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frontier for providing financial services is estimated by using either parametric or non-parametric techniques. From this frontier, scale and scope economy estimates can be derived. Shifts in the best practice frontier over time can be used to measure technological change. And, the researcher's classification of financial services into outputs and inputs can be used to generate productivity estimates. These indicators can be used to gauge the performance of financial institutions. In the second stage, the distance each financial institution is away from the best practice frontier is calculated. Financial institutions closest to the estimated frontier are deemed most "efficient." In theory, such tasks should be fairly straightforward. But, in practice, there is no consensus on whether some financial services, such as deposits, are inputs or outputs, on how to measure (i.e., impute and quality-adjust) financial services, on what frontier is appropriate, or on how to treat risks. Indeed, the rapid evolution of financial services offered and the dramatic changes in the ways that financial institutions manage their risks have resulted only in more diversity of opinions on these basic matters. Nevertheless, this methodology has been used to consider the effects of deregulation, mergers, and market structure on financial institution efficiency and productivity. Strikingly, much of the variability in performance across banks has been left unexplained, but the main empirical findings have been quite robust across studies, particularly given the discrepancies in their basic assumptions.

The second part considers how strategic decisions and their implementation influence the performance and efficiency of financial institutions. On the supply side, a financial institution's business strategy affects its service mix, geographic portfolio concentrations, scale and scope of operations, efficiency, and risks. On the demand side, a financial institution's strategic decisions can affect its client mix, generate network economies for consumers and businesses, and can build relationships that allow for highly tailored, rather than standardized, services. Once the strategic decisions are made, it appears that operational considerations (e.g., process designs, human resource management practices, and

technology infrastructures) can move financial institutions closer to the "best practice" frontier. Thus, the adoption of regulatory, financial, and technological innovations can not only shift the best practice frontier out, but also allow some financial institutions to move closer to the new frontier.

The third part focuses on how innovations challenge financial institutions and their regulators. Two case studies are presented: One on electronic payments and one on easing geographic restrictions. With regard to electronic payments, it is argued that regulators have a special role to play in the adoption of technical standards because scale economies and positive network effects remain unexploited. With regard to easing geographic restrictions for banks in the United States, it is argued that this recent deregulation will promote the growth of more efficient banks and will reduce financial instability. The lesson learned here is that each innovation that affects financial institutions brings forth another innovation.

Risk is the final topic of the volume. International data are used to infer that a financial institution's risks can be reduced if it uses incentive-based compensation schemes for its employees and if its business strategy is centered on building relationships with customers.

In sum, this collection of papers is worth reading by those interested in identifying the effects of innovations on firms, by those who desire to understand what makes a financial institution perform better, and by those who find the dynamic processes between financial, technological, and regulatory innovations of interest.

DIANA HANCOCK\*

*Board of Governors of the Federal Reserve System*

*Capital Ideas and Market Realities: Option Replication, Investor Behavior, and Stock Market Crashes.* By Bruce I. Jacobs. With a foreword by Harry M. Markowitz. Malden, Mass. and Oxford: Blackwell, 1999. Pp. xx, 399. \$64.95, cloth. ISBN 0-631-21554-9, cloth; 0-631-21555-7, pbk. *JEL 2000-0123*

\*The opinions expressed do not necessarily reflect those of the Board of Governors or its staff.



Public interest in the stock market, stock price levels, and stock market volatility all seem to be at an all-time high. Talk of speculative bubbles and of major "corrections" abounds. Is a stock market crash inevitable? Are there destabilizing forces that exacerbate stock market moves, and if so what are they? And what is a nervous investor to do in this situation? Jacobs, who received his Ph.D. in finance from Wharton and who has worked in the investment management industry for about 20 years, has written a book with the intent of providing some insight into these questions. He provides a detailed analysis of the 1987 stock market crash, as well as some more recent events such as the near collapse of Long Term Capital Management (LTCM). Although 1987 seems far away now, the volume is both fascinating and timely, because understanding this bit of finance history can be important in providing some perspective on today's markets and on what might come.

While the book includes numerous citations and discussions of academic papers, it is not technical. (Material in an appendix reviews the basic concepts associated with options and option replication techniques, and a detailed glossary explains many of the relevant terms.) The volume is divided into four parts. Part I provides some background on the ideas behind synthetic portfolio insurance and the development of the portfolio insurance market in the early and mid 1980s. It also examines the weaknesses and potential pitfalls of synthetic portfolio insurance. Part II describes possible explanations of the crash of 1987, starting with attempts to explain it as a rational reaction to fundamental information, and continuing with behavioral models involving "animal spirits," bubbles, cascades, and chaos. Part III focuses on the role of dynamic trading in the crash. In this part Jacobs puts synthetic portfolio insurance on trial for being a culprit in the 1987 crash and concludes, after examining some "alibis," that it did play a major role in the crash. Part IV describes events related to option replication strategies following the crash.

