we ran a multivariate regression analysis to determine the extent to which all the factors *combined* might explain the market's performance during the collapse. Multivariate regression analysis helps explain the extent to which certain independent variables are related to a dependent variable whose behavior one wants to understand.

We identified seven factors that together explain about 30% of the total variability in the price change surrounding the market debacle. As one might expect, the variables found to be most significant are the price performance for the last 12 months, the five-year expected growth rate, the coefficient of variation in analysts' forecasts, the beta coefficient, dividend yield, P/E, and the number of securities analysts following the stock. (For a more detailed discussion of our methodology, see the Appendix.)

The Role of Program Trading

Many of those investigating the crash, among them the Presidential Task Force on Market Mechanisms (known as the Brady Commission), have suggested that program trading accelerated, or even triggered, a significant downfall following the initial price decline.

It is hard to separate the price impact of programmed transactions from regular transactions even with a detailed, minute-by-minute record of price and volume information—which was unavailable for our study. Moreover, the conceptual distinction between the two types of trading is often unclear, since computer programs can be modified, or even abandoned, based on current information. This is especially true in an extreme crisis. In view of the magnitude of the crash and the amount of money involved, it is unlikely that major institutional investors simply allowed their computers to run rampant. Most likely, executives were constantly informed about stock price and volume and changed their strategy to meet the crisis as best they could.

Nevertheless, our analysis cannot reject the possibility that program trading was responsible for part of the price decline and for a temporary overreaction. Our findings, however, indicate that if such a reaction took place, it did not move prices beyond what was justified by the fundamentals of the companies in question. At most, program trading may have accelerated a process of price adjustment that would and should have been triggered anyway. Stock

Program trading was not the culprit. It only speeded up and completed the needed adjustment.

prices were overvalued because of speculative buying before the crash. Program trading supplied the resounding slap to wake up the market by boldly pushing the system to its limit, but it was not the culprit. As in most other cases, it is wrong to blame the messenger.

Our study suggests that program trading not only did not interfere with market rationality, but actually contributed to market efficiency by speeding up and completing the price adjustment process.

The evidence, documented in Graph Two, indicates that program trading played a critical role in compressing the crash to three days, during which prices declined by 26.2% (as measured by the Dow).

The Dow, whose components are most widely used for program trading, collapsed in three days, while the equally weighted Wilshire index, which is dominated by stocks not traded under programs, took ten days to hit bottom.

Our conclusion that program trading contributed to the efficiency of the market, rather than the opposite, is perhaps not surprising given the characteristics of program trading. The various program-trading systems are run by, or for, large financial institutions. Therefore, the stocks traded have large market capitalizations and are highly liquid. For these stocks, the effect of any one trade on a stock's price (called the price-trade impact) is usually very small. In addition, information on this widely followed sector of the market is plentiful and open to everybody—more than any other group.

Program trades are designed to be executed instantly and automatically when certain conditions are met, and they have a very low transaction cost. This business not only is highly competitive but also encompasses extensive arbitrage trading in attempts to take advantage of price discrepancies where the

same stocks are traded in different markets. Finally, given the low margin requirements, investors can take highly leveraged positions.

Thus, program trading creates ideal conditions for an instantaneous flow of funds, across markets and across financial instruments, with almost no budget constraints or any other barriers. All these characteristics are consistent with market efficiency.

New technology in computers and communications has created a worldwide market with immense volume and a plethora of financial instruments. Program trading restrictions in such case may postpone price adjustments within and across capital markets, but they cannot prevent those changes from occurring. The biggest effect of restrictions, therefore, would be to impede market efficiency. If that is true, why limit program trading at all?

Predicting the Crash

It is obvious that few players saw the collapse coming, but would following the experts—analysts and insiders—have cushioned the blow? Did expert stock picks at least fall the least in the crash? Did the various market “leading indicators” foresee any storm clouds? And did the mutual funds, those havens for the small investor, protect their holdings?

Brokers and Analysts. We used data available on the Dow Jones News/Retrieval service to obtain information on brokers’ favorites. The data group 25 stocks unanimously recommended for purchase by analysts covering them prior to the crash. We computed the price performance for each list of stocks to determine its performance against the market between October 1 and October 19.

