# A Symposium Sponsored By
# The Federal Reserve Bank of Kansas City

# FINANCIAL MARKET
# VOLATILITY

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# Contents

# Foreword

Observers had suspected that the world's financial markets were becoming increasingly volatile long before the stock market declined sharply on October 19, 1987. But that major decline ignited a new sense of urgency in addressing these suspicions. In the post-October 19 environment, it became imperative to examine and understand the entire issue of volatility, not only in equity markets, but in credit markets, commodity markets and foreign exchange markets as well.

The Federal Reserve Bank of Kansas City, recognizing that imperative, devoted its 1988 symposium, the twelfth in a continuing series on major public policy issues, to "Financial Market Volatility." A distinguished group of presenters and commentators shared their views and research results on various aspects of this vital topic.

We gratefully acknowledge the contributions of all those who participated in the symposium, especially those of Stuart E. Weiner, research officer and economist in the Bank's Research Department, who helped develop the program.

This much we know: in today's highly integrated financial markets, volatility not only can occur, but it can circle the globe, transmitted from one market to another in a matter of hours or even minutes. The international character of the Bank's 1988 symposium points up this growing globalization. We hope these proceedings will add to understanding and encourage others to study the issue of financial market volatility.

ROGER GUFFEY

President
Federal Reserve Bank of Kansas City
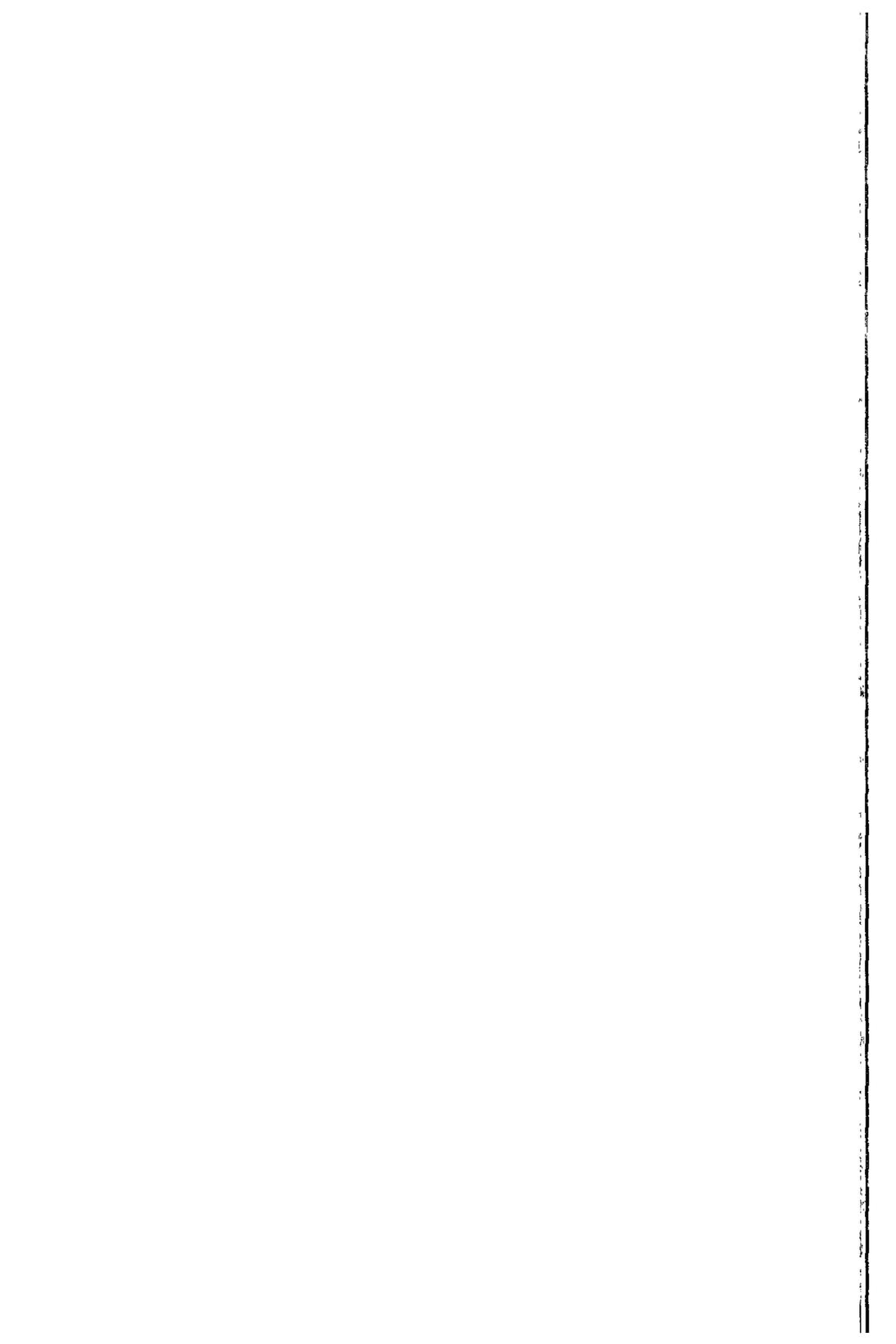
# The Contributors

**Franklin R. Edwards,** Professor, Columbia University

Mr. Edwards is the Arthur F. Burns professor and director of the Center for the Study of Futures Markets at Columbia University. Dr. Edwards has been a member of the faculty of the Columbia Business School since 1966, serving as vice dean of the school from 1979 to 1981. Prior to joining Columbia University, he worked at the Board of Governors of the Federal Reserve System and at the Office of the Comptroller of the Currency in Washington, D.C. Dr. Edwards has been a consultant to a number of regulatory agencies, financial institutions, and law firms on matters relating to antitrust law and regulation. He has published numerous articles and testifies frequently before Congressional committees.

**Jacob A. Frenkel,** Economic Counsellor and Director of Research, International Monetary Fund

Mr. Frenkel is the economic counsellor and director of research at the International Monetary Fund. Dr. Frenkel joined the faculty of the University of Chicago in 1973 and since 1982 has been the David Rockefeller Professor of International Economics. Dr. Frenkel is a fellow of the Econometric Society and a research associate of the National Bureau of Economic Research. He is on the Board of Editors of the *American Economic Review* and *Economics Letters,* as well as other publications. Dr. Frenkel is the author or editor of numerous books and articles on international macroeconomics, inflation, and financial markets.

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Mr. Gertler is an associate professor in the Department of Economics at the University of Wisconsin. He is also a faculty research fellow of the National Bureau of Economic Research. Dr. Gertler has been on the faculty at Cornell University and been a visiting associate professor at Stanford and Princeton Universities. He is the author of numerous scholarly articles on macroeconomic theory and monetary economics.

**Morris Goldstein,** Deputy Director, Research Department, International Monetary Fund

Mr. Goldstein is the deputy director of the Research Department at the International Monetary Fund. He came to the Fund in 1970. Dr. Goldstein has served as research fellow at the Brookings Institution, senior technical advisor at the U.S. Treasury Department, and visiting research associate at the London School of Economics. He has published many articles in the field of international economics.

**Charles A. E. Goodhart,** Professor, London School of Economics

Mr. Goodhart is the Norman Sosnow Professor of Banking and Finance at the London School of Economics. Before joining the London School of Economics in 1985, he had worked at the Bank of England for 17 years as a monetary adviser, becoming a chief adviser in 1980. Earlier he had taught at Cambridge University. Dr. Goodhart has written several books on monetary history and monetary policy.

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Mr. Hale is first vice president and chief economist of Kemper Financial Services, Inc., and vice president and director of Kemper-Murray Johnstone International, Inc. He joined Kemper Financial Services in 1977. Mr. Hale is a member of the National Association of Business Economists and the New York Society of Security Analysts. He is a director of Intermarket Publishing Corporation and also a member of the Financial Instruments Steering Committee of the Chicago Mercantile Exchange and the United States-Japan Consultative Group of International Monetary Affairs. He has written articles on a broad range of economic subjects.

**Robert E. Hall,** Professor, Stanford University

Mr. Hall is a senior fellow at the Hoover Institution and professor of economics at Stanford University. He is engaged in research on inflation, unemployment, taxation, and monetary policy. Prior to joining Stanford in 1978, Dr. Hall was professor of economics at the Massachusetts Institute of Technology. Dr. Hall is a fellow of the Econometric Society and a fellow of the American Academy of Arts and Sciences. He serves as director of the research program on Economic Fluctuations of the National Bureau of Economic Research. Dr. Hall has advised a number of governmental agencies on national economic policy, including the Treasury Department and the Federal Reserve Board. He has published numerous articles in scholarly journals.

**Robert D. Hormats,** Vice Chairman, Goldman Sachs International Corporation

Mr. Hormats is vice chairman of Goldman Sachs International Corporation. His primary responsibilities are the development and execution of Goldman Sachs' business in Western Europe and Canada. Prior to joining Goldman Sachs in 1982, Dr. Hormats served as a senior staff member for international economic affairs on the National Security Council (1974-1977), deputy assistant secretary of state for economic and business affairs (1977-1979), deputy United States trade representative with the rank of ambassador (1979-1981), and assistant secretary of state for economic and business affairs (1981-1982). He is the author of several articles on international finance and economics.

**R. Glenn Hubbard,** Professor, Columbia University

Mr. Hubbard is a professor of economics and finance at the Graduate School of Business at Columbia University. He taught previously at Northwestern University and Harvard University and was a John M. Olin Fellow in residence at the National Bureau of Economic Research. Dr. Hubbard is a member of the Brookings Panel on Economic Activity and is a research associate of the National Bureau of Economic Research. He has sewed as a consultant to the U.S. Departments of Energy and State, U.S. International Trade Commission, Social Security Administration, Center for Urban Economic Development Institute, National Petroleum Council, and private cor-

porations. Dr. Hubbard has contributed numerous articles to economic journals.

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Mr. Krugman is a professor of economics at the Massachusetts Institute of Technology. Before joining the MIT faculty in 1980, Dr. Krugman was on the faculty at Yale University. Dr. Krugman is a research associate of the National Bureau of Economic Research and a fellow of the Econometric Society. He has done consulting work for the Bank of Portugal and the U.S. State Department and is currently on the Board of Advisors of the Institute for International Economics and the Overseas Development Council. In 1982-1983, Dr. Krugman served as international policy economist on the Council of Economic Advisers. He has published a number of scholarly articles on international economics.

**Alexandre Lamfalussy,** General Manager, Bank for International Settlements

Mr. Lamfalussy is the general manager for the Bank for International Settlements in Basel, Switzerland. Dr. Lamfalussy joined the Bank for International Settlements in 1976 and served as economic adviser and head of the Monetary and Economic Department until 1981, when he was named assistant general manager. He became general manager in 1985. Dr. Lamfalussy is on leave from a professorship at the University of Louvain, Belgium. Previously, Dr. Lamfalussy was associated with the Banque de Bruxelles, first as an economist and economic adviser and later as executive director and chairman of the executive board. Dr. Lamfalussy is the author of several books and articles.

**Louis I. Margolis,** Managing Director, Salomon Brothers Inc.

Mr. Margolis is a managing director of Salomon Brothers Inc. and manager of the Equity Options and Futures Department. He joined Salomon Brothers in 1979. Mr. Margolis is a member of the Financial Products Advisory Committee of the Chicago Mercantile Exchange, the Financial Products Advisory Committee of the Commodities Futures Trading Commission, and the Options and Futures Committee of the Securities Industry Association. In addition, he is a member of the Board of Directors of the National Options and Futures Society, Inc.

**Frederic S. Mishkin,** Professor, Columbia University

Mr. Mishkin is a professor of economics and finance in the Graduate School of Business at Columbia University. Previously, he had been on the faculty of the University of Chicago Economics Department. Dr. Mishkin has been a member of the Brookings Panel on Economic Activity and currently is a research associate of the National Bureau of Economic Research. Dr. Mishkin has served on the editorial board of the *American Economic* Review and, at present, is an associate editor of the *Journal of Business and Economic Statistics* and the *Journal of Applied Econometrics.* Dr. Mishkin has published several books and contributed numerous articles to professional journals.

**Michael Mussa,** Member, U.S. Council of Economic Advisers

Mr. Mussa is the macro member on the Council of Economic Advisers, appointed by President Reagan in 1986. Before joining the White House, Dr. Mussa was the William H. Abbott Professor of International Business at the University of Chicago. Dr. Mussa has also taught at the University of Rochester, the Graduate Center of the City University of New York, the London School of Economics, and the Graduate Institute of International Studies in Geneva, Switzerland. Dr. Mussa is a fellow of the Econometric Society. In 1981, he received the Prix Mondial Nessim Habif from the University of Geneva for his research in international economics. Dr. Mussa has written a number of books and articles in the areas of international trade and finance, macroeconomics and monetary economics, and municipal finance.

**Brian Quinn,** Executive Director, Bank of England

Mr. Quinn is executive director of the Bank of England, responsible for banking supervision and banking operations. Dr. Quinn joined the Bank of England in 1970 in the Economics Division. From 1974 to 1977, he was assigned to the Cashier's Department, and from 1977 to 1982, he was head of the Information Division. He served as assistant director of the Banking Supervision Division from 1982 to 1984 and became head of that division in 1984. He was named executive director of the Bank earlier this year. Previously, Dr. Quinn was an economist in the African Department at the International Monetary Fund (1964 to 1970) and IMF representative to Sierra Leone (1966 to 1968).

**Robert V. Roosa,** Partner, Brown Brothers Harriman and Company

Mr. Roosa is a partner of Brown Brothers Harriman and Company. He is also a director of the American Express Company, the Owens-Corning Fiberglas Corporation, Texaco, Inc., and the National Bureau of Economic Research as well as a member of the Brookings Institution, the New York Stock Exchange Advisory Committee on International Capital Markets, and the Advisory Committee of the International Finance Corporation. Before joining Brown Brothers Harriman in 1965, he was Undersecretary of the Treasury for Monetary Affairs (1961 to 1964), and preceding that was with the Federal Reserve Bank of New York for 15 years. In 1984, Dr. Roosa received from the Emperor of Japan the First Class Order of the Sacred Treasure. Dr. Roosa has written extensively on international financial arrangements.

**Robert J. Shiller,** Professor, Yale University

Mr. Shiller is a professor of economics at Yale University. Before joining the Yale faculty in 1982, he taught at the Massachusetts Institute of Technology, Harvard University, the University of Pennsylvania, and the University of Minnesota. Dr. Shiller is a research associate of the National Bureau of Economic Research and a fellow of the Econometric Society. He has sewed as a member of the American Economic Association Advisory Committee, the Brookings Panel on Economic Activity, and the National Science Foundation Panel for Economics. Dr. Shiller has also sewed as foreign editor of the ***Review of Economic Studies*** and associate editor of the ***Journal of Econometrics.*** He is the author of numerous professional journal articles.

**Lawrence H. Summers,** Professor, Harvard University

Mr. Summers is the Nathaniel Ropes Professor of Political Economy at Harvard University, where he specializes in macroeconomics, the economics of taxation, and the study of financial markets. He served as Domestic Policy Economist at the President's Council of Economic Advisers during 1982-1983 and currently serves on the Congressional Budget Office's Board of Economic Advisers. In 1987, he was the first social scientist to receive the National Science Foundation's $500,000 Alan T. Waterman Award. He was also elected as a fellow of the American Academy of Arts and Sciences. He is the editor of ***The***

*Quarterly Journal of Economics,* a member of the **Brookings** Panel
on Economic Activity, and a Research Associate of the National Bureau
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**James Tobin,** Professor, Yale University

Mr. Tobin is the Sterling Professor of Economics at Yale University,
where he has been a faculty member since 1950. Since 1955, he has
been a member of the research staff of the Cowles Foundation for
Research in Economics at Yale. From 1961-1962, he served as a
member of the President's Council of Economic Advisers. Dr. Tobin
was president of the Econometric Society in 1958, president of the
American Economic Association in 1971, and president of the Eastern
Economic Association in 1977. He was awarded the American
Economic Association's John Bates Clark Medal in 1955. In 1981,
he received in Stockholm the Prize in Economic Science established
by the Bank of Sweden in memory of Alfred Nobel. A member of
the National Academy of Sciences, Dr. Tobin is the author or editor
of 11 books and more than 200 articles. He has served as a consul-
tant to the Federal Reserve System, the U.S. Treasury, and other
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# The Moderators

**Robert Eisner,** Professor, Northwestern University

Mr. Eisner is the William R. **Kenan** Professor of Economics at
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dent of the Midwest Economic Association and vice president of the
American Economic Association. Dr. Eisner has written many books
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**Lyle Gramley,** Senior Staff Vice President and Chief Economist, Mortgage Bankers Association

Mr. Gramley is the senior staff vice president and chief economist of the Mortgage Bankers Association of America. He joined the Association in 1985. Previously, he was a governor of the Federal Reserve Board. Dr. Grarnley joined the Federal Reserve System in 1955 as a financial economist at the Federal Reserve Bank of Kansas City. In 1962, he joined the faculty of the University of Maryland as associate professor of economics. In 1964, Dr. Gramley became a staff economist at the Federal Reserve Board and later was named director of the Board's Division of Research and Statistics. Dr. Gramley became a member of the President's Council of Economic Advisers in 1977, where he continued until his appointment to the Federal Reserve Board in 1980. Dr. Gramley has authored numerous articles and papers on a wide range of economic topics.

# Introduction

*Stuart E. Weiner*

The stock market crash of 1987 sent shock waves through the world's financial markets. Stock exchanges in New York, Chicago, London, Tokyo, Frankfurt, and a host of other cities suffered major declines. In response, credit markets, commodity markets, and foreign exchange markets registered sharp swings. Not since the Great Depression had the world seen such turmoil in financial markets.

But, dramatic as it was, the crash of 1987 was not the first hint that something was amiss. For several years, there had been a perception that financial market volatility was rising. The crash only served to bolster that perception.

In an effort to learn more about the volatility of markets, the Federal Reserve Bank of Kansas City sponsored a symposium titled "Financial Market Volatility," held at Jackson Hole, Wyoming, August 17-19, 1988. The symposium brought together distinguished academics, industry representatives, and policymakers. Three basic questions were posed. First, what are the sources of financial market volatility? Second, what impact does it have on domestic and international economies? And third, what public policies should be adopted in response? The view of most of the participants at the symposium was that too little is known about the causes and consequences of financial market volatility to have much confidence in any particular policy response.

This article summarizes the papers and commentary presented at

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the symposium. The first section examines the sources of financial
market volatility. The second section explores the consequences of
financial market volatility. The third section evaluates possible policy
responses. The final section summarizes the remarks of an overview
panel.


## Sources of volatility

Robert Shiller and Frederic **Mishkin** led off the symposium with
an examination of the sources of financial market volatility. They
agreed the sources are difficult to identify.

In his paper ''Causes of Changing Financial Market Volatility,''
Robert Shiller noted that recent financial market volatility is not
unique. Throughout the postwar period, stock markets, commodity
markets, bond markets, and foreign exchange markets have recorded
sharp movements. And while it is true these markets exhibited con-
siderable volatility in 1987, volatility does not appear to be trending
upward.

Shiller stressed that very little is known about the determinants
of financial market volatility. Economists and other researchers simply
do not have a proven theory of financial fluctuations. The theories
that do exist are often unconvincing.

As an example, Shiller pointed to the efficient markets explana-
tion of financial market volatility. This theory argues that changes
in financial market prices reflect changes in underlying economic
variables. The data do not appear to support this theory, however,
because financial market volatility shows little relation to the volatility
of such variables as industrial production, short-term interest rates,
or the price level.

Nor do technological innovations provide an adequate explanation
of financial market volatility. Narrowing his focus to the stock market,
Shiller argued that stock index futures, arbitrage program trading,
and portfolio insurance probably did not play a fundamental role in
the October 1987 stock market crash. He noted that the stock market
has been quite volatile in the past, when such innovations did not
exist. Consequently, proposals that would limit or otherwise alter
these innovations are likely to be ineffective or even counterproduc-
tive. These proposals include trading halts or ''circuit breakers,''

increased margin requirements on futures contracts, limitations on index arbitrage, and the abolishment of portfolio insurance.

One explanation of financial market volatility that does have some merit, according to Shiller, is market psychology. Investors sometimes appear to react to each other rather than to some fundamental event, and this process can set into motion large market swings. Shiller contended that market psychology was a key factor behind the stock market crash of 1987. As evidence, he pointed to an investor survey that he took immediately after the crash: The survey suggests that, on the day of the crash, investors were not responding to any specific news item but to the news of the crash itself.

In discussing Shiller's paper, Frederic Mishkin agreed that stock market volatility is difficult to explain. And although he was somewhat skeptical about Shiller's survey evidence, he too believed that factors other than underlying economic fundamentals might have played a role in the stock market crash of 1987.

Mishkin pointed out that most of the recent proposals to reduce stock market volatility would make markets less efficient. Markets would become less liquid, respond more slowly to new information, or reveal less about trading pressures. So even if such proposals reduced volatility—and it is not clear that they would—they would have a detrimental impact on market efficiency.

Mishkin also addressed the role of monetary policy in the face of financial market volatility. Monetary policymakers have two options when confronted with financial market volatility. They can attempt to reduce this volatility by intervening in markets, or they can stay out of the markets but stand ready to function as lender of last resort in the event of a financial crisis. Mishkin indicated a preference for the latter. He cited the Federal Reserve's responses to the Penn Central crisis of 1970 and the stock market crash of 1987 as successful applications of this approach.

## Consequences of volatility

Volatility in financial markets could have far-reaching ramifications. Symposium participants suggested that such volatility could disrupt domestic economic activity, unsettle international asset flows, and place strains on global supervisory efforts.

## *Domestic impact*

In their paper "Financial Factors in Business Fluctuations," Mark Gertler and R. Glenn **Hubbard** examined the impact of financial market fluctuations on business fluctuations. Through what channels, they asked, can financial market disruptions affect the real economy?

Gertler and **Hubbard** noted that economists have long thought there could be an important link between the financial and real sectors of the economy. The Great Depression has always seemed an obvious example. Recently, economists have developed models that examine this link formally. These models usually apply to capital investment, but they can often be applied to consumer spending and hiring decisions as well.

According to these theories, financial market fluctuations can affect the real economy through two channels: fluctuations in the internal net worth of firms and fluctuations in the availability of bank credit. In the first case, a faltering economy or a redistribution of wealth from debtors to creditors lowers the **collateralizable** net worth of firms, making it more difficult for those firms to borrow. Consequently, capital investment declines. In the second case, a financial disruption, such as a bank failure, reduces the flow of bank credit to borrowing firms, also causing investment to decline. In both cases, changes in the financial sector lead to changes in the real sector.

Gertler and **Hubbard** claimed that evidence supports these theories. Econometric studies and historical events strongly suggest that financial market fluctuations can have an impact on the investment of firms, particularly small firms. Consequently, financial market fluctuations can have an impact on the macroeconomy.

Gertler and **Hubbard** also offered an explanation for why the stock market crash of **1987** had such little effect on the economy. While stock prices did show considerable variability in **1987,** they did not show exceptional changes from the beginning of the year to the end of the year. Therefore, to the extent that changes in stock prices mirror changes in firms' collateralizable net worth (which is not directly observable), the net worth of firms did not change substantially for the year as a whole. Consequently, one would not have expected much effect on investment and, hence, on the overall economy. Moreover, it is not clear that changes in stock prices actually mirror changes in a firm's net worth. And finally, Gertler and **Hubbard** noted that

the crash of 1987—unlike the crash of 1929—did not cause a severe restriction of bank credit, because the Federal **Reserve** aggressively stepped in to provide adequate liquidity.

In discussing the Gertler-Hubbard paper, Robert Hall agreed that financial market fluctuations can affect the real economy through the two channels identified by Gertler and **Hubbard**. Hall noted that the model they presented—with its emphasis on the firm's internal net worth—was an example of what he calls the "back-to-the-wall" theory of finance. This theory holds that an effective arrangement for shareholders and managers is for shareholders to receive payments that resemble fixed debt, not variable dividends, and for managers to retain exceptional profits but also be liable for exceptional losses. In this sense, managers' backs are to the wall. Hall asserted that many financial arrangements in the real world take this form. Hall agreed with Gertler and **Hubbard** that the 1987 stock market crash was fundamentally different from the 1929 crash and that its effects were therefore quite different as well.

### *International impact*

Charles Goodhart, in his paper "The International Transmission of Asset Price Volatility," examined the links throughout the world's financial markets. He asked whether financial markets, especially equity markets, have become more interdependent. Specifically, is volatility in one market now more likely to be transmitted to other markets?

**Goodhart** reported that recent research with a colleague suggests that financial markets have not become more interdependent. According to this study, volatilities in various domestic markets showed no tendency over the 1967-to-1985 period to become more highly correlated internationally. Thus, **Goodhart** argued, one must be cautious in adopting the view that financial market interdependence is on the rise.

**Goodhart** stressed, however, that international transmission mechanisms can still play a major role on certain key occasions. And the stock market crash of 1987 appears to have been such an occasion. Research by other colleagues of **Goodhart** suggests that developments before and after the crash are consistent with the view that a normal

''contagion'' relationship among markets turned into a panicky ''cross-infection'' relationship.

**Goodhart** explained that there is nothing abnormal about movements in one stock market being affected by movements in another. Indeed, it is rational for domestic analysts to take their cue partly from movements overseas—in effect, allowing foreign analysts to evaluate foreign news for them. But, **Goodhart** added, such contagion can escalate into cross-infection when domestic analysts ignore fundamentals and pay excessive attention to the prices set by others. Econometric studies of the London, Tokyo, and New York stock markets indicate that contagion did, in fact, escalate after the crash. And this escalation would help explain one of the puzzling features of the crash, the nearly universal decline of stock markets worldwide despite different institutional frameworks and different economic outlooks.

**Goodhart** also presented some results of a study he currently has under way, which examines the relationship between stock market movements and foreign exchange movements. To the extent that foreign exchange movements are a good proxy for fundamental news, incorporating such movements in econometric studies should allow the researcher to get a better handle on contagion and cross-infection effects in stock markets. Unfortunately, Goodhart's preliminary results suggest that foreign exchange movements are not a good proxy for fundamental news. Nevertheless, **Goodhart** has been able to draw two tentative conclusions from his work. First, among the three stock markets, London, Tokyo, and New York, the Tokyo market appears to be the most immune to international developments, while the London market appears to be the most vulnerable. And second, in the wake of the October 1987 crash, the New York market appears to have become more vulnerable.

In commenting on the **Goodhart** paper, Brian Quinn agreed that the London, Tokyo, and New York stock markets are quite different in structure, and thus one would expect differing degrees of international sensitivity. Quinn concurred that the London market is probably the most open of the three.

Quinn emphasized that it is important to determine whether the 1987 crash represented a special, isolated case or the arrival of a new era of heightened volatility. Quinn's view, in contrast to Goodhart's, was that financial markets have become more volatile

and interdependent. As evidence, Quinn pointed to the sweeping, global nature of the **1987** crash and, more narrowly, to the growing importance of foreign activity on the London stock exchange. Quinn stressed that this growing integration of the world's financial markets will put heavy demands on industry supervisors and regulators.

Michael Mussa, in his discussion of the **Goodhart** paper, echoed the view that international transmission was very much in evidence during the stock market crash of **1987.** Fundamentals—a deterioration in the U.S. trade account, a rise in U.S. and other interest rates, and a possible policy dispute between the United States and West Germany—were probably responsible for the initial decline in the U.S. stock market on the morning of October **19.** The 300-point decline over a two-hour period in midday, however, was probably due to psychological factors. Whatever the reasons for the decline, the collapse of the U.S. market fueled collapses in the Tokyo and London markets, and the situation did not improve until the U.S. market stabilized the next day.

### Supervisory impact

In his luncheon address, "Globalization of Financial Markets: International Supervisory and Regulatory Issues," Alexandre **Lamfalussy** examined the role of bank supervisors and securities market supervisors in today's world of highly integrated markets. He offered several comments on the rationale for supervision as well as some thoughts on the October **1987** stock market crash.

Lamfalussy noted that the principal rationale for supervising financial institutions, especially banks, is to ensure stability of the financial system. He also noted that this rationale has been challenged in recent years. Some analysts believe bank supervision is unnecessary to achieve financial stability. They argue that deposit insurance, by preventing bank runs, has made banking crises obsolete. Other analysts believe bank supervision can actually impair financial stability. They argue that **supervision** reduces the efficiency of the banking system and weakens market discipline.

While acknowledging that supervision has its costs, Lamfalussy contended that the benefits of supervision outweigh these costs. In his view, deposit insurance has not eliminated the risk of systemic

runs on banks. Moreover, the risks in banking have been rising as a result of greater competition and major imbalances in the world economy, the latter generating disruptive swings in financial markets. Consequently, Lamfalussy stated, "I do think that in order to preserve the stability of the banking system . . . bank management needs the support of the restraining influence of supervision—even at the cost of some loss of efficiency, whatever the definition of efficiency may be." As to who should do the supervising, Lamfalussy responded, "It is obvious that in today's globalized banking market, supervision has to be as far as possible globalized, both in the geographical and in the inter-industry sense of the term." Lamfalussy pointed to the recent G-10 agreement on bank capital standards as a concrete example of globalized supervision.

Turning to the stock market crash of 1987, Lamfalussy reported that he was quite struck by the speed with which it circled the globe. The crash left no doubt in his mind that the world's financial markets had become more integrated. Lamfalussy was also impressed by the resilience of markets after the crash. Actions by the Federal Reserve and other central banks to provide ample liquidity played a key role in stabilizing markets, Lamfalussy asserted. And finally, Larnfalussy reiterated his call for globalized supervision, noting that the crash "alerted bank supervisors and securities market supervisors to the necessity of cooperating with one another both nationally and internationally."

## Policy response

The recent turmoil in financial markets has generated numerous proposals for reform. Major reforms have been proposed for stock markets and foreign exchange markets. Symposium participants had differing views on the merits of such proposals.

### *Stock market proposals*

In his paper "Policies to Curb Stock Market Volatility," Franklin Edwards examined recent proposals to reduce stock market volatility. He asserted that these efforts are misplaced and counterproductive.

In developing his argument, Edwards first noted that the causes of stock market volatility have not been clearly identified. However, disagreement about its causes has not prevented a proliferation of proposals to reduce this volatility. Proposed remedies include curbs on program trading, portfolio insurance, and index arbitrage; higher margin requirements on index futures and options; and the imposition of trading halts, or circuit breakers, in markets. Edwards sees problems with virtually all of these proposals.

Edwards reported that he is not convinced that program trading, portfolio insurance, and index arbitrage have increased stock market volatility. As a result, he is not convinced that restricting these types of trading would be beneficial. Indeed, Edwards argued, such restrictions could prove costly to society.

Higher margin requirements on index futures and options also make little sense, according to Edwards. Higher margins may reduce speculation in markets, but less speculation would not necessarily lead to less volatility in these markets. Speculation can be stabilizing as well as destabilizing. As an example, Edwards pointed to the October 1987 crash. On October 19 and 20, speculators were net buyers of stocks, not net sellers. Had higher margins been in place at the time, these speculators and their stabilizing influence may well have been absent.

Edwards argued that circuit breakers are also problematic. Under a circuit breaker scheme, trading would be stopped when certain predetermined conditions occurred—for example, when prices fell too low or volume rose too high. The fundamental problem with circuit breakers is that they do not allow markets to adjust fully to new information. If the breaker is activated, the determination of equilibrium prices is interrupted. An additional objection to circuit breakers is that they may foster the kind of panic selling or buying they are intended to prevent. Fearing they may be locked into undesirable positions, traders may buy or sell frantically as the breaker threshold approaches.

Edwards contended that, rather than focusing narrowly on limiting volatility in domestic equity markets, policymakers should direct their attention to the far-reaching developments in international financial markets. The financial world is rapidly becoming a single, global market, and policymakers need to take steps to ensure that this global market is as liquid and efficient as possible.

In commenting on the Edwards paper, Lawrence Summers indicated

he would not rule out remedial intervention in stock markets. He is not convinced that unbridled volatility and a hands-off policy stance yield benefits to the real economy.

Summers identified two types of trading strategies that investors pursue: negative feedback strategies and positive feedback strategies. Under negative feedback strategies, investors buy when the market declines. Under positive feedback strategies, investors sell when the market declines. Because positive feedback strategies are self-reinforcing—that is, declines in the market lead to further declines in the market—they are likely to increase volatility. Thus, Summers argued, in evaluating proposals to reduce stock market volatility, one should consider whether they would discourage positive feedback strategies.

Summers suspects that low margin requirements encourage positive feedback strategies. Indeed, Summers believes that greater liquidity in futures markets in general probably encourages positive feedback strategies more than negative feedback strategies. Thus, Summers reported, he is not averse to making markets less liquid, to "throwing some sand in the wheels."

David Hale, in his discussion of the Edwards paper, suggested the stock market crash of 1987 was something of a blessing. One should not necessarily view it as a problem, he argued, but rather as a solution to other problems. Specifically, 'the crash lowered inflation fears and reduced upward pressure on interest rates, thus strengthening the U.S. economy in 1988. Hale agreed with Edwards that higher margin requirements on futures contracts would probably not have cushioned the crash. And, also like Edwards, Hale asserted that policymakers need to think seriously about how the financial system is evolving. Technology, securitization, and globalization are transforming the financial landscape.

## Foreign exchange market proposals

In their paper "Exchange Rate Volatility and Misalignment: Evaluating Some Proposals for Reform," Jacob Frenkel and Morris Goldstein examined recent proposals for reducing volatility and misalignment of exchange rates. These proposals include target zones, restrictions on international capital flows, and enhanced international

coordination. Frenkel and Goldstein did not advocate one proposal over the others, but rather highlighted the relevant issues involved in all three.

Frenkel and Goldstein stressed that there is an important distinction between exchange rate volatility and exchange rate misalignment. Exchange rate volatility refers to short-term fluctuations of exchange rates around their long-term trends. Exchange rate misalignment refers to significant deviations in exchange rates from their long-term equilibrium levels. Some analysts believe exchange rates have been both excessively volatile and misaligned in recent years.

Frenkel and Goldstein noted that exchange rate volatility has been much higher in the floating-rate period than in the Bretton Woods period. Moreover, this volatility has shown no tendency to subside as the floating-rate period has worn on. However, in the post-Bretton Woods era, exchange rates have been less volatile than interest rates, stock prices, and commodity prices. Are today's exchange rates excessively volatile? Are they seriously misaligned? Frenkel and Goldstein asserted that the answers are not obvious.

Turning their focus to proposed remedies, Frenkel and Goldstein first examined target zones. Under a system of target zones, nations agree to try to keep their currencies within certain bands. The width of the bands, the frequency with which the bands are revised, and the authorities' commitment to the bands are crucial features of a target-zone agreement. The principal advantage of target zones is they may force discipline on a nation's fiscal policy. Had target zones been in place in the early 1980s, for example, the United States might have been dissuaded from running huge federal budget deficits for fear of running up the value of the dollar. The principal disadvantage of target zones is they may force monetary policy to pursue conflicting goals—for example, fighting inflation *and* discouraging an appreciating currency.

Restricting international capital flows, either directly or through taxation, is another proposal for reducing exchange rate volatility. Such proposals are based on the notion that speculation in exchange markets causes excessive volatility. The problem with this view, according to Frenkel and Goldstein, is that speculation can be stabilizing as well as destabilizing. So capital restrictions could be counterproductive. In addition, there is the possibility of "regulatory arbitrage," of capital restrictions in one country simply leading to more

speculation and more volatility in another country.

Enhanced international coordination is a third proposal for reducing exchange rate volatility. Related to (and perhaps incorporating) target zones, enhanced coordination would require major countries to modify their macroeconomic policies more willingly to ensure consistent policies across countries. As Frenkel and Goldstein pointed out, several questions arise in considering coordination proposals. For example, should coordination be conducted continuously or only at times of crisis? How many nations should be involved? And are the gains from enhanced coordination ultimately worth the effort?

In discussing the Frenkel-Goldstein paper, Paul Krugman contended that exchange rates are excessively volatile. He believes financial markets in general, and foreign exchange markets in particular, are often irrational in the sense that trading is not always based on fundamentals. And in the case of exchange rates, at least, the resulting volatility is deleterious because it can impair the ability of firms to make sound decisions. Because such firms are unable to distinguish fundamental developments from speculative bubbles, their location and sourcing decisions suffer.

Krugman advocated a return to some type of fixed exchange rate system. He argued that such systems have worked effectively in the past. Krugman was less enthusiastic about policy coordination, feeling the prospects are not as encouraging.

Robert Hormats, in his discussion of the Frenkel-Goldstein paper, argued that target zones and policy coordination could be effective in reducing market volatility. Hormats believes foreign exchange markets in recent years have been driven by expectations. And expectations of central bank policies have been particularly important. According to Hormats, if the leading nations of the world decided to move to a "hard" target-zone system, one with narrow and infrequently revised currency bands, central bank policies would become even more critical. In particular, one or more central banks would have to emerge—as the Bundesbank has emerged in the European Monetary System—as the anchor around which other central banks could converge.