An insured portfolio is one with a return guaranteed not to fall below a pre-specified level at a pre-specified time. Holding an insured portfolio is equivalent to holding a po-

sition in the portfolio and a put option on that portfolio such that the holder has the right to sell it at a pre-specified price. Because organized markets in long-term options on diversified portfolios (e.g., the S&P 500) were not available in the 1980s, an industry evolved to provide portfolio insurance through dynamic trading strategies. These strategies were based on the option pricing theory of Black, Scholes, and Merton, which shows that under certain assumptions it is possible to replicate the payoff of an option by a dynamic trading strategy using the underlying asset (on which the option is written) and riskless borrowing or lending. Synthetic portfolio insurance was marketed aggressively in the mid 1980s, especially by the company Leland, O'Brien, and Rubinstein (LOR), the main developer and provider of the technique. By October 1987, more than \$60 billion, and possibly as much as \$100 billion worth of portfolios were "insured" using dynamic option replication strategies.

The book provides a detailed and very interesting analysis of the way in which portfolio insurance was sold to institutional investors. Many of the advertisements and statements made by those selling the technique are reproduced. Jacobs discusses the possible motives for holding portfolio insurance, and then examines the potential problems of attempting to provide such insurance through dynamic trading. For example, if the volatility of the underlying stocks changes unexpectedly or if the price process is discontinuous, dynamic option replication might not work as intended. A key property of option replication strategies, in fact, is that they are "trend following": They call for buying the underlying portfolio when prices increase and selling when prices decrease. It is argued that if many investors are using these strategies, this has the potential to exacerbate market moves and lead to increased volatility in the underlying stock market. (The possible equilibrium impact of portfolio insurance on volatility is discussed, for example, in Sanford J. Grossman and Zhoguan Zhou [Dec. 1996, "Equilibrium Analysis of Portfolio Insurance," *J. Finance*, 51:4, pp. 1379-1403], who show in fact that portfolio insurance increases price volatility.)

The success of option replication strategies



also depends critically on the liquidity of the stock markets, because the theory justifying these strategies assumes that any desired trades will be executed immediately at prices equal to (or very close to) those that trigger the trades. For this to be the case, there must always be investors ready and willing to take the other side of the transaction that is called for by the replication strategy. As we observed in the 1987 crash as well as on a number of other occasions (including the LTCM crisis), the market does not always possess this degree of liquidity, and so option replication and similar strategies cannot always deliver the promised outcome.

Dr. Jacobs wrote a number of articles in the early and mid-1980s pointing out the potential pitfalls of synthetic portfolio insurance strategies, and he has been an active participant in the debate over the culpability of portfolio insurance in the 1987 crash. He claims, for example, that the aggressive marketing efforts of portfolio insurers played on the instinctive greed and fear of investors, implying that one can enjoy the upside while being protected from the downside at insignificant (or even negative) cost and, in effect, misleading investors. For investors who did not understand fully the nature of the option replication strategies on which portfolio insurance is based, the crash was obviously a rude awakening. While the author quotes some of the defense arguments in the "trial" of portfolio insurers, readers should bear in mind that he represents the prosecution.

In developing his analysis, Jacobs also takes issue with the efficient market paradigm, and discusses many papers on speculative bubbles, cascade models, and behavioral finance. Although these can be relevant in trying to explain stock market crashes, it is not clear whether they are necessary or consistent with the book's main theme. For example, he refers to option replication strategies as "noise." However, trading based on pure noise is inherently unpredictable. Option replication strategies, by contrast, are a deterministic function of prices. Models in which portfolio insurance contributes to the crash do not require that investors act on the basis of animal spirits or fads. In Gerard Genotte and Hayne Leland (Dec. 1990, "Market Liquidity, Hedging and

Crashes," *Amer. Econ. Rev.* 80:5, pp. 999–1021) and Charles J. Jacklin, Allan W. Kleidon, and Paul Pfleiderer (1992, "Underestimation of Portfolio Insurance and the Crash of October 1987," *Rev. Finan. Stud.*, 5:1, pp. 35–63), for example, investors are simply not aware of the extent to which others are using synthetic portfolio insurance. Price run-ups and crash-like events can occur because the actions of portfolio insurers cannot fully be distinguished from those of informed investors.

Synthetic portfolio insurance has fallen out of favor following the 1987 crash. In response to the demand for hedging and portfolio protection, option exchanges expanded the menu of long-term options available on the exchange, and the market in over-the-counter options sold by investment banks has grown dramatically. Jacobs argues, however, that option replication strategies are still being used and act as destabilizing forces, because those who sell over-the-counter options, as well as those making market in options on the exchange, engage in dynamic option replication strategies similar to those used by portfolio insurers of the mid 1980s.

Will there be another major stock market crash? And if so, who will be "blamed" for it? Will it be again professional investors, trading on the basis of fancy mathematical models whose assumptions do not always hold, or are there other forces lurking around these days? (Consider, for example, day traders or investors found in chat rooms around the internet.) These are difficult questions. As for what a nervous investor should do, Jacobs concludes the book by urging investors to go back to basic portfolio theory: diversify and invest for the long run. For many investors, this is probably the best advice around. It is, incidentally, also consistent with market efficiency.

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## H Public Economics

*Setting National Priorities: The 2000 Election and Beyond.* Edited by Henry J. Aaron and Robert D. Reischauer. Washington, DC: Brookings Institution Press, 1999. Pp. xv, 496. \$44.95, cloth; \$18.95, paper. ISBN 0-8157-7402-8, cloth. 0-8157-7401-X, pbk. *JEL* 2000-0552