Analysts’ and brokers’ favorites were not protected from the market’s fall. Brokers’ “best buys” lost 29.7% compared with 28% for the stock universe. If the so-called experts had anticipated the crash, we would have expected them to recommend stocks with higher yields, less risk and uncertainty, and more asset-based fundamental value than the stocks that they did in fact recommend.

To a large extent, financial analysts and their sales representatives, the brokers, created and continuously supported the speculative optimism that preceded the crisis. Evidently carried away by the momentum that they had helped to create, they were as surprised by the catastrophe as everybody else.

Insiders. Insiders were no more successful than analysts at predicting the market. Using information

reported to the SEC, we analyzed the 25 stocks that insiders had bought most heavily in the months before the market crash. Those stocks yielded a –31.4% return, compared with a –28% return for our 2,000-stock sample. In retrospect, whatever inside information these investors may have had did not help them to improve market performance during the crash.

These results are not surprising. The 1987 market crash was a macro-generated event. A company’s insiders have no real advantage in predicting macroeconomic variables that may affect the market. And they are no better in assessing their own companies’ prospects in the market. Consequently, a strategy designed to follow insiders should have been hit as hard as any other company-related investment strategy—and indeed it was. Insiders suffered more than the average investor because, like the other big losers we’ve discussed, the speculative bubble associated with insider activities during the precrash bull market was larger than average. Again, a high degree of rationality prevailed in the correction of a group of stocks that were overpriced.

Mutual Fund Holdings. In their advertising campaigns, the mutual funds warn that investing is risky and should be left to the experts—the funds’ experts. How prescient were they about the crash? We checked mutual funds’ cash levels as an indicator of equity market optimism—the larger the percentage of cash held, the more pessimistic the funds’ managers were. The results indicate a complete failure to predict the market slide. The mutual fund industry as a whole had about 91% of its portfolios invested just before the crash, and cash reserves were much lower than before the boom began in 1986. With very few exceptions, the managers evidently followed the speculative fever to its bitter end.

Barron’s Confidence Index. This closely watched index measures the ratio of the yield on a group of

Analysts, mutual funds, and insiders missed the coming crash. Was anything right?

high-grade corporate bonds to the yield on a group of intermediate-grade corporate bonds. As the latter falls in relation to the former, the index rises, signaling rising optimism of the “big money guys” and, consequently, a rising stock market. The *Barron’s* index performed poorly in predicting the crash. In fact, the value on the index published just a couple of days

Graham Values and Components

Date	Average EPS (\$)	Projected Growth Rate (%)	Yield AAA Corporate Bonds (%)	Graham Value	Relative Graham Value (RGV)	Overvalued/ Undervalued (%)
September 30, 1986	\$4.14	11.68%	8.90%	65.21	1.19	- 19%
September 30, 1987	3.86	11.66	10.03	53.88	0.83	17
October 19, 1987	3.55	11.57	10.42	47.43	1.04	- 4

before the crash (in the October 19 issue of *Barron's*) was 97, versus 92 a year before. In other words, just prior to the crash, the indicator was 5.5% higher than it was at the onset of one of the most explosive bull runs in stock market history.

TED Spread. The TED (Treasury bill-Eurodollar) spread is the spread between near-term contracts on Eurodollar futures and Treasury bills. It is generally accepted as a measure of international financial confidence and has historically fluctuated around 1%. Here, the results in predicting the crash are better. During the week before the crash, the TED spread stood at 1.61 compared with .79 on October 19, indicating more than a 50% decline in confidence. The more accurate predictive power of the TED spread is best explained by its inclusion of an international dimension, unlike the *Barron's* index. In the months before the crash, capital markets became highly international and interactive; the U.S. stock market became tied to the movements of the world financial markets more than ever before. Evidently, the TED spread captures the sense of the interrelated world market better than the more traditional U.S. confidence indexes.

The Graham Formula

We have seen that analysts, mutual funds, leading market indicators, and insiders were not effective in predicting the crash. Did anything come close?

Completely by chance, while looking through an old textbook to answer a student's question, we came across a formula developed by Benjamin Graham in 1962 and revised in 1974.⁴ We decided to test the ability of this very simple, almost naive, value-based investment formula to predict the crash.