## Panel overview

Three participants—Louis Margolis, Robert Roosa, and James

Tobin—provided an overview of the issues raised at the symposium. Margolis and Roosa focused on the stock market and foreign exchange market, respectively, while Tobin addressed his comments more generally.

Louis Margolis contended that U.S. equity markets are in the midst of an evolutionary process. That process began in 1975, when deregulation eliminated fixed commission rates on secondary market trading. This switch to fully negotiated rates has squeezed the profits of the commission brokerage business, especially the profits of specialists and block traders. It is no coincidence, Margolis asserted, that full-service firms have shifted resources away from secondary market trading and toward the more profitable areas of new security issuance, mergers and acquisition, and leveraged buyouts.

Margolis continued that, with their profit margins reduced, specialists and block traders can no longer provide adequate liquidity to the market in times of stress. They simply do not have the financial resources to make bids that would stabilize the market. At old commission levels they had the necessary funds to provide liquidity, but at current levels they do not. The October 1987 crash is a case in point. Insufficient liquidity was one reason why the crash was so abrupt.

Margolis emphasized, however, that equity markets are developing alternative sources of liquidity. These sources include options, futures, electronic screen-based trading, and portfolio trading. In other words, equity markets are being transformed. The appropriate policy response, according to Margolis, is to encourage this transformation, to remove any obstacles that could trigger another crash.

Robert Roosa, in his remarks, suggested that the volatility of today's financial markets can be traced to two basic sources. The first is the unprecedented integration of these markets and the related appearance of new instruments and new trading techniques. This integration has permitted individual and institutional investors to respond more quickly and more effectively to profit opportunities. The second source of today's volatility is long-term, underlying cycles in the real economy. These cycles cause prices of financial assets, particularly foreign exchange rates, to follow sustained paths for a time, then to stall, then suddenly to decline or rise to new sustained paths. The result is significant asset price volatility.

Roosa believes that growth with stability is the proper objective

of economic policy. Accordingly, he strongly endorses the recent efforts by the G-5 countries (United States, Japan, West Germany, Great Britain, France) to achieve that stability. Roosa reported that he has been quite encouraged by the coordination the G-5 countries have displayed since the Plaza Agreement of September 1985. In particular, he has been encouraged by the system of target zones that has emerged. These target zones represent a step back toward fixed exchange rates, which Roosa believes were partially responsible for the ''remarkable'' worldwide growth of the Bretton Woods era. The world economy has pressing imbalances, Roosa argued, and enhanced coordination among the world's leading countries appears a promising way to address those imbalances.

James Tobin, in his comments, argued that financial markets should be made less liquid. Asset prices are not driven solely by fundamentals—indeed, prices often appear to be driven by sheer speculation. Such speculation, Tobin asserted, wastes productive resources, especially human resources.

Tobin emphasized that economists and other researchers do not have a good theory of volatility. For example, it is not clear how volatility should be measured. Should it be measured over a day, over a month, or over a year? Nor is it clear how volatility is related to volume. Does volatility rise when transactions volume rises? Or does the opposite occur? Researchers do not know.

One thing that Tobin is confident about is that asset prices do not always reflect fundamentals. Herd behavior—in which traders react to each other rather than to some fundamental development—is responsible for much market movement, Tobin claimed. Related to this is the preoccupation of traders with seemingly minor news stories, statistical releases, and policymaker statements. It is hard to believe, Tobin asserted, that all of these items represent fundamental news.

To reduce financial market volatility, Tobin advocated a tax on the volume of transactions in stock markets, foreign exchange markets, and perhaps other markets. The purpose of this tax would be to discourage short-term speculation and encourage portfolio decisions based on long-term fundamentals. A tax of 1 percent, on both buying and selling, might be reasonable. In addition, Tobin would change the capital gains tax, introducing a sliding scale of tax rates linked to holding periods. For example, the capital gain on a financial asset held less than one year would be subject to full taxation,

while the gain on an asset held 30 years would be subject to no taxation. Like the transactions tax, this measure would presumably lengthen the horizon for portfolio decisions. It is **Tobin's** view that financial markets would benefit from such "sand in the wheels."

The stock market crash of **1987** emphasized how turbulent financial markets can become. It also provided the impetus for much new research on financial market volatility. The issues have proved to be quite complex.

The experts brought together at the Federal **Reserve** Bank of Kansas City's **1988** symposium concurred that financial market volatility is not well understood. Symposium participants did not reach a consensus on the sources of volatility. Nor did they reach a consensus on the consequences of volatility. A point they did agree on was that financial market volatility largely remains a mystery. And in light of this, most participants felt policymakers should proceed very cautiously before adopting any particular policy response.

# Causes of Changing Financial Market Volatility

*Robert J. Shiller*

Financial market prices, prices of stocks, bonds, foreign exchange, and other investment assets, have shown striking changes in volatility through time. For each of these **kinds** of assets there are years when prices show enormous unpredictable movements from day to day or month to month, and there are years of stable, uneventful markets. Why does volatility change from year to year, and what (if anything) should be done about it by government regulators and self-regulatory organizations? The **striking** increase in stock market volatility since around the time of the stock market crash, October 19, 1987, makes these questions seem especially relevant now. Many people in the investing public are upset about the increased volatility, and are writing letters to congressmen, agency heads, and industry leaders to do something.

The problem for those who formulate policy is that very little is known about the causes of changes in volatility of financial prices. This paper tries'to state what we know concretely about causes of changes in financial market volatility, discusses some of my own research on causes of the stock market crash of 1987, and presents a view of volatility in financial markets that is relevant to policy decisions to deal with the volatility.

## Changes in volatility through time

### The stock market

The current episode of stock market volatility is hardly unique.

There have been repeated episodes of high stock market volatility throughout stock market history.

The stock market drop on October 19, 1987 was the biggest one-day price change ever in percentage terms. The Dow Jones Industrial Average fell 22.6 percent in one day. The drop was almost twice as big as the next biggest one-day drop, on October 28, 1929. However, the overall pattern of volatility in 1987 and 1988 is not so unique in history.'

Chart 1 shows the changing volatility of stock prices, as measured by the standard deviation of percentage changes in the nominal Standard and Poor Composite Stock Price Index, from 1871 to 1987.

## Chart 1

## Volatility of Stock Market Prices, 1871–1987
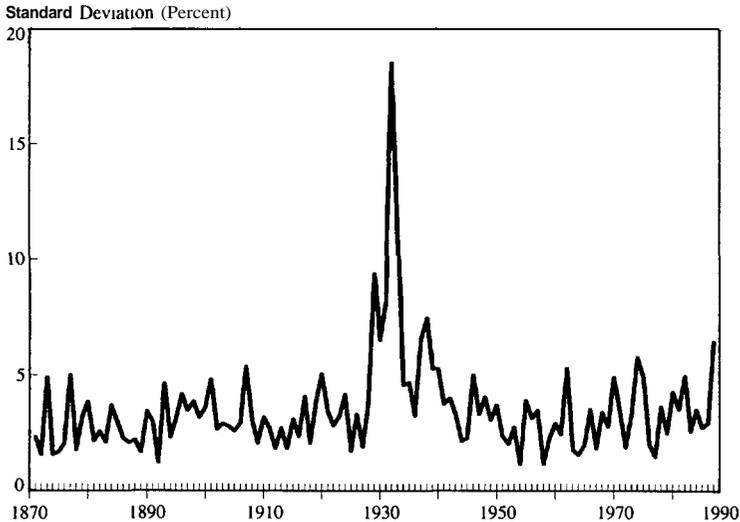
Standard Deviation (Percent)



Notes: For each year, the standard deviation of month to month percentage changes is shown for the Standard and Poor Composite Index. The estimated standard deviation is based on twelve monthly observations for each year. See Appendix for source of data.

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**1** Note that the *two-day* drop, October 28-29, 1929, is still the biggest two-day drop (as measured by the Dow Jones Industrial Average) in history. The biggest month-to-month percentage change in the monthly Standard and Poor Composite Index was between July and August of 1932, when the index increased 50.3 percent. This price increase, which is almost twice as big in absolute value as the biggest month-to-month price drop ever, seems to be largely forgotten. The concentration of attention on 1987 as a unique year in stock market history is to some extent an artifact of the one-day interval chosen.

The figure shown for each year is the standard deviation (estimated from 12 observations) of the 12 monthly stock price changes for the year.[2] Note that the volatility of stock price changes was higher in the years 1929 through 1933 and 1937 and 1938 than it was in 1987. Note also that there were many other years in which volatility was almost as high as in 1987. The tendency for discussion of volatility to single out the record-breaking one-day stock market drop on October 19, 1987 obscures the real dimensions of volatility over all the year.

## Other speculative markets

As shown in Chart 2, other speculative markets show substantial changes in volatility through time, and these changes are largely unrelated to the changes in stock price volatility.

An index of raw industrial commodity prices shows very high volatility at the beginning of the sample, low volatility through most of the 1950s and 1960s, and higher volatility in the late 1970s and 1980s. This overall pattern does not match up well at all with the pattern of volatility of stock prices.

The dollar-pound exchange rate was very stable in the period of fixed exchange rates, except for a couple of large movements at times of devaluations of the pound (from $4.03 to $2.80 in 1949 and from $2.80 to $2.40 in 1967). If one takes account of the devaluations, there is not any striking change in overall volatility over the sample. There has been a gradual uptrend in volatility since the period of floating rates began in 1971, with short-run variations that do not correspond to those in stock prices.

Long-term bond yields were extremely variable around the time of the Federal Reserve's new operating procedures, instituted in 1979 and abandoned around 1982. This period of high volatility does not correspond to periods of really high volatility in stock prices or exchange rates, though commodity prices did show high volatility then.

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[2] Data starting 1918 are monthly averages of daily closing prices; before 1918 are averages across stocks of midpoint and high and low price for each stock. The standard deviations shown are therefore downward biased measures of the standard deviation of the point-to-point price change. For a Wiener process, the standard deviation of the unit interval change in the unit average is 0.816 (the square root of $\frac{2}{3}$) times the standard deviation of the unit interval change in the Wiener process.

# Chart 2

## Volatility in Various Speculative Markets, 1948-1987
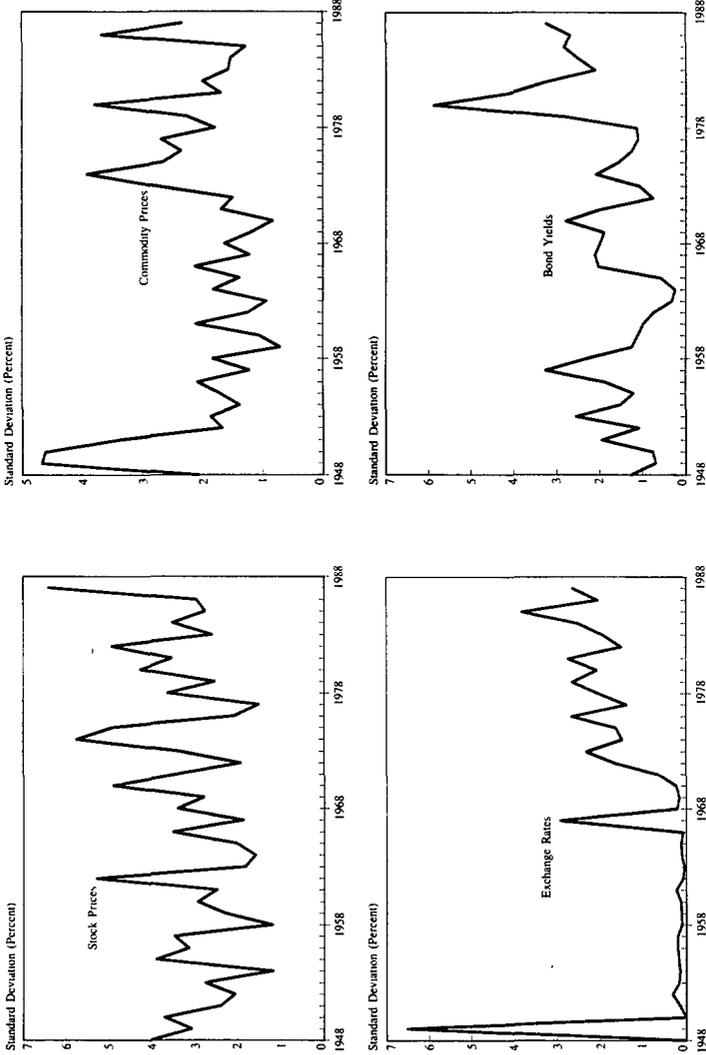


Notes: For each year, the standard deviation of month to month percentage changes is shown for the following data series: stock prices (as in Chart 1), commodity prices (raw industrials), exchange rate (US/UK), and long-term bond yields (Moody's Aaa). The estimated standard deviation is based on twelve monthly observations for each year. See Appendix for source of data.

## Background economic variables

It would be natural to expect that the changes in volatility through time in speculative markets would correspond to changes in volatility in real nonfinancial variables. Efficient markets theory would lead us to suspect this, since the theory says that prices in speculative markets are driven by fundamentals. But even other theories, let us say psychological theories, would tend to suggest that there is a relation between volatility in speculative markets and volatility of other macroeconomic variables.

*G.* William Schwert (1987) has done a time series analysis of the volatility of U.S. stock prices 1859-1986 and compared this volatility through time with other macroeconomic variables.[3] He concluded that stock volatility is not "closely related to the volatility of other economic variables," and referred to this conclusion as a "puzzle." He found that the volatility of inflation, money growth, industrial production and business failures is high during war periods, yet the volatility of stock returns is not particularly high during those periods. He pointed out that "there were many 'financial crises' or 'bank panics' during the 19th century in the U.S. that seem to be associated with very high and volatile short-term interest rates, yet there is no obvious effect on the level of stock price volatility."[4]

Standard deviations of percentage changes in industrial production, short-term interest rates, the price level and housing starts are plotted in Chart **3.** The patterns of changing volatility show little relation to the pattern of volatility in the speculative markets, except for the fact that there is some correspondence between the volatilities of short-term interest rates and long-term interest rates.[5]

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[3] See also Officer (1973).

[4] Schwert (1987), p. 27. Shapiro (1989) noted the lack of change in volatility between pre- and post-depression samples, and inferred that the volatlity of the aggregate economy must not have changed.

[5] The sharp spike in the volatility of the inflation rate in 1974 is due to the dismantling of price controls in early 1974, as well as an oil price shock then. The sharp spike in the volatility of short-term interest rates in 1958 is due to the fact that short rates dropped precipitously in the recession to very low levels: 1.50 percent in July. Then an increase to 1.96 percent in August marked a 31 percent increase in interest rates in one month.

# Chart 3

## Volatility of Background Economic Variables, 1948-1987
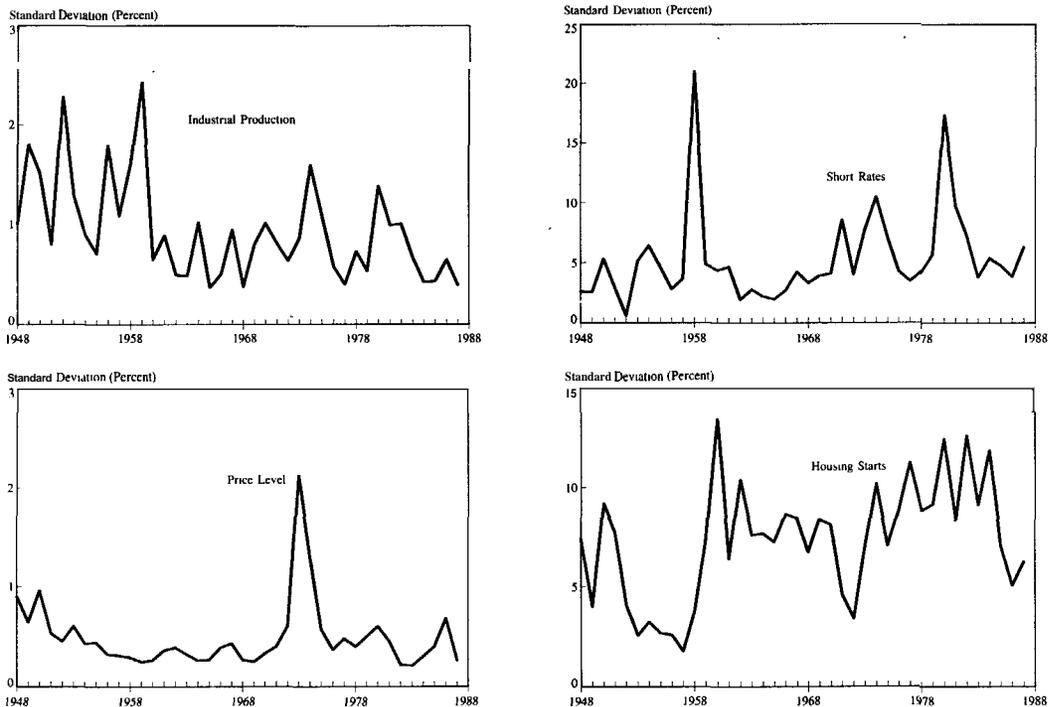


Notes: For each year, the standard deviation of month to month percentage changes is shown for the following data series: industrial production, short term interest rates (commercial paper), price level (PPI), and housing starts. The estimated standard deviation is based on twelve monthly observations for each year. See Appendix for source of data.

*Robert J. Shiller*

## *Interpretation*

Two striking facts emerge from the plots. First, volatility seems to change dramatically through time for typical financial and macroeconomic variables. Second, there seem to be as many patterns of volatility changes as there are variables explored here.

Volatility shows no reliable **uptrend** through time. It is true that for all four speculative markets represented in Chart 2, volatility is higher in 1987 than it was on average over 1952-87. (The standard deviations in Chart 2 were 104 percent higher for stocks, 24 percent higher for commodities, 129 percent higher for the exchange rate, and 66 percent higher for bonds.) But there has been so much **year**-to-year noise that this does not signal an **uptrend**. The background economic variables did not show high volatility in 1987.

## Proposals to deal with high volatility

Volatility in speculative markets seems to be viewed by the public as a legitimate concern of government regulators, and so any increase in volatility in markets tends to be accompanied by public demands on regulators. Thus, the increased volatility of exchange rates after the freeing of the dollar generated proposals to return to fixed exchange rates, and the increase in volatility in interest rates following the 1979 new operating procedures of the Federal Reserve produced demands that they stabilize interest rates. However, at the present time, with the vivid event of the stock market crash of 1987 on everyone's minds, most reform proposals concern the stock market, and I will concentrate attention on it here.

## *Influential proposals*

Two proposals have been the centerpiece of recent discussion: trading halts and increased margin requirements on futures contracts. Neither of these proposals is likely to have a big effect on volatility.

*Trading halts.* The Brady **Commission** (1988) proposal most relevant to reducing volatility was its proposed "circuit breakers" that could stop trading in crisis times. The Reagan-appointed Working Group (1988) also approved such trading halts, but on a limited basis. All that group proposed relevant to volatility reduction was a **one**-

hour trading halt after a big market drop, **250** or **400** points on the Dow. These trading halts would hardly ever be invoked; the crash, itself, last October would be the only time in history that these halts would have been triggered.

*Margins on futures contracts.* It has long been noted that the advent of futures markets in effect provided a loophole around the margin requirements imposed by the **1934** Securities Exchange Act, and many people would like to see the margins on futures regulated by a government agency and, presumably, increased. David Ruder, Securities and Exchange Commission commissioner, was the dissenting member of the Working Group who wished to see margin requirements raised on stock index futures. But he is proposing only modest increases in margin requirements, to the **20** to **25** percent range. The Intermarket Coordination Act of 1988 introduced by Senator William Proxmire sets up an agency that would manage such margin requirement changes. Another proposed bill, the Securities Futures Market Credit Protection Act, would have the Federal Reserve impose margin requirements on stock index futures and options. Although neither the Brady Commission nor the bills in Congress explicitly calls for higher margin requirements on futures contracts, but rather the coordination of margin requirements across markets; arguments for the proposals make sense only if the intention is to raise margin requirements on futures contracts.

## More radical proposals

Active use of margin requirements to stabilize markets has also been proposed. David Ruder, in his March **31** testimony before the Senate Banking Committee, said that "the Commission stated that the costs or benefits of more limited margin changes—such as increasing initial margin requirements in times of extreme downward price volatility for futures sales only—could be considered."[6] This is a very radical proposal, in that it would put the SEC or other agency in the business of actively stabilizing the stock market.

There are other proposals to deal with the large volatility in stock markets. The most radical of these is the abolition of futures markets

6 Ruder (1988), p. 22.

altogether. Donald **Regan** strongly made this proposal to the Senate Banking Committee May 11, 1988. Others are seen as supporting such a proposal. Louis Lowenstein, professor of law at Columbia University, said, "Futures markets are worse than useless. They distort the process by which capital markets are supposed to allocate resources to their most productive uses. They divert attention from the business fundamentals that are the market's proper concern."[7] James **Tobin** said (earlier) of such futures contracts, "The country cannot afford all the markets that enthusiasts may dream **up**."[8] The abolition of futures markets is probably not a viable proposal, as closing down a major industry is unlikely to be achieved for such a dubious benefit.

Rather than abolish futures markets, one might try to cut these markets off from the cash markets by abolishing the arbitrage between the two markets. The "collar" imposed by the New York Stock Exchange, which closes down the DOT system for index arbitrage when the market makes a 50-point move, is a step in this direction. A number of major firms have dropped index arbitrage at customer insistence. Proposals to inhibit index arbitrage are inherently weak. It may be possible to make index arbitrage more difficult, and so the prices on the futures and cash market may be less closely linked, but there will undoubtedly be someone who will try to arbitrage the markets so long as markets are free.

Portfolio insurance was blamed by the Brady Commission as an important contributor to the crash. Portfolio insurance is too **ill-defined** a scheme to be effectively abolished. If one tried to do it, it might only be driven underground, so to **speak**.[9] Portfolio insurance is only a formalization of stop-loss behaviors already in evidence long ago. Portfolio insurance is a sort of fad that increased stop-loss behavior. But stop-loss behavior is in the mind of traders, and not something that can be regulated so long as people are 'not barred from selling.

Other proposals are to discourage big investors from trading. The Brady Commission emphasized that the crash was caused by a few

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[7] **Lowenstein (1988), p. 11.**

[8] J. Tobin (1984), p. 10.

[9] **Of course, portfolio insurance has shown signs of drying up on its own in the aftermath of the crash.**

big investors. Following up on this, Roberta S. Karmel, partner of
Kelley, Drye and Warren, in a New York *Times* Op-Ed piece May
18, 1988, blaming the big traders, proposed declaring index arbitrage
and portfolio insurance imprudent investment strategies, or taxing
short-term profits of tax-exempt, institutions.

## The nature of the evidence that the proposals might help

There is a remarkable dearth of solid research about the effec-
tiveness of these proposals to reduce the large stock market volatil-
ity we have seen lately. All the proposed measures seem to have going
for them is a rough sort of intuitive plausibility. For all we know,
adopting them might even increase, not decrease, volatility, or reduce
economic efficiency rather than enhance it.

The problem in evaluating these proposals is most importantly the
absence of an agreed-upon theory of financial fluctuations. Lacking
this and recognizing that any controlled experiment would likely take
centuries to provide reliable evidence—we cannot know the effects
of the proposals on stock market volatility.

What can we say objectively about these proposals? How can we
evaluate, for example, whether margin requirements are effective?
One way that has been used in the literature is to regress volatility
of stock prices on the level of margin requirements. Such regres-
sions explaining stock price volatility are of some possible value,
but will not resolve whether extending high margin requirements to
futures contracts will now reduce the volatility. The margin require-
ment changes may have been in response to changes in other variables,
or otherwise correlated with them. Hardouvelis (1988), who has
undertaken a careful study by regression methods using U.S. data
since 1931, claims to have found that margin requirements help reduce
volatility.[10] He attempted to correct for the reverse causation possibil-

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[10] Official margin requirements were, of course, zero in the part of his sample from 1931
through most of 1934, before the 1934 Securities Exchange Act took effect, and volatility
in the stock market was extremely high then. Thus, he finds a spurious "effect" of margin
requirements on volatility, when in fact, causality runs from volatility to margin requirements.
When he truncates his sample to start in 1935, he finds margin requirements are just barely
significant at the 5 percent level. His significance levels are perhaps unreliable, since he cor-
rects for only the 12-month moving average induced autocorrelation of residuals, not the ap-
parent year-to-year autocorrelation that extends further.

ity by including lagged volatility measures and other variables in the regression, on the theory that margin requirements may be set in response to volatility. Including lagged volatility means that he is no longer exploring a link between volatility and margin requirements, but between an incremental unexplained volatility and margin requirements.[11] There is also always the possibility in such multiple regression contexts that the margin requirement enters the regression only because it proxies for something else. For example, Hardouvelis found that the Fed tends to impose high margin requirements when the stock market is high relative to its average value over the past five years. He argued that since high stock prices are associated with low volatility, the apparent effect of margin requirements may be spurious. He attempted to deal with this problem by including stock prices relative to trend in the regressions explaining volatility. But of course if there is any error in his measure of the variables entering the Fed reaction function, the estimation problem may yet persist. If we don't know what enters the Fed reaction function, we have a fundamental estimation problem.

Even if margin requirements do reduce volatility, they may do so in a bad way, by making markets less efficient and slower to respond to genuine information.

Similar difficulties attend efforts to demonstrate the effectiveness of trading halts in reducing volatility. In an effort to evaluate these measures, some scholars have compared the experience of countries that have imposed trading halts with those that do not. For example, the Hong Kong stock market was closed for days in 1987, **and** the drop in stock prices there was slightly greater than in the U.S. However, in considering the effects of world-wide crashes like that in 1987, closing a regional market may not have much significance. People in Hong Kong were probably watching the U.S. market. Such data does little for us in evaluating the effects of a major change in U.S. stock market policy.

In any event, major stock crashes are rare events, whose genesis may well be qualitatively different from normal day-to-day moves in stock prices. There just aren't enough data to tell reliably the effects

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[11] **With a lagged dependent variable in the regression, a recursive substitution argument shows that he is relating the current level of volatility to long distributed lags of margin requirements and other variables.**

of the proposed measures at times of market crashes. More generally, the effects of the measures may depend qualitatively on how people perceive the measures, e.g., what kind of policy stance they think that they signal or what people think the reaction of other people will be to the measures. The effectiveness of the measures may change from time to time if these perceptions change.

As for the proposals to inhibit trading by big traders, the Brady Commission did document the amount of concentration of sales in the hands of big investors. But this concentration was not overwhelming. Moreover, any such statistics do not tell us who is at fault in causing the market crash. The question is why no one stepped in to buy when the market was dropping fast, and why no one bid the price of stocks back up to their former levels within months after the crash. Blame cannot be pinned on any one group.

## The efficient markets hypothesis

The only people who really sound like they might know what they're talking about regarding the proposals are those in the efficient markets camp who oppose the proposals. The efficient markets hypothesis, which has been very influential for the last couple decades, asserts that prices "efficiently incorporate all public information" about fundamentals, fundamentals being economic variables that ought by rational calculation to affect securities prices. If prices reflect such genuine information, then the increased volatility we've seen is for good reason, a lot of important information flowing into the market, and ought not to be tampered with.

The efficient markets theorists have long sounded persuasive; there are superficially appealing arguments for the notion and a lot of scholarly statistical work that claims to support it. There is, of course, an important element of truth to the efficient markets hypothesis: it is not easy to get rich quickly, and so any trading rule that is proposed to do this should be eyed with a lot of suspicion. But we must be careful not to overgeneralize from this truth. Suppose that the volatility of stock market prices does vary through time for reasons unrelated to any economic fundamentals. This need not imply that there is a trading rule that will produce rapid wealth with little risk, so that the rule might well be overlooked by many people. One may

indeed find it difficult to even demonstrate at conventional significance levels the statistical significance of the departure from market efficiency.[12]

## Recent criticisms of the efficient markets hypothesis

Beginning with papers by LeRoy and Porter (1981) and Shiller (1981), a literature has emerged arguing that financial markets may be too volatile to be accounted for in terms of efficient markets hypothesis. These original papers have been subjected to a lot of criticism (notably by Flavin in 1983, Kleidon in 1986, and Marsh and Merton in 1986). A second generation literature has grown up that is not vulnerable to these initial criticisms.[13]

The excess volatility discerned in these papers has more recently been given a new name by Fama and French (1988). They call it the forecastability of long-period returns. Poterba and Summers (1987) have shown a positive correlation of returns over short time intervals, and negative over long intervals, another characterization of excess volatility of prices.

These papers are rejections of specific efficient markets models, and do not necessarily call into question the general paradigm of market efficiency. But since they do test major specific efficient markets models that people presumed had a lot of evidence going for them, it is certainly appropriate to consider also some non-efficient markets alternatives.

## Causes of the current period of high stock market volatility

Much of the public discussion of the current period of high volatility has focused on factors that are unique to the present time, as if the present volatility were unprecedented in history. The premise of many of the recent studies—that we should look only at current events or even just at the time of the crash around October 19, 1987—is faulty.

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[12] See Shiller (1979) and (1984), Perron and Shiller (1985) and Summers (1986).

[13] See Campbell and Shiller (1988 a,b); Mankiw, Romer and Shapiro (1986); Scott (1985); and West (1987).

Much of the discussion has, in fact, been focused on technological innovations, inventions that altered the environment that one faces in financial markets. There are three such inventions commonly singled out: stock index futures markets, program trading to arbitrage the cash and futures markets, and portfolio insurance.

The stock index futures market, the Standard and Poor Composite Index Futures contract, was established in 1982, and has grown rapidly since. The dollar value of the daily volume on the Standard and Poor Composite Index Futures exceeds the dollar volume of stocks traded on the New York Stock Exchange on most days.

Program trading for index arbitrage links together the stock index futures markets and the cash markets. It is hard to see that this trading should itself be blamed for stock market volatility. Given that we have two different markets for much the same product, someone will arbitrage them to guarantee that one price reigns.

A third factor is portfolio insurance. Portfolio insurance was effectively invented in 1972 when Black and Scholes circulated the first draft of their paper on options pricing (1973). That paper made it very clear how to do portfolio insurance, although the concept was not clearly delineated until Hayne Leland's article (1980). The growth of portfolio insurance took off in the mid-1980s. I argued elsewhere (1988) that the growth of portfolio insurance ought not to be regarded as the normal consequence of a technological innovation, coming as it did so late after the invention. Rather, the popularity of portfolio insurance should be regarded as an investor fad like many other investor fads. It may also be regarded as a symptom of nervousness about the "overpricing" of the market that emerged in the mid-1980s.

All of the above technological innovations probably played a role in the volatility of stock markets in 1987-88, but probably not primarily as innovations per se. Rather, it was the perception that these innovations were influencing markets that contributed substantially to the volatility.

## Survey evidence

I have done a substantial amount of survey research (some jointly with Karl Case, William **Feltus,** and John Pound) to understand investor behavior.

Right after the stock market crash of October 19, 1987, I sent out

questionnaires **asking** people what they were thinking on that day. I sent out 1,000 questionnaires to institutional investors and received 284 responses. I sent out 2,000 questionnaires to individual investors and received 605 responses.

I interpret my survey results (1987) about the crash on October 19 as indicating that no news event, other than the news of the crash itself, precipitated the crash. Rather, the dynamics of stock market prices seem to have more to do with the internal dynamics of investor thinking, and the medium of communications among large groups of investors is price. In a period when there is a widespread opinion that the market is under or overpriced, investors are standing ready to sell. It takes only a nudge in prices, something to get them reacting, to set off a major market move.

The story told by investors, themselves, on days of big market moves does not bear a very strong resemblance to the story that seems to be on the minds of many advocates of the proposals to reduce volatility. The latter story seems to be one that attributes unusual stock price movements to a small group of investors who are gamblers or risk lovers, and who are vulnerable to sharp swings of optimism and pessimism, euphoria or panic. Discourage them by margin requirements from **taking** large positions, and we will quiet down the market. Close markets for a while when they are panicking and their composure may return. But it is not clear that the proximate causes of sudden moves of the stock market are the accompanying sudden mood swings among investors. The suddenness is certainly largely due to the fact that investors are trying to outsmart each other, trying to be the first to move. Those investors whose behavior would not be influenced by margin requirements or market closings are perhaps just as likely to act suddenly at a time of a big market.move.

Decisions to buy or sell do not seem to be related very strongly to feelings that the market is over or underpriced. In my questionnaire survey of investors undertaken right after the crash of October 19, 1987, I found that about 90 percent of investors who bought or sold on that day, both institutional and individuals, reported thinking the market was overpriced right before the crash. Decisions to buy or sell on October 19 or on preceding days bore very little relation to opinions about over or underpricing of the market.

Professional investors do seem to be using futures markets for speculative purposes. A poll of pension fund managers'conducted

by *Institutional Investor* magazine **(1985)** asked them why they trade in stock index futures markets. The most common answer was ''as a quick and low-cost way to adjust equity exposure in expectation of big market moves,'' chosen by **55.6** percent of respondents. Hedging or arbitrage played a much smaller role in their activity. Note the wording: ''in expectation o f ' means that they are trying to beat the market and this means they are speculating.

## Interpretation

I interpret my survey results about the crash on October **19** as indicating that no news event, other than the news of the crash itself, precipitated the crash. Rather, the dynamics of stock market prices then seemed to have more to do with the internal dynamics of investor thinking. Of course, if people did not communicate, then their changes in thought patterns would not coincide in time. But people do communicate a great deal. There are both a fast mode of investor communication and a slow mode. The fast mode of communications among large groups of investors is through price. Some investors react very quickly to price changes. The slow mode, which tends to set patterns of reaction rather than cause behavior on a particular hour of the day, is interpersonal conversation and the communications media.

The reason that a big stock price drop occurred on Monday, October 19, and not on some other date is likely to be due to the reaction of U.S. investors to the price decline on the previous Friday, October **16.** This preceding price decline was, itself, likely to be a reaction to a price decline on Thursday, October **15,** which was a reaction to a price decline on Wednesday, October **14.** The interesting question is why the reactions tended to build at this time, rather than decline in intensity. The answer to this question may be phrased in terms of the mental set of investors then or to a chance occurrence of other disturbances which caused unusual attention to be drawn to the price declines. One thing is certain: the price declines became a media event that commanded widespread public attention, and part of the answer to this question must concern the behavior of managers of news media.

It is, of course, risky to generalize from a study of the stock market crash to conclusions about the variability of stocks through time. It is also wrong to generalize from research about the aggregate stock

market to reach the conclusion that prices of individual stocks are largely influenced by noise; news about fundamentals and information-based changes in predictions for future earnings probably do dominate price movements for certain individual stocks or other individual financial assets. More research combining notions of market efficiency with behavioral work is needed.

## Implications for policy

The above analysis of recent stock market volatility might suggest, since market psychology is taken to play an important role in this volatility, that some policy intervention by the government or the self-regulatory organizations might be a good thing. However, the same analysis does not allow for any certainty about the probable effects of policy. Policies intended to reduce volatility might actually increase volatility; policies intended to improve economic efficiency might hinder it.

Margin requirements on stock index futures discourage certain groups of people equally from buying or selling in futures markets, namely those people who find it difficult to put up margin. It's not clear how these people differ from others who are undeterred by margin requirements. The simple idea behind these margin requirement proposals is that reckless speculators, who might have fueled the bull market just prior to the October 1987 crash, are those who will be deterred from buying. But other effects are possible, and I have not been able to find any objective research to disentangle the possible effects. Imposing margin requirements on futures contracts might also deter others from offsetting the effects of reckless speculators.

The Committee of Inquiry appointed by the Chicago Mercantile Exchange to study the crash asserted in its Preliminary Report that comments about higher margin requirements on index futures would have made the October 19 crash worse. The report said,

> The largest amount of selling, as we have seen, was by pension funds, trusts, and other institutional portfolio holders **. . .** these institutions do not operate with leverage and could generally meet even very large margin

requirements. Increased margins would affect primarily
the individual speculative accounts and these . . . were
actually net buyers by and large on both days (October
19 and 20).[14]

Whether or not this analysis of the effects margin requirements would
have had then is convincing, it does show the difficulty of the ques-
tions involved in judging what the effects of increased margin
requirements would be.

Putting higher margin requirements on stock index futures means
that the speculation may be less "quick and low cost". This might
mean that the market would tend to be stabilized. But it could work
the other way. Futures markets are also used in order to prevent other
activities of portfolio managers from affecting their overall equity
position. In the *Institutional Investor* poll, *14.8* percent of respondents
reported that they use the futures markets "as an occasional hedge
against active managers' portfolios," 29.6 percent "as a hedge against
equity holdings that have to be liquidated in changing overall asset
mix," and 18.5 percent "to maintain equity exposure during transi-
tions, while new managers are being selected or getting their cash
allocations invested." These investors are using stock index futures
to *offset* the effects of their decisions on their overall demand for
equities. Making it harder for them to do this would tend to exacer-
bate market volatility. Which of these effects will predominate if
higher margins on index futures are instituted? No one knows.

In fact, it seems that the kind of judgment error that a "bull market"
like that of the late 1920s or the late 1950s-early 1960s represents
may not be just to expect that the aggregate market will continue
to go upward. Most investors are not investing just in index port-
folios; most are picking specific stocks that strike them as good invest-
ments. Periods of great enthusiasm for stocks may be periods when
people are very interested in picking individual stocks, and confi-
dent of their own abilities to make such choices. One is attracted
to a speculative position not just because one thinks the aggregate
market will go up, but also because one has an exciting investment

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[14] See Miller et.al. (1987).

concept that one wishes to pursue. Some people will try·to offset their individual investments with futures markets sales, so as not to raise their overall equity exposure too much. Therefore, **any** discouragement from dealing in futures markets might possibly make speculative bubbles more prominent than otherwise.

Of course, policymakers must decide on a **response·to** the market volatility now, and are forced to rely on poorly informed judgments as to the probable effects of policy. In the future, the accumulation of research from both a conventional and a behavioral standpoint may help their judgments become somewhat more informed.

# Appendix: Data Sources (Monthly)

A. Speculative Prices

   Stock Prices,: The Standard and Poor Composite Index, monthly average starting 1918; before that, based on midpoint of high and low prices for individual stocks for the month.
   Commodities Prices: CRB (BLS Formula) Spot Market Index, Raw Industrials, Commodity Research Bureau, Inc., 1967=100, monthly, not seasonally adjusted.
   Exchange Rate: Monthly average of Daily US/UK exchange rate, cents per pound, not seasonally adjusted.
   Bond Yields: The Moody AAA Corporate Bond Yield Average.

B. Background Economic Variables

   Industrial Production: Industrial Production Total Index, 1967=100 seasonally adjusted, Board of Governors of the Federal Reserve System.
   Short Interest Rate: 6-month prime commercial paper rate (4-6 month before November 1979) bank discount rate, Board of Governors of the Federal Reserve System.
   Price Level: Producer Price Index, all commodities, not seasonally adjusted, 1967=100, U.S. Department of Labor, Bureau of Labor Statistics.
   Housing Starts: New privately owned housing units started, thousands of units, U.S. Department of Commerce, Bureau of the Census. Data for years 1946-58 represent nonfarm housing starts, 1959 includes farm and nonfarm housing starts.

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# Commentary on
# 'Causes of Changing Financial Market Volatility'

*Frederic S. Mishkin*

I found Bob Shiller's paper to be very stimulating, and although I do not share some of his views on what drives stock market behavior, I am in agreement with his main conclusions. Although the title of Shiller's paper is the "Causes of Changing Financial Market Volatility," its focus is actually somewhat narrower in that it spends most of its time discussing volatility in the stock market and whether current proposals to reduce this volatility make sense. I start my discussion by focusing on the narrower topic of stock market volatility and what Shiller has to say about it, but I will have some things to say about a more general issue that this conference is likely to address: what should be the role for monetary policymakers in dealing with financial market volatility both in the stock market and in other financial markets?

## Stock market volatility and current proposals to reduce it

The public, and as a consequence politicians, often view traumatic events as unique and so are prone to blame these events on unique institutional changes that are correlated with the traumatic event. Thus it should be no surprise that many politicians and "experts" blame the Black Monday Crash of October 19, 1987 on the recent development of futures markets in stock index futures, index arbitrage and portfolio insurance. Shiller provides an important service by pointing out that the recent volatility in the stock market is by no means

unique. As Shiller's Chart 1 shows, volatility in the stock market during 1987 is not at all unusual by historical standards. Indeed, it is not even clear that we are facing an uptrend in stock market volatility. Once it is recognized that recent stock market volatility is not unique, it becomes harder to blame this volatility on recent financial market innovations.

Shiller's Charts 2 and 3, as well as a recent paper by Schwert (1987), make it clear that explaining stock market volatility is no easy task. The linkage between volatility in the stock market with that in other financial markets or with other economic variables is weak. Without a clear-cut understanding of the sources of stock market volatility, designing appropriate policies to shrink volatility is an extremely difficult task.

One view of financial market volatility with a large number of adherents is a particular variant of the efficient markets hypothesis, which, as stated by Shiller, "asserts that prices efficiently incorporate all public information about fundamentals." In this view of the world, large changes in stock prices reflect large shifts in investors' rational expectations about future values of the fundamental economic variables that affect the valuation of common stocks. With this particular efficient markets perspective, reforming markets so that they exhibit reduced volatility is a bad idea, because it only keeps the markets from reflecting the true volatility of underlying values.

As those who are familiar with Bob Shiller's work know, Bob is quite hostile to the efficient markets hypothesis and has been quoted in the press as saying that it is one of the worst ideas that economists have ever developed. My own view is that this position is far too extreme. First it should be pointed out that other characterizations of the efficient markets hypothesis are more limited than the one that Shiller describes. The characterization of efficient markets that I subscribe to is the following: an efficient market is one in which unexploited profit opportunities are eliminated so that expectations are optimal forecasts (the best guess of the future) using all available information.[1] This idea has been an extremely useful one in economics and helps explain many patterns that we see in the data.

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[1] This is the characterization of efficient markets that I describe in my textbook, *The Economics of Money, Banking and Financial Markers,* Mishkin *(1986).*

One possible lesson from the crash is that factors other than market fundamentals might have an important impact on stock prices. Shiller cites his survey evidence to support the position that no news event about fundamentals precipitated the crash. Although I am inclined to agree with this conclusion because the timing of the crash does not seem to be well aligned with a major news event about fundamentals, I must say that I am more cautious about **Shiller's** survey evidence than he seems to be. For example, he found that about 90 percent of investors who bought or sold on the day of the crash reported ***after the crash*** that they thought the market was overpriced right before the crash. Does this mean, as Shiller seems to think, that investors actually thought the market was overpriced before the crash? I am skeptical. Everyone always likes to think of himself or herself as smarter than the rest, and in hindsight, we usually think that we were smarter than we actually were. In spite of my skepticism about the survey results, the stock market crash has shifted my priors away from thinking that the market is always driven by market fundamentals.

Shiller cites additional evidence against the efficient markets hypothesis, but we must be somewhat careful in interpreting the evidence. There does seem to be a strong case that the stock market is more volatile than it should be with an efficient markets model in which there is ***an additional assumption*** that the rate at which future payment streams are discounted is constant. However, models have been developed (Cecchetti, Lam and Mark in 1988, for example), which suggest that an economy with risk averse agents may display high volatility and forecastability of long-period returns consistent with what we find in the data because of time variation in the rate at which payment streams are discounted. One important piece of evidence that Shiller does not mention which suggests that something other than market fundamentals drives stock prices is found in French and Roll (1986). They find that closings of the New York Stock Exchange on Wednesdays in the second half of 1968 because of the paperwork backlog reduced stock price volatility. Since these closings of the exchange can be reasonably classified as unrelated to the amount of new information arising in the economy, the fact that volatility dropped when these markets were closed suggests that trading and price changes by themselves and not just market fundamentals play a role in stock market volatility.

What conclusion about market efficiency should we draw from the literature described above and the occurrence of the stock market crash itself? First, as even Shiller seems to accept in his paper, the occurrence of large movements in stock prices, even if not driven entirely by fundamentals, does not indicate that there are unexploited profit opportunities in the stock market. Thus a stock market crash of the type we saw in 1987 does not provide evidence against the primary principle of the efficient markets hypothesis: that market expectations will be optimal forecasts using all available information. The Black Monday crash is not the death knell of efficient markets theory. On the other hand, the stock market crash and other evidence make economists such as myself less enamored with the view that market prices reflect only market fundamentals. Thus, I am in agreement with Shiller that in evaluating proposals for reform of financial markets, it is worth examining alternative views of financial market behavior in which market fundamentals are not the whole story.

What I found striking about Shiller's analysis of current proposals to deal with high stock price volatility is that, despite his and-efficient market views, he comes to very similar conclusions to those held by proponents of the efficient markets hypothesis in which prices reflect only fundamentals. Indeed, Shiller's analysis and conclusions on the value of these proposals are remarkably consistent with those found in Frank Edwards[7] paper which will be presented later in the conference. Shiller points out that many of the current proposals are as likely to raise stock price volatility as to reduce it. Reducing the ability of certain investors to engage in market transactions by raising margin requirements, through trading halts, or by eliminating certain market activities such as index arbitrage or even futures trading in stock indexes, may mean that prices will undergo larger rather than smaller swings. The investors frozen out may be exactly the ones that would limit destabilizing speculation. For example, it appears that during the crash the biggest sellers were institutions who are less affected by margin requirements. Furthermore, making financial futures markets less available by increased margin requirements, taxes, or outright elimination will limit the ability of investors to hedge individual investments. This, too, could increase price volatility. Indeed, foreign markets that had little futures trading seemed to suffer as large stock price declines as in the U.S., and ironically, a study

of the crash by the London Stock Exchange concluded that it would have been better off if there had been increased index arbitrage. Finally, Shiller points out that most of the current proposals may make markets less efficient, that is, less able to respond to genuine information. This would produce a definite loss of economic welfare.

I strongly agree with Shiller's conclusions mentioned above. To put a more general perspective on evaluating the current proposals to reform financial markets, I think it is best to think of two types of reforms to reduce market volatility: ones that are designed to make financial markets more efficient—i.e., be more liquid, respond more quickly to new information, and reveal more information about trading—and ones that are designed to make markets less efficient. Most of the current proposals are ones that fall into the later category. As Shiller, and Edwards later point out, making a market less efficient may increase volatility rather than reduce it. In addition, making a market less efficient by slowing down its ability to change prices, by keeping out certain investors, or by closing it altogether, means that information will not be as effectively transmitted to the economy. Thus, even if making a market less efficient does reduce price volatility, this still may be a very bad idea because useful information will be unable to surface in the marketplace. The overall conclusion from evaluating proposals with this framework is unlikely to support making financial markets less efficient and proposals for reform that have received the most attention recently may thus be way off base.

## Is there a role for the Federal Reserve in dealing with financial market volatility?

Since it seems that many of the recent proposals are likely to do more harm than good, we might think that there is no constructive role for policymakers to deal with financial market volatility. I will argue that this is not the case. The Federal Reserve does have an important role to play to help deal with market volatility, but what should it be?

Political pressure to reduce financial market volatility is often an important factor that impinges on monetary policymakers. Often in the past, members of Congress have complained about volatile interest rates, especially when they are rising, and have put pressure on the

Federal Reserve to reduce interest rate fluctuations. Not surprisingly, Federal Reserve monetary policy is directed at smoothing interest rates, in part to keep Congress off its back. Concerns about volatility in stock market prices in the past have also stimulated Federal Reserve action. Worries about "excessive" speculation in **1929** led the Fed to tighten monetary policy, and the ensuing stock market crash is often attributed to the Fed tightening. Is Federal Reserve manipulation of financial markets to reduce volatility a good idea?

The answer is likely to be no. Government manipulation of asset prices can only improve economic well-being if the government knows better than the marketplace what asset prices should be. This is unlikely. Historical experience with government price setting is typically an unhappy one. Governments do not set prices at correct levels, especially because narrow political interests often dominate government decisionmaking. As a result, most economists are strong supporters of free markets with a minimum of government price manipulation. There is even a growing belief throughout the world that a major strength of the U.S. economy over those in the third world or the eastern block is our free markets.

To give a more concrete example of the undesirability of government manipulation of asset prices to reduce market volatility, let us examine the following question: Would the U.S. economy have been better off if the stock market crash of **1987** had been prevented? I would argue that the answer is no. What seems to be perverse about the behavior of the stock market in **1987** is not that stock prices declined over 30 percent from their peak in August, but that they rose so much in the first place. Most market analysts seem to agree that the stock market level after the crash was more in line with fundamental values than before the crash. (This is consistent with Shiller's survey results.) If the stock market crash was just a big mistake, the market should have risen back to its former level. That it did not do so is an indication that in order for the economy to have had correct information about the valuation of equities, the stock market needed to seek a lower level. If policy manipulation had prevented the crash, then the economy would have been denied valuable information.

I hope that I have now convinced you that government intervention in financial markets to manipulate prices is a mistake and should not be an enterprise undertaken by the Fed or any other government

policymaking body. However, the Fed does have an important role to play when financial market prices are volatile: its traditional role of lender of last resort. Financial market volatility does present the economy with the danger that it can lead to financial panic. Because financial panics involve the externality of one firm's failure increasing the probability of another firm's failure, there is a clear-cut role for government intervention to improve economic welfare. Indeed, an important mandate for the Fed since its founding has been the prevention of banking panics, and in recent years, the Fed has expanded this mandate to the prevention of panics in other financial markets.

Two examples illustrate how the Fed has responded to a shock in financial markets in a constructive way: the actions taken after the **Penn** Central **bankruptcy** and the response to the Black Monday crash.

Prior to 1970, commercial paper was considered one of the safest money markets because only corporations with very high credit ratings issued debt in this market. In 1970, Penn Central was a major issuer of commercial paper (over $200 million), and when it went bankrupt in June of 1970, the investing public began to fear that other issuers of commercial paper might also be vulnerable. Not surprisingly, many corporations now found that they would be unable to roll over their commercial paper and they were faced with the possibility of default on their debt coming due. The **Penn** Central bankruptcy, then, had the potential for sending other companies into bankruptcy which, in turn, might have triggered further **bankruptcies—leading** to a full-scale financial panic. When the Fed was informed of the precarious state of affairs, it indicated that it would make discount loans to member banks that would make loans to the corporations who could no longer sell their commercial paper. As a result, these corporations did not default and a potential financial panic was avoided.

The Black Monday crash provided the Fed with another dangerous situation. Although October 19, 1987 will go down in the history books as the largest one-day decline in stock prices to date, reports in the financial press indicated that it was on Tuesday, October 20, that the markets faced the greatest **danger.**[2] The stress of keeping

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**2** See "Terrible Tuesday: How the Stock Market Almost Disintegrated a Day After the Crash," *Wall Street Journal,* Friday, November *20,* 1987.

markets functioning'during the sharp decline in stock prices on Monday, October 19, meant that many brokerage houses and specialists were severely in need of additional funds to finance their activities. However, understandably, New York banks, as well as foreign and regional U.S. banks, growing very nervous about the financial health of securities firms, began to cut bank credit to the securities industry at a time when it was most needed. The potential of a spreading collapse of securities firms was present. To prevent this from occurring, Alan Greenspan announced before the market opened Tuesday, October 20, the Federal Reserve System's "readiness to serve as a source of liquidity to support the economic and financial system." In addition to this extraordinary announcement, the Fed reversed its previously tight monetary policy and began injecting reserves into the banking system. It also contacted key New York banks and encouraged them to make loans to the securities industry. The basic strategy was then to provide liquidity to the banking system who would then provide liquidity to the securities industry. The aftermath of the Fed's strategy was that financial markets kept functioning on Tuesday and a market rally ensued that day with the Dow Jones Industrial Average climbing over 100 points.[3]

It is always hard to determine whether the Fed should be credited with preventing panics when a financial panic does not occur. After all, a successful Fed intervention is one that leaves the markets functioning in a normal fashion. Only when the Fed does not perform its role of lender of last resort in a financial crisis is it obvious that the Fed's lender of last resort role is important. Unfortunately, we learned this the hard way when the Fed did not perform its role of lender of last resort during the banking panics of **1930** to **1933.** The Fed's failure to perform this role during that period is now clearly viewed as a major reason for the disastrous economic performance during those years.

The Fed's performance of its role of lender of last resort to prevent financial panics has two major advantages over alternative policies which restructure markets to make them less efficient or which

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[3] **An important aside here is that the Fed's injection of reserves into the banking system was only temporary; after the crisis was over, the Fed withdrew reserves from the banking system so that on net its actions were not inflationary.**

engage in asset price manipulation. First, since the lender of last resort function does not interfere with price setting in the market, but is rather intended to make sure that there is enough liquidity for market makers, it allows the market to reflect and transmit information in an efficient manner. Indeed, a case could be made that the Fed's lender of last resort role makes the markets more efficient because investors know that market makers will always have sufficient liquidity to keep the market functioning well.

The second advantage of the Fed lender of last resort function is that it will only rarely be invoked. The two examples I have discussed above are the only two in the postwar era that I am aware of in which the Fed has performed this role to prevent panics outside of the banking system. Even if the lender of last resort role has some undesirable efficiency consequences, it impinges on the markets only rarely. Other policies which affect the functioning of the financial system in normal times have the potential for much greater efficiency losses because they are continually affecting the markets. Even if these other policies help the markets during periods of extreme volatility, they will decrease efficiency during normal times. The Fed's lender of last resort role does not suffer from this problem.

## Concluding comment

Since the Fed has performed its role of lender of last resort so admirably in the recent stock market crash episode and it didn't need an academic economist to tell it what to do, why is it important to emphasize that this is an important role for policymakers? My response to this is that it is just as important to highlight an incident where things are done right as it is to point out when things are done wrong. By so doing it is more likely that the right things will be done in the future. Indeed, it is important that the Federal Reserve always be vigilant and be ready to perform at a moment's notice its lender of last resort role to prevent a financial panic. It is also worth pointing out to politicians that having the Fed standing ready to perform this role also makes it less necessary to interfere in financial markets to reduce their volatility.

To finish my discussion, let me even take a fairly radical position to stimulate our thinking: The stock market crash was actually a good

thing for aggregate economic activity and preventing the crash would
have been harmful. Because financial markets continued to function
well after the crash, most likely because of Federal Reserve actions,
there were no serious adverse consequences to the crash. (The oppo-
site was the case during the Great Depression because of the Fed's
failures during that period.) Indeed, the economy has been doing quite
nicely since October 19, 1987, and if anything, may be too expan-
sionary. Without the decline in stock market values as a consequence
of the crash, consumer spending would be even stronger than it is
currently. Not only would this put more inflationary pressure on the
economy, but it would also leave less room for the export sector to
expand its sales. Without some slowdown in consumer spending as
a result of the crash, our exports cannot climb sufficiently for us to
make rapid progress on reducing our trade deficit. Maybe instead
of coming up with proposals to prevent a stock market crash like
the one we had in 1987, we should be happy that a large decline
in stock prices actually occurred.

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# Financial Factors in Business Fluctuations

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## Introduction

What role do financial market imperfections play in business fluctuations? This is a very old question, of course, one which surfaced as early as the Great Depression, motivated then by the collapse of the financial system that occurred just prior to the trough. There is new interest, however. Events such as the stock market crash, the debacle in Texas banking, the farm debt crisis, and the Third World debt problem have filtered into lunch table conversations, prompting new debates about the link between the financial system and the macroeconomy. At a more formal level, recent research in macroeconomics—both theoretical and empirical—has resurrected the idea that capital market imperfections may be significant factors in business volatility by making new progress in characterizing the mechanisms.

This paper outlines the case for a financial aspect to business fluctuations, in light of the contributions of this new literature. It also reviews some of the main evidence supporting this idea, evidence based on both historical and contemporary data. Finally, it presents some new empirical results consistent with the notion that particular capital market imperfections may contribute to the volatility of business output and business fixed investment, in particular.

To keep matters manageable, the analysis concentrates mainly on the implications of financial market frictions for investment volatility, though some of the basic arguments are relevant to explaining fluctuations in employment demand, inventory investment, and consump-

tion[1] (particularly, expenditures on durable goods) as we discuss below. Also for tractability, the paper focuses on financial as opposed to monetary factors in business fluctuations. The following crude distinction is made: factors involving imperfections in markets for borrowing and lending are considered "financial," while those involving variations in the quantity of the medium of exchange are considered "monetary."

The next section expands on the motivation, and provides a general overview of the arguments we plan to make. We review informally existing evidence that supports these arguments. We then present a theoretical model that explicitly motivates how financial factors may affect investment, one which is a simplified and representative version of the models currently popular in macroeconomics. Following that presentation, we report some existing tests of the model's basic predictions, and also present two new sets of results. The first demonstrates that the inverse relation between sales variability and size documented in many studies may be due to financial rather than technological factors, in contrast to the conventional view.[2] The second lends support to a theoretical prediction of the model, that the effects of capital market frictions on investment should be asymmetric, having more impact in recessions than booms. The final section presents conclusions and addresses some policy questions. As the reader might expect, we discuss why the fact that the stock market crash has not had a major impact on the economy is not inconsistent with our overall message.

## The interdependence of financial and real decisions

### *Overview*

It is first useful to place this discussion in the context of contemporary research in macroeconomics. Over the last decade, much of the effort in this field has involved developing models of business

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[1] The importance of "liquidity-constrained" consumers for aggregate movements in consumption is examined by Scheinkman and Weiss (1986) and Hubbard and Judd (1986).

[2] See, e.g., Mills and Schumann (1985).

fluctuations in which the structural relationships are explicit outcomes of rational economic behavior. The centerpiece is the "real business cycle" paradigm, developed by Kydland and Prescott (1982). Roughly speaking, this framework explains fluctuations using the stochastic competitive equilibrium growth model, altered to include variable labor supply. Tractability is a key aspect. To date, the (suitably modified) stochastic growth model is the only macroeconomic framework which evolves purely from first principles and which, at the same time, is capable of confronting actual business cycle data.[3]

There are two features of real business cycle theory highly relevant to the discussion here. First, financial factors are completely absent. Because all markets function perfectly in the competitive equilibrium growth model, the Modigliani-Miller theorem applies; financial structure is both irrelevant and indeterminate. This limits the ability of this paradigm to explain severe economic contractions such as the Depression, where breakdowns in financial trade appear to play an important role.[4] In addition, the framework is silent about the regular cyclical movements of financial variables such as balance sheet positions, liquidity ratios, and bank credit, documented by a number of economists.[5] This issue is important to the extent that these financial variables may not merely be responding passively to the oscillations in real output.

The second key aspect is that the basic real business cycle model relies on large and persistent exogenous productivity disturbances in order to explain the observed magnitudes of business cycles. The problem here is that it is difficult to identify these disturbances in practice. They are not directly observable, making it difficult to corroborate the basic story.[6]

This latter feature has motivated a new stage of research aimed at enriching the endogenous component of the propagation mechanism. The common objective is to rationalize and test theories that

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[3] See Prescott **(1986).**

[4] See Bernanke **(1983).**

[5] See, e.g., Wojnilower (1980), Eckstein and Sinai **(1986),** and Friedman **(1982) (1983).**

[6] See Summers **(1986).**

can explain how relatively small exogenous shocks can produce large fluctuations in output. Several different avenues are.currently being pursued: one is to make productivity changes **endogenous;**[7] a second is to introduce increasing returns to scale and imperfect competition to motivate demand **externalities;**[8] and a third, which we consider here, is to explore the implications of certain capital market imperfections. These approaches can be viewed as complementary; they certainly need not be mutually **exclusive.**[9]

The notion of a financial aspect to the growth and fluctuation in output was common in earlier **work.**[10] A main contribution of the new research is to place the ideas in the traditional literature on firmer theoretical ground, to attempt to match the standard set in real business cycle theory. To this extent, it borrows heavily from the economics of information and incentives to explicitly motivate frictions in capital markets and, correspondingly, a meaningful role for financial structure in real economic activity.''

The new work stresses two basic avenues in which financial factors may contribute to investment volatility. Each presumes a setting where informational asymmetries between borrowers and lenders introduce incentive problems in financial relationships.

The first involves the firm's internal net worth, which becomes a critical determinant of the terms under which it can borrow in this type of environment. To the extent that movements in the firm's collateralizable net worth are procyclical, an ''accelerator'' mechanism emerges. During booms it becomes easier to borrow; the rise in borrower net worth reduces the premium attached to (uncollateralized) external finance. Conversely, the premium rises in recessions, making it more difficult to borrow. The countercyclical movement in the wedge between the cost of external and internal funds makes invest-

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[7] See, e.g., Christiano and Eichenbaum (1988).

[8] See, e.g., Hall (1986).

[9] Hall (1988) suggests one way in which the latter two approaches may be synthesized.

[10] See, e.g., Fisher (1933), Gurley and Shaw (1955) and (1960), Roosa (1951), Kindleberger (1978), and Minsky (1964) and (1975).

[11] See Gertler (1988) for a survey of the new literature and a discussion of the traditional work as well.

ment more volatile than it would otherwise be. Note the fact that this wedge does not exist in a setting of perfect markets.

A related implication is that **redistributions** of wealth between creditors and debtors also contribute to investment variability. This occurs due to the impact of the redistribution on borrower net worth. One example is the erosion of borrowers' collateral during the Depression. A large unanticipated price deflation induced this erosion. Declining prices increased the real debt burdens of borrowers by nearly 40 percent in the period from 1929 to 1933. Indeed, Irving Fisher (1933) cited the ''debt deflation'' as the main reason for the severe investment collapse. [12] Two more recent examples involve the decline in agricultural and oil prices. In each case, many argue, there was a financial factor present which magnified the impact of the price decline on investment activity. In particular, the drop in prices reduced the ability of firms in each sector to borrow by lowering their collateralizable net worth.

The second main avenue stressed involves the supply of intermediary credit, particularly business loans supplied by commercial banks. Underlying this channel is the idea that certain classes of borrowers—those for whom the added costs of finance induced by incentive problems are large relative to their funding needs—may find it prohibitively expensive to obtain financing by directly issuing securities on the open market. Financial intermediaries help overcome this friction by exploiting scale economies in the evaluation and monitoring of borrowers. By doing so, they facilitate the flow of funds between savers and certain kinds of investors. In this regard, the terms under which intermediary credit is available are key determinants of investment by firms that do not have easy access to direct credit.

The corollary argument is that factors which alter the flow of intermediary credit may have important consequences for investment behavior. Examples include the flight of depositor funds out of the banking system during the Great Depression and the sharp rise in interest rates that induced ''disintermediation'' in the mid-1960s. In addition, some economists have resurrected the view that monetary policy matters primarily by influencing the supply of commercial bank

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[12] **See also** Tobin **(1975).**

credit rather than the quantity of the medium of exchange.[13] The idea is that substitutes for money are more readily available than substitutes for commercial bank credit (again, for certain classes of firms).

Theoretical models which motivate these types of real-financial mechanisms from first principles are now in abundance. The main challenge remaining is to quantify their importance. This task is at an early stage. A basic problem is that many different theories make similar predictions about the time-series behavior of investment. This has prompted a strategy of testing the cross-sectional implications of competing hypotheses. In contrast to the basic neoclassical model of investment (which the real business cycle model embeds), these new theories stressing financial effects predict that investment should vary across firms according to their net worth positions, holding constant everything else. This prediction offers a way to test the theories, to the extent that it is possible to find proxies for firms' internal net worth. As we discuss below, several papers have pursued this strategy; and subject to the caveat just mentioned, they have found evidence supporting a role for financial factors.

A related cross-sectional prediction is that financing patterns should vary across firms according to the differences in the (incentive-induced) costs they face in obtaining external finance. In particular, firms subject to capital market frictions should be more likely to rely on retained earnings and bank debt than on direct credit. These financing patterns do indeed emerge in the data, as we elaborate below, given that a firm's size is a reasonable rough proxy of its ability to borrow. Keep in mind that the basic real business cycle framework suggests no determinate pattern.

Overall, the theme that emerges from this initial empirical work is that financial factors are important to the behavior of small, growing firms, at least relative to large, mature firms. (However, we believe it would be a mistake to conclude that large firms never confront capital market frictions—Chrysler and Texaco provide good counter-examples.[14]) This raises the question: How significant are small firms

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[13] See, e.g., Blinder and Stiglitz (1983).

[14] Cutler and Summers (1987) discuss measures of the costs of financial distress in the recent Texaco-Pennzoil case.

in business fluctuations? We are currently trying to obtain a precise answer to this question; it requires an ambitious effort. However, we present some numbers later indicating that small firms play a non-trivial role in the economy. This preliminary evidence supports pursuing the issue further.

## Financial factors: historical evidence

The historical evidence linking financial factors to business fluctuations is compelling. The Great Depression provides the most prominent example. Bernanke (1983) details the breakdown in credit flows that likely amplified the downturn over the period from 1930 to 1933. There were two main causes: first, the collapse of the banking system; and second, the precipitous decline in borrower net worth. Regarding the former, nearly half of the banks existing in 1930 ceased operating by 1933, and many of the surviving ones suffered large losses. This had the effect of reducing credit flows to borrowers who did not have easy access to non-intermediated funds.[15] Regarding the latter, the ratio of debt service to national income more than doubled. The combined effect of declining output and deflation sharply deteriorated borrower balance sheets, shrinking their collateral, thus constraining their ability to obtain further credit.

Calomiris and Hubbard (1987) obtain related evidence for the period from 1879 to 1914, prior to the founding of the Federal Reserve System. They show that the basic debt-deflation story may apply to this era as well. Their results indicate that deflationary shocks preceded declines in bank loan supply and output. Moreover, deflationary episodes were associated with increasing spreads between the interest rates on "low quality" and "high quality" commercial paper of similar maturities.

During both these periods, there were also obvious differences in behavior across firms. Smaller firms tended to be more sensitive to the effects of financial market disturbances. Calomiris and Hubbard cite contemporary academic studies and newspaper accounts empha-

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[15] This is distinct from the purely *monetary* transmission mechanism (i.e., the decline in the money supply) stressed by Friedman and Schwartz (1963).

sizing the closing of many small, solvent businesses during the panics of 1884 and 1893. Credit was largely unavailable to small businesses during those periods; they were required to settle in cash. Sprague (1910) noted that during periods of tight bank credit, smaller firms were differentially affected both because lenders sought only notes of the highest quality and because larger firms had access to the commercial paper market.

Evidence of heterogeneity in the impact of credit stringency on firms in the early 1930s is widespread. See, for example, Hart's (1938) discussion of the problems faced by farmers and state and local governments; Klebaner's (1974) analysis of the difficulties faced by unincorporated businesses and small corporations in 1931 and 1932; Kimmel's (1939) account of the strong positive relationship between firm size and the availability of bank credit (holding constant the line of business); and the results of the Hardy-Viner study of credit availability in the Seventh Federal Reserve District in Stoddard (1940), noting the problems of small businesses (previously deemed by local lenders to have been of high quality) in obtaining bank credit.

It is interesting to observe that small firms bore a disproportionately large share of the decline in profits during the Great Depression. Merwin (1943) notes that, as a class, large firms (with assets of more than $50 million) reported positive profits even during 1931, 1932 and 1933. Similar evidence is discussed by Chandler (1971). Fabricant (1935) reports the high rate of losses relative to capitalization for small firms, a pattern mitigated or reversed for large firms. This differential impact on small versus large firms is further suggestive that financial influences may have been significant.

*Financial factors and the modern economy*   ·

Documenting the significance of financial factors for contemporary business fluctuations is less straightforward, due to the absence of events as pronounced as the Depression. Nonetheless, there is a pattern of evidence which, at a minimum, is sufficient to justify further pursuit of this topic. The pattern is roughly as follows: First, small firms' sales and investment (per dollar of assets) are more volatile than large firms'. Second, there is evidence that capital market imper-

fections may be an important determinant of this added volatility.[16] Third, small firms are a nontrivial component of GNP, using various measures of "smallness." Beyond this, there are several recent episodes in which it is clearly possible to identify important financial influences on investment.

As a stylized fact, sales, employment, and investment are more volatile in small firms than large firms. These patterns are well known. Hymer and Pashigian **(1962)** and Evans **(1987)** find that the variability of firm growth decreases with firm size, and Evans **(1987)** finds that the probability of firm failure decreases with age. Greater variability of earnings and sales in smaller firms is true historically as well.[17] The negative correlation between firm age and life expectancy in the decade after World War II has been documented by Churchill **(1955).**

There exist nonfinancial theories capable of explaining qualitatively why firm volatility declines with size.[18] However, there is also considerable reason to believe financial factors are at work as well. To begin with, firms differ systematically in how they finance investment. These differences are related to firm size in a way that suggests they reflect varying abilities to obtain credit.[19] Small firms tend to rely more heavily on internally generated funds than do large firms, and the use of non-bank debt is important only for large firms. Commercial banks are an important source of credit for small and medium-sized firms which lack access to impersonal, centralized securities markets.

Using data from the Quarterly Financial Report of Manufacturing, Mining, and Trade Corporations, we summarize financing practices of manufacturing firms by size in Table 1.[20] Two features of Table 1 are of particular interest. First, internal finance provides the

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[16] Brock and Evans (1988) put forth a related argument. They note that small corporations account for most of the observed mean-reversion behavior (i.e., non-random-walk behavior) in stock prices, and they cite finance constraints as a possible explanation.

[17] See, e.g., Merwin (1943).

[18] See Jovanovic (1982) and Mills and Schumann (1985).

[19] Costs of flotation alone are not likely to be sufficient to account for these differences; see the review of studies in Fazzari, Hubbard, and Petersen (1988a).

[20] These data exclude new equity issues, which are small in the aggregate.

# Table 1
## Sources of Funds by Size Class, U.S. Manufacturing Firms, 1970-1984

**Sources of Funds (percent of total)**

| Firm Class | Short-Term Bank Debt | Long-Term Bank Debt | Other Long-Term Debt | Retained Earnings | Percentage of Long-Term Debt From Banks | Average Retention Ratio |
|---|---|---|---|---|---|---|
| All Firms | 0.6 | 8.4 | 19.9 | 71.1 | 29.6 | 0.60 |
| **By size class** | | | | | | |
| Under $10 million | 5.1 | 12.8 | 6.2 | 75.9 | 67.3 | 0.79 |
| $10 – $50 million | 5.9 | 17.4 | 6.9 | 69.8 | 71.6 | 0.76 |
| $50 – $100 million | 3.1 | 12.9 | 5.3 | 78.7 | 71.0 | 0.68 |
| $100 – $250 million | −0.2 | 13.3 | 12.0 | 74.9 | 52.4 | 0.63 |
| $250 – $1 billion | −2.3 | 10.6 | 15.4 | 76.3 | 40.8 | 0.56 |
| Over $1 billion | −0.6 | 4.8 | 27.9 | 67.9 | 14.7 | 0.52 |

Notes: Entries are authors' calculations based on data taken from U.S. Department of Commerce, Bureau of the Census, **Quarterly Financial Report of Manufacturing, Mining, and Trade Corporations,** various issues. The data underlying the calculations are expressed in 1982 dollars. "Size class" refers to the value of net plant. Funds raised from new equity issues are excluded from the calculations.

largest fraction of net funds raised for firms in all size categories. In addition, the proportion of income retained by firms varies across size classes; there is a negative correlation between firm size and the retention ratio. That retention ratios and the fraction of net worth accounted for by accumulated retained earnings are negatively correlated with firm size is true historically as well.[21] This feature is noted in contemporary data on individual firms by **Fazzari, Hubbard, and Petersen (1988a),** hereafter known as FHP. Second, there are important differences in the composition of debt finance across firms. The percentage of long-term debt coming from banks—lending institutions specializing in monitoring borrowers through customer relationships—declines with firm size. The financing patterns present in the manufacturing sector tend to hold economy-wide as well.[22]

A second general type of evidence involves econometric studies of firm investment behavior using panel data. Indeed, using panel data from individual manufacturing corporations, FHP find that proxies for internal net worth are important in explaining investment behavior, particularly for smaller firms in the sample. These results arise after controlling for measures of investment opportunities, as we discuss in detail later.

**FHP's** results indicate that firms with assets of under $25 million (in 1982 dollars) tend to face capital market frictions (in the sense that internal funds were important for investment, controlling for investment opportunities). How important are these kinds of firms in the aggregate? Let us err on the side of understating their importance by picking a more conservative benchmark of $10 million in assets. In the nonfinancial business sector as a whole, firms in this category (under $10 million in assets) accounted for 45 percent of total assets and 46 percent of net worth in 1986.[23]

More detailed breakdowns of shares of total assets and receipts accounted for by firms of various sizes (as measured by total assets) are available for the corporate sector and are presented in Tables 2 and 3. Firms with less than $10 million in assets accounted for

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[21] See **Butters and Lintner (1945) and the references therein.**

[22] See *The State of Small Business: A Report of the President, 1988.*

[23] *Ibid.,* **p.** 160.