Graham suggested a straightforward, practical tool for evaluating a stock's intrinsic value. His model is based on a few company-specific and market-related

fundamental factors: current earnings per share, projected growth, the underlying "appropriate" earning yield, and interest rate expectations as captured by the yield on AAA corporate bonds, by which is calculated what we call the Relative Graham Value (RGV). (See the Appendix for a detailed analysis of the equation.) An RGV of less than one indicates that a stock is overvalued and should not be bought, while an RGV greater than one implies that the stock is undervalued and should be bought.

For curiosity's sake, we calculated an RGV for IBM as of two weeks before the crash. The result was an unbelievably exact prediction of IBM's closing price on Black Monday. Encouraged by this result, we computed the RGV for each stock in our data base that had all the necessary data (a total of more than 1,800 companies) for several time periods: a year before the crash, two weeks before the crash, and the day after the crash. We then computed the weighted average RGV for the sample as a whole and compared the actual performance of the market to the performance predicted by the Graham model.

While the simple Graham valuation model was not very effective in predicting actual market performance in the year preceding the crash—when irrationality prevailed—it worked almost perfectly during the crash.

As the table entitled "Graham Values and Components" shows, on September 30, 1986, a year before the crash, the value of RGV for the market was 1.19, indicating that the average stock was undervalued by about 19%. During the following year the Wilshire 5000 market index went up by 35% and was 16% overvalued, according to the Graham model. (We chose the Wilshire 5000 because it compares well in size to the large number of stocks in our RGV study.) On September 30, just before the slide, the RGV was .83, indicating that the average stock was overvalued by about 17%; the Graham model was predicting a significant market decline. On October 19 the Wilshire 5000 fell by 17.9%—almost the exact drop predicted by Graham's model.

After the market closed on October 19, with a new state of affairs (including lower interest rates), the RGV stood at 1.04, indicating a slight upside correc-

4. Graham, Dodd, and Cottle, *Security Analysis*; Benjamin Graham, "The Decade 1965-1974: Its Significance for Financial Analysts," *The Renaissance of Value* (Charlottesville, Va: Financial Analysts' Research Foundation, 1974).

Industry Leaders That Followed Their Graham Values

Name	Closing Price (\$) October 19	Graham Formula Price (\$) October 19	RGV* October 19	RGV† October 1	Overvalued October 1 (%)	October 1-19 Price Change (%)
American Home Products	\$ 66.00	\$ 64.3	.97	.78	22%	-22.9%
Bristol-Myers	37.00	36.0	.97	.74	26	-26.7
Campbell Soup	50.25	48.4	.96	.78	22	-22.5
Central & South West	28.62	27.3	.95	.90	10	-9.5
Colgate-Palmolive	36.00	34.8	.97	.71	29	-29.8
Commonwealth Edison	27.12	26.4	.97	.88	12	-13.2
Contel	29.00	28.6	.98	.81	19	-21.3
Cooper Industries	45.00	44.6	.99	.65	35	-37.4
Dow Jones	32.87	32.3	.98	.72	28	-29.7
Federated Department Stores	38.37	36.9	.96	.72	28	-28.6
General Cinema	34.50	35.2	1.02	.69	31	-34.9
General Motors	59.75	62.0	1.04	.78	22	-28.0
Great Northern	39.00	38.1	.98	.70	30	-31.7
Gulf Canada Resources	10.87	10.4	.95	.61	39	-38.3
H.J. Heinz	36.00	36.9	1.03	.78	22	-27.3
Hilton Hotels	60.75	63.5	1.04	.78	22	-28.3
IBM	103.25	101.1	1.00	.71	29	-31.5
Kimberly-Clark	43.12	43.0	1.00	.77	21	-25.5
Marriott	30.50	29.2	.96	.81	19	-19.2
McDonald's	39.37	41.2	1.05	.80	20	-27.1
Monsanto	68.12	66.3	.97	.73	27	-28.2
Norfolk Southern	27.25	28.3	1.04	.86	14	-21.0
PPG Industries	31.00	31.4	1.01	.72	28	-31.5
PepsiCo	31.00	29.7	.96	.78	22	-22.0
J.C. Penney	43.00	45.1	1.05	.81	19	-25.9
Pillsbury	33.00	31.8	.96	.76	24	-24.4
Pitney Bowes	31.75	33.0	1.04	.72	28	-33.2
Raytheon	66.75	69.0	1.03	.86	14	-19.7
Sara Lee	33.00	31.9	.97	.74	26	-26.5
Schering-Plough	38.75	29.7	.97	.74	26	-26.9
Scott Paper	60.00	61.7	1.03	.77	23	-27.9
SmithKline Beckman	44.62	45.7	1.02	.80	20	-25.3
Southern	20.50	20.4	.99	.95	5	-7.9
Sterling Drug	40.37	40.7	1.01	.69	31	-34.2
TRW	39.62	39.9	1.01	.65	35	-37.6
Tandem Computers	22.00	22.0	1.00	.69	31	-33.8
Union Carbide	20.25	19.3	.95	.71	29	-28.3
US West	49.00	47.4	.97	.84	16	-16.8
Warner-Lambert	56.25	55.3	.98	.69	31	-32.4
Average	40.60	40.8	.99	.76	24	-26.5