# Table 2
# Firm Size, Assets, and Receipts: All Corporations

Accounting for Percentage of Total

| Asset Size Class (**$000s**) | Number of Firms | Assets | Receipts |
|---|---|---|---|
| No assets | 3.8% | 0% | 1.1% |
| Less than 100 | 51.8 | 0.5 | 3.2 |
| 100–250 | 18.5 | 0.9 | 3.3 |
| 250–500 | 10.4 | 1.1 | 3.6 |
| 500–1,000 | 6.9 | 1.4 | 4.4 |
| 1,000–5,000 | 6.4 | 3.9 | 11.7 |
| 5,000–10,000 | 0.9 | 1.7 | 4.2 |
| 10,000–25,000 | 0.6 | 2.9 | 4.9 |
| 25,000–50,000 | 0.3 | 3.6 | 3.4 |
| 50,000–100,000 | 0.2 | 4.0 | 3.4 |
| 100,000–250,000 | 0.1 | 5.8 | 5.3 |
| More than 250,000 | 0.1 | 74.2 | 51.5 |
| | 100.0 | 100.0 | 100.0 |

Note: All figures are for 1984, and are taken from *Source Book: Statistics of Income, Active Corporation Income Tax Returns, 1984* (published in *1987*).

31.5 percent of receipts in the corporate sector as a whole. The industry sector breakdowns for firms with less than $10 million are as follows: 72.4 percent in construction, 17.4 percent in mining, 14.8 percent in manufacturing, 70.5 percent in services, 10.4 percent in transportation and utilities, 52.3 percent in wholesale and retail trade, and 11.5 percent in finance, insurance, and real estate. It is important to recognize that these figures for the corporate sector understate the economy-wide importance of small firms, since the latter are much more predominant among unincorporated businesses (proprietorships and partnerships). Further, the unincorporated sector is nontrivial. It has accounted for 60 percent of total business and capital income in the postwar period. Corporate profits were 87 percent of pro-

# Table 3
# Firm Size, Assets, and Receipts: Corporations in Major Industry Groups

## Major Industry

| Asset Size Class ($000s) | Construction | | Mining | | Manufacturing | | Services | | Utilities | | Wholesale & Retail Trade | | Finance, Insurance, and Real Estate | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | R | A | R | A | R | A | R | A | R | A | R | A | R |
| No Assets | 0% | 1.2% | 0% | 1.6% | 0% | 0.76% | 0% | 1.1% | 0% | 0% | 0% | 0.8% | 0% | 2.5% |
| Less than 100 | 3.0 | 9.0 | 0.29 | 1.5 | 0.16 | 0.5C | 6.9 | 21.2 | 0 | 0 | 2.1 | 3.5 | 0.14 | 1.5 |
| 100–250 | 5.1 | 7.9 | 0.50 | 1.0 | 0.35 | 0.74 | 7.7 | 14.0 | 0.33 | 1.5 | 4.5 | 5.1 | 0.26 | 1.4 |
| 250–500 | 7.2 | 9.5 | 0.91 | 1.5 | 0.56 | 1.2 | 6.3 | 9.1 | 0.46 | 1.7 | 5.8 | 6.1 | 0.32 | 1.0 |
| 500–1,000 | 9.7 | 12.1 | 1.3 | 2.7 | 0 93 | 1.8 | 6.6 | 7.9 | 0.59 | 1.7 | 7.6 | 8.0 | 0.4 | 1.1 |
| 1,000–5,000 | 23.2 | 24.6 | .4.4 | 5.9 | 3.5 | 6.5 | 13.8 | 13.1 | 1.6 | 4.3 | 2.0 | 21.8 | 1.2 | 2.7 |
| 5,000–-10,000 | 8.7 | 8.1 | 2.8 | 3.2 | 1.9 | 3.3 | 5.3 | 4.1 | 0.65 | 1.2 | 7.2 | 7.0 | 0.7 | 1.3 |
| 10,000–25,000 | 9.5 | 7.4 | 4.8 | 4.4 | 2.9 | 4.3 | 7.0 | 5.1 | 1.1 | 2.0 | 7.7 | 7.2 | 2 2 | 2.6 |
| 25,000–50,000 | 5.9 | 4.3 | 4.1 | 4.2 | 2 4 | 3.2 | 4.8 | 3.5 | 0.91 | 1.5 | 5.1 | 3.9 | 3.4 | 3.8 |
| 50,000–100,000 | 4.5 | 3.3 | 3.3 | 3.4 | 2.5 | 3.1 | 5.7 | 3.7 | 0.86 | 1.3 | 4.5 | 4.0 | 5.0 | 4.6 |
| 100,000–250,000 | 4.0 | 2.4 | 7.7 | 5.9 | 5.1 | 5.6 | 8.0 | 4.8 | 1.8. | 2.4 | 7.8 | 6.1 | 6.7 | 6.0 |
| More Than 250,000 | 19.2 | 10.2 | 68.9 | 64.7 | 79.7 | 69.0 | 27.9 | 12.4 | 91.7 | 82.5 | 45.7 | 26.5 | 79.7 | 71.5 |
| | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100 0 | 100.0 |

Note: "A" and "R" refer to "assets" and "receipts," respectively. All figures are for 1984, and are taken from *Source Book: Statistics of Income, Active Corporation Income Tax Returns, 1984* (published in 1987).

## Table 4
## The Relative Importance of Small Firms in Major Industries

| Major Industry | Share in Gross Product | Share of Firms with < 500 Employees | |
| --- | --- | --- | --- |
| | | In GPO (1976) | In Employment (1986) |
| Agriculture | NA | NA | 79.1% |
| Mining | 3.0% | 32.2% | 34.7 |
| Construction | 5.3 | 83.5 | 85.4 |
| Manufacturing | 28.7 | 19.1 | 35.2 |
| Transportation, Communications, and Public Utilities | 10.8 | 21.6 | 33.2 |
| Wholesale Trade | 9.2 | 83.9 | 70.4 |
| Retail Trade | 12.0 | 62.4 | 59.0 |
| Finance, Insurance, and Real Estate | 16.7 | 45.6 | 44.5 |
| Services | 14.3 | 82.0 | 49.1 |

Note: Shares in GPO by sector and size for 1976 are taken from Joel Popkin, ''Measuring Gross Product Originating in Small Business: Methodology and Annual Estimates, 1955 to 1976,'' Report to the Small Business Administration, September 1980. Shares in employment for 1986 are taken from *The State of Small Business: A Report of the President, 1988,* pp. 62-63. ''Small businesses'' are defined as firms with fewer than 500 employees.

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prietors' income of sole proprietorships and partnerships in 1950, and 88 percent in 1986, the most recent year for which complete data are available.[24]

The number of employees is another measure available to assess the importance of small firms. Indeed, the official definition of a "small business" is a firm with no more than 500 employees. Using this criterion, small businesses accounted in 1986 for about 54 percent of total employment. We provide a further breakdown in Table 4 of the shares of small firms (those with fewer than 500 employees) in gross product originating (GPO) and employment. Small business shares are nontrivial in all sectors, ranging from 19 percent of GPO in manufacturing to about 84 percent in construction and wholesale trade. As the Small Business Administration report mentioned previously emphasizes, these firms are likely to face borrowing constraints; they have small asset bases (typically less than $10 million), and are likely to finance investments with retained earnings or bank credit. (The emergence of the "junk bond" market is changing this somewhat, at least for medium-sized firms. In the conclusion, we discuss why capital market frictions remain relevant to firms issuing junk bonds.)

Finally, several contemporary events provide some informal evidence in support of the themes being developed here. Consider the "credit crunch" of 1966. During this period, rising interest rates caused funds to flow out of depository institutions (which were subject to deposit interest rate ceilings at the time).[25] Chart 1 highlights differences in the rate of investment and the growth rate of real sales for various size classes of manufacturing firms during this period. (The groups are those classified in the *Quarterly Financial Report of Manufacturing, Mining, and Trade Corporations.*)Declines in the rate of investment and in the growth rate of real sales were disproportionately borne by smaller firms, firms largely dependent on bank credit for external finance. The analysis of such episodes with panel data on individual firms is an important task for future research. We believe, however, that the preliminary evidence here

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[24] See **Nelson (1988).**

[25] **In the first half of 1966, primarily savings and loans felt the "crunch;" mortgage lending fell dramatically. Commercial banks felt the pinch in the second half of the year when the Federal Reserve lowered the ceiling rate on bank time deposits and increased reserve requirements.**
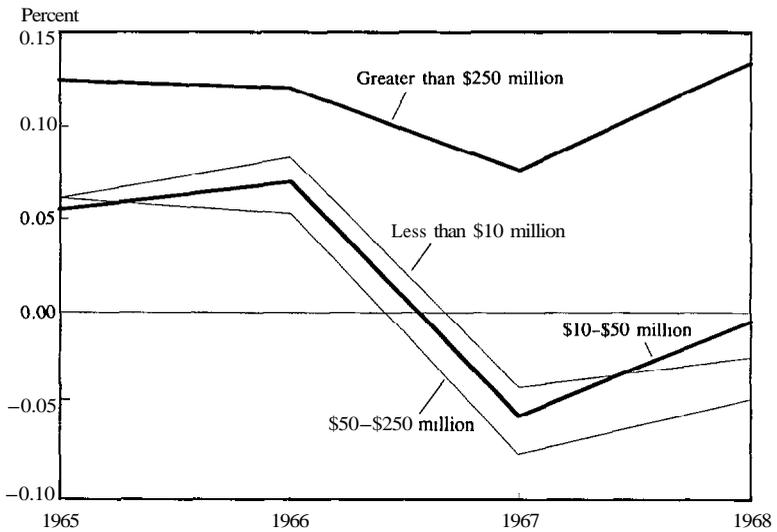
# Chart 1

## Movements in Investment and Sales—1966 'Credit Crunch'
### (Manufacturing. Firms, Groupings by Size)

### Investment/Capital

Percent



### Growth Rate of Real Sales

Percent
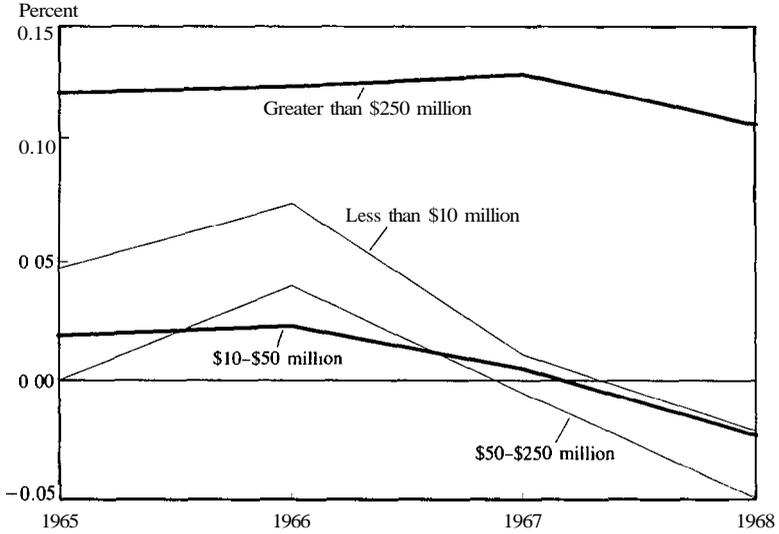
is at least suggestive of the importance of firm heterogeneity in response to financial disturbances.

The recent deflations in the agricultural and oil sectors provide evidence supporting the idea that internal net worth may be a key factor in the investment decision. Calomiris, **Hubbard,** and Stock (1986) document how the collapse in farm land values (collateral) made it difficult for small farmers to obtain financing for still-profitable projects. **Reiss** (1988) notes that for the domestic petroleum industry, finance constraints on "independents" contributed to their sharp decline in exploration and development spending. He finds important effects of declines in cash flow on declines in investment spending, holding constant measures of investment opportunities. In addition, Reiss describes ways in which debt contracts placed restrictions on firms' decisions during deflationary periods, and analyzes the strong links between the value of firms' oil and gas reserves and the amount which producers could borrow.

## A theoretical model of financial influences on investment

This section presents a simple partial equilibrium model of investment. We design the framework for expository purposes; it is intended to capture some of the basic aspects of the newly-developed models of finance and business fluctuations.[26] Our goals here are threefold: first, to illustrate how it is possible to rationalize formally an interdependence between real investment behavior and financial structure; second, to trace out the macroeconomic implications of this link; and third, to suggest some testable hypotheses. The subsequent section pursues these tests.

The model we develop characterizes the investment and financial decisions of an entrepreneur who undertakes risky projects. A central feature is that the entrepreneur has greater knowledge about certain aspects of the investment process than do the lenders from whom she seeks funding. This precipitates a conflict of interests between

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[26] See, e.g., Bernanke and Gertler (1989), Calomiris and Hubbard (1987), Farmer (1984), Greenwald and Stiglitz (1986), Townsend (1988), and Williamson (1987).

the two parties. The conflict (an "agency" problem) manifests itself by driving a wedge between the price of externally and internally generated funds. For this reason, the cost of investing, and hence the borrower's investment decision, depends on her financial position, particularly her collateralizable net worth.

In the example we choose, lenders cannot fully observe how the entrepreneur uses investment funds. It is not important that the informational friction assumes this particular form; a wide variety of plausible scenarios generate the same qualitative results.[27] Nonetheless, scholars from both the past (Berle and Means in 1932) and the present (Easterbrook in 1984, Jensen in 1986) emphasize that the inability of lenders to monitor perfectly the actions of borrowers is characteristic of many financial relationships, and is a fundamental source of "imperfections" in capital markets.

The problem arising under this information structure is that the entrepreneur has the incentive to misallocate funds to favor herself (e.g., to overinvest in perquisites or to select projects which provide her with some additional personal gratification). Lenders account for this problem by insisting that financial relationships be structured in a way that aligns the borrower's incentives with their own. The agency problem introduces real costs to the investment process to the extent that the provisions of the financial contract induce the entrepreneur to invest in a way that differs from what she would choose under symmetric information. In this regard, real and financial decisions are interdependent.

The model works as follows. There are two periods, zero and one. In period zero, a risk neutral entrepreneur uses hard capital K and (possibly) soft capital C to produce output Y which becomes available to sell in period one. The technology is risky, making output random. There are two possible productivity states, "good" and "bad," and this uncertainty is realized after the investment decision is made.

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[27] For example, in Bernanke and Gertler (1987), entrepreneurs have private information about the expected return on their investment projects, which adds an Akerlof (1970) "lemons premium" to the cost of external finance, analogous to Greenwald, Stiglitz, and Weiss (1984) and Myers and Majluf (1984). In Calomiris and Hubbard (1987), entrepreneurs have private information about the riskiness of their projects, which leads to credit rationing of some classes of borrowers, as in Keeton (1979) and Stiglitz and Weiss (1981).

Output is the numeraire good, and each kind of capital has its price normalized at unity. "Hard capital" refers to machinery. "Soft capital" may be thought of as any input which improves the likelihood that a given level of hard capital input will generate a good output realization. Examples include organizational expenditures, maintenance expenditures, and inventories.

To keep things as simple as possible, suppose the entrepreneur can improve the probability of a good output realization if she uses enough soft capital to satisfy a required level that is proportional to the quantity of hard capital used. In particular, suppose

$$\text{(1a)} \quad \tilde{Y} \quad = \quad \begin{cases} f(K), \text{ with probability } \pi^g \\ \alpha f(K), \text{ with probability } \pi^b \end{cases}$$

$$\text{(1b)} \quad C \quad \geq \quad \nu K,$$

and

$$\text{(2a)} \quad Y \quad = \quad \alpha f(K),$$

$$\text{(2b)} \quad C \quad < \quad \nu K,$$

where $f(K)$ is twice continuously differentiable, strictly increasing, and strictly concave, with $f(0) = 0$, $f'(0) = \infty$, and $f'(z) \to 0$ as $z \to \infty$. Further, $\pi^g + \pi^b = 1$, $0 < a < 1$, and $v > 0$. Also, assume for simplicity that the random productivity realization (when soft capital is employed) is uncorrelated with events elsewhere in the economy.

Clearly, the entrepreneur will either use $\nu K$ units of soft capital or none at all.[28] Suppose that, for any level of hard capital employ-

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[28] See Genler and Rogoff (1988) for a setting in which project success probabilities are continuous concave functions of the quantity of soft capital employed. In that setting, the amount of soft capital used is a continuous function of the model's parameters.

ment, it is always efficient to use soft capital, in the sense that the expected gain in output net of costs is positive. This requires the following parameter restriction:

(3) $(\pi^g + \pi^b \alpha)/(1 + v) > \alpha$

It follows that *in the absence of informational frictions* the entrepreneur invests (chooses K) to satisfy

(4) $(\pi^g + \pi^b \alpha)f'(K) - (1 + v)r = 0.$

where r is the gross riskless interest rate and is given exogenously. The first term in equation (4) is the expected marginal benefit from adding a unit of hard capital, given a complementary addition of v units of soft capital. The second term is the marginal cost. Let K* be the value of K that satisfies equation (4), and refer to it as the "first best" value. Note also that K* is unrelated to financial variables; the Modigliani-Miller theorem applies.

The same need *not* hold under asymmetric information. Suppose, as alluded to earlier, that lenders cannot perfectly observe how the entrepreneur allocates the funds she borrows. In particular, suppose that expenditures on hard capital are observable by outsiders, but expenditures on soft capital are unobservable. The idea is that the quantity of machines in place is relatively easy to measure, but that organizational, maintenance, and inventory expenditures are difficult to monitor. The problem arising is that the entrepreneur may be tempted to divert funds intended for soft capital to enhance her personal gain. While this personal gain can assume many subtle forms,[29] we will posit simply that the entrepreneur can abscond with the funds, and invest them secretly in a riskless asset (e.g., a Swiss bank account).

Rational lenders recognize the incentive problem. Accordingly, they require that the financial contract be designed to eliminate the entrepreneur's incentive to cheat. The net effect is that K may fall below K*, and that the extent of this decline will depend inversely on the borrower's net worth. To see this formally, think of the

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[29] Refer to Berle and Means (1932) for a classic discussion.

entrepreneur as entering a contract with a competitive financial inter-
mediary.[30] Assume the entrepreneur has an initial liquid asset posi-
tion of W (in units of the **numeraire** good) and collateralizable expected
future profits worth $V/r$ in present value, where V is the value of
this profit stream in the subsequent period (period one).[31] (Her net
worth is thus $W + V/r$.) Suppose further that W is less than K*,
to guarantee that the entrepreneur will want to borrow.

The contract specifies a quantity borrowed (equal to $(1 + \nu)K - W$),
a payment $P^g$ to the intermediary in the event that the project yields
the "good" output level, $f(K)$, and a payment $P^b$ in the event of the
"bad" output level, $\alpha f(K)$. The features of the contract are chosen
to maximize the entrepreneur's expected profits, given by

$$(5) \quad (\pi^g + \pi^b\alpha)f(K) - \pi^g P^g - \pi^b P^b.$$

The contract must offer the intermediary an expected return equal
to the opportunity costs of its funds, the gross **riskless** interest rate
times the quantity borrowed. (The intermediary uses no resources;
it simply channels funds from depositors to lenders.) Accordingly,
the contingent payments $P^g$ and $P^b$ must satisfy

$$(6) \quad \pi^g P^g + \pi^b P^b = r[(1 + \nu)K - W].$$

The contract must also provide the entrepreneur with the incen-
tive to allocate funds as promised, i.e., to invest in soft capital as
a complementary input to hard capital, rather than to take the money
for personal use. Thus, the provisions of the contract must satisfy
the following "incentive constraint":

$$(7) \quad (\pi^g + \pi^b\alpha)f(K) - (\pi^g P^g + \pi^b P^b) \geq (\alpha f(K) - P^b) + r\nu K.$$

Equation (7) requires that the entrepreneur's expected gain from

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[30] One key feature of the new literature on real-financial interactions is that contractual
arrangements are derived endogenously so that the theoretical predictions do not hinge on
arbitrary restrictions on financial structure.

[31] See Gertler (1988) for a model in which V is derived explicitly. In that model, production
is repeated over time, and entrepreneurs enter multi-period contracts with intermediaries.

honesty exceed her gain from misallocating the funds intended for investment in soft capital. The latter is the sum of the net contractual payoff, $\alpha f(K) - P^b$, she receives when there is a bad output realization (which is guaranteed when soft capital is not used) and the return on the funds she invests for personal use, $r\nu K$.

A way to lower the entrepreneur's temptation to cheat is to raise $P^b$, the amount she must pay the intermediary in the event of a bad outcome. The problem, however, is that the amount the entrepreneur can credibly promise to pay is limited by her available assets, in this case the sum of the gross revenue she earns in the bad state and the market value of her expected future profits. Thus, the following "limited liability" condition is also a constraint on the form the contract takes:

$$(8) \quad P^b \leq \alpha f(K) + V.$$

The formal contracting problem is to choose K, $P^g$ and $P^b$ to maximize (5) subject to (6), (7), and (8). When the incentive constraint is not binding, K simply adjusts to K*. This can be seen by substituting equation (6) into equation (5) and maximizing with respect to K. Further, the pattern of contractual payments is indeterminate; any combination of $P^g$ and $P^b$ which satisfies the expected return constraint (6) is acceptable.

Real investment and financial decisions are no longer independent when the incentive constraint (7) is binding. To see this, first note that the limited liability constraint (8) must also bind in this situation; this is because it is desirable to raise $P^b$ as much as possible to lower the entrepreneur's temptation to cheat. We can accordingly obtain a relation for K by using (6) and (8) to eliminate $P^g$ and $P^b$ from equation (7):

$$(9) \quad (\pi^g + \pi^b\alpha)f(K) - r(1 + 2\nu)K + r(W + V/r) = 0.$$

When equation (9) holds, investment is an increasing function of the borrower's net worth,[32,33] that is,

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[32] This result is a central feature of Bernanke and Gertler (1987), (1989) and Calomiris and Hubbard (1987).

[33] To see that the derivative is positive, note that from equation (9),

$$1 + 2\nu = \left[\frac{(\pi^g + \pi^b\alpha)f(k)}{K/r} + \frac{(W + \nu/r)}{K} \quad \frac{(\pi^g + \pi^b\alpha)f'(K)}{r}\right] \quad \text{since} \quad \frac{f(K)}{K} > f'(K).$$

(10) $\dfrac{\partial K}{\partial (W+V/r)} = [(1 + 2\nu) - (\pi^g + \pi^b\alpha)f'(K)/r]^{-1} > 0.$

The problem here is that the entrepreneur's temptation to cheat depends positively on the amount of uncollateralized funds she borrows. Hence, additional net worth makes it feasible to invest more without violating the incentive constraint.

Figure 1 illustrates the solution. The (EO) curve portrays expected output as a function of hard capital input, given that soft capital is used as a complementary input. The (OC) curve portrays the opportunity cost of investment, also as a function of K. The first-best optimum corresponds to the value of K where the slopes are equal; that is, K equals K* at this point. The (IC) curve represents the sum of the entrepreneur's net gain from dishonesty and the cost of the funds she borrows, expressed as a function of K. Thus, the difference between the (EO) and (OC) curves reflects the entrepreneur's expected profits if she invests honestly, while the difference between the (IC) and (OC) curves is her gain from misusing the soft capital funds.

## Figure 1
## Internal Net Worth and the Investment Decision
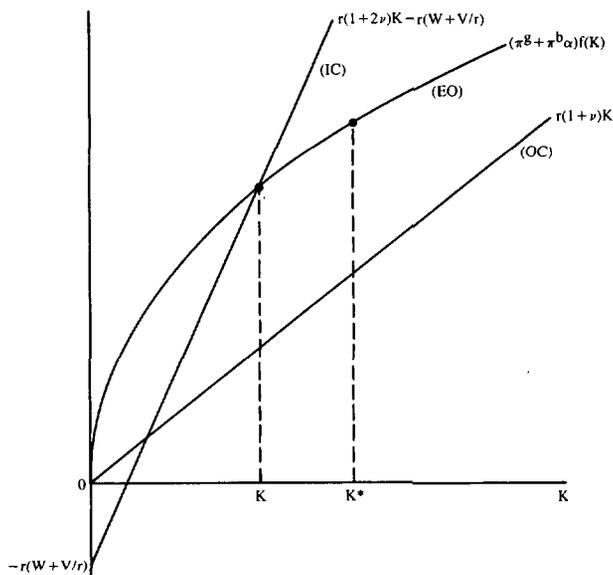
The way the curves are drawn, the incentive constraint is violated
if investment is fixed at K*; the gap between the (IC) and (OC) curves
exceeds the gap between the (EO) and (OC) curves where K equals
K*. The amount of uncollateralized borrowing must decline; therefore
K must fall below K*. The solution is at the point below the first-
best optimum where the (EO) and (IC) curves intersect. At this point,
the entrepreneur's expected profits are maximized subject to the incen-
tive constraint being satisfied. The incentive constraint holds since
the gaps between the (EO) and (OC) curves and between the (IC)
and (OC) curves are identical. Expected profits are maximized since
they are lower at any smaller value of K, and since any larger value
of K is not feasible (i.e., the incentive constraint is not satisfied).

A rise in borrower net worth shifts the (IC) curve rightward,
pushing K toward K*. By increasing her personal stake in the pro-
ject, the rise in (W + V/r) reduces the entrepreneur's incentive to
misallocate funds intended for soft capital investment. This allows
the entrepreneur to borrow more, permitting K to rise. Figure 2
illustrates this behavior. Once investment reaches K*, further
increases in net worth have no impact; we return to this point later.

## Figure 2
## Effect of an Increase in Net Worth on Investment
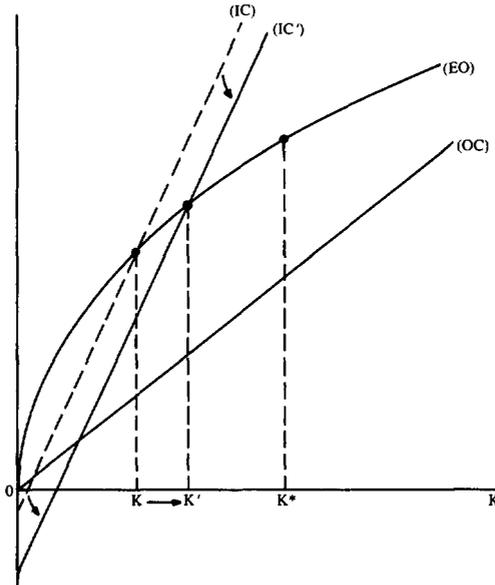
In this situation, it is feasible to fix investment at the first-best optimum, so there is no reason to do otherwise; additional investment only lowers the entrepreneur's expected profits.

It is also useful to note that K depends inversely on the gross interest rate r, even when the incentive condition constrains investment below the first-best optimum. A rise in r pivots the (IC) curve leftward, moving K further below K*. [34] The rise in r magnifies the incentive problem by worsening the entrepreneur's financial position, thus increasing her gain from cheating (relative to being honest); the level of investment K declines accordingly.[35]

Finally, it is interesting to observe that financial structure becomes determinate in this case. The optimal financial contract specifies a unique pattern of payoffs, in contrast to the case of symmetric information. This occurs because the contract is designed to minimize the incentive problem. It is also interesting that the theoretical financial contract derived here resembles most "real world" contracts in the basic sense that lenders receive a smoother pattern of payoffs across risky outcomes than does the borrower.[36] (Recall that the optimal contract has lenders receive everything in the event of a bad outcome.)

Several features of the model are particularly relevant to thinking about economic fluctuations. First, the analysis suggests how there could emerge an "accelerator" mechanism which magnifies investment fluctuations. During booms, when borrower net worth is high—either due to past accumulation of assets (resulting in a high W) or to optimism about the future (resulting in a high V)—agency costs of finance are relatively low, providing added stimulus to investment.

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[34] The effect of a rise in r is unambiguous in this case since $K > W$.

[35] One way in which the rise in r lowers investment is by reducing the entrepreneur's collateralizable net worth (i.e., V/r falls). Indeed, Fisher (1911) originally stressed this mechanism. In a description of the impact of rising interest rates, he states:

> "Further, with the rise of interest, the value of certain collateral securities, such as bonds, on the basis of which loans are made, begins to fall. Such securities, being worth the discounted value of fixed sums, fall as interest rises, and therefore, cannot be used as collateral for loans as large as before." (p. 64).

[36] For an example in which the contracts may resemble either equity or intermediary credit lines, see Bernanke and Gertler (1987).

Conversely, the decline in borrower net worth during recessions raises agency costs of obtaining finance, further depressing investment.[37, 38]

A second prediction is that investment fluctuations may exhibit asymmetries. Investment downswings in recessions may be sharper than upswings during booms. In booms, it is more likely the incentive constraints are relaxed; if this is so, further increases in borrower net worth may have a minimal impact on investment. In downturns, it is much more probable that the constraints bind; alternatively, it is more likely that they bind over a wider cross-section of firms. Thus, in recessions, investment may be more sensitive to movements in borrower net worth.

What are the testable implications of this model? Unfortunately, it is difficult to discriminate between competing theories with a pure time-series analysis. Most macroeconomic theories predict a "procyclical" relationship between investment and output (though some purely neoclassical frameworks have difficulty explaining the magnitude of investment fluctuations). However, the model presented here has implications for cross-sectional differences in investment behavior. In contrast to the frictionless neoclassical model, the framework here predicts that, ceteris *paribus,* investment will vary across firms positively with differences in firms' internal net worth. Furthermore, this variation is likely to be more pronounced in recessions than in booms.

A related prediction, one consistent with evidence presented earlier, is that financing patterns should vary across firms, depending on their

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[37] Calomiris and Hubbard (1987) discuss how this kind of setting may induce precautionary saving by firms. Gertler (1988) also discusses how entrepreneurs will have the incentive to adjust production to insure against fluctuations in their net worth, resulting in production being more volatile than otherwise. The relevance of these channels for economic fluctuations is documented in Eckstein and Sinai (1986).

[38] In the context of the model we presented, effects of investment tax credits or changes in tax depreciation rules on the cost of capital will depend on internal net worth as well. In the symmetric information case, the introduction of an investment tax credit would pivot the (OC) curve to the right, increasing K*. However, for values of internal net worth for which incentive problems arise, the (IC) curve will also pivot to the right, raising actual investment K. In general, the net worth effects of tax policies—and not just their effects on the cost of capital— will be important. *Average* tax burdens—and not just effects of taxation on marginal incentives— will be important for investment decisions in some firms. See Fazzari, Hubbard, and Petersen (1988b).

respective net worth positions. In particular, internal financing should be relatively more predominant among firms with low net worth relative to their desired investment levels. Relatedly, bank **loans**— which involve monitoring and close customer relationships to address the incentive problems—should be the principal form of external finance for this class of firms.

## Empirical evidence on financial factors and real outcomes

Evidence for *manufacturing* firms

In the previous section, we outlined testable implications of the "financial factors" approach for cross-section, time-series **data.** These implications involve: (i) variation across firms in financing patterns, (ii) a link between investment and internal net worth (holding constant measures of investment opportunities), and (iii) an asymmetry in the effect of changes in internal net worth on investment.

To test these propositions, we use data on 421 manufacturing firms over the period from 1970 to 1984 constructed from Value Line sources by FHP (1988a). We follow FHP in using long-run retention behavior as a proxy for perceived differences in the cost of internal and external funds. Such a criterion is intuitive. If the cost disadvantage of external finance is small, then retention behavior should be irrelevant to real investment decisions. On the other hand, firms that finance most of their investment from retained earnings may do so because they face high costs of obtaining external finance at the margin for the kinds of reasons discussed in the previous section. Fluctuation in internal net worth should affect investment spending for these types of firms. Insiders' net worth is, of course, unobservable in the data; we follow FHP, and use firm cash *flow* as a proxy.

To implement the classification by retention behavior, we group firms into three categories— "high retention," "medium retention," and "low retention." "High retention" firms have a ratio of dividends to net income of less than 0.1 for at least 10 years. "Medium retention" firms have a dividend-income ratio less than 0.2 (but greater than 0.1) for at least 10 years. The remaining firms comprise the "low retention" category. This is the classification suggested by FHP.

## Table 5
## U.S. Manufacturing Firms Grouped by Retention Patterns, 1970-84 Summary Statistics

| | Category of Firm | | |
|---|---|---|---|
| Statistic | High Retention | Medium Retention | Low Retention |
| Number of firms | 49 | 39 | 334 |
| Average retention ratio | 0.94 | 0.87 | 0.58 |
| Average real sales growth (percent per year). | 13.7 | 8.7 | 4.6 |
| Average of firm standard deviations of investment-capital ratios | 0.17 | 0.09 | 0.06 |
| Average of firm standard deviations of cash flow-capital ratios | 0.20 | 0.09 | 0.06 |
| Average of firm standard deviations of annual growth rate of real sales (percent per year) | 26.0 | 19.1 | 14.0 |
| Median capital stock, 1970 (millions of 1982 dollars) | 27.1 | 54.2 | 401.6 |
| Median capital stock, 1984 (millions of 1982 dollars), | 94.9 | 192.5 | 480.8 |

Source: Authors' calculations based on samples selected from the Value Line data base.

We present summary statistics for the firms in each class in Table 5.[39] Firm size is negatively correlated with retention of earnings, corroborating the general pattern for the manufacturing sector illustrated in Table 1. By construction, the high-retention firms are closest to the margin of requiring external funds to finance investment opportunities. The evidence in Table 5 suggests that these firms had more

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[39] Further discussion of the classification system is given in FHP (1988a).

variable internal net worth and investment than other firms in the sample. The standard deviations of the cash flow-capital ratio and investment-capital ratio are greatest for the high-retention group. In addition, sales variability—measured by the standard deviation of the growth rate of real sales over the period—is substantially higher for the high-retention firms than for the low-retention firms.[40] While a technological choice model might be able to explain heterogeneity in the variability of sales growth,[41] it would not explain the coincidence of sales and investment variability across retention classes. In Table *6,* we report standard deviations of sales growth by retention class for five (two-digit-S.I.C.) industry groups in which high-retention firms are most important. There are, of course, differences across industry groups in sales growth variability. In all cases, however, the standard deviation of the growth rate of real sales is roughly twice as large for the smaller, high-retention firms than for the larger, low-retention firms.

We next test directly for the sensitivity of firms' investment spending to movements in internal net worth. We work within the Tobin's q framework, since q—the ratio of the market value of the firm to the replacement value of its capital stock—will capture the *market's assessment* of the firm's *investment opportunities.*[42] If financial factors are unimportant, internal and external funds will be perfect

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[40] This pattern holds up within individual two-digit-S.I.C. categories.

[41] One explanation is that firms of different sizes could coexist in equilibrium in an industry subject to random demand. Mills and Schumann (1985) note that some firms could assume greater fixed costs taking advantage of scale economies, while other firms could rely more on variable factors (e.g., labor), trading off static efficiency for "flexibility." Using data on manufacturing firms from COMPUSTAT, Mills and Schumann find that sales and employment variability are negatively related to firm size and market share within an industry. The assertion that high fixed costs are incurred to take advantage of scale economies is probably questionable, since minimum efficient scales in U. S. manufacturing are, in general, small. See the discussion in Domowitz, Hubbard, and Petersen, (1988).

To pursue these ideas further, we regressed the firm standard deviations of real sales growth on (the log of) the beginning-of-sample-period capital stock (as a measure of size) and two-digit-S.I.C. industry dummies (as proxies for industry-specific sales variability). We found that firm size is negatively related to sales variability. When we allow for different intercepts by retention class, pure size effect virtually disappeared. Such results are again suggestive of the role played by financial considerations for smaller firms.

[42] Variable definitions and construction are described in FHP (1988a, Appendix B).

# Table 6
# Sales Variability Across Retention Classes Within Industries

|  | **Standard Deviation of Real Sales Growth** | | |
|  | **(Percent per Year)** | | |
| **Industry Group** | **All Firms** | **High Retention** | **Medium Retention** | **Low Retention** |
|---|---|---|---|---|
| 20: Food and Kindred Products | 15.1 | 28.5 | 27.6 | 11.2 |
| 28: Chemicals and Allied Products | 13.1 | 21.3 | 17.5 | 11.7 |
| 35: Machinery, Except Electric Machinery | 21.2 | 26.6 | 17.8 | 17.0 |
| 37: Transportation Equipment | 19.1 | 38.2 | 16.4 | 15.5 |
| 38: Instruments and Related Products | 16.4 | 23.8 | 12.1 | 11.3 |

Source: Authors' calculations based on samples of firms drawn from the Value Line data base.

substitutes, and q will be a sufficient statistic summarizing investment opportunities; contemporaneously dated information about internal net worth (here firm cash flow) should be irrelevant.[43] Specifically, we estimate for each retention class a model of the form.[44]

$$(11)\ I_{it}/K_{i,t-1} = a_i + bQ_{i,t-1} + (c + d\ RECESSION_t) \times$$

$$(CF/K)_{i,t-1} + u_{it},$$

where i and t represent the firm and time period, respectively.

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[43] This is strictly true under assumptions of perfect competition (equality of price and marginal cost) and constant returns to scale. In general, output measures may matter. FHP (1988a) explore this issue further. What we stress here are differences across retention classes in the effect of internal finance on investment.

[44] For a derivation based on adjustment costs of investment, see Summers (1981), Hayashi (1982), and FHP (1988a).

All variables are measured at the end of the period. I and K denote investment and the replacement value of the capital stock; Q represents the value of Tobin's q (defined as the sum of the value of equity and debt less the value of inventories divided by the replacement cost of the capital stock), adjusted for personal and corporate tax considerations. CF denotes cash flow (after-tax earning plus depreciation). RECESSION is a dummy variable equal to unity in 1974, 1975, 1981, and 1982, and equal to zero otherwise; it is included to test whether the effect of internal net worth on investment varies over the cycle; u is an error term. The equations were estimated over the 1970-1984 period with fixed firm and time effects. Results are reported in Table 7.

## Table 7
## Effects of Q and Cash Flow on Investment, 1970-1984

| | Category of Firm | | |
| Variable | High Retention | Medium Retention | Low Retention |
|---|---|---|---|
| $Q_{i,t-1}$ | 0.0005 | 0.004 | 0.002 |
| | (0.0004) | (0.0009) | (0.0003) |
| $(CF/K)_{i,t-1}$ | 0.506 | 0.339 | 0.246 |
| | (0.034) | (0.038) | (0.011) |
| RECESSION | 0.197 | 0.099 | −0.026 |
| | (0.054) | (0.050) | (0.012) |
| $\overline{R}^2$ | 0.37 | 0.30 | 0.20 |

Note: The dependent variable is the investment-capital ratio $(I/K)_{it}$ for the ith firm at time t, where I is investment in plant and equipment and K is the beginning-of-period capital stock. Independent variables are defined as follows: Q is the sum of the value of equity and debt less the value of inventories, divided by the replacement cost of the capital stock, adjusted for corporate and personal tax considerations; CF/K is the cash flow-capital ratio. RECESSION is a dummy variable equal to unity in 1974, 1975, 1981, and 1982, and equal to zero otherwise. The equations were estimated using fixed firm and year effects (not reported). Standard errors appear in parentheses.

Two features of the results in Table **7** are of particular interest. First, there are important economically and statistically significant differences across retention classes in the effects of the previous period's cash flow on investment.[45] Greater retention is associated with a closer link between internal finance and investment, suggesting that internal and external finance are imperfect substitutes for high-retention firms. That such firms are, on average, small and rapidly growing (relative to other firms in the sample) is consistent with the predictions of models of asymmetric information stressing the importance of firms' internal net worth (balance sheet position). Second, the asymmetric effect of internal net worth on investment predicted by the model is present. Cash flow effects for high-retention firms and medium-retention firms are substantially stronger in economy-wide recession years. The same is *not* true for the large, mature low-retention firms.

Large firms, of course, account for a greater fraction of firms in the Value Line sample than they do in the economy. Again, we note that manufacturing firms of the same size or smaller than the firms in the high-retention and medium-retention classes account for an important fraction of aggregate sales and assets. From Table **3,** manufacturing corporations with less than $100 million in assets account for about 15 percent of total assets and 25 percent of total sales in the manufacturing sector.,

## Concluding discussion

Recent research by macroeconomists has stressed the development of business cycle frameworks in which financial structure is irrelevant. It seems doubtful, however, that such models can explain the

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[45] Similar evidence has been obtained for Japanese manufacturing firms by Hoshi, Kashyap, and Scharfstein (1988). They find that membership in a *keiretsu* group and the presence of a group bank are important in the provision of information and the avoidance of credit rationing when investment opportunities are promising. Indeed, Hoshi, Kashyap, and Scharfstein use panel data on Japanese firms to show that investment is sensitive to fluctuations in internal finance—after adjusting for investment opportunities measured by q—only for firms not in keiretsu groupings. The investment behavior of firms in the groups with access to a group "main bank" is well described by standard perfect-capital-market investment models.

magnitude of or heterogeneity in investment fluctuations without appealing to large exogenous disturbances. The approach taken here is to emphasize the role of financial factors in amplifying investment swings, the motive being to lessen the need to rely on external driving forces to explain economic fluctuations. While the issue is far from resolved, we believe there is sufficient evidence to date to continue trying to model and measure the role of "financial factors" in the business cycle.

We finish by addressing some issues pertinent to our analysis.

### *Implications of the stock market crash.*

Most economists agree that the October 1987 crash appears to have had a minimal impact on real activity. After a temporary period of decline, initial public offerings of equity are back to their normal levels. Further, it is difficult to identify any obvious effects of the crash on the behavior of aggregate variables. How does this square with the analysis here?

The story we presented emphasized that the'critical determinant of a firm's borrowing capacity is its internal net worth, the value of the stake of inside owners/managers. In this regard, it is important to recall that stock prices rose dramatically in the nine months prior to the crash; the effect of the crash was largely to wipe out these gains and return the market to trend. Even if one believes that movements in stock prices are closely connected to movements in internal net worth (we do not), it is still probably the case that the annual change in internal net worth was not exceptionally large (i.e., the change from January 1987 to January 1988). It is unlikely that high frequency variation (e.g., weekly variation) in net worth has much impact on investment because of adjustment costs. Seen in this light, it is not surprising that the stock market volatility had little impact.

It is probably also true that short-run variation in stock prices does not mirror movements in firms' internal net worth. First, a sizable fraction of a publicly traded firm's equity is typically held by outside parties who have no more information than any other claimants about the inner workings of the firm; it is not appropriate to include their holdings in the measure of internal net worth. What ultimately

matters for our purposes is the value of the collateral (broadly defined) that creditors perceive the firm has to offer. This value may be unrelated to high-frequency variation in stock prices, and particularly so if this variation is not tightly connected to changes in fundamentals.

Also, before drawing any parallels with earlier times, it is important to recognize that the stock market crash in 1929 was not the most economically significant "financial" event of the Depression. Rather, as Bernanke (1983) emphasizes, the banking collapse and the debt crisis (induced by the massive deflation) had far more substantial effects on the severity of the downturn. Similar events, of course, did not arise in the aftermath of the 1987 crash. This was at least in part due to the commitment of the Federal Reserve to preserve the smooth functioning of the financial system—monetary policy was expansionary in response to the crash—in conjunction with institutional safeguards such as deposit insurance.

## *Fluctuations in employment demand and in spending on consumer durables*

To the extent that labor is a quasi-fixed factor (as in Farmer, 1985) or there is a lag between labor input and production (as in Greenwald and Stiglitz, 1986), then the theory of investment demand presented here extends naturally to a theory of employment demand. In either of these cases, firms may need to borrow to finance labor input. It follows that procyclical movements in internal net worth can lead to accelerator effects on employment demand in the same way they may for investment demand. Indeed, using English data, Nickell and Wadhwani (1987) find negative effects of leverage and debt service on employment, holding constant real variables.

One could also envision developing a theory linking (household) net worth to durable goods demand. Suppose that consumers need to self-insure against adverse movements in their respective labor incomes due to the absence of perfect insurance markets. The need to hold precautionary balances may make their spending on large durables highly sensitive to their existing asset positions. Indeed, there is evidence linking household spending on durables to balance sheet variables.[46] Thus, financial factors could have a role in the volatil-

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[46] See, e.g., Mishkin (1978).

ity of spending on consumer durables, as well as of spending on producer durables.

## Agency costs of "free cash flows"

The analysis presented here may appear in conflict with the "free cash flow" theory of investment, invoked recently to explain the current wave of corporate restructuring as a product of excessive investment.[47] We stress, however, that the two approaches are not in conflict. Indeed, in the model we developed, outside lenders cannot determine directly whether borrowers are efficiently allocating investment funds, which is precisely the problem upon which the free cash flow theory builds. Underinvestment can occur in the approach we characterize here because the outside lenders take into account borrowers' incentives *before* supplying funds. The free cash flow story typically begins at a later stage, *after* lenders have already provided funds to the firm.

Further, the conclusion of the free cash flow theory that management should pay out *outsiders'* cash is perfectly consistent with our analysis. This is true because the theory we presented emphasizes the role of *internal net worth* in investment, and not cash flow, *per se.* The confusion arises (we think) because empirical researchers must rely on variables such as firm cash flow as proxies for movements of insiders' net worth.

## 'Junk bonds' and increased leverage

The recent growth of markets for non-investment-grade bonds ("junk bonds") has extended to smaller corporations the ability to issue marketable securities.[48] However, available evidence suggests that the terms under which these securities are issued are closely connected to the financial position of the firm, in a way consistent with

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[47] See, e.g., Jensen (1986).

[48] Such bonds have existed previously (e.g., in the 1930s), but their popularity has resurged in the past decade. See the discussion in Loeys (1986).

the theory presented here—indeed, the security in our theoretical model is easily interpretable as a junk bond. Coupon rates on these bonds are typically quite high relative to Treasury bonds of similar maturity, reflecting a perceived default risk.[49] Further, studies indicate that measures of *(inter alia)* internal net worth and liquidity predict this default risk well, and thus predict well the spread between junk bond coupon rate and the riskless rate.[50] Given that the agency costs of investing are positively related to this spread (as our theoretical model predicts), then the link between internal net worth and real investment decisions clearly remains for firms issuing junk bonds.

What about the more general issue of the increased use of leverage in the corporate sector? In the theory presented here, the important distinction is how the value of the firm is divided between *insiders* and *outsiders,* given that the insiders' net worth governs the agency costs of investing. Less important is how the liabilities issued to outsiders are divided between equity and debt, the point being that there are likely to be agency costs associated with issuing equity, as well as with issuing debt. Thus, in our view, increased leverage is significant for macroeconomic stability only if it is associated with declining internal net worth, and/or only to the extent it makes insiders vulnerable to the risk of a sudden wealth redistribution, as occurred in the debt-deflation of the 1930s.[51]

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[49] Loeys (1986, p. 6) notes that the risk premium of non-investment-grade bonds over Treasury issues averaged 300-600 basis points over the 1981-1986 period. Over the period from 1970 to 1984, the default rate of non-investment-grade bonds averaged 2.1 percent per year, relative to roughly zero for investment-grade securities. See Altman and Nammacher (1986), Table 10.

[50] See Altman (1987).

[51] See also the discussion in Bernanke and Campbell (1988).

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# Commentary on 'Financial Factors in Business Fluctuations'

*Robert E. Hall*

This paper reflects one of the important trends in macro thinking about corporate finance: There is an internal economic life of the firm where the most important decisions—employment, investment, production—are made. The players within the firm are the salaried managers of the firm and the workers. Quite separately, there are wealthy individuals and institutions who provide finance for these activities. These wealthy individuals trade with each other claims on the operations run by managers in organized securities .markets.

It's a fact of life that in an economy like that of the U.S., there are relatively few wealthy managers. So there always needs to be a bridge between managers and wealth which is held either in the form of institutions or by a relatively small number of very wealthy individuals who haven't the managerial skills or time to "run their own show." This bridge—the interaction between the managers and the wealthholders—involves some difficult problems of incentives and moral hazard, which are very well developed in this paper. I endorse both the example given here in the paper, and the general principle it illustrates: that although the managers are playing with the wealthholders' wealth, wealthholders would like managers to make decisions as if they were deploying the managers' own wealth. That bridge and its implications for macroeconomics—in particular, for the transmission of gyrations of financial markets into the real economy—is what this paper is about.

What has emerged from thinking about this situation is what I call the "back-to-the-wall" school of finance theory. Contributions in

various forms have been made by Jensen, **Meckling,** Stiglitz, **Green-wald,** Gertler, **Hubbard** and others. The idea is that the managers should control a certain amount of genuine equity—the managerial or so-called internal equity. It is their own equity in the sense that the managers get to keep the fruits of their entrepreneurial successes and, as well, must pay for their failures. If the managers are to see themselves as equity-holders, they must not have a draw on the wealth of the wealthholders, nor must they surrender their profits to the wealthholders.

**A** key idea in the back-to-the-wall school, again which was well developed in this paper, is the so-called *finance* contract. The finance contract governs the relation between the wealthholder on the one hand and the managers on the other. The derivation of this finance contract and the identification of its characteristics is the major theoretical contribution of this school. The derivation in Gertler-**Hubbard** of their theoretical model is a perfect example of the finance contract and the kinds of principles and results that you get from posing this finance contract question. In their example, the wealthholder is called a banker and the manager is called an entrepreneur. The general flavor of their results is that the payments made by the managers to the wealthholders should be as insulated as possible from the success or failure of the firm. So in contrast to the traditional view of what it means to be a shareholder, which is to have residual claim of what's left over from the operation of the firm, the back-to-the-wall theory says that this type of equity doesn't make sense from the point of view of the intended incentives. That is, traditional equity is not the type of contract that emerges from this framework. In fact, the whole thrust of this research is that even if the finance contract is, in principle, written as equity, it should actually resemble debt as much as possible. So the back-to-the-wall theory strongly endorses either explicit debt or the equivalent, which is "equity" that functions like debt.

Because of the need to make the finance contract have debt-like features, the distinction between debt and equity is not a hard and fast one. In general, the solution to the problem of the **wealthholder-**manager relationship is a finance contract which has debt and equity elements.

For the sake of illustration, I identify below some real-world applications of back-to-the-wall finance principles:

1. The loan agreement between a bank and a firm should give the bank full value in the event of adverse developments and should not have any extra repayment or sweeteners in the event of success. Not only should the marketable assets of the firm be pledged, a major point of **Gertler** and **Hubbard,** but the personal assets of the managers should be pledged as well. In every situation I know of involving a small business and a bank, the bank extracts security interest in the homes and other assets of the managers, which is exactly in line with this idea that there should be a noncontingent pledge that there be no effect to the equity interest of the bank whatsoever. That is, the bank should get its value out no matter what happens just as the entrepreneurs get to keep the proceeds of their successes.

2. In a start-up situation, the incentive problems are particularly acute. If you look at the **kind** of a deal a venture capitalist (the wealthholder) should make with the entrepreneurs, it has the following character: the venture capitalists should have a full liquidation preference and the principals should invest all of their personal wealth, including all available house equity.

**3.** For a publicly traded firm, you have a new and different set of principles because there the funds at stake are coming from a huge set of shareholders who receive their value through dividends, net redemption of shares, and similar techniques. All of these payment methods taken together—primarily dividends—should be insulated from the results of the firm's operations. In other words, dividends should be smooth and the commitment of managers to pay dividends should be independent of the success of the firm. Dividends should really be like interest payments with some long-term flexibility. A cut in a dividend should be an act of desperation on the **part** of the firm rather than simply routinely **making** the shareholders have a residual claim on the firm. Again, I would assert that this is a much better model of dividend payment than the traditional residual-claim-of-shareholder model.

4. Even better than smooth dividends, is that wealthholders hold debt rather than equity. So the back-to-the-wall school offers a very strong endorsement of junk bonds and other high leveraged investment.

5. The managers' internal equity must be protected against takeover or preserved in **the** event of a takeover. Back-to-the-wall theory does not support the **general·hostility** of finance economists to measures

that defend the corporation against hostile takeovers. Those measures are part of the way the managers are given effective ownership of the internal equity.

The macro implications of the back-to-the-wall finance theory constitute the basic subject of the Gertler-Hubbard paper. While there's relatively little space in the paper devoted to the general topic of this conference—the effect of the stock market crash on the substantive decisions of the firm—I think what is said is exactly on the point.

The first task here is to explain why Tobin's celebrated q-theory does not apply—firms do not expand aggressively when their market values exceed the reproduction costs of their assets (as in the spring and summer of 1987), nor do they contract when market value falls. There's no better illustration of that than what appears to be the total insulation of substantive activities of firms from the collapse of the stock market. The back-to-the-wall theory explains why the decisions made by managers are insulated from the valuation of the essentially fixed payments the managers are committed to making to shareholders. What happens when the stock market crashes is that the wealthholders trading with each other put a lower value in the same essentially fixed payment stream that the managers committed themselves to make. Such trading has no impact on the managers' commitment, which is still to provide the same flow of dividends and interest payments and therefore has no substantive effect within the firm. But the gyrations can still occur in securities markets.

A second and very important point that Gertler and Hubbard make in the paper is noting a contrast between the 1987 collapse in the stock market and the Great Depression. Two things happened in the Great Depression that did not happen this time around which are central with respect to the back-to-the-wall theory. One is that a class of wealthholders, especially important for smaller firms—namely banks—was devastated. If you wipe out a set of wealthholder-intermediaries who are specialized in being half of a partnership for an important class of firms, not surprisingly, the managers who do not have the wealth themselves can't go on. So you'd expect a very sharp substantive response, whereas nothing like that happened in 1987. Second, the internal equity—the managerial equity—was wiped out in the depression by deflation. It appears that the nature of the commitment between managers and wealthholders is to nominal payment streams; interest is invariably set in nominal terms and I believe

that dividends are set in nominal terms as well. There is a **commit-**ment to nominal dividends which wipes out managerial equity if the price level declines sharply as it did in the depression. So I see all that as fitting in very well to the back-to-the-wall story.

Finally, the other type of macro implication which was worked on in great detail in this paper deals with the exaggeration of investment and other responses that occur in the back-to-the-wall situation. In part, back-to-the-wall theory is seen by an emerging school of macroeconomics (both G-H and this discussant are members of that school) as central to an explanation of the boom and recession character of overall activity. Gertler and Hubbard's theme is that "imperfections" in capital markets described by the back-to-the-wall theory contributes to output volatility, especially to investment volatility.

Gertler and **Hubbard** describe that situation as one involving imperfections but I would point out that I think using the term imperfection is a little off the point. Of course, firms operating under back-to-the-wall principles are not as efficient as those in an, ideal economy where'investors are costlessly fully informed. But the appropriate comparison is to other solutions to the practical problems of letting managers deploy other people's wealth, such as government control of investment. For example, the Soviet Union solves this finance contract problem in a different way by having investment controlled by the central government. But I assert that this is even worse than the back-to-the-wall solution. The basic incentive problem here is not one just of a capitalist economy, it's very much one of a socialist economy as well. And this type of answer, it seems to me, is really saying that our way, the back-to-the-wall way is a constrained option and, in that case, I think calling it an imperfection is only relative to an unobtainable situation. In sum, the "imperfection" looks pretty good.

Gertler and **Hubbard** present empirical work intended to support the back-to-the-wall theory against alternatives. Their basic premise is that only a fraction of firms is governed by the principles of **back-**to-the-wall finance. These are the firms that pay out a relatively small fraction of earnings as dividends; the group tends to contain smaller firms. G-H find that output and investment volatility are higher in the back-to-the-wall group and that investment is more tightly linked to cash flow. Although I find these results mildly supportive of the

thesis, I question the basic premise. There is just as much reason for the shareholders in a large, mature corporation to keep their managers' backs to the wall as there is for the bankers of large firms.

The acid test of the back-to-the-wall theory is the following: what happens within a firm if there is a $1 million windfall? According to standard theory, nothing happens substantively within the firm. The $1 million is passed on as part of the residuals to the shareholders and the windfall has no effect on investment, employment or output. According to back-to-the-wall theory, the $1 million is an addition to managerial equity. Because back-to-the-wall **principles** require that managers earn above the market rate on their invisible (soft capital) investment, any windfall gets turned into soft capital and has a substantial effect on output, investment and employment. In the version of this that I believe in, the **Gertler-Hubbard** version, managers are equity constrained and use it to buy more capital; therefore, there's an increase in the capital stock and in the output and the employment of the firm, as a result of the windfall. That's the acid test. That's the empirical work that should be done. I have my doubts about the work that's actually been done, but if something like that could be done, we would really be able to find out some of the answers to these questions.

# The International Transmission
# of Asset Price Volatility

*Charles Goodhart**

## Introduction

There is a human tendency to overstate current difficulties and problems and to compare perceived present disturbances with some (partly mythical) prior golden age when everything was calm and ordered. To take one example, during the 17 years in which I was associated with forecasting in the Bank of England, I cannot now recall a single forecast which did not begin with some such proviso as, "In current circumstances it is unusually difficult to construct a forecast."

The same trait holds true in assessments of asset price volatility. [1] It was a regular occurrence for senior officials at the Bank of England (and for pundits elsewhere) to complain that asset price volatility was higher at the present time (as each year went by) than in previous

[1] It holds true as well in some exaggeration of the extent to which the integration of asset markets worldwide is said to be unprecedented. By many tests world financial markets were more integrated in the period 1890-1914 than now. Tests of the kind originated by Feldstein would probably suggest much greater international integration in the earlier period; see Feldstein and Horioka (1980), Feldstein (1983) and Obstfeld (1986 a and b). International monetary substitution was surely higher, and international portfolio (bond) elasticities of substitution almost certainly so. The *proportion* of non-British assets (mostly bonds, with a high weighting of railway bonds) actively traded on the London Stock Exchange was, I would expect, higher in 1913 than in 1988. O. Morgenstern (1959) compiled a massive study *of* correlations between

periods. It was not clear to me that that claim was well-founded econometrically, and eventually I encouraged a visiting economist (from the RBNZ) to test such claims.

He used an ARCH model rather than the common, simpler moving variance about moving mean (MVAMM) approach. There are several possible advantages in using the former technique (besides showing off greater technical sophistication). First, it could allow any predictable change in the asset prices to be discounted, i.e., "it measures the dispersion around the conditional rather than about the sample mean;" given, however, the martingale/random walk characteristics of most asset price series, this advantage is not of much significance for this kind of study. Second, the MVAMM requires an "arbitrary" choice of window, and weights all the observations within the window with a value of unity and those outside with a zero weighting. Instead, with an ARCH test, the order of lag and weighting are primarily (e.g., subject to non-negativity and stationarity requirements) determined by the data themselves.[2,3]

Anyhow, the results of this test[4] did not support the hypothesis that asset price volatility has increased monotonically over time. There

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national asset price movements in earlier decades. I should be prepared to bet, since I have not done the empirical work to sustain the claim, that the correlations between national short-term interest rate movements were higher in the earlier period, and that the correlations between equity indices were probably much the same then as now.

In what ways then, if at all, is the international financial community significantly more integrated than before 1914? Whereas news does travel even more swiftly than before, the crucial innovation for international integration was the earlier telegraphic cable and radio. One novel feature of our more recent period is the interpenetration of each others countries national markets by multi-national firms. The elasticity, in response to differential profit possibilities, of direct investment seems much higher now than then; there was no equivalent of Coca Cola, McDonalds, Shell, Ford or Unilever before 1914. It is odd that most of our models concentrate on portfolio capital flows, and attach so little attention to direct capital flows.

The other main distinction between the period before 1914 and the 1980s was that in the earlier period the international integration of national financial markets was constructed on the basis of, and supported by, a stable, essentially single currency system (the Gold Standard). The interaction now of a unified global capital market with an unstable system of independent national currencies has led to major problems arising in recent years, notably exchange rate misalignments, but this is too wide an issue to pursue further here.

[2] In practice, however, the ARCH and the MVAMM estimates of volatility have given broadly similar results in these exercises.

[3] See Dickens (1987a).

**was** a golden age of asset price tranquillity in the 1960s, but we were flung out of that Garden of Eden in 1973, and asset price volatility in the United Kingdom (equity prices, short and long interest rates) then rose to higher levels in the years 1973-75 than at any other time during this data period, 1967-85. Subsequently, "distinct cycles in variability were evident . . . with trough levels generally around the average levels experienced in the 1967-72 period, and peak levels well in excess of the trough levels, although except for the exchange rate series, below the peak levels in 1973-75 period."[5]

Bank of England officials not only complained about worsening asset price volatility, they frequently asserted that such enhanced volatility was imported from abroad, that the supposedly greater disturbances in London were generated by larger fluctuations elsewhere. (New York was usually the proposed perpetrator.) Such claims were particularly common in the early 1980s, when volatility in the New York money and bond markets did increase by a factor of "five to eight times the levels prior to 1979."[6]

Anyhow, it seemed worthwhile to move on from a study of asset price volatility in the United Kingdom to a companion exercise to examine international comparisons of asset price volatility. This study, mainly by Dickens,[7] is available in the Bank of England Discussion Papers (Technical Series), no. 15, February 1987. The conclusions to this are reproduced here in an Appendix. Briefly, there are some international linkages between volatilities in bond and equity markets (though very little international linkage between volatility in national money markets), but these relationships are less strong than much casual empiricism claims. The main periods of asset price disturbance were 1973-75 (broadly) and 1979-82 (focused in U.S. money and bond markets). We observed no tendency for national asset price volatilities either to 'increase monotonically over time, or to become more closely internationally correlated over time.

We need, therefore, to be suspicious about embracing the view that there has been any Ionger-term trend toward enhanced interna-

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[5] See Dickens (1987b), p. 10.

[6] *Ibid.*

[7] I wrote Sections **7.8** to 9 jointly with him.

tional transmission of asset price volatility. This does not, however, rule out the possibility that such transmission mechanisms may play a major role on certain key occasions.

Indeed, I very much doubt whether this conference, or my own particular topic within it, would have been organized were it not for the crash of October 19, 1987. When that crash occurred, my colleague, Mervyn King, and I, having jointly founded the Financial Markets Research Group at the London School of Economics in 1986, concluded that the comparative advantage that the FMG might have in the post-mortems on this event would be to examine some aspects of the international linkages and transmission mechanisms involved. In our view, the most "puzzling feature of the October 1987 crash was the almost uniform fall in world stock markets, despite important differences in economic prospects, market mechanisms, and their prior "degree of overvaluation."[8]

Nevertheless, it always seemed a fair bet, and was in the event correct, that the various studies commissioned in each country to delve into the minutiae of the evidence of the working of their own stock markets during the crash would indeed concentrate on local (parochial?) national performance and pay relatively little attention to the international dimension. This was mainly because of the obvious focus of each country's inquiry on the performance of its own national market.[9] It was also partly because there were (and remain) limitations in the data available to test some of the forms of international linkage. Thus, casual empiricism has claimed that an unusually large proportion of equity sales in many equity markets worldwide on October 19/20 was by "foreigners". In London, however, fiscal requirements whereby certain taxes can be avoided by those declaring themselves non-resident, allow the residence of purchasers of equities to be broadly estimated, but not that of sellers. So there is no data here to test such casual empiricism, and I am not aware of data (or studies) elsewhere that could properly examine this claim.

Even when the Brady Commission (1988) did consider interna-

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[8] See King and Wadhwani (March 1988a), p. 2.

[9] One feature of this internal concentration has been the comparative absence of discussion about disintermediation, to stock markets abroad, of business temporarily prevented by national "circuit-breakers".

tional linkages, it took the view that these "were unlikely to have been important during the crash because there had not been any perceptible rise in correlations between markets over time."[10] While that finding is consistent with those of Dickens, above, and indeed with Wadhwani and King's own subsequent results, it is a ***non sequitur*** to deduce from the absence of any low-frequency trend that there should also be no significant much-higher-frequency relationship at a time of particular crisis and high volatility.

## International linkages and the crash of 1987

As already noted, the most puzzling aspect of the crash, or so it appeared to us in the FMG, was the similarity of decline in stock markets worldwide. This throws doubt on a number of possible explanations. It is hard enough—indeed, generally accepted as impossible—to find "news" that could justify the scale of decline in the NYSE between October 16 and 19, but to seek to find such "news" in every major country, virtually simultaneously, would, indeed, be piling Pilion on Ossa. Again valiant—but not entirely convincing—efforts have been made to identify stock exchange bubbles developing and breaking simultaneously in New York, London and Tokyo.[11] I would challenge anyone to find a bubble also in Frankfurt, and yet the stock market there fell in line with the rest in October. Moreover, if it all had been just a bubble breaking, why has the bubble re-inflated so soon in Tokyo, but not elsewhere?

My own personal favorite explanation is that, after an initial decline caused by a "rational" interpretation of worsening fundamentals, the subsequent collapse in U.S. securities markets was the result of a market failure, with a dysfunction between the futures markets, driven down, in part, by portfolio insurance, and the NYSE where the specialists were insufficiently capitalized to absorb the pressures, including the sales arising from programmed trading arbitraging between the two markets.

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[10] King and Wadhwani, Ibid.

[11] See G.A. Hardouvelis, Federal Reserve Bank of New York Working Paper, 8810, (April 1988).

Be that as it may, if the decline in the NYSE had been the result of market failure, at least in some significant part, why did the U.S. markets not then "bounce back" toward their appropriate fundamental value, and just as, or more, difficult to understand, why should foreign markets have declined as much? The two questions are, of course, closely linked. Many of the major international companies are quoted on several exchanges, and arbitrage will ensure that their price is the same on geographically-separated exchanges which are open at the same time. But if the decline in New York had been due to local market failure, driving the price of commonly quoted multi-nationals below their "fundamental value," then that should have led to subsequent buying on other exchanges where the market mechanisms were different and not subject to the same pressures.

It is the case, I believe (but have not seen rigorously demonstrated), that shares of (non-U.S.) companies with U.S. connections, either in the form of a quotation on a U.S. exchange or with a large export market there, fared slightly worse in their domestic (non-U.S.) stock markets, than comparable shares (with similar Betas) but no U.S. exposure, during the week of October 19-26, though even this has been denied.[12] Certainly the impression (casual empiricism) that I received was of the general, widespread nature of the collapse across all shares, with or without particular U.S. connections, in all the world's main stock exchanges. It may be that this impression is incorrect; certainly it deserves testing. Nevertheless, my feeling was that we were witnessing then a contagious transmission of a (panicky) reassessment of the discount factor to be applied to future earnings on equity as a class of asset, rather than any more reasoned review of the likely future path of company profits either in the United States or more widely in the western world.

Certainly there was much newspaper and "pundit" comment at the time about declines in stock exchange values becoming self-reinforcing as a result of international interactions and "cross-infection." The sell-off in one market, say New York, precipitated

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[12] See the article by N. Goodway in *The Observer,* November *29, 1987,* reporting some research by Paul Masson of Kleinwort Grieveson which concludes that the idea that shares with international listings were harder hit than most by the crash was "a myth."

consequential falls in other markets around the world, notably in Tokyo and London, where price falls then caused further dismay and price declines in New York, and so on.

There has been sufficient general interest in the possible existence of this concept of ''cross-infection'' between international markets to make my colleagues and me at the FMG keen to see if we could undertake any econometric tests to explore the existence of such phenomena. This is not an easy exercise to undertake. The problem is that it is hard to distinguish between a case when two markets move together because they are both responding ''rationally'' to some common ''news'' which will affect the expected future streams of corporate profits and dividends, and/or their riskiness, from the case when one market simply becomes ''infected'' by observation of price movements in the other.

It is extremely difficult to define ''cross-infection'' rigorously in a world in which ''news'', the unanticipated element in announcements, is hard, and often virtually impossible, to measure on a common basis. Indeed, it is, in part, because it is so difficult to assess what the ''news'', or its implications, really amounts to, that stock exchange practitioners will tend to look, perhaps especially in setting initial prices at the opening in the morning, at what assessments have already been made in stock exchanges abroad. This tendency will, no doubt, be most marked when the ''news'' either arrives initially in, or is most easily interpreted by, the other stock exchange. (For example, if the U.S. President were to die, stock exchange participants in non-U.S. countries might wish to take their lead from the price changes that would occur on the NYSE, rather than try to estimate the ''fundamentals'' themselves.)

There is, therefore, *normally* some ''contagion'' of price changes in one market affecting prices elsewhere. There is nothing irrational about this. Stock exchange participants are simply trying to extract the ''signal'' about the ''news'' relevant to their own markets from the ''portmanteau'' statistic of changes in the indices in the main centers elsewhere. Where such ''contagion'' turns into the ''cross-infection'' described above, comes in those cases where the self-confidence of stock exchange participants to assess the fundamental value(s) of assets themselves, independently, erodes, so that they start to pay much greater (excessive) attention to prices set by others in the market, and less to fundamentals. This is akin to a (partial) switch

in regime from a rational, efficient market in which values depend on the present discounted value of expected future cash flows (with participants trying to reach an independent judgment) to Keynes' beauty contest. In our international framework the onset of such "cross-infection" might best be measured by a significant rise in the "contagion" coefficient relating price changes in one stock market to (prior) changes in other stock markets.

Even here, one cannot disprove the hypothesis that a rise in the "contagion" coefficient may have been a rational response to greater co-variance in "news" affecting both (all) markets. I doubt whether it is strictly possible to construct any test which would enable the "news" hypothesis of asset pricing to be refuted. All that we can do is to explore whether it is possible to present data which seem more consistent with the hypothesis of internal market dynamics such as "cross-infection", and by the same token, less consistent with the pure "news' hypothesis.

A first exercise along these lines has been undertaken by my colleagues, Mervyn King and Sushil Wadhwani. A first draft of their paper, "Transmission of Volatility between Stock Markets," was presented at the LSE Financial Markets Group Conference on Stock Market Behavior, March 29, 1988; a revised version (July 1988) has been sent to my discussants, and a later version is available on request from the Financial Markets Group at LSE, Discussion Paper No. 48. They put forward a model wherein, "Information is of two types, systematic and idiosyncratic. The former, denoted by u, is information that affects market values in both countries. The latter, denoted by v, is relevant only to a specific country. We assume that both u and v have two components, corresponding to information that is observed in one country or the other. If information from both countries were fully revealed, then the process that would generate changes in stock prices is assumed to be

$$(1) \quad \Delta s_t^1 = u_t^1 + a_{12}u_t^2 + v_t^1$$

$$(2) \quad \Delta s_t^2 = a_{21}u_t^1 + u_t^2 + v_t^2$$

where $\Delta s_t^j$ denotes the change in the logarithm of the stock market price index in country j between time $t-1$ and time t."[13]

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[13] See King and Wadhwani, (1988b), p. 4.

The authors then impose the restriction that "news which affects both countries is always revealed first in one country or the other, but never simultaneously . . . If information is not fully observable in both markets, the investors and market-makers set prices according to

(3) $\Delta s_t^1 = u_t^1 + a_{12}E_1(u_t^2) + v_t^1$

(4) $\Delta s_t^2 = a_{21}E_2(u_t^1) + u_t^2 + v_t^2$

where $E_1$ and $E_2$ denote the expectations operator conditional upon information observed in markets 1 and 2 respectively."[14]

This leads to a "signal extraction problem to find the minimum-variance estimator for the value of the relevant news term that has been observed in the other market." This approach then allows them to proceed to use the fact that "markets operate in different time zones and are closed for part of the day . . . to identify the contagion coefficients" linking the markets together.

I would, however, note that it is actually the case that news items going to market participants in, say New York, over the major wire services such as Reuters, Telerate, UPI, etc., are *potentially* simultaneously available in Tokyo and London, if market operators were at their desks there. In one sense, the bulk of all *major* news announcements is now, for all practical purposes, available simultaneously worldwide. What remains the case, however, is that such "news" is not *assimilated* on a continuous basis by all market operators since they have, mercifully, gone home.

When a market participant goes into the office in the early morning, he has, besides the newspapers, and the possibility of looking at other sources of information on "news" between the prior market close and the forthcoming opening, the opportunity of seeing how the markets in other time zones have reacted to the "news". Rather than try to work out the effect on "fundamentals" by examining all the myriad individual bits of news, the market participant will treat the movements in other major markets as a valuable portmanteau guide to the way in which he, himself, should adjust prices before

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[14] *Ibid.*, p. 5.

the opening. The participant is especially likely to do this in those cases where he/she reckons that markets abroad are more likely to reach a correct pricing decision than he/she could do by an independent study of the effect of the "news" on the fundamental value of the assets.

The interesting question, is, therefore, not whether prior movements in other stock exchanges influence the close/open price change in stock exchange i; we should expect them to do so. Instead, it is whether the scale of such linkages, the size of the coefficient, appears to increase at times when we suspect that "cross-infection" may be present. Remember that we cannot rigorously refute the counter-claim that any such increase in the size of the coefficient could be due to greater variability in actual "news" making each market "rationally" respond more to movements in the others. One can only judge the balance of probabilities on the basis of the data, the historical evidence and one's individual priors.

Be that as it may, the authors demonstrate "the fact that the correlation coefficient between hourly price changes in London and New York rose after the crash, an observation that is consistent with the idea that the extent of contagion grew after October 19. When we allow for time zone trading, and examine interactions between Tokyo and London and New York in turn, this finding is confirmed . . . The impact of changes in Tokyo on both London and New York has risen since the crash. Results using monthly data for the UK and the U.S. over a longer time period yield the same picture . . . The paper tests the hypothesis that the contagion coefficients increase with volatility . . . Table 3 . . . shows that the value of the contagion coefficient measuring the impact of New York on London depends on volatility. The estimated coefficient of 0.36 is large."[15]

## Interactions between stock market price indices and the forex market

My chief function so far has been to report the results of papers by Dickens and by King/Wadhwani, both of which I have encour-

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[15] See King and Wadhwani, (1988a), p. 2.

aged from the sidelines, that are germane to this issue. I have also, however, done some research, myself, on this subject.[16]

The starting point for my own research was prior work that I had done on the characteristics of hourly data on spot exchange rates, using data from Money Market Services (MMS) International, for the period January-July 1986.[17] Subsequently, in order to examine the interactions between price indices on the major stock exchanges, we had obtained hourly data of price indices from London, Tokyo arid New York over the days, September 1 to November 30, 1987. I was able to obtain hourly forex data for four spot exchange rates bilateral with the U.S. dollar, those being the deutsche mark, the British pound, the yen and the Swiss franc for the same period in 1987, again from MMS International to whom my thanks are due.