*Relative Graham Value at the AAA current bond yield of 10.42%.

†Relative Graham Value at the AAA current bond yield of 10.03%.

tion of 4%. In the following four weeks the market went up by 3.7%.

The Graham model also predicted the Black Monday closing prices of many leading companies in several industries. These companies and their RGV values are listed in the table titled "Industry Leaders That Followed Their Graham Values." Note that the model predicted a postcrash average price of \$40.80 for the entire group. The actual price was \$40.60 (see the first two columns).

How could such a simple and almost-forgotten valuation approach predict the drop in stock prices during the crash with such accuracy? Why did it work better for leading companies?

Simple as it is, the Graham model represents a down-to-earth valuation approach that focuses on the key market-related and company-specific variables. The evidence shows that at the very early stages of the crash, investors adopted a basic, no-nonsense valuation approach. Amazingly, the resulting pricing mechanism can be captured, to a large extent, by Graham's formula.

We don't know why the formula performed better for the large, more established, and leading companies (regardless of industry). Possibly as the crash developed, large-portfolio managers, who usually invest in these companies, changed their strategy

more radically than others did toward the basic approach reflected in the Graham formula. Further, as a group, they may be more familiar with the fundamental value approach. Another possible explanation is that the available input data required for the Graham formula, such as earnings growth estimates, are of better quality for larger, established companies.

For many years the academic community has ignored the Graham formula, probably because of its simplicity. For investors who want to know whether we think it is useful, perhaps the most we can say based on our study is that it should no longer be ignored. The Graham approach of fundamental analysis should be considered among other tools as a predictor of long-term trends.

Our findings suggest that the irrational behavior that typically biases traditional asset pricing and valuation models in normal times was reduced to a minimum during the crash. Consequently, the classical fundamental valuation approaches and the traditional pricing models worked well. The generality of the conclusion, that economic models and other theories in social science may work better under catastrophic situations, is an important empirical question and should be studied further.

Appendix: Data and Methodology

The methodology that we employed in our analysis is simple.

We studied the market performance of more than 2,000 stocks before and after October 19, 1987. This sample covered the entire New York Stock Exchange, the American Stock Exchange, and frequently traded over-the-counter stocks. We obtained the data through on-line down-loading of the Finstat Micro/Search data base provided by Shearson Lehman Hutton. The data base included information on prices, more than 100 company- and market-related fundamental variables, and analysts' earning-projection variables on each company. The analyst projection data are supplied to Finstat by Zacks Investment Research, which periodically canvasses more than 1,200 analysts across the country for earnings and growth predictions. We obtained additional current data from the various data bases included in the Dow Jones News/Retrieval service.

We tested the market's reaction during the crash to various measures of fundamental value and risk—the variables that investors under normal condi-

tions consider important in deciding whether to sell or hold their shares. These variables include dividend yield, underlying asset value, quality of earnings, uncertainty, and risk measures. We looked at the companies and industries that fared well and not so well, at whether the experts had predicted such performance, and at whether existing theory could have forecast the crash.