My assessment of the major economic "news" that was moving stock exchange prices in the autumn of 1987, (such as data on the U.S. current account, U.S.-German policy discords, U.S. fiscal developments, etc.), was that these would also impinge on the forex market. With forex spot exchange rates approximating to a random walk, the intensity of internationally available "news" might, therefore, be provided by the absolute size of the change (in the logarithm of)[18] the spot exchange rate. So my idea was to use data on the scale of forex market fluctuations as a proxy for the intensity of the arrival of common news, affecting all the major stock exchanges.

During this period, as will be demonstrated below, "news" which was associated with an appreciation in the U.S. dollar was generally regarded as favorable by all three stock exchanges; declines in the U.S. dollar were considered likely to generate higher U.S. interest rates (bad for the NYSE), whereas the adverse effect on British and Japanese competitiveness of an appreciating currency would not— given local financial conditions—be offset by lower domestic interest rates. But this reaction was peculiar to the circumstances pertaining

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[16] With the research support of L. Figliuoli.

[17] See Goodhart and Giugale (1988).

[18] The first study, on relative variance, used actual data; the second study, employing regression analysis, used the log transform.

then. One could easily envisage other circumstances when "news", **e.g.,** of a cut in U.S. interest rates, could lead to a simultaneous rise on the NYSE and depreciation of the dollar. So, although in some tests, partly for my own interest, I did regress **actual** stock exchange price index movements on **actual** forex price percentage changes, the main tests involve an examination of the relationship between the **variances** (or in the **absolute changes** without regard to sign) in the forex market and in the stock markets.

Stock markets are only open for part of each 24-hour **working** day, unlike the forex market which is continuous from Sunday, 23.00 hours, GMT, when Sydney opens the new **working** week, to 23.00 hours, GMT, on Friday, when the market closes on the West Coast of the United States. During the intervening weekend, both markets (ignoring Tokyo's Saturday market) are, for most practical purposes, shut. Taking then the 566 consecutive observations of the changes in the index on the London Stock Exchange,[19] 502 represented hourly changes with both markets open simultaneously, 51 represented overnight weekday breaks when the London Stock Exchange was shut, but the forex market open, and 13 represented weekend breaks, with both markets largely shut. Our data period for the NYSE covers the same days, September 1 to November 30, but includes rather fewer observations. This is partly because the NYSE covers eight hours a day, whereas the London Stock Exchange is open nine hours a day, and also because there were rather more missing observations for NYSE.[20] Overall for the NYSE, there were 479 observations, 418

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[19] No data are available for Friday, October 16, when the London Stock Exchange was shut because of the hurricane. Friday was then treated as part of the weekend, October 17/18. Other gaps in the data for the London Stock Exchange were for the following hours, at

|          GMT        |                     |
|---------------------|---------------------|
| 08,03,09            | Hour, day, month    |
| 08,04,09            |                     |
| 08,24,09            |                     |
| 08,19,10            |                     |
| 09,12,11            |                     |

In each case this was the opening observation, so we simply treated the next hour as the opening observation.

[20] In most cases we had complete hourly data running from the **NYSE** opening (13.00 hours GMT until October 23, 14.00 hours GMT from October 26) to the close (20.00 hours GMT until October 23, 21 hours GMT after October 26). The market was shut on November 26 (Thanksgiving) and on September 7 (Labor Day). In addition, there were no data for the usual opening hour on October 19-21, nor for the penultimate hour of the market from October 23 until November 6. In the first case, we treated the first available hour as the opening figure; in the second case, these were treated as missing observations.

with both markets open, 49 weekday nights, 12 weekend **breaks.** Price indices on the Tokyo Stock Exchange are collected less frequently, at 23.15 - 00.00 - 02.00 - 03.15 - 04.00 - 06.00, GMT. Since our **forex** data are at end-hour, we treated the observations taken at quarter after the hour as if they had occurred at the preceding beginning hour. By convention, the opening observation in Tokyo at 23.00 hours is the same as that of the previous night's close. We assume here that, by 23.15 hours, GMT, the TSE can make an equivalent change to overnight information, as can be achieved on the stock exchanges in New York and London. While that would seem plausible, and is all that can be done with the data, the **TSE's** convention in this respect may have some responsibility for the differing behavior between the TSE and the two other stock exchanges. Our data covered the same period[21] and provided 362 observations in all, with 296 overlapping hours, 53 weekday nights and 13 weekends.

My first exercise was to examine the bilateral relationships and correlation between the *variance* of each of the stock exchange series and of the three main spot **forex series,**[22] both overall and in the **sub**-periods (jointly open, overnight, weekend—though there were too few weekend observations to hope for useful statistical results in this last case). Let us assume that, prior to October 19, stock markets reacted primarily to a combination of idiosyncratic domestic information available during working hours and to international "news" proxied by **forex** market fluctuations, so long as the **forex** market was open. Then my hypotheses would be:

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[21] There were no market reports on November 23. Other missing hours were:

| | GMT | |
|---|---|---|
| | 00,01,09 – 05,01,09 | Hour, day, month |
| (Holiday) | 00,15,09 – 06,15,09 | |
| (Holiday) | 00,23,09 – 06,23,09 | |
| | 00,02,11 – 06,02,11 | |
| (Holiday) | 00,03,11 – 06,03,11 | |
| (Holiday) | 00,23,11 – 06,23,11 | |

These were treated as missing data.

[22] The Swiss franc spot rate was so highly correlated with the deutsche mark that we decided, to save time and space, to omit it.

H(1) The ratio of the variance of the **forex** market to the variance of the stock exchange would be higher when the **forex** market was open and the stock exchange shut;

H(2) This would be caused by a relative decline in the stock exchange variance when the stock exchange was shut, with no change in the **forex** market variance (**forex** market open throughout);

H(3) The correlation between variances would be greater when the stock exchange was shutlforex open, because of less domestic idiosyncratic noise affecting the stock exchange.

I want to compare behavior before the crash with behavior after the crash, when "contagion" and "cross-infection" may be expected to be more prevalent. In order to avoid having the results dominated by the extreme observations of October 19-23, when some of the observations may well also be inaccurate, the post-crash comparison utilized data from October 26 onward. If "cross-infection" was more prevalent after October 26, there will have been other sources of price variation—notably movements in other stock exchanges—in addition to **forex** price changes, influencing the stock exchange in question when it was shut. Consequently,'

H(4) Post-October 26, the higher level of the ratio of the variances (**forex** variance divided by stock exchange variance) when the stock exchange was **shut/forex** open as compared to overlapping (both open) hours, would diminish, or even reverse;

H(5) Post-October 26, the decline in the variance of the stock exchange when it was shut compared to when it was open would be much less marked than pre-October 19;

H(6) Post-October 26, the correlation of variance **forex/variance** stock exchange would decline throughout, but especially when the stock exchange was shutlforex open.

Table 1 (printed in its entirety at the end of this article) records the variances (of the stock exchange price indices and spot exchange rates separately), the ratios of these variances, the correlations between these variances, and the significance of these correlation coefficients

for each stock **exchange/spot** rate pairing. For each pairing these data are reported from the complete data set, and for the sub-divisions, **i.e.**, overlapping hours, weekday nights, weekends, and pre-October 19 and post-October 26. Column 1 in each case records the variance of stock exchange prices; column 2, the variance of the spot exchange rate; Column 4, the normalized ratio (since the scales were so different) of the two variances, defined as Variance **Forex** divided by Variance Stock Exchange; so a high ratio figure implies high **forex** variability relative to stock exchange variability. Column 3 gives the correlation between the two series of variances, and column 5, an N-test of their significance, where the critical values are the same as for **t-tests.**[23] It should be remembered that the hourly spot exchange rates tend to move **together,**[24] so that the results for the differing spot rates with the same stock exchange are not to be regarded as independent in any sense.

In most cases, the variance of the stock exchange indices are lowest in the period before October 19, are higher in the second period after October 26, and are highest in the full period, because of the dominating influence of high variability in the crash week itself. The exceptions are: NYSE, the variance during overlapping hours (both markets open) was lower after October 26 than before October 19, but the variance over the few weekends was even higher after October 26th than over the whole period. In Tokyo, the weekday overnight variance was higher in the final sub-period (after October 26) than in the full period, and the ordering of the variances'over weekends had a higher variance in the few weekends in the earlier sub-period than in the later sub-period.

In the case of the **forex** market, the ordering is somewhat different with the variances for all exchange rates, in all stock exchange comparisons and timings (full, overlapping, weekday, weekend), being lowest pre-October 19, but higher post-October 26 than in the full period; exceptions were that in the NYSE, the variance of all three **forex** markets, overnight on weekdays, was higher in the full period

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[23] The N-tests were estimated as $T^{1/2} \mu(\tau)$ where $T$ is the number of observations, and $\mu(\tau)$ is the $\tau$ − th sample autocorrelation, because under the null hypothesis of zero correlation among the returns the sample autocorrelation at any lag $\tau \neq 0$ will tend to be, in large samples, independently distributed, with a mean of zero and a variance of $1/T$. See Harvey (1979). p. 146.

[24] See Goodhart and Giugale (1988).

than in the second sub-period, and in London, at weekends, the variance of the yen was lowest at the weekends after October 26.

Let us now turn to the six hypotheses put forward earlier.

H(1): Ratio of variance of **forex** market to the variance of the stock exchange indices would be higher (i.e., figure in Column 4 higher) when **forex** market **open/stock** exchange shut (i.e., overnight weekdays) than when both are open (i.e., overlapping).

This is found to be the case for all stock **exchange/currency bilateral** pairings for the period up till October 19. It is true for the whole period in New York, but not for any currency in New York after October 26, (remembering that currency movements are not independent), primarily because the intra-day variance in the NYSE fell away sharply then. It is not true in London for the whole period; even though in both sub-periods the ratio of variance in the **forex** market to the stock exchange is higher overnight than during the overlapping period, the reverse (greater **forex** than stock exchange variability intra-day relative to overnight), must have dominated decisively in the crash week. In Tokyo, the hypothesis is supported in all **period/pairings.**

H(2): This would be caused by a relative decline in the stock exchange variance when the stock exchange was shut, with no change in **forex** market variance.

Recall that the stock exchanges are only open for part of the day, 9-17 GMT, for a total of nine hours in London; 14-21 GMT, for a total of eight hours in New York; and 23-6 GMT, for a total of eight hours in Tokyo. Accordingly, the hourly gap from close to open is 15, 16, 16 hours respectively in London, New York and Tokyo. If the series followed a pure random walk, then the respective variances should be equivalently higher in the overnight gap than during the overlapping hours.

Table A below shows the shortfall from the predicted variance (if random walk held) for the stock exchange and currencies, *given* the variance during the overlapping period, for the overnight break.

## Table A
## Comparison of Actual Overnight Market Variance, with Random Walk Expectation, given Variance during Overlapping Hours

| | | Random Walk Prediction | Actual | Percentage Discrepancy |
|---|---|---|---|---|
| (1) | NYSE | | | |
| | Full Period | 6222.4 | 754.5 | 87.87 |
| | Pre Oct 19 | 2262.4 | 75.0 | 96.68 |
| | Post Oct 26 | 1144.0 | 732.0 | 36.01 |
| and Pound | Full Period | 93.8 | 36.43 | 61.24 |
| | Pre Oct 19 | 25.12 | 13.25 | 47.25 |
| | Post Oct 26 | 148.48 | 35.83 | 75.87 |
| Dm | Full Period | 107.04 | 43.32 | 59.53 |
| | Pre Oct 19 | 23.52 | 16.98 | 27.81 |
| | Post Oct 26 | 174.56 | 26.66 | 86.73 |
| Yen | Full Period | 0.4800 | 0.252 | 47.38 |
| | Pre Oct 19 | 0.2336 | 0.1534 | 34.33 |
| | Post Oct 26 | 0.7232 | 0.2079 | 71.25 |
| (2) | London Stock Exchange | | | |
| | Full Period | 1546.5 | 567.20 | 63.32 |
| | Pre Oct 19 | . 85.20 | 34.08 | 60.00 |
| | Post Oct 26 | 588.60 | 166.27 | 71.75 |
| and Pound | Full Period | 78.30 | 25.21 | 67.80 |
| | Pre Oct 19 | 30.60 | 12.61 | 58.79 |
| | Post Oct 26 | 110.10 | 40.12 | 63.56 |
| Dm | Full Period | 86.55 | 27.83 | 67.85 |
| | Pre Oct 19 | 26.4 | 11.87 | 55.04 |
| | Post Oct 26 | 128.55 | 45.69 | 64.46 |
| Yen | Full Period | 0.441 | 0.1602 | 63.67 |
| | Pre Oct 19 | 0.2355 | 0.1419 | 39.75 |
| | Post Oct 26 | 0.612 | 0.1855 | 69.69 |
| (3) | Tokyo Stock Exchange | | | |
| | Full Period | 380928 | 9911 | 97.40 |
| | Pre Oct 19 | 70768 | 6002 | 91.52 |
| | Post Oct 26 | 317668 | 13638 | 95.71 |
| and Yen | Full Period | 0.3456 | 0.2575 | 25.49 |
| | Pre Oct 19 | 0.2928 | 0.1804 | 38.39 |
| | Post Oct 26 | 0.376 | 0.2598 | 30.90 |
| Dm | Full Period | 35.344 | 43.11 | −21.97 |
| | Pre Oct 19 | 27.264 | 19.93 | 26.90 |
| | Post Oct 26 | 35.264 | 46.68 | −32.37 |
| Pound | Full Period | 30.832 | 38.693 | −25.50 |
| | Pre Oct 19 | 14.624 | 19.99 | −36.69 |
| | Post Oct 26 | 40.48 | 45.81 | −13.17 |

I would interpret these figures as follows. Given the relatively few data and the fact that we are considering variances, I would not regard any percentage discrepancy less than plus-or-minus 50 percent as out of line with the basic random walk hypothesis. I would consider any discrepancy greater than 85 percent as clearly out of line with random walk expectations, and the intervening range, 50-85 percent, as problematical.

These results then suggest that, prior to October 19, in New York, the variance ratio for the forex market was *broadly* in line with, not all that far below, (random walk) theoretical expectations, whereas the variance ratio for the NYSE was massively below its random walk expectation; but that, after October 26, the relative variance in the stock exchange over the break rose dramatically (partly a very sharp rise in the overnight variance, partly a surprising decline in intra-day variance), while the variance ratio for the forex market declined relative to its random walk expectation largely because the forex variance was much higher during the hours when the NYSE was open (after October 26) than when it was shut.

In Tokyo, the relative variance of the forex market remained quite close to its theoretical expectation throughout, but in both sub-periods, especially the latter, and throughout, the variance of the stock exchange was vastly below its random walk expectation (given its variance when open).

In London, both the forex market and the stock exchange exhibited variances somewhat, but not vastly, below their random walk expectations, given the variances during the common overlapping periods. This shortfall, however, remained apparently roughly constant throughout.

These results show marked differences between centers and over time which are not particularly easy to rationalize. The stock exchange variances in New York before October 19, and in Tokyo throughout, when closed overnight during the week, are vastly below their random walk expectation. The shortfall from random walk expectation is much less for London, and NYSE after October 26. I interpret this to mean that NYSE, pre-October 19, and TSE throughout, were dominated by idiosyncratic domestic "news" only becoming available during working hours, but that the NYSE, post-October 26, and London Stock Exchange, throughout, were primarily influenced by more international factors.

Again, in New York before October 19, and Tokyo throughout, the relative variance of the forex markets was consistent (broadly) with random walk; but in London, and in New York after October 26, the relative variance of the forex market appeared to decline (compared with random walk expectations) when the local market was shut, although markets abroad were open. I have, in other exercises, found evidence of significant time dependence of volatility in forex markets, e.g., being at its highest in the London/New York overlap, and lowest while the Asian markets are open, and also some significant negative (first-order) auto-correlation in forex markets using hourly data[25] and in minute-by-minute data.[26] There appears to be evidence that such negative auto-correlation increases in scale when markets are disturbed, e.g., around large "jumps". The above findings, in part, follow from the nature of the time dependence in forex market volatility mentioned above.

Be that as it may, H(2) is only partially supported. It holds fully for TSE, and for NYSE before October 19, but neither for NYSE after October 26, nor for London throughout. In both these latter cases, the ratio of stock exchange variance is not all that far from its random walk expectation, whereas the ratio of forex variance is quite markedly below its random walk expectation during the overnight workday break.

Let us next turn to,

**H(3)** The correlation between variances would be greater when the stock exchange was shut/forex open, than when both were open, (less domestic noise).

Because of fewer observations, it is harder to find *significant* correlations overnight. In this exercise I am simply comparing the size of coefficients in Column **3**; the hypothesis is that the coefficient will be larger (more positive) during the overnight break period than intra-day.

The results of this test were generally negative. The correlation coefficients were just as frequently lower overnight than during the

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[25] *Ibid.*

[26] *See* Goodhart and Figliuoli (1988).

intra-day period, and there was no real pattern as between the earlier (pre-October 19) and later sub-periods. Generally, over *all* observations, and over *all* overlapping observations, the correlation between the contemporaneous variability of stock exchanges and forex markets is high, but such correlation may depend somewhat on the outliers observed in the crash week, October 19-26. If one takes *all* observations in the sub-periods, pre-October 19 to post-October 26, there remain some signs of significant correlations, but the strength of such relationships lessens rapidly as further sub-division within periods is attempted.

This is rather a blow to the maintained hypothesis, since the latter involved the suggestion that stock exchanges would be comparatively more sensitive to general international news, as proxied by movements in the forex market, when they were shut than when they were open. I have no explanation for this, but it does, it would appear, tend to throw doubt on the adequacy of forex market changes as an adequate proxy for common, international news affecting stock exchanges. Perhaps the reportedly large amount of official intervention during this period could have weakened the link between forex market movements and the arrival of internationally relevant "news".

I had, however, expected the correlation between the variances in the two markets to decline after October 26, especially during the overnight break, $H(6)$, because, under conditions of "cross-infection", the various stock exchanges would pay more attention to movements in stock markets elsewhere, and consequently, less to forex market movements. There was support for this hypothesis in London, but not in New York or Tokyo; in the latter, the reverse occurred.

. We have also already effectively reviewed both $H(4)$ and (5). These hypotheses are strongly supported in New York, but are not supported at all in London or in Tokyo.

The conclusions of this first exercise are thus mixed. What does seem to emerge is that behavioral reactions in the various separate stock exchanges were quite different during this (relatively short) data period. In Tokyo, all the variances increased in the later sub-period, but the relationship between these variances and their random walk expectation remained unchanged, whereas the correlation between the variability in the forex markets and in the TSE rose in the later period. In London, as elsewhere, variabililty rose generally

in the latter sub-period, but the correlation between the variability in the forex markets and in the London Stock Exchange declined; again, the relationship between the variances and their random walk expectations remained unchanged during the two sub-periods, but with a totally different overall pattern from TSE. In New York, by contrast, the relationship between the variances and their random walk expectations changed quite sharply in the two sub-periods, but there was no apparent clear change in the correlations between the forex market and NYSE variability.

It may be simply that the data period is too short to allow any worthwhile conclusions to be drawn, but the only apparent lesson from this first exercise is that there may be quite markedly differing behavioral reactions and patterns in the different national stock markets.

In the second exercise I moved on from a study of contemporaneous variance (where the basic idea is that common "news" may cause simultaneous movements in both, forex and stock exchange, series) to a study, using regression analysis, of the reaction of each stock exchange, when shut, to movements in both the other stock markets and in the forex market, in the intervening periods between the prior market close and the market opening of the stock exchange under consideration (as dependent variable).

In this regression, the change in stock market i, from close, usually t-16 hours, to open at t, is regressed on·the change in the other two stock markets from t-16 to t hours, the change in each forex market (entered one at a time) from t-16 to t, and the change in stock market i during the previous day, t-24 to t-16. Thus for London, the close-open price change will be regressed on the remaining price index change on the NYSE from the time of the London close to the NYSE close, the price change in Tokyo from open to close, the change in the forex market from London close to the time of the London open. The lagged dependent variable, e.g., the London Stock Exchange price change during its previous working day, is entered because the London change will represent information to other stock exchanges and induce price changes in New York and Tokyo. Thus, in order to extract signals about the information contained in changes in prices there, London market participants should (theoretically) discount changes induced by foreign markets' reaction to prior London changes. Thus, despite possible complete consistency with random

**walk** price movements, we would expect a (relatively small) negative coefficient on the lagged dependent variable. This is a simpler version of the more complex, and theoretically appropriate, equations which King and Wadhwani have specified and tested.[27]

As noted earlier, my hypothesis was that relevant, important international "news" would be reflected in large changes in the forex market, but that news that, say, drove the dollar down, would sometimes be favorable, and sometimes unfavorable, to stock markets in each country. Thus I expected to find a relationship between absolute (i.e., without regard to sign) changes in forex exchange rates and in stock markets. The equation below was, therefore, .tested first with *all* variables entered in the form of *absolute* (i.e., without regard to sign) changes in the logarithms.

$$SE_{1,t} - SE_{1,t-16} = \text{constant} + b, \text{ intervening change } SE_2 + b_2$$
$$\text{intervening change } SE_3 + b_3 (FX, - FX_{t-16}) + b_4 (SE_{1,t-16} - SE_{1,t-24})$$

My hypothesis was that $b_3$ would be positive and significant, and that I might then be able to treat either the level of b, and b,, or at least the change in their values between sub-periods, as an improved estimate of "contagion" and "cross-infection".

As can be seen from Table 2, (printed at the end of this article) this hypothesis/hope was not supported by the data. This table shows the absolute change in each stock exchange regressed on its "own" currency; with the deutsche mark/dollar rate taken as the own rate for the NYSE. In no case does the own currency prove significant. The coefficients for the other currencies, when entered in turn, are shown in Table 2A, which also appears at the end of this article. Over the whole period they are all positive, but only in one case (deutsche mark affecting London Stock Exchange) does the coefficient approach significance. In the two sub-periods, pre-October 19 and post-October 26, all the coefficients remained insignificant, and there were even a few negative signs, mostly pre-October 19.

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[27] **For a fuller description of how such equations may be derived and specified, see King and Wadhwani (1988b). My only contribution is to add another variable, the change in the logarithm of the spot forex, to the basıc equation.**

Another feature of the period taken as a whole was that absolute movements in the TSE appeared to affect the absolute movements of the exchanges in London and New York, and absolute movements in the London Stock Exchange seemed to have a significant effect on volatility in NYSE (omitting the overlap), and on TSE; but the absolute movements in NYSE appeared to have no significant effect on volatility in TSE, and a smaller effect on London than Tokyo had. The impact of the London Stock Exchange on TSE appears to be caused by outliers in the week of October 19-26, since neither the absolute movements in NYSE nor in London appeared to affect volatility in TSE in the two sub-periods, pre-October 19 or post-October 26. The greater significance of TSE, than of NYSE, on London in the whole period is also probably due to outliers in the crash week itself, which may have distorted the more usual pattern, whereby volatility in NYSE normally has a greater effect on London, than does volatility in TSE, as shown in the results for the two sub-periods.

If we examine then the results for the sub-periods, which are less affected by the extreme observations of October 19-23, but on the other hand have fewer observations, 29 and 23 respectively, a pattern does emerge that mirrors some of the earlier results from Table 1. Absolute movements in London, as the dependent variable, close-open, are more closely associated with absolute movements on other stock exchanges. **Absolute** movements on the TSE did not reflect volatility in either London or NYSE in either sub-period. On the NYSE, however, there are signs of greater responsiveness to volatility abroad in the second sub-period, than in the first (t values for TSE rising from 0.72 to 1.42 and for London, from 0.316 to 1.83).

In addition to the regressions based on absolute changes, I also ran regressions using actual changes in the logarithms of exchange rates and of the stock exchanges. (See Tables 2 and 2A.) These regressions indicated a much stronger role for exchange rates, with all three stock exchanges responding positively to an appreciation of the dollar in this period. (The British pound is measured in units of dollars per pound, the opposite to the deutsche mark and yen, so a fall represents dollar appreciation.) In the full period, all currency coefficients are significant, and more than half have t values greater than 3. Again, the relatively weak effect of prior changes of the NYSE on the TSE is surprising, especially in the post-October 26 period, when one might have expected a greater sensitivity to develop. The London Stock

Exchange seems clearly the most open to external influence, both in the whole period, and, on balance, in the two sub-periods. The NYSE was least affected by external influences in the first pre-October 19 sub-period, but became much more responsive, and more responsive than TSE, after October 19.

I must reiterate that the significant effect of dollar appreciation on all three stock exchanges during this period must be regarded as particular to the conjuncture of the time. The fact that linkages existed between stock markets, but not with the forex market, when considering absolute changes, whereas linkages appeared both among stock exchanges and with the forex market in actual changes, is interesting, but I am not at all sure what to make of it.

The effect of *actual* movements in the forex market on the stock exchanges is rather less marked in the two sub-periods. The signs of the coefficients continued in all cases to indicate that all stock exchanges rose when the dollar appreciated (i.e., the pound was lower; the deutsche mark, Swiss franc and yen were higher), but the t values fell to about 1.5 in most cases, only over *2* with the deutsche mark in New York pre-October 19. Once again the explanatory power of these external influences (taken together) is comparatively high for the London Stock Exchange in both sub-periods, and rises from NYSE quite markedly in the second, as compared with the first, sub-period. In contrast with the other findings, however, there are rather more signs in these sub-period regressions of actual stock exchange index/currency movements abroad having as much effect on TSE as on other stock exchanges, though the stronger effect appeared to come from NYSE before October 19 and from London after October *26.* The comparatively stronger apparent effect (on balance) of the London exchange, than of NYSE, on TSE remains a curiosum; it may well be a spurious consequence of a small data set.

My initial expectation had been that stock exchanges would have reacted comparatively more to forex movements, as a proxy for international "news", prior to October 19, and more to price changes in other stock exchanges, ("cross-infection"), after October *26.* There is some slight support for this hypothesis in the case of the NYSE, but not for the London exchange nor the TSE where the reaction to both external influences (forex and other stock exchanges) remained largely unchanged in the two sub-periods.

This section reports work at an early stage of progress, so all con-

clusions must be tentative. It appears, however, that the basic hypothesis that I entertained in undertaking the work, that the (absolute) change in forex prices might be an adequate proxy for the intensity of common international ''news'' and that such changes would have a particularly strong effect on changes in stock exchange price indices when the stock markets were closed, has not been supported by the data. This does not, however, also imply that the statistical exercises run here have cast no further light on the subject under discussion, the international transmission of asset price volatility.

Instead, I believe that one can draw some tentative conclusions. First, stock market,reaction to international developments differ as between the separate markets. These results suggest that Tokyo is most immune to international influence and London most open. The results from the sub-periods in exercises 1 and 2 do not indicate any significant difference in the openness, or reactions to international news, of either London or Tokyo as between the two periods. By contrast, New York appeared, on these tests, relatively immune to international influence before October 19, but the sub-period results from both exercises 1 and 2 suggest that the New York Stock Exchange was jerked into a much more intense concern with, and appreciation of, international factors by the crash'and its aftermath.

A common interpretation of the crash is that it represented an outstanding example of the pervasive influence of American asset price changes on the rest of the world. That may be so, and my colleagues, King and Wadhwani, are examining even higher frequency data for the crash week, itself. But once the crash week was past, a feature of my own results is that the main increase of the strength of linkage appears to have been in the other direction, from the rest of the world to asset price changes in New York.

# Appendix
# International Comparison of Asset Market Volatility
# Dickens: February 1987

## Conclusion

This study of the inter-relationships between asset price volatility in different countries has just involved some preliminary, and mainly descriptive, statistical exercises. In particular, we were not successful in extending the study beyond simple bilateral into multilateral relationships.

Nevertheless, we believe that we have unearthed some interesting facts, notably that the cross-country relationship between money market volatilities is much less close in most cases (an exception being the UK with no significant cross-country relationship in either case) than between bond market volatilities. There is also quite a close relationship between volatilities in equity markets among U.S., UK and Germany, but less with other countries. The relationship between volatilities in money and bond markets in individual countries varies, with some countries showing strong correlation (U.S., Japan, France), but others weak relationships (Italy, Germany, UK).

Overall, assuming that asset market events in the U.S. exhibit weak exogeneity relative to asset markets elsewhere—though this hypothesis was not tested—the main chain of causation appears to have run as follows: (1) U.S. policy regime changes; (2) changing U.S. short rate volatility; (3) changing U.S. long rate volatility; (4) changing long rate (and exchange rate?) volatility in other countries. The UK, however, appeared least affected and Germany, the most affected, by this.

The empirical results do, however, suggest that this line of causality is considerably weaker than might have been expected, particularly over the 1979-82 period which saw very strong cyclical increases in the volatility of both U.S. money and bond market interest rates.

A competing scenario which gains moderate support from the results, is that similarity in volatility across countries has been more a product of the coincidence of similar economic "mentalities" and policy regimes than any uni-directional causality. This scenario is consistent with the evidence found that only major international

developments such as the 1973-74 oil price shock and related world recession have produced similar contemporaneous volatility responses across all markets and all countries.

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# Table 1

1=**VAR** SE    2=**VAR** Dm    3=Correlation Coefficient    4=Ratio    5=N Test

## NYSE/DM

### (A) Whole Period

| All Obs: n=479 | | | Overlapping Hours: n=418 | | | Weekdays, Overnight: n=49 | | | Weekends: n=12 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| 449.2 | $15.36 \times E^{-6}$ | 0.281 | 388.9 | 6.69 | 0.124 | 754.5 | 43.32 | 0.443 | 641.7 | 75.10 | 0.32 |
| 4 | 5 | | 4 | 5 | | 4 | 5 | | 4 | 5 | |
| 34.19 | 6.16 | | 17.19 | 2.53 | | 57.42 | 3.10 | | 117.03 | 1.1 | |

### (B) Pre-Oct 19

| All Obs: n=255 | | | Overlapping Hours: n=224 | | | Weekdays, Overnight: n=26 | | | Weekends: n=5 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| 133.9 | 4.31 | 0.143 | 141.4 | 1.47 | 0.148 | 75.10 | 16.98 | 0.248 | 105.1 | 9.72 | 0.04 |
| 4 | 5 | | 4 | 5 | | 4 | 5 | | 4 | 5 | |
| 32.16 | 2.29 | | 10.38 | 2.21 | | 22.64 | 1.27 | | 92.45 | 0.1 | |

### (C) Post-Oct 26

| All Obs: n=189 | | | Overlapping Hours: n=164 | | | Weekdays, Overnight: n=19 | | | Weekends: n=6 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| 216.2 | 18.42 | 0.237 | 71.15 | 10.91 | 0.080 | 732.0 | 26.66 | −0.156 | 741.1 | 80.39 | −0.21 |
| 4 | 5 | | 4 | 5 | | 4 | 5 | | 4 | 5 | |
| 85.2 | 3.26 | | 152.6 | 1.02 | | 36.42 | −0.68 | | 108.47 | −0.52 | |

*Charles Goodhart*

# Table 1 — *Continued*

1=VAR SE    2=VAR Dm    3=Correlation Coefficient    4=Ratio    5=N Test

## NYSE/Yen
### (A) Whole Period

| All Obs: n=479 | | | Overlapping Hours: n=418 | | | Weekdays, Overnight: n=49 | | | Weekends: n=12 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| 449.2 | 0.0795 | 0.281 | 388.9 | 0.0300 | 0.122 | 754.5 | 0.2526 | 0.452 | 641.7 | 0.2159 | 0.14 |
| 4 | 5 | | 4 | 5 | | 4 | 5 | | 4 | 5 | |
| 17.69 | 6.15 | | 7.72 | 2.49 | | 33.5 | 3.16 | | 33.7 | 0.51 | |

### (B) Pre-Oct 19

| All Obs: n=255 | | | Overlapping Hours: n=224 | | | Weekdays, Overnight: n=26 | | | Weekends: n=5 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| 133.9 | 0.0422 | 0.086 | 141.4 | 0.0146 | 0.120 | 75.00 | 0.1534 | −0.11 | 105.1 | 0.0730 | 0.63 |
| 4 | 5 | | 4 | 5 | | 4 | 5 | | 4 | 5 | |
| 31.47 | 1.37 | | 10.33 | 1.80 | | 51.00 | −0.54 | | 69.5 | 1.4 | |

### (C) Post-Oct 26

| All Obs: n=189 | | | Overlapping Hours: n=164 | | | Weekdays, Overnight: n=19 | | | Weekends: n=6 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| 216.2 | 0.0917 | 0.320 | 71.55 | 0.0452 | 0.045 | 732.0 | 0.2079 | 0.3946 | 741.1 | 0.2894 | 0.07 |
| 4 | 5 | | 4 | 5 | | 4 | 5 | | 4 | 5 | |
| 42.4 | 4.40 | | 63.2 | 0.48 | | 28.42 | 1.81 | | 39.1 | 0.18 | |

## Table 1 — *Continued*

1=VAR SE    2=VAR Dm    3=Correlation Coefficient    4=Ratio    5 = N Test

### NYSE/Pound
### (A) Whole Period

| All Obs: n=479 | | | Overlapping Hours: n=418 | | | Weekdays, Overnight: n=49 | | | Weekends: n=12 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| 449.2 | 13.40×E-6 | 0.228 | 388.9 | 5.85 | 0.052 | 754.5 | 36.43 | 0.385 | 641.7 | 6.7218 | 0.28 |
| 4 | 5 | | 4 | 5 | | 4 | 5 | | 4 | 5 | |
| 29.82 | 4.99 | | 15.04 | 1.07 | | 48.28 | 2.70 | | 104.75 | 0.97 | |

### (B) Pre-Oct 19

| All Obs: n=255 | | | Overlapping Hours: n=224 | | | Weekdays, Overnight: n=26 | | | Weekends: n=5 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| 133.9 | 3.93 | 0.861 | 141.4 | 1.57 | 0.074 | 75.0 | 13.25 | −0.101 | 105.1 | 0.42 | −0.758 |
| 4 | 5 | | 4 | 5 | | 4 | 5 | | 4 | 5 | |
| 29.33 | 0.054 | | 11.07 | 1.11 | | 176.7 | −0.517 | | 4.02 | −1.7 | |

### (C) Post-Oct 26

| All Obs: n=189 | | | Overlapping Hours: n=164 | | | Weekdays, Overnight: n=19 | | | Weekends: n=6 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| 216.2 | 18.17 | 0.239 | 71.5 | 9.28 | −0.000 | 732.0 | 35.83 | 0.009 | 741.4 | 95.14 | −0.16 |
| 4 | 5 | | 4 | 5 | | 4 | 5 | | 4 | 5 | |
| 84.02 | 3.28 | | 129.9 | −0.00 | | 48.95 | 0.04 | | 128.32 | −0.40 | |

*Charles Goodhart*

# Table 1 — *Continued*

1=VAR SE     2=VAR Dm     3=Correlation Coefficient     4=Ratio     5=N Test

## LSE/DM

### (A) Whole Period

| All Obs: n=566 | | | Overlapping Hours: n=502 | | | Weekdays, Overnight: n=51 | | | Weekends: n=13 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| 177.3 | $11.60 \times E^{-6}$ | 0.326 | 103.1 | 5.77 | 0.188 | 567.2 | 27.83 | 0.179 | 1046.7 | 72.45 | 0.50 |
| 4 | 5 | | 4 | 5 | | 4 | 5 | | 4 | 5 | |
| 65.44 | 7.74 | | 55.97 | 4.21 | | 49.08 | 1.28 | | 69.26 | 1.81 | |

### (B) Pre-Oct 19

| All Obs: n=289 | | | Overlapping Hours: n=256 | | | Weekdays, Overnight: n=27 | | | Weekends: n=6 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| 9.68 | 3.84 | 0.377 | 5.68 | 1.76 | 0.181 | 34.08 | 11.87 | 0.337 | 3.56 | 15.48 | 0.203 |
| 4 | 5 | | 4 | 5 | | 4 | 5 | | 4 | 5 | |
| 397.0 | 6.41 | | 309.3 | 2.90 | | 348.4 | 1.75 | | 4347.6 | 0.5 | |

### (C) Post-Oct 26

| All Obs: n=233 | | | Overlapping Hours: n=207 | | | Weekdays, Overnight: n=20 | | | Weekends: n=6 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| 88.03 | 17.20 | 0.214 | 39.24 | 8.57 | 0.074 | 166.27 | 45.69 | −0.231 | 773.85 | 74.80 | −0.17 |
| 4 | 5 | | 4 | 5 | | 4 | 5 | | 4 | 5 | |
| 195.5 | 3.26 | | 218.3 | 1.06 | | 274.8 | −1.03 | | 96.7 | −0.43 | |