First, for each variable we separated the sample into quintiles, each containing a roughly equal number of securities. Next we calculated the price performance of each quintile between October 1 and October 19 and compared it with the market average for the same period. We chose these dates in order to capture the full effect of the crash.

Trying to uncover patterns in the selling spree, we replicated this procedure for a large number of fundamental variables and risk measures. Our variables included detailed industry grouping, company market value (as a proxy for size), dividend yield, price-to-book ratio, P/E, beta, five-year earnings growth projections, debt-equity ratio, current ratio, several measures relating to cash flow, the coeffi-

cient of variation of analysts' forecasts, and the number of analysts covering the stock (as an estimate for the company's degree of "neglect"). In addition, we formed quintiles based on each company's last 1-, 3-, and 12-month price performance before the crash to determine the role of profit taking during the collapse.

To ascertain more refined relationships between company characteristics and price performance, which may not have been apparent in the quintile breakdown, we repeated the analyses for smaller ranges of the variables' measures by forming equal deciles for each variable. This procedure closely resembles an isovariate crash analysis like, for example, a comparative assessment of price decline during the crash for portfolios of companies of roughly equal size, earning multiples, risk groups, and so forth.

Next, we performed univariate cross-sectional regression analyses (studying one variable across all companies) to obtain measures of statistical significance for each variable's correlation with price performance and correlations among the variables surrounding the crash. This study yields a more rigorous check of the quintile and decile analysis. We then estimated a multivariate model to look at each variable's contribution to price change in the context of other variables.

We also checked the performance of investment strategies based on insiders' trading patterns, brokers' favorites, and corporate restructurings. Finally, with other data, we assessed investor confidence levels and tested an integrated valuation model, the Graham formula.

Multivariate Analysis. We first determined candidates to include in the multivariate regression by running a correlation analysis on about 100 variables against the price performance of the market between October 1 and October 19. Next we selected for possible inclusion all variables that had correlation coefficients that were significant at the 95% level of confidence. To select the final form of the regression, we employed a stepwise multivariate regression procedure designed to maximize the equation's R-square.

The final form of the multivariate regression equation follows. The T-statistics, in parentheses, are listed beneath the coefficients.

$$\Delta P_j = -16.73 - 7.05 \beta - .08 P/E - .29 GR - .02 C.V. + .21 Est + .21 Yld - .05 TMP$$

$$\begin{array}{l} (-11.7)(-7.2)(-3.0)(-4.3)(-2.9)(-5.2)(1.6)(-6.7) \\ R\text{-Square} = .30 \quad F = 59.11 \quad \text{Prob} > F = .0001 \end{array}$$

Where ΔP_j = Price Change in stock j between October 1 and October 19, 1987:

β = Beta of stock j

P/E = The price-earnings ratio of stock j prior to October 19

GR = Projected five-year earnings-per-share growth rate for company j

CV = Coefficient of variation in analysts' forecasts

Est = Number of analysts following stock j

Yld = Dividend yield of stock j prior to the crash

TMP = 12-month price performance of stock j prior to the crash

Together, these variables show that there was a significant return to rational behavior, with each variable showing the correct sign within the multivariate regression equation.

The Graham Formula. The Graham formula proposes to calculate a company's intrinsic value V_j^* as:

$$V_j^* = EPS_j(8.5 + 2g_j)/4.4/Y_{aaa}$$

Where EPS_j is the company's last 12-month earnings per share, g_j is the company's long-term earnings growth estimate, and Y_{aaa} is the yield on AAA corporate bonds. The constant, 8.5, represents the appropriate P-E ratio for a no-growth company as proposed by Graham. The average yield of high-grade corporate bonds in 1962, when this model was introduced, was 4.4, and so the last expression in the formula is an adjustment factor for changing interest rates.

To apply this approach to a buy-sell decision, each company's relative Graham value (RGV) can be determined by dividing the stock's intrinsic value V_j^* by its current price P_j :

$$RGV_j = V_j^*/P_j$$

An RGV of less than one indicates an overvalued stock, while an RGV of greater than one indicates an undervalued stock.

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