# Table 1 — *Continued*

1=VAR SE      2=VAR Dm      3=Correlation Coefficient      4=Ratio      5=N Test

## LSE/Yen

### (A) Whole Period

| All Obs: n=566 | | | Overlapping Hours: n=502 | | | Weekdays, Overnight: n=51 | | | Weekends: n=13 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| 177.3 | 0.0598 | 0.2483 | 103.1 | 0.0294 | 0.197 | 567.2 | 0.1602 | −0.023 | 1046.7 | 0.1978 | 0.23 |
| 4 | 5 | | 4 | 5 | | 4 | 5 | | 4 | 5 | |
| 33.7 | 5.91 | | 28.5 | 4.41 | | 28.2 | −0.165 | | 18.9 | 0.86 | |

### (B) Pre-Oct 19

| All Obs: n=289 | | | Overlapping Hours: n=256 | | | Weekdays, Overnight: n=27 | | | Weekends: n=6 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| 9.68 | 0.0409 | 0.349 | 5.86 | 0.0157 | 0.161 | 34.08 | 0.1419 | 0.255 | 3.56 | 0.1960 | 0.502 |
| 4 | 5 | | 4 | 5 | | 4 | 5 | | 4 | 5 | |
| 422.0 | 5.93 | | 275.4 | 2.57 | | 416.4 | 1.32 | | 5506.3 | 1.2 | |

### (C) Post-Oct 26

| All Obs: n=233 | | | Overlapping Hours: n=207 | | | Weekdays, Overnight: n=20 | | | Weekends: n=6 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| 88.03 | 0.0813 | 0.306 | 39.24 | 0.0408 | 0.115 | 166.27 | 0.1855 | −0.218 | 773.85 | 0.1887 | 0.164 |
| 4 | 5 | | 4 | 5 | | 4 | 5 | | 4 | 5 | |
| 92.3 | 4.68 | | 103.9 | 1.65 | | 111.6 | −0.97 | | 24.4 | 0.40 | |

**Table 1 — *Continued***

1=VAR SE     2=VAR Dm     3=Correlation Coefficient     4=Ratio     5=N Test

## LSE/Pound
### (A) Whole Period

| All Obs: n=566 | | | Overlapping Hours: n=502 | | | Weekdays, Overnight: n=51 | | | Weekends: n=13 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| 177.3 | $10.01 \times E^{-6}$ | 0.271 | 103.1 | 5.22 | 0.176 | 567.2 | 25.21 | 0.051 | 1046.7 | 60.969 | 0.42 |
| 4 | 5 | | 4 | 5 | | 4 | 5 | | 4 | 5 | |
| 56.46 | 6.45 | | 50.61 | 3.96 | | 44.45 | 0.36 | | 58.24 | 1.53 | |

### (B) Pre-Oct 19

| All Obs: n=289 | | | Overlapping Hours: n=256 | | | Weekdays, Overnight: n=27 | | | Weekends: n=6 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| 9.68 | 3.73 | 0.372 | 5.68 | 2.04 | 0.287 | 34.08 | 12.61 | 0.209 | 3.56 | 7.72 | −0.138 |
| 4 | 5 | | 4 | 5 | | 4 | 5 | | 4 | 5 | |
| 385.3 | 6.33 | | 359.86 | 4.60 | | 370.03 | 1.08 | | 2170.0 | −0.338 | |

### (C) Post-Oct 26

| All Obs: n=233 | | | Overlapping Hours: n=207 | | | Weekdays, Overnight: n=20 | | | Weekends: n=6 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| 88.03 | 15.27 | 0.209 | 39.24 | 7.34 | 0.090 | 166.27 | 40.12 | −0.263 | 773.85 | 66.14 | −0.277 |
| 4 | 5 | | 4 | 5 | | 4 | 5 | | 4 | 5 | |
| 173.5 | 3.19 | | 186.9 | 1.30 | | 241.3 | −1.17 | | 85.47 | −0.68 | |

## Table 1 — *Continued*

1=**VAR** SE      2=**VAR** Dm      3=Correlation Coefficient      4=**Ratio**      5=N Test

## TSE/DM
### (A) Whole Period

| All Obs: n=362 | | | Overlapping Hours: n=296 | | | Weekdays, Overnight: n=53 | | | Weekends: n=13 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| 21260. | 19.963 | 0.148 | 23808. | 2.209 | 0.262 | 9911. | 43.11 | 0.325 | 10871. | 133.71 | 0.17 |
| 4 | 5 | | 4 | 5 | | 4 | 5 | | 4 | 5 | |
| 0.939 | 2.81 | | 0.0928 | 4.49 | | 4.350 | 2.37 | | 12.30 | 0.62 | |

### (B) Pre-Oct 19

| All Obs: n=189 | | | Overlapping Hours: n=155 | | | Weekdays, Overnight: n=28 | | | Weekends: n=6 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| 4929. | 7.503 | 0.144 | 4423. | 1.704 | 0.072 | 6002. | 19.93 | 0.156 | 9450. | 6.91 | −0.66 |
| 4 | 5 | | 4 | 5 | | 4 | 5 | | 4 | 5 | |
| 1.522 | 1.98 | | 0.385 | 0.90 | | 3.32 | 0.825 | | 0.732 | −1.6 | |

### (C) Post-Oct 26

| All Obs: n=143 | | | Overlapping Hours: n=116 | | | Weekdays, Overnight: n=21 | | | Weekends: n=6 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| 18461. | 24.98 | 0.092 | 19853. | 2.204 | 0.108 | 13638. | 46.68 | 0.379 | 6302. | 146.64 | 0.108 |
| 4 | 5 | | 4 | 5 | | 4 | 5 | | 4 | 5 | |
| 1.353 | 1.10 | | 0.111 | 1.16 | | 3.423 | 1.74 | | 23.27 | 1.10 | |

# Table 1 — Continued

1=VAR SE   2=VAR Dm   3=Correlation Coefficient   4=Ratio   5=N Test

## TSE/Yen

### (A) Whole Period

**All Obs: n=362**

| 1 | 2 | 3 |
|---|---|---|
| 21260. | 0.1204 | 0.142 |
| 4 | 5 | |
| 0.566 | 2.70 | |

**Overlapping Hours: n=296**

| 1 | 2 | 3 |
|---|---|---|
| 23808. | 0.0216 | 0.268 |
| 4 | 5 | |
| 0.091 | 4.61 | |

**Weekdays, Overnight: n=53**

| 1 | 2 | 3 |
|---|---|---|
| 9911. | 0.2575 | 0.229 |
| 4 | 5 | |
| 2.608 | 1.67 | |

**Weekends: n=13**

| 1 | 2 | 3 |
|---|---|---|
| 10871. | 0.4143 | -0.11 |
| 4 | 5 | |
| 3.81 | -0.41 | |

### (B) Pre-Oct 19

**All Obs: n=189**

| 1 | 2 | 3 |
|---|---|---|
| 4929. | 0.0746 | 0.119 |
| 4 | 5 | |
| 0.153 | 1.634 | |

**Overlapping Hours: n=155**

| 1 | 2 | 3 |
|---|---|---|
| 4423. | 0.0183 | 0.068 |
| 4 | 5 | |
| 0.041 | 0.85 | |

**Weekdays, Overnight: n=28**

| 1 | 2 | 3 |
|---|---|---|
| 6002. | 0.1804 | -0.026 |
| 4 | 5 | |
| 3.01 | -0.14 | |

**Weekends: n=6**

| 1 | 2 | 3 |
|---|---|---|
| 9450. | 0.0768 | -0.605 |
| 4 | 5 | |
| 0.812 | -1.48 | |

### (C) Post-Oct 26

**All Obs: n=143**

| 1 | 2 | 3 |
|---|---|---|
| 18461. | 0.1525 | 0.155 |
| 4 | 5 | |
| 0.826 | 1.85 | |

**Overlapping Hours: n=116**

| 1 | 2 | 3 |
|---|---|---|
| 19853. | 0.0235 | 0.303 |
| 4 | 5 | |
| 0.119 | 3.27 | |

**Weekdays, Overnight: n=21**

| 1 | 2 | 3 |
|---|---|---|
| 19638. | 0.2598 | 0.374 |
| 4 | 5 | |
| 1.905 | 1.71 | |

**Weekends: n=6**

| 1 | 2 | 3 |
|---|---|---|
| 6302. | 0.8066 | -0.069 |
| 4 | 5 | |
| 1.2802 | -0.16 | |

# Table 1 — *Continued*

I=VAR SE    2=VAR Dm    3=Correlation Coefficient    4=Ratio    5=N Test

## TSE/Pound

### (A) Whole Period

| All Obs: n=362 | | | Overlapping Hours: n=296 | | | Weekdays, Overnight: n=53 | | | Weekends: n=13 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| 21260. | 17.454 | 0.133 | 23808. | 1.927 | 0.256 | 9911. | 38.693 | 0.277 | 10871. | 85.653 | 0.05 |
| 4 | 5 | | 4 | 5 | | 4 | 5 | | 4 | 5 | |
| 0.821 | 2.53 | | 0.081 | 4.40 | | 3.904 | 2.02 | | 7.879 | 0.18 | |

### (B) Pre-Oct 19

| All Obs: n=189 | | | Overlapping Hours: n=155 | | | Weekdays, Overnight: n=28 | | | Weekends: n=6 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| 4929. | 7.479 | 0.117 | 4423. | 0.914 | 0.091 | 6002. | 19.99 | −0.005 | 9450. | 6.76 | −0.50 |
| 4 | 5 | | 4 | 5 | | 4 | 5 | | 4 | 5 | |
| 1.52 | 1.61 | | 0.21 | 1.13 | | 3.33 | −0.027 | | 0.71 | −1.2 | |

### (C) Post-Oct 26

| All Obs: n=143 | | | Overlapping Hours: n=116 | | | Weekdays, Overnight: n=21 | | | Weekends: n=6 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| 18461. | 24.48 | 0.086 | 19853. | 2.53 | 0.045 | 13638. | 45.81 | 0.394 | 6302. | 125.3 | 0.072 |
| 4 | 5 | | 4 | 5 | | 4 | 5 | | 4 | 5 | |
| 1.38 | 1.02 | | 0.127 | 0.48 | | 3.359 | 1.81 | | 19.89 | 0.18 | |

# Table 2
## Whole Period n=57

### (1) Absolute Changes (without regard to sign)

| Dependent Variable Close - Open | Constant | 1st Other Market | 2nd Other Market | Own Currency | Lagged Dependent | $R^2$ | DW | F | LL |
|---|---|---|---|---|---|---|---|---|---|
| LSE | 0.201 E-02 (0.87) | 0.217 (2.37) NY | 0.370 (3.32) T | 0.532 (1.17) | 0.340 (0.25) | 0.680 | 2.304 | 30.16 | 180.0 |
| NYSE | 0.229 E-02 (1.18) | 0.425 (5.20) T | 0.377 (3.27) L | 0.247 (0.61) DM | −0.150 E-01 (−0.24) | 0.643 | 2.055 | 25.81 | 185.3 |
| TSE | 0.366 E-02 (3.73) | 0.939 E-01 (2.03) L | −0.803 E-02 (−0.40) NY | 0.182 (1.04) | 0.277 E-02 (0.91 E-01) | 0.053 | 1.72 | 1.76 | 231.4 |

### (2) Actual Changes

| Dependent Variable Close - Open | Constant | 1st Other Market | 2nd Other Market | Own Currency | Lagged Dependent | $R^2$ | DW | F | LL |
|---|---|---|---|---|---|---|---|---|---|
| LSE | 0.803 E-03 (0.52) | 0.280 (3.41) NY | 0.345 (3.81) T | 1.205 (−3.65) | 0.158 (1.59) | 0.731 | 2.572 | 38.28 | 174.4 |
| NYSE | 0.142 E-02 (0.67) | 0.278 (2.91) T | 0.285 (1.99) L | 1.731 (3.74) DM | −0.322 (−4.19) | 0.443 | 2.075 | 11.95 | 157.4 |
| TSE | 0.216 E-02 (2.84) | 0.209 (4.02) L | 0.273 E-01 (1.06) NY | 0.334 (2.55) | −0.799 E-02 (−0.28) | 0.353 | 2.407 | 8.50 | 214.7 |

## Table 2 — Continued
### Pre-October 19 n=29

### (1) Absolute Changes (without regard to sign)

| Dependent Variable Close · Open | Constant | 1st Other Market | 2nd Other Market | Own Currency | Lagged Dependent | $R^2$ | DW | F | LL |
|---|---|---|---|---|---|---|---|---|---|
| LSE | 0.16 E-02 (1.27) | 0.280 (2.22) NY | 0.819 E-01 (0.49) T | 0.338 (0.95) | 0.162 (1.83) | 0.19 | 1.29 | 2.61 | 130.4 |
| NYSE | 0.46 E-02 (2.14) | 0.115 · (0.98) · T | −0.952 E-01 (−0.316) L | 0.108 (0.24) DM | −0.423 (−0.43) | −0.11 | 1.79 | 0.30 | 116.2 |
| TSE | 0.15 E-02 (1.00) | 0.113 (0.70) L | 0.084 (1.22) NY | 0.014 (0.63) | 0.99 (0.85) | −0.04 | 1.85 | 0.76 | 127.0 |

### (2) Actual Changes

| Dependent Variable Close · Open | Constant | 1st Other Market | 2nd Other Market | Own Currency | Lagged Dependent | $R^2$ | DW | F | LL |
|---|---|---|---|---|---|---|---|---|---|
| LSE | 0.17 E-02 (2.26) | 0.249 (2.80) NY | 0.420 E-01 (0.49) T | −0.343 (−1.37) | 0.118 (1.01) | 0.35 | 1.40 | 4.61 | 1.0 |
| NYSE | 0.57 E-03 (0.50) | 0.351 E-01 (0.25) T | 0.478 (2.01) L | 0.836 (2.19) DM | 0.096 (1.03) | 0.183 | 2.05 | 2.51 | 108.8 |
| TSE | 0.20 E-02 (2.77) | 0.355 (2.92) L | 0.173 (2.87) NY | 0.95 E-01 (0.58) | −0.564 (−0.55) | 0.48 | 1.59 | 7.49 | 125.2 |

*Charles Goodhart*

## Table 2 — Continued
### Post-October 26 n=23

### (1) Absolute Changes (without regard to sign)

| Dependent Variable Close - Open | Constant | 1st Other Market | 2nd Other Market | Own Currency | Lagged Dependent | $R^2$ | DW | F | LL |
|---|---|---|---|---|---|---|---|---|---|
| LSE | 0.30 E-02 (0.40) | 0.704 (2.15) NY | 0.278 (1.26) T | −0.130 (−0.21) | 0.905 (0.50) | 0.16 | 2.61 | 2.00 | 74.6 |
| NYSE | −0.57 E-02 (−0.74) | 0.41 (1.42) T | 0.48 (1.83) L | 0.444 (0.58) DM | 0.507 (2.38) | 0.33 | 2.56 | 3.53 | 70.1 |
| TSE | 0.44 E-02 (1.85) | 0.28 E-01 (0.30) L | −0.535 (−0.55) NY | 0.752 (1.89) | −0.345 (−0.40) | −0.02 | 2.46 | 1.08 | 89.3 |

### (2) Actual Changes

| Dependent Variable Close - Open | Constant | 1st Other Market | 2nd Other Market | Own Currency | Lagged Dependent | $R^2$ | DW | F | LL |
|---|---|---|---|---|---|---|---|---|---|
| LSE | 0.629 E-03 (0.23) | 0.437 (1.705) NY | 0.327 (2.03) T | −0.919 (−1.72) | 0.301 (2.11) | 0.48 | 1.79 | 5.91 | 68.3 |
| NYSE | 0.26 E-02 (0.70) | 0.58 (2.37) T | 0.41 (1.61) L | 0.92 (1.17) DM | 0.20 (1.02) | 0.37 | 1.80 | 4.14 | 60.9 |
| TSE | 0.26 E-02 (1.82) | 0.320 (3.34) L | −0.119 E-01 (−0.13) NY | 0.392 (1.54) | 0.151 (1.95) | 0.42 | 2.43 | 4.84 | 81.8 |

# Table 2A

## Other Currency Coefficients
### (A) Absolute, Whole Period

|       | Pound           | Dm              | Yen             | SwFR            |
|-------|-----------------|-----------------|-----------------|-----------------|
| LSE   | /               | 0.726<br>(1.82) | 0.420<br>(0.94) | 0.521<br>(1.37) |
| NYSE  | 0.346<br>(0.83) | /               | 0.297<br>(0.72) | 0.255<br>(0.66) |
| TSE   | 0.201<br>(1.29) | 0.230<br>(1.39) | /               | 0.216<br>(1.31) |

### (B) Actual, Whole Period .

|       | Pound              | Dm              | Yen             | SwFR            |
|-------|--------------------|-----------------|-----------------|-----------------|
| LSE   | /                  | 1.105<br>(3.90) | 0.945<br>(2.94) | 0.916<br>(3.17) |
| NYSE  | −1.736<br>(−3.66)  | /               | 1.598<br>(3.59) | 1.585<br>(3.72) |
| TSE   | −0.285<br>(−2.14)  | 0.371<br>(2.69) | /               | 0.358<br>(2.83) |

## Pre-Oct 19
### (A) Absolute

|       | Pound              | Dm                 | Yen                      | SwFR                      |
|-------|--------------------|--------------------|--------------------------|---------------------------|
| LSE   | /                  | −0.038<br>(−0.64)  | 0.219<br>(1.14)          | 0.358<br>(1.60)           |
| NYSE  | −0.133<br>(−0.31)  | /                  | −0.613 E-01<br>(−0.20)   | 0.727 E-02<br>(0.18 E-01) |
| TSE   | 0.163<br>(0.71)    | 0.330<br>(1.17)    | /                        | 0.490 E-01<br>(0.18)      |

### (B) Actual

|       | Pound              | Dm              | Yen             | SwFR                  |
|-------|--------------------|-----------------|-----------------|-----------------------|
| LSE   | /                  | 0.718<br>(1.46) | 0.166<br>(0.89) | (0.292)<br>(1.31)     |
| NYSE  | −0.684<br>(−1.64)  | /               | 0.451<br>(1.69) | 0.611<br>(1.87)       |
| TSE   | −0.102<br>(−0.57)  | 0.256<br>(1.22) | /               | 0.940 E-01<br>(0.49)  |

# Table 2A — *Continued*

## Post-Oct 26

### (A) Absolute

|      | Pound | DM | Yen | SwFR |
|------|-------|-----|-----|------|
| LSE  | / | 0.364 | 0.329 | −0.304 E-01 |
|      |   | (1.34) | (0.53) | (−0.60 E-01) |
| NYSE | 0.951 | / | 0.612 | 0.499 |
|      | (1.33) |   | (0.77) | (0.75) |
| TSE  | 0.424 | 0.506 | / | 0.662 |
|      | (1.26) | (1.56) |   | (1.86) |

### (B) Actual

|      | Pound | DM | Yen | SwFR |
|------|-------|-----|-----|------|
| LSE  | / | 0.289 | 0.791 | 0.448 |
|      |   | (1.14) | (1.19) | (0.93) |
| NYSE | −1.085 | / | 1.801 | 0.944 |
|      | (−1.38) |   | (1.70) | (1.34) |
| TSE  | −0.300 | 0.329 | / | 1.423 |
|      | (−1.29) | (1.29) |   | (1.86) |

# Commentary on 'The International Transmission of Asset Price Volatility'

*Brian Quinn*

I should like to offer some general observations stimulated by Charles Goodhart's interesting and impressive paper before looking at the particular analysis he offers. I might add that I have known Charles for many years, mostly as a colleague in the Bank of England. As this paper indicates, he combines a vigorous mind with a keen awareness of what is going on that is of interest to policymakers in the economic and financial world.

## General remarks

First, technical though much of the paper may be—and both the logic and the econometrics demand much concentration on the reader's part—the issues addressed are of direct significance for those charged with the formulation and execution of public policy in the area of securities and banking markets. For example, the capital requirements set by the Securities and Investment Board and by The Stock Exchange in London for professional participants in securities trading will incorporate measures of volatility of the relevant asset prices. These measures are being reconsidered right now in the aftermath of the collapse of equity prices last year. Likewise, banking supervisors in the United Kingdom, exercised by the very large underwriting commitments which some British banks are taking on, are considering how to set concentration limits on these exposures taking account, *inter alia,* of the recent movements in asset prices including, but not confined to, equities.

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In coming to judgments on these **matters** a good deal depends on whether last October's events are to be regarded as a single, one-off phenomenon arising from a unique combination of external economic conditions, market conditions and technical operating features in particular stock exchanges; or whether they mark the arrival of a quite new and disturbing phase in financial markets. On the answer to this question, where the results of the work of Dickens, King and **Wadhwani** as well as Charles **Goodhart** are directly relevant, depends whether firms in London, New York and Tokyo have to reassess both the capital and the systems and controls which they employ in running their business; and whether that assessment is encouraged by the regulators and supervisors.

More generally, the more light that can be thrown on the events and aftermath of last October, the less difficult it will be for operators, regulators and monetary authorities to decide what **kind** of supporting supervisory and regulatory framework is appropriate to the evolving international banking and capital markets. Charles may doubt that these markets are more integrated than ever before and, by some definitions of integration, he may be correct. But something is going on out there. The Stock Exchange in London estimates that the turnover value of customer business in foreign equities in the London market in the first half of 1988 probably approached one-half of the value of turnover in domestic UK equities. Overseas client business represented about 20 percent of the value of all equity transactions in the London market last year. The value of non-British securities held by UK pension funds increased more than 30 times between 1980 and 1987, reaching 17 percent of total funds; and the proportion of UK investment trusts' and unit trusts' investments in overseas stocks in September last year reached 40 percent of the total.

Last October, when the collapse in equity prices first began to manifest itself, the Governor of the Bank of England established a small, ad **hoc working** group to keep a close and continuous watch on the evolving situation hour by hour and to advise on any measures that might need to be taken. That group, which consisted of both securities and banking supervisors, set up and maintained close and frequent contact with the corresponding authorities in other countries, notably the United States, Australia, Hong Kong and, to a lesser extent, Japan. From where I sat during that period, and from what I observed during and immediately after the week of October 16-23,

there was no doubt in my mind that, during that period at least and probably beyond, equity markets round the world influence and are influenced by one **anothers'** behavior. This is not to say that individual market structures, regulatory requirements and operating character- istics do not still play a major part in the determination of asset prices in each center even in turbulent conditions affecting world markets generally. But I believe the direction of developments is clear enough.

If this is so, there is little time to be lost in clarifying the lines of responsibility for the supervision of firms conducting business in a number of financial centers; in developing and securing lines of communication between the relevant supervisory and regulatory authorities; and in ensuring that these steps include banking as well as securities supervisors, given what our group observed last October about the nature of the close and growing links between banks and securities markets. I suspect Alexandre **Lamfalussy** may wish to say something about this important matter later today.

There is one further point I would like to make before turning to the content of Charles **Goodhart's** paper. Whether or not last October was an isolated case, it is clear that we could have had a very nasty accident indeed. In circumstances where markets had lost their com- posure and rumors were rife it was vital that the authorities in the countries concerned should take the correct action. The decision of the Federal Reserve to supply liquidity to the market, and the way in which this was done, was a model of its kind. I also believe that the solution adopted by Her Majesty's Government to deal with the BP issue, and the easing of short-term interest rates in the UK, played important parts in easing pressures at that time.

## The Goodhart paper

Let me now offer some particular comments on Charles Goodhart's paper.

First, I want to make it clear that I was not one of the people in the Bank of England complaining about greater volatility in finan- cial markets. As the person in charge of the Bank's Press Office for much of that time, I was too busy complaining about other people. What I do remember is that when we issued British Government stock in the **mid-1970s,** a movement of a half-point in that market in a day

was something that attracted comment. Not that I believe price volatility is, *per* se, bad. It probably means there is a real competitive market out there; but like some other participants at this conference, I do believe volatility has increased very substantially in most financial markets in the developed centers and that it may already be excessive in the terms which Professor Shiller specifies it.

I would add that the Quality of Markets Report of the International Stock Exchange in London for Winter 1987-88 is in no doubt that ''significantly increased volatility is now the norm.'' That report contains much information reflecting studies of the crash and of a longer period. Among other things it concludes that much of the pressure in London last October derived from the international nature of the London market; that an open verdict is returned on whether foreign selling of UK stocks contributed greatly to the collapse of prices in London; and that, after the initial shock, the markets in most centers went their own way. These conclusions may not have been supported by analysis having quite the same degree of academic rigor as those contained in Charles Goodhart's paper, but they are interesting and informative nonetheless.

As a lapsed economist, I cannot offer any expert critical evaluation of the econometric work in the paper—if I ever could. However, I find the results of the Dickens and the King and Wadhwani work intuitively plausible. I can readily believe that markets go through prolonged periods when the frequency and range of price movements are fairly stable, followed by periods when because of changes in market structure like Big Bang or the abolition of fixed commissions, prices move around in a lively and unprecedented way. Even if nothing else changes, market fashions sometimes do. The cult of the equity certainly captured the imagination of both investors and suppliers of this form of security 'for a spell.

I also find it quite reasonable to believe that last October an unusual conjuncture of circumstances led to a collapse of prices and composure in the New York Stock Exchange, leading to a pinball machine effect in equity prices in other exchanges and back to New York. I do not go along with Charles' view that equity markets as a whole before that event were not overheated. I have not had the opportunity to look at yield gaps in the different markets but I do recollect considerable feverishness in equity markets, sometimes associated with takeover activity—real or imagined—notably in New York, Lon-

don and Sydney. Frankfurt is, I agree, less easy to explain but that may be because I know very little about that particular market.

This interpretation of the crash is, of course, not at odds with the results of Charles' own work, where he is **looking** for evidence of greater asset price links internationally on either side of the crash. However, I have to wonder whether it is realistic to look for meaningful results in the wake of a shock as severe and abrupt as any this century. Investors are surely right to be very cautious about committing themselves, especially to purchases of overseas assets or on overseas exchanges; advisers are **licking** their wounds; and market-makers are still sorting out their books, **looking** at their operating results and at those of **their competitors** and, more fundamentally, asking themselves whether this is the **kind** of business they wish to be in. People are, in brief, **looking** inward rather than outward.

**Looking** at the analysis in greater detail, I can understand Charles' disappointment with the inconclusive results of his work. I would offer three comments, most of which are reflected in his own paper:

1.  The differences between the structures of the three markets he examines are, outside a traumatic event like last October, quite large enough to substantiate significant differences in a given class of asset prices, and in the extent to which news from "outside" affects prices in those markets, in anything but **very** abnormal conditions. There are differences in capitalization of participants, in the obligation to quote continuous prices, in the use of computer-driven techniques, in the duration of account periods, in funding arrangements, etc.

2.  The relative results which his work shows for London, Tokyo and New York again broadly conform with my own a **priori** expectations. Since 1979, and more especially since 1986, London has sought to establish itself as a prime international equity market; more than 100 of the Stock Exchange's 360 member firms are under non-UK control and there are in London more than 40 large international houses making markets in the stocks of non-British companies. By contrast, the insularity of the Tokyo market is well known and its idiosyncratic characteristics well acknowledged. The results for the NYSE are interesting. Perhaps the experience of October has caused people in that market to look around themselves a little more.

3.  Finally, I sympathize with Charles' suspicion that relating any other market observation to movements in nominal spot **forex** changes may be a misplaced act of faith. I understand why he chose to employ

it and admire his ingenuity. However, I do not think of that market as a paradigm for rational behavior, certainly not in anything like a short-term or even medium-term sense. Perhaps we should talk not of Random Walk behavior in that market but of Random Lurch or Random Stagger. However, I regret to say that I do not have anything better to offer at this stage.

# Commentary on
# 'The International Transmission of
# Asset Price Volatility'

*Michael Mussa*

In reading Charles' paper on "The International Transmission of Asset Price Volatility," I divided the paper into three main parts. There are some perspicacious comments at the start, followed by a summary primarily from the work of King and Wadhwani, and then Charles' own efforts to relate asset price volatility and its international transmission to movements in the foreign exchange market as a kind of index of international disturbances.

Let me comment on those three elements in turn and then make a few remarks about how I view the international transmission of financial market disturbances. The context of this discussion is, of course, the stock market crash of last year and the associated volatility that followed that disturbance. Charles makes the point early in his paper about the general complaints about asset market volatility. I think Henry Kaufman's point was apparently not well appreciated. Sometimes it is appropriate for things to be volatile—after all, economic circumstances do change and it is appropriate for prices to adjust to reflect those changes. Nevertheless, Charles writes, **"Bank** of England officials not only complained about worsening asset price volatility, they frequently asserted that such enhanced volatility was imported from abroad." New York was usually the proposed perpetrator. New York apparently felt the heat, because they tried to shift the focus of concern about a thousand miles west to the futures markets in Chicago.

On this general point, who is to blame? I recall a favorite story from the days when I first started teaching at the University of

Rochester. I saw a television news report of the suppression of a great riot in the Ohio state prison. The National Guard placed a huge charge of dynamite against a cellblock wall, blew a big hole in the wall, and then rushed in to beat up all the prisoners. Reporters asked the governor after the riot was over who was responsible for the riot. The governor replied with an absolutely straight face that it was the work of outside agitators.

 .The outside-agitators theory is, of course, a very popular one whenever anything goes wrong. And I think we want to be a little bit careful in view of the fact that—reference to astrology notwithstanding—it is probably appropriate to view the world as a closed economy with no outside agitators.

In his paper, Charles points to one key fact. The most important and relevant fact about the stock market crash for the purpose of the current issue, which is discussion of international transmission, is that the crash was not limited to a single country, the United States. Rather, the crash occurred of roughly equal magnitude essentially simultaneously, allowing for the natural rotation of the earth, in virtually every stock market around the globe. And that key fact suggests that either there must have been some huge common disturbance that was affecting all markets simultaneously, or somehow a disturbance that occurred in one market must have rolled through to affect other equity markets around the world, suggesting international transmission disturbances.

I would add to Charles' observation two further observations of my own. First, the stock market crash of mid-October was certainly not the only major stock market crash that we have observed around the world in the last decade. There were significant drops in the previous decade in the Milan market, the Tel Aviv market, the Mexico City market, and the Hong Kong market. These were all relatively small markets, but they did not cause any significant reverberations in the rest of the world. I think these examples serve to show there can be individual disturbances in particular equity markets that are not reflected in the rest of the world.

It is relevant to note, however, that if you have a big disturbance in a particularly large stock market—or if you say that New York and Tokyo are subject to a simultaneous impulse—perhaps the rest of the world cannot simply ignore this disturbance the way they did the disturbance in the Hong Kong market, the Tel Aviv market, the

Mexico market, or the Israeli market. This is an issue to which I'll return in a little bit.

My second observation to add to Charles'—and a key fact—is that since the stock market crash of last fall, the real economy has not seen any disastrous consequences of that stock market decline. And I think that is equally impressive as a fact as the sort of common magnitude of stock market declines on a worldwide basis.

After discussing these general issues, Charles turns to a summary of results that are found by his colleagues, King and Wadhwani. Through their empirical technique, King and Wadhwani attempt to measure contagion or cross-effects of stock market movements. The theoretical story they tell is that in each individual stock market around the world there are sets of disturbances that affect stock prices. There are two fundamental types of these disturbances—disturbances that ought to affect only your market and disturbances that ought to affect all stock markets on a worldwide basis. The difficulty for people in other stock markets, however, is that they see only the price change in your particular market, and they don't know whether that price change has occurred because of an idiosyncratic factor that ought to be limited to your market or because of some common element that ought to be influencing all stock markets around the world. Not knowing for sure the source of the price disturbance, and not having independent information of their own to make a complete evaluation, they look at the price change in your market. Then they decide they ought to take this information into account. And so the stock price abroad responds to a change in the stock price in the United States.

We have a contagion effect when the source of the price change in the United States is an idiosyncratic factor that ought to be limited in its effect only to the U.S. market rather than spreading to the rest of the world. But the incapacity to distinguish between these two sorts of disturbances leads to this spreading of what ought to be idiosyncratic effects on stock prices. King and Wadhwani attempt to measure these contagion effects by a relatively ingenious technique of looking at stock price changes either when a market opens, or between its opening and its close, and relating these changes to simultaneous movements, or to open-close or close-close movements, in other stock prices.

The key findings that come out of this hypothesis are that con-

tagion effects will increase with the increase in volatility, and that there is in fact an increase in volatility associated with their measure of contagion effects. King and Wadhwani conclude from this that increases in contagion increase overall stock market volatility.

I have a couple of problems with the King and Wadhwani paper. First, I wasn't sure whether technically the conclusion follows. The coefficient in the theoretical model ought to be sensitive to variances —and to covariances for that matter—of the two types of shocks. If we have the little-boy-who-cried-wolf model, which is to say all shocks in the U.S. market are idiosyncratic, then people will know that and in the rest of the world there will be no response to U.S. price movement. On the other hand, if people know those shocks are idiosyncratic, they will respond all the time. However, we should change the rules of the game on them. And you say, well look, people believe that the United States never cries wolf but the United States starts to cry wolf like mad; then, of course, you get contagion effects spreading to the rest of the world. But it seems you haven't played an entirely fair game, in the sense that you're using the parameters from one situation and applying them to another situation. And one would technically need to consider whether those coefficients should be adjusted if the fundamental nature of the shocks—the variances and the covariances between them—are being changed.

Moreover, as I indicated earlier, I think there can be other explanations for why very large movements in one stock market can be reflected in movements in stock prices in other markets. Even if it is because the United States is going totally nuts for some completely idiosyncratic reason—if the U.S. stock market declines by 500 points in a given day—that fact is simply not relevant in Tokyo, regardless of the source of the disturbance. If that magnitude of change occurs in the stock market, it is a relevant piece of information.

Now let's turn to Charles' own efforts to look at foreign exchange movements, particularly when stock markets are closed, as a source of information about the international disturbances. He finds two key things. One, when the dollar goes up, that is generally good for stock markets. And two, he rejects his own hypothesis that large foreign exchange movements during times when the stock market is closed would have relatively larger effects on stock prices when the markets open. Let me comment on those two things. First, the relationship of the dollar going up to the performance of stock markets, I suspect,

is a particular consequence of the circumstances that prevailed in **1987** when we had coordinated efforts on the part of major governments to attempt to limit the dollar's downward movements. Those efforts needed to be reinforced, some would argue, by pushing up U.S. interest rates when the U.S. trade balance deteriorated. So if the dollar did come under downward pressure, there might be an expectation that bad things would happen, and the stock markets would react to that understanding of the structure of the situation. And that would not necessarily be a situation that would prevail in other circumstances. Second, concerning the hypothesis about the magnitude of foreign exchange rate volatility versus stock market volatility, I think there are considerable difficulties in attempting to draw such a relationship. For one thing, there have been times in the past when exchange rates were completely fixed, and with that, of course, we would not expect any relationship at all between exchange rate volatility and stock market volatility. Second, we have not lived in a world in which exchange rates are completely and freely flexible. Particularly during **1987,** there were fairly vigorous efforts to limit exchange rate movements. And it may well have been the absence of exchange rate movements, combined with the effort to limit those movements, that created stock market reaction rather than movements in the foreign exchange market itself. I think Charles said, "Well, it may just be that the foreign exchange rate is a poor proxy for international disturbances." I might add that it is probably a particularly poor proxy in view of the linkages of other economic policies to the exchange rates.

Finally, let me comment on the general issue of whether international transmission of the major disturbance was associated with the stock market crash of last October. I think this cannot be rigorously proved by the usual standards of statistical analysis, but a careful reading of the chronology of the facts suggest an important degree of international transmission. As was suggested earlier from the floor, during the week before October **19** there were a number of important changes in fundamental factors: the deterioration of the U.S. trade account, the increase in U.S. and other interest rates, the policy dispute between the U.S. government and the West German government over who should be raising and who should be lowering interest rates, and a variety of other views, which probably fed together with the general impression that the stock market was overvalued.

In any event, when the Brady Commission sent out its survey to ask people what, in the week preceding the crash, was responsible for the stock market decline, the respondents indicated that fundamental rather than psychological factors were predominant in their estimates. They pointed in particular to the increase in interest rates and ''overvaluation'' of the stock market as the leading fundamental factors. When these same people were asked for their explanations of the 500-point decline on October 19, the leading category of explanation was ''psychological factors.'' By far and away the most important psychological factor was ''pure heck.'' This is, I think, consistent with the facts that on the opening—even given the delay in opening—the New York stock market exchange dropped 100 to 150 points, recovering during the mid-morning 50 to 70 points, and dropping again by the early afternoon. So it was down about 200 points by the 2 o'clock measurement on the Dow. In the next two hours, it dropped another 300 points. It is difficult to find the news that would have produced this result.

Indeed, having served in Washington for nearly three years now, I know it is true that the only safe secret is a secret known by only one person. It is inconceivable to me that some great fundamental economic change occurred roughly between 2 o'clock and 4 o'clock (New York time) on October 19—a change that would have produced a 300-point drop in the Dow—and a change that no one would even recognize. It is also inconceivable to me that there was a vast and successful conspiracy of silence to prevent knowledge of this change from permeating to the *Wall* Street *Journal,* to the New York *Times,* and to other investigative reporters who have sought to find the true explanation of the crash.

Subsequent to the decline in New York, I think we saw reactions in Tokyo and in London, and the situation was only finally stabilized on the afternoon of October 20, when the U.S. market began to show some recovery. So I think the chronology of developments in mid-October certainly suggests that something peculiar happened in the U.S. market, particularly on October 19, and the effects of this disturbance were transmitted around the world to influence stock behavior in other markets.

# Globalization of Financial Markets: International Supervisory and Regulatory Issues

*Alexandre Lamfalussy*

I was delighted to accept your invitation to come to Jackson Hole. To economists and specialists in financial markets, Jackson Hole is, of course, firmly on the map of conference centers for the excellence of its seminars; but Wyoming is not a territory with which I can claim great familiarity. When I looked at the map to get my bearings, the schoolboy in me was intrigued to observe our proximity to such famous names from the Wild West as the Big Horn River and Fort Custer. General Custer might not have cared much about instability of the financial variety, but he would surely have made a forceful contribution as a discussant for a seminar devoted to policy responses to disorder and instability of a different kind.

My subject today is international supervisory issues and I propose to divide my remarks into two parts. First, I should like to use (or abuse) the privilege of a luncheon speaker to make some very general observations on the rationale for official supervision of financial institutions, and for international cooperation in this field, in today's world; and second, I shall look at some current issues facing supervisors. A good deal of what I shall have to say will be about the supervision of banks, but I shall also refer to supervision of securities markets.

To begin, then, with the question as to the rationale for supervision in today's world. The traditional goal assigned to the supervi-

sion of the financial industry in general, and of **banking** in particular, is to ensure the stability of the system as a whole by promoting sound management of individual institutions. The reason for caring more about stability in the financial, and especially the banking, sector than about that in any other industry appears to be twofold: first, the failure of individual institutions can lead to chain reactions within the system because of the strong links tying institutions to each other, because of the speed at which funds can be shifted and because of the overwhelming role of expectations; and, second, as a result of its central place in the mechanism of credit allocation and in the payments and settlements system, whatever happens within the **banking** world can have far-reaching consequences for the real economy. It is for these reasons that central banks have been entrusted with the lender-of-last-resort function, of which bank supervision—so runs the argument—would seem to be the natural corollary.

I have not noticed anyone seriously challenging the view that the pursuit of stability in banking is a worthwhile objective, nor, indeed, that the achievement of this objective presupposes that central banks should be able and willing to perform (at least in a global sense) their **lender-of-last-resort** function. What has been questioned, however, by a number of observers and analysts in recent years is whether supervision has become largely unnecessary to the achievement of systemic stability and also whether it may not actually be counter-productive. I propose to look briefly at both these views.

Those who argue that supervision has become largely unnecessary are, in effect, saying that nowadays bank failures are no more **harmful** economically than failures of firms in other sectors of the economy. This assertion is based on the existence of retail deposit insurance schemes, which mean that most bank depositors now run no risk of losing their money if a bank fails. From this it is argued that the threat of systemic runs on banks leading to a multiple contraction of bank money and credit is now a thing of the past. This view would seem to be supported by the observation of what has, or rather has not, happened in recent years. In contrast to events in the 1930s, the numerous and, in some instances, very severe shocks that have affected individual banks or even the whole industry in the 1980s have not produced large-scale disturbances that could be called a genuine **banking** crisis.

The second of the two views I mentioned, namely that bank **super-**

vision may actually be counterproductive, is based on the argument that supervision has costs in weakening the efficiency with which banking functions. This is not a new view and it has several inter-connected facets. Regulatory prescriptions governing, say, minimum capital or liquidity ratios are accused of inviting bank managements to suspend their own judgment on the risk involved in certain bank activities and/or to try to evade the cost they imply. At the same time, supervision, especially if carried out by the central bank, may induce the latter to bail out individual institutions more or less systematically. The argument that supervision is the natural corollary of the lender-of-last-resort function is therefore turned upside down: supervision carries with it the temptation to be lender of last resort to individual institutions in a fashion and with a predictability that would tend to distort management behavior. The result would be a weakening of market discipline, reinforcing the supposedly perverse influence of deposit insurance. Banks may take greater risks than they otherwise would with their depositors' money and, at the same time, depositors may be less attentive to the quality of bank management. The efficiency of market discipline would be impaired. Note that the logical implication of this view is that individual banks should be allowed to fail, or at least that no single institution should be able to operate on the assumption of a bailout—a principle I would find hard to contradict.

I would not want to deny that banking supervision, or retail deposit insurance, may in *general* involve some costs. These costs may be characterized as interference with the workings of the market. They include some loss of efficiency in banking and, of course, costs to the taxpayer to the extent that the bailout is financed by the state. I would not dispute either that some specific aspects of individual countries' supervisory regimes may be unnecessary, or even perhaps, counterproductive. Nor do I wish to hide my mixed feelings on observing the frequency of bailouts. But I believe that both the supervisory and the rescue techniques are improvable, so that these costs can be reduced, although not completely eliminated. More important, however, to my mind is the question about the balance between the costs and benefits of official supervision.

To that question I would give the traditional answer that the benefits of supervision clearly outweigh the costs, for two reasons. First, I think it is an exaggeration to say that retail deposit insurance schemes

have largely extinguished the risks of systemic runs on banks. Quite apart from the fact that not all countries provide deposit insurance, the main thing wrong with this argument is that insurance does not cover wholesale deposits, nor deposits placed in foreign branches. In saying this, I am well aware that in the United States there is an active brokerage trade engaged in cutting up wholesale deposits into retail slices. But insurance is not, indeed should not be, complete, and I would add that it is in the field of wholesale banking in the Euromarkets that competition has been keenest in recent years, and that banking has become more integrated worldwide.

I am familiar with the argument that wholesale (i.e., corporate) depositors are supposed to be able to judge the quality of bank managements, and therefore, to look to the safety of their deposits, better than the man in the street. Recent experience does not suggest that this is always the case. For instance, it was not true of the wholesale depositors at Continental Illinois Bank, particularly those in the Euromarkets from which Continental drew a large part of its funding.

My second reason, or set of reasons, for holding the traditional view has to do with the structural changes that have taken place in banking over the past decade and with some of their consequences. The main features of these changes have been international financial integration, the wave of financial innovations and the deregulation of banking. Their most important consequence has been a very marked increase in competition between financial intermediaries, both in their home markets and, even more so, internationally.

There are three points to which I would draw your attention to this connection. First, greater competition in banking is supposed to improve the allocation of resources through banks. I am ready to accept this as a general proposition, but I have some difficulty in forgetting the lessons of the debt crisis. The present external over-indebtedness of many sovereign borrowers—one of the largest con-temporary macroeconomic imbalances, and one that continues to give a lot of headache to the banks themselves—emerged at a time when bank credit was provided by banks which were not only competing freely with each other but were doing so with very little regulatory impediment. The Euromarket of the 1970s and early 1980s came as close as possible to the model of a free, unregulated market. It is, of course, true that "overlending" could not have happened without

"overborrowing", and that it was not easy to foresee a combination of world slump with very high interest rates. Nevertheless, anyone who had the experience of seeing bankers queuing up in front of the offices of lesser developed country (LDC) finance ministers at that time cannot help feeling that the highly competitive environment had something to do with the emergence of the problem.

Second, in recent years, there has been a very large increase in corporate and household debt ratios, particularly here in the United States but also in some other industrial countries, carrying obvious risks in the event of a cyclical downturn. One cannot rule out, in my view, the influence of financial innovations, notably leveraged buyouts, on the increase in corporate debt ratios.

Third, and more generally, competition works partly through the elimination of weaker units from the system—the process that Schumpeter described as "creative destruction". If, like me, you cannot accept the view that the risk of systemic runs on banks is now a thing of the past, you feel that such destruction can be more dangerous in banking than in any other sector of the economy. Moreover, the worldwide integration of banking has given this risk a dimension that it never had before.

My purpose in making these points is not to argue that the costs of increased competition in banking outweigh the benefits. I do not believe that they do; nor do I wish to underestimate those benefits. My argument is simply this. The rapid evolution toward a more and more competitive environment in banking exerts tremendous pressure on bank management to outperform rival banks or simply to fight for survival. This means not only cost cutting but also finer pricing for deposits, a search for higher-yielding investment, new ventures, the use of innovative techniques and new products. In other words, it is likely to imply an incentive to greater risk-taking. Add to this a very uncertain and basically imbalanced global macroeconomic environment leading to wildly fluctuating exchange rates, interest rates, stock prices, real estate values and commodity prices, and it is hard to avoid the impression that the risks in banking have been set on a rising trend. I do think that in order to preserve the stability of the banking system, which is a valuable aim in its own right, bank management needs the support of the restraining influence of super-vision even at the cost of some loss of efficiency, whatever the defini-tion of efficiency may be. And it is obvious that in today's globalized

banking market, supervision has to be as far as possible globalized, both in the geographical and in the inter-industry sense of the term.

I now turn to some current supervisory issues. Capital adequacy lies at the heart of sound banking. For some years, therefore, the efforts of supervisors to help banks meet the challenges of the more competitive environment in which they now operate have been concentrated on strengthening banks' capital positions. The accord reached last month by the G-10 central banks on capital adequacy represents the culmination of those efforts. I know that the agreement has not been universally acclaimed by all sections of the banking community in the United States, but it has also been criticized, from different angles, in other countries. This is, perhaps, the sign that it is a good agreement, well-balanced and distributing the strategic adjustment efforts evenly across the world. I would like to spend a few minutes considering the importance of this landmark in supervisory cooperation.

It has two aims: to strengthen bank capital standards in the G-10 countries where the core of the international banking system is located; and to do so in a way that tends to equalize the impact of supervision on the competitive positions of banks in different G-10 countries.

Disparities between national regulations with respect to the measurement of capital and the assessment of capital adequacy can have a number of harmful consequences. First, banks in countries with high capital standards are less able than their opposite numbers in countries with lower standards to compete for new business. Second, as a consequence, banks with lower capital and larger balance sheets will be able to lend on substantially lower margins with the result of diminishing returns for all. Third, some banks may, therefore, take on riskier, higher-margin lending in an effort to boost their earnings. And, fourth, the combination of these factors can make it harder for banks, and for supervisors, in a given country to raise their capital standards in isolation from what is happening elsewhere.

It may be argued that over the long run the market might do the job that the new accord on capital adequacy is designed to do. The market would, without any help from supervisors, pass its verdict on weak and inadequately capitalized banks and would reward strong banks for their prudence. But the history of banking does not suggest that the market can do this sort of thing and, *at the same time,* preserve the system's stability. This is a practical illustration of the

general point I made earlier, namely that whatever costs supervision may imply, they are likely to be offset, especially in today's world, by the advantages such supervision produces in terms of the preservation of financial stability.

Turning now to the securities markets, last October's stock market crash and the events that followed it were remarkable for two features, the first having been the speed at which other markets reacted to the fall in prices on Wall Street. That was the most dramatic illustration we have yet had of the degree to which financial markets are now integrated worldwide. Moreover, this reaction occurred despite quite marked contrasts between different countries, both in economic conditions and in **price/earnings** ratios for equities.

The second feature was the resilience that the markets displayed after the crash. There was no cumulative decline of share prices which, in fact, stabilized rather quickly (except in Japan) at lower levels.

This resilience of markets was no doubt partly the result of the rapid and efficient way in which the Federal Reserve and other central banks supplied extra liquidity to their markets. Given that the authorities took those actions, we shall never know to what extent there were also market forces at work that prevented a tailspin of prices which would certainly have had deflationary effects on the real economy. Probably there were such forces at work. But, in my view, it was a good thing that the central banks did not wait to see how effective they would have been, on their own, in stabilizing the situation.

One consequence of the post-crash resilience of markets was that no really large-scale problems emerged in the financial markets, either for individual institutions or, still less, for the system itself. This means, in my view, that there is no reason in the light of last year's events to consider drastic changes in the ways that markets work and, in particular, to try and put into reverse the structural changes of the past decade. At the same time, however, the crash certainly pointed up issues for market participants and for supervisors in both the banking and securities markets.

Those who supervise securities markets have had brought home to them, more clearly than before, the extent to which the cash securities markets and the markets in derivative instruments are linked to one another. Effective supervision of the securities markets must cover all their different parts.

Those responsible for supervising banks have realized more clearly than before the implications of the banks' increased involvement in the securities business. In fact, the losses sustained by banks on equity holdings were, in most instances, substantially offset by gains on their bond portfolios. The full implications of the banks' participation in the securitization phenomenon of the 1980s will only become apparent when we next experience a period of rising interest rates and falling bond prices—when there might well be no offset from rising equity prices to banks' losses on their bond portfolios.

Last year's events have also alerted bank supervisors and securities market supervisors to the necessity of cooperating with one another, both nationally and internationally. Action is now being taken to organize such cooperation. Even at the national level this may not always be easy, for institutional and other reasons. Internationally, it is likely to prove even more difficult, since the greater the number of countries that attempt cooperation the harder it becomes to reach an agreement that is both worthwhile and workable. But the worldwide character of financial markets and the geographical mobility of both financial transactions and financial institutions mean that cooperation between supervisors in different parts of the financial system needs to be put on the widest practicable basis.

Let me conclude by expressing my conviction that one of the great challenges policymakers are facing today is to encourage market participants to behave in a way that maximizes the advantages of free global competition without exposing the system to greater instability. They can do this by creating an appropriate regulatory framework and by implementing stability-oriented macroeconomic policies. I have tried to make the point several times that the adjustment of supervisory practices and their coordination internationally have an essential part to play. It was not within my remit today to insist on the role that must be assumed by macroeconomic policies—and their coordination—but it is clear to me that the high capital mobility implied by free competition will not be tolerant vis-a-vis policies that lead to, or appear to be unable to correct, large financial imbalances, be they domestic or international. And this intolerance would express itself in continued exchange rate and financial asset price volatility— the very topic of this symposium.

# Policies to Curb Stock Market Volatility

*Franklin R. Edwards*

## Concern about volatility

In October, 1987, stock markets everywhere in the world fell sharply, some by more than 40 percent. Subsequently, stock price volatility increased and trading volume fell precipitously. Some contend that the fall in trading volume is a consequence of the increased volatility. Investors are being scared off. The market is viewed as too erratic, too risky. Higher volatility and narrower market participation, some also argue, may be the reason that stock prices still have not recovered to pre-crash levels.[1]

Concern about stock market volatility pre-dates the October crash. Volatility was increasing even before the crash.[2] October 19 and 20 simply intensified this concern. In addition, several reports on the crash highlight volatility as a problem. For example, the Securities and Exchange Commission (SEC) says at the outset of its report:

" . . . when price swings reach extreme levels, they can have a number of adverse consequences. First, such volatility

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[1] Fischer Black, "An Equilibrium Model of the Crash," unpublished, March 1988, p. 7; and K. French, G. Schwert, and R. Stambaugh, "Expected Stock Returns and Volatility," *Journal of Financial Economics* 19 (1987) pp. 3-29.

[2] Franklin Edwards, "Does Futures Trading Increase Stock Market Volatility?" *Financial Analysts Journal* (January/February 1988) pp. 63-69.

increases market-making risks and requires market inter-
mediaries to charge more for their liquidity services, thereby
reducing the liquidity of the market as a whole. Second, if such
volatility persists, securities firms are less able to use their
available capital efficiently because of the need to reserve a
larger percentage of cash-equivalent investments in order to
reassure lenders and regulators. Third, greater volatility can
reduce investor confidence in investing in stocks. As a result
of these effects, we believe substantially increased price volatility
could, in the long run, impact the ability of U.S. corporations
to raise capital efficiently through the sale of equity securities."[3]

The message of this paper is that this emphasis on volatility is
misplaced and counterproductive. Curbing volatility is an elusive
policy target. It is not clear why volatility rises and falls, and policies
directed at reducing it are unlikely to succeed and may also have
harmful effects. Finally, there are more important issues that require
attention.

## What has happened to stock market volatility?

While stock market volatility soared last October when stock prices
plummeted, it has declined significantly from its highs during October
and the months immediately following the crash. Table 1 shows that
daily volatility·of the S&P 500 index, the Dow Jones index, and the
NASDAQ 100 index have all declined by 50 percent during the last
few months relative to volatility during the three months that followed
the crash. This decline occurred in both daily close-to-close prices
and intra-day high-low prices. Volatility is currently at about the level
it was during the first nine months of 1987, or before the crash.
Although it is higher than it was in 1986 and in many earlier years,
similar or even higher levels of volatility occurred in 1974-75, 1980,
and 1982 (see Charts 1 and 2).

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[3] "The October 1987 Market Break", A Report by the Division of Market Regulation, U.S.
Securities and Exchange Commission (February 1988) p. XII.

# Table 1
## Alternative Estimators of Volatility for Different Daily U.S. Stock Indexes, 1973-1988

| Time Period | $N^c$ | S&P 500 | | Dow Jones | | NASDAQ100 | |
|---|---|---|---|---|---|---|---|
| | | $CC^a$ | $PHL^b$ | $CC^a$ | $PHL^b$ | $CC^a$ | $PHL^b$ |
| 6/1/73–9/30/79 | 1599 | 0.9117 | — | — | — | — | — |
| 10/1/79–9/30/82 | 760 | 0.9743 | — | — | — | — | — |
| 10/1/82–12/31/82 | 62 | 1.4685 | — | — | — | — | — |
| 1983 | 253 | 0.8394 | — | — | — | — | — |
| 1984 | 253 | 0.8003 | — | — | — | — | — |
| 1985 | 252 | 0.6344 | 0.5150 | 0.6459 | 0.5652 | 0.7796* | 0.6362* |
| 1986 | 253 | 0.9289 | 0.7556 | 0.9721 | 0.8348 | 0.9858 | 0.7258 |
| 1/1/87–9/30/87 | 189 | 0.9858 | 0.8907 | 1.0184 | 0.9674 | 1.0459 | 0.8682 |
| 10/1/87–10/31/87 | 22 | 6.1101 | 4.1255 | 6.6929 | 5.2954 | 5.9119 | 3.9023 |
| 11/1/87–1/31/88 | 62 | 1.9484 | 1.5391 | 2.0445 | 1.7113 | 2.1274 | 1.7747 |
| 2/1/88–5/27/88 | 83 | 1.0193 | 0.8444 | 1.1284 | 0.9631 | 1.0059 | 0.8845 |

a. CC: Standard deviation of daily close-to-close percentage price changes, measured as

$$\ln \left[ \frac{\text{Close } P_t}{\text{Close } P_{t-1}} \right] *100$$

b. PHL: Parkinson's high-low daily price estimator defined as the square root of

$$\frac{0.361}{N} \sum_{i=1}^{N} \ln \left[ \frac{\text{High } P_t}{\text{Low } P_{t-1}} \right]^2 *100$$

c. N: Number of days or observations in sample period.

* There were only 31 observations in 1985.

## Chart 1

### S & P 500 Index - Daily Volatility
Monthly: June 1973 to May 1988

Standard Deviation (Percent Daily Price Changes)
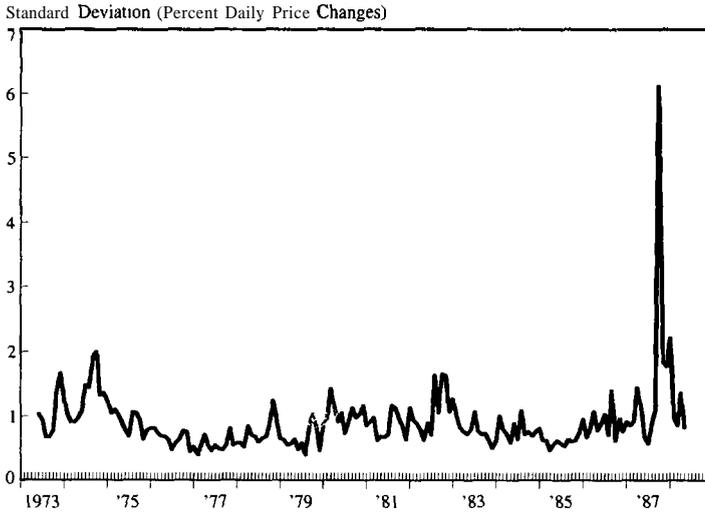


## Chart 2

### S & P 500 Index − Daily Volatility
Monthly: June 1973 to May 1988

Annualized Standard Deviation (Percent Daily Price Changes)
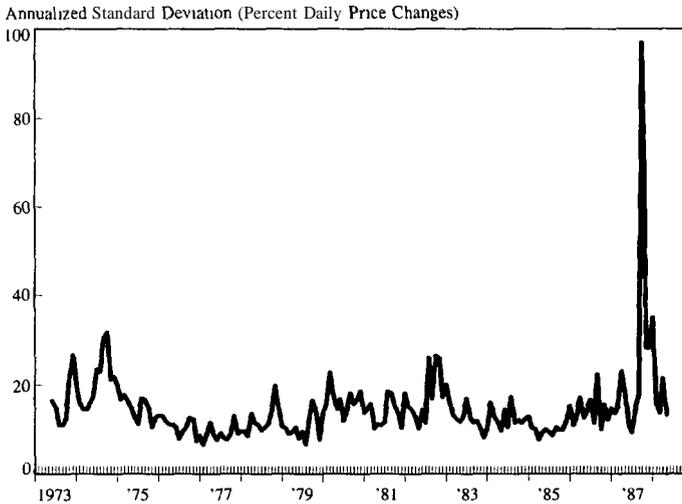
Table 2 compares stock market volatility in Japan and the United Kingdom (the other large markets) to the United States. The patterns are similar. Volatility rose substantially in all markets during October 1987 and during the three months following the crash. In the last few months it also has declined in all markets, although the decline is relatively greater in Japan and relatively less in London. Indeed, unlike the markets in the U.S. and the UK, volatility in Japan is now at the same level as in 1985.

Several conclusions emerge from the data. First, both inter-day and intra-day stock market volatility in all markets rose to unprecedented levels during October 1987 (Chart 1). Second, volatility in

### Table 2
### Volatility in U.S., Japan and U.K.
(Standard Deviations of Close-to-Close Daily Percentage Changes)"

| Time Period | U.S. (S&P 500) | Japan (Nikkei 225) | U.K. (Financial Times 500) |
|---|---|---|---|
| 1985 | 0.6344 (252) | 0.5319 (245) | 0.7729 (246) |
| 1986 | 0.9289 (253) | 0.9378 (246) | 0.8094 (246) |
| 1/1/87–9/30/87 | 0.9858 (189) | 1.1036 (186) | 1.0257 (190) |
| 10/1/87–10/31/87 | 6.1101 (22) | 4.4545 (22) | 5.4637 (22) |
| 11/1/87–1/31/88 | 1.9484 (62) | 1.5773 (62) | 1.4978 (62) |
| 2/1/88–5/27/88 | 1.0193 (83) | 0.5663 (83) | 1.2010 (82) |

*Standard Deviation of $\ln \dfrac{\text{Close } P_t}{\text{Closer } P_{t-1}} * 100$

The number of daily changes in each time period is shown in parentheses.

all markets has declined significantly in recent months, and especially in Japan and the U.S. (Table 2). Third, the volatility of both the S&P 500 and Dow Jones index has behaved in a similar fashion to that of the NASDAQ 100 index, on which no futures contract is currently traded (Table 1). Fourth, while volatility has declined recently, it remains somewhat higher relative to earlier years (Table 1). Fifth, although volatility remains high, today's level is not without precedent. Similar levels of volatility occurred during the 1970s and 1980s (as well as in the 1930s)[4] (Chart 1).

## Why has volatility increased?

Stock market volatility changes significantly over time. Despite many attempts to explain changes in volatility, we know very little about the factors that cause volatility to change.[5] For example, Schwert attempts to relate changes in stock market volatility to a number of economic factors: financial leverage, corporate bond yields, corporate earnings and dividend yields, stock trading activity, the volatility of interest rates, bond prices, and macroeconomic variables. He concludes that "none of these factors . . . plays a dominant role in explaining the behavior of stock volatility over time."[6]

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[4] The conclusions, incidentally, also hold for many different estimators of volatility not shown here because of redundancy.

[5] See e.g., R. Officer, "The Variability of the Market Factor of the New York Stock Exchange," *Journal of Business* 46 (1973) pp. 434-452; F. Black, "Studies of Stock Price Volatility Changes," Proceeding of the 1976 Meetings of the Business and Economics Statistics Section, American Statistical Association (1976) pp. 177-181; A. Christie, "The Stochastic Behavior of Common Stock Variances: Value, Leverage and Interest Rate Effects," *Journal of Financial Economics* 10 (1976) pp. 407-432; R. Merton, "On Estimating the Expected Return on the Market: An Exploratory Investigation," *Journal of Financial Economics* 8 (1980) pp. 323-361; R. Pindyck, "Risk, Inflation, and the Stock Market," *American Economic Review* 76 (1986) pp. 1142-1151; K. French, G. Schwert, and R. Stambaugh, "Expected Stock Return and Volatility," *Journal of Financial Economics* 19 (1987); T. Bollerslev, R. Engles and M. Wooldridge, "A Capital Asset Pricing Model with Time Varying Covariances," *Econometrica* 55 (1987); G. Gennottee and T. Marsh, "Variations in Ex-ante Risk Premiums on Capital Assets," unpublished manuscript, University of California at Berkeley (1987); A. Abel, "Stock Prices under Time-Varying Dividend Risk: An Exact Solution in an Infinite-Horizon General Equilibrium Model," unpublished manuscript, University of Pennsylvania (1987).

[6] G. W. Schwert, "Why Does Stock Market Volatility Change Over Time?" unpublished (1987) p. 1.

Since the crash, considerable attention has been devoted to the effect of futures trading on stock market volatility, and in particular, to the effect of certain trading strategies such as portfolio insurance, program trading, and index arbitrage. (Historical evidence does not support the view that the introduction of futures trading on equity indexes in 1982 increased stock price volatility.)' The SEC's report adopts this position when it says:

> " . . . the availability of the futures market has spawned institutional trading strategies that have greatly increased the velocity and concentration of stock trading.
>
> . . . we believe that the increased concentration and velocity of futures-related trading and resultant increases in stock market volatility can have long term, profound impacts on the participation of individual investors in the stock market.''[8]

Work on the connection between various kinds of trading and market volatility, however, has just begun, and it is too early to draw firm conclusions.[9] At present we have no empirical evidence to link particular trading strategies to volatility.

## Proposed remedies

Notwithstanding our poor understanding of the causes of stock market volatility, a number of measures have been proposed (or are being discussed) that would, according to their supporters, dampen price volatility. I classify these as falling into three categories:

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[7] Franklin Edwards, *op. cir.*

[8] SEC Report, p. XIV.

[9] See e.g., Ronald Anderson and Mehmet Tutuncu, ''The Simple Price Dynamics of Portfolio Insurance and Program Trading,'' Columbia Futures Center Working Paper #173 (June 1988).

— Regulations to curb certain **kinds** of trading activities;

— Institutional arrangements designed to enable the existing **market-making** systems to cope better with the current needs and trading strategies; and

— Proposals for substantial changes in the existing market-making system that would arguably enhance market liquidity and lessen volatility.

It is, of course, difficult to appraise the potential for these proposals to reduce volatility without understanding what is causing the volatility in the first place. Some things can be said, nevertheless, which may help to clarify the debate and to elucidate the pros and cons of the proposals.

## *Curbs on portfolio insurance and program trading*

None of the studies of the stock market crash recommends direct curbs on program trading, portfolio insurance, or index arbitrage. Further, all of them conclude '' . . . that derivative index markets provide valuable hedging and market timing benefits to institutions . . . ''[10] There have, nevertheless, been calls to curb or even to ban entirely portfolio insurance and index arbitrage. Under pressure from large corporate clients, a few large brokerage firms have "voluntarily" stopped doing index arbitrage for their own accounts.

There are five arguments against restricting these types of trading. First, it is not clear that they do, in fact, increase volatility. They may or may not. We do not know. Second, with the development and increasing dominance of institutional trading, and of index fund management, there are benefits to being able to trade the entire market (or to do "basket" trades). It is, for one thing, cheaper, and therefore beneficial to the owners or beneficiaries of institutional funds. Curbing such trading may impose greater costs on society than the possible gain from lessened volatility. Third, if the cause of instability is port-

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[10] See e.g., the SEC Report, p. XIV.

folio insurance trading, curbing such trading in futures markets is unlikely to have much effect. Portfolio insurance strategies can be (and are) implemented in the cash market as well, with the same potential effects." Fourth, the volume of portfolio insurance done prior to October 19 may have been "excessive," in that users overestimated its benefits. The experience of last October is likely to result in a reappraisal of these benefits, so that the volume of portfolio insurance in the future may not be large enough to cause instability. Finally, there are other ways to curb volatility, without having to sacrifice the benefits of either derivative markets or the new trading strategies. One way is to develop market-making systems that can provide the necessary market liquidity to support institutional trading. [12]

### Regulations to bolster the present system

*Higher futures margins.* Both the SEC and the Brady Commission reports call for higher margins on index futures and options. In its report, the SEC says:

> " . . . low margins contribute to increased speculative trading that, in normal market conditions, contribute to the illusion of almost unlimited liquidity in the futures market. During a market break, however, that liquidity disappears at a rate geometrically larger than does liquidity in the lower-leveraged stock market. For these reasons, the Division believes that relatively low margins may contribute to increased concentrated institutional trading and resulting greater price volatility." [13]

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[11] Ronald Anderson and Mehmet Tutuncu, *op. cit.*

[12] The NYSE and the CME are already considering joint arrangements that would facilitate trading large baskets of stocks. See c.g., "Steps to Aid Big Trades Weighed," *The New York Times* (June *10,* 1988) p. D1, col. 3.

[13] Katzenbach, N., "An Overview of Program Trading and Its Impact on Current Market Practices," A Study Commissioned by the New York Stock Exchange, December 21, 1987. The report also calls for higher futures margins. The studies of the General Accounting Office, the Commodity Futures Trading Commission, and the Chicago Mercantile Exchange do not recommend raising margins.

The Brady Commission says:

> "All margin requirements have one aspect in common: margins
> are collateral and control the effective economic leverage
> achievable in any financial instrument . . .

> It has long been recognized that margin requirements, through
> leverage, affect the volume of speculative activity. Controlling
> speculative behavior is one approach to inhibiting overvalua-
> tion in stocks and reducing the potential for a precipitate price
> decline fueled by the involuntary selling that stems, for exam-
> ple, from margin calls.

> . . . low futures margins allow investors to control large posi-
> tions with low initial investments. The clear implication is that
> margin requirements affect intermarket risk and are not the
> private concern of a single market place . . .

> To protect the intermarket system, margins on stock index
> futures need to be consistent with margins for professional
> market participants in the stock market."[14]

The debate about whether higher margins should be imposed on
stock index futures is not a debate about whether current margin levels
in futures markets are sufficient to maintain market integrity. Futures
margins are security deposits, whose purpose is to insure that futures
traders honor their contractual obligations. In the event of a trader
default, Futures Commission Merchants (FCMs) and futures clear-
ing associations are protected by their holding of margin deposits.
Margins on futures do not involve extensions of credit, as they do
in securities markets.

Futures margins are now established by FCMs and clearing associa-
tions, and not by government. Margins are different for different

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[14] **"Report of The Presidential Task Force on Market Mechanisms," The Brady Commis-
sion (January 1988) p. 65. This suggests that futures margins should be raised to 20 to 25 percent.**

commodities, for different types and sizes of transactions, and can be changed at any time. Their levels are related to the risk associated with specific commodities and transactions. customers' positions are marked-to-market daily and additional "variation" margin is called for daily (or even intra-day) if a customer incurs trading losses.

The events of October 1987 showed this system to be remarkably sound. Although substantial margin calls were issued ($3 billion by futures and option exchanges on both October 19 and 20), there were few defaults. Despite an historic market drop, futures markets came through almost unscathed. There were no major FCM defaults, and no clearing association defaults. Whether this system might have cracked had prices continued to fall, and at what point, we do not know. That it did not break in October is testimony to its strength.

The SEC and Brady Commission recommendations to raise margins on futures contracts to levels consistent with those imposed on stock trading is based upon a belief that higher margins *reduce speculative activity* and, as a consequence, *increase market stability.* These recommendations, however, do not appear to be based on the events of October 19 and 20. Higher margins on those days would not have made a difference. The selling in futures markets that the reports point to as particularly harmful was by pension funds, trusts, and other large institutions. These institutions do not operate with leverage, and would not have been constrained by higher margin requirements. They could easily have borrowed against their stock positions to meet initial margin requirements, and, in any case, exchanges require only "hedger" margins of these institutions, which are much lower than "speculator" margins.[15] Thus, at least with respect to the market plunge on October 19 and 20, higher futures margins would not have

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[15] In a recent speech echoing the SEC Report, SEC Chairman Ruder said that increased velocity and concentration of trading volume in the stock and futures markets and between those markets had increased stock price volatility and that this was partly due to the lower levels of margins in futures markets (*Investors Daily,* February *24,* 1988) p. 5. Ruder contends that the growing concentration of trading in the hands of a "few" institutions is causing greater price volatility. It is difficult to see the connection between this argument and the one that says low margins cause greater price volatility. In addition, it is important to recognize that institutions such as portfolio insurers and mutual funds may be acting in response to decisions of individual investors and fund managers. The mutual fund sales that occurred on October 19, in particular, were the result of hundreds of independent decisions by investors to redeem their fund shares.

prevented what happened.[16]

More likely, the impact of higher futures margins would have fallen most heavily on speculators. On October 19 and 20 both large and small speculators were net buyers, offsetting rather than reinforcing the sell-order imbalance. If higher margins had been in place during the crash, the result could very well have been worse. Speculators might have been deterred from playing the stabilizing role that they did.

The argument for higher futures margins rests not on a factual basis but on two propositions: first, that higher margins reduce speculative activity; and, second, that by reducing speculative activity, prices will be more stable because excessive price fluctuations will be eliminated. While it is possible that higher margins will reduce speculative activity (as well as other trading), it is not clear that less speculative trading will diminish the magnitude of price movements in either direction. Speculation is as likely to be stabilizing as destabilizing.[17]

Our experience with the dramatic increase in silver prices during 1979-80 is not reassuring. As silver prices rose, exchanges substantially increased margins. The effect, however, was not to deter the long speculators but to make participation in the market by both short hedgers and short speculators more expensive. Many of the shorts exited the market, causing prices to rise even further. Thus, the effects of higher margin levels are more subtle and less obvious than intuition might suggest. Their impact can fall on either longs or shorts, or both, with unpredictable volatility effects.

Stock and other asset prices may also be determined more by the

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[16] It also is a strained argument to contend that low futures margins were the cause of the 30 percent increase (from January to August of 1987) in stock prices leading up to the crash. On October 15, the open position in the S&P 500 futures contract was less than 1 percent of the value of stocks listed on the NYSE. Could this position be held responsible for a 30 percent increase in the value of stocks?

[17] There has been a long and inconclusive academic debate about whether speculative activity is on net stabilizing or destabilizing. The results of theoretical models depend critically upon the underlying assumptions that are used. It also has proven difficult to test empirically the effects of speculation. See e.g., M. Friedman, "The Case for Flexible Exchange Rates," in *Essays in Positive Economics,* University of Chicago Press (1953); A. Beja and B. Goldman, "On the Dynamic Behavior of Prices in Disequilibrium" *Journal of Finance* (May 1980) pp. 235-248; and O. Blanchard, "Bubbles, Rationale Expectations, and Financial Markets," *Crises in the Economic and Financial Structure,* Paul Wachtel, ed., Lexington Books (1982) pp. 295-315.

expectations of asset holders than by trading activity. Asset prices can change sharply with little trading. There need be no systematic relationship between the volume of trading and the magnitude of a commodity's price change. The value of real estate, for example, often changes substantially with few transactions, or even with no transactions. Stock and futures markets are no different. Higher futures margins, which work by increasing trading costs and reducing trading activity, need have no predictable or appreciable impact on either price levels or price volatility. Lower trading volume does not necessarily mean either lower prices or less volatility.

Higher futures margins are not without cost. They increase the costs to futures market participants, and, in particular, to speculators. This will reduce both the volume of trading and open interest, and market liquidity. The result will be higher transaction costs (commissions, etc.), and possibly, greater price volatility. In addition, hedgers' costs may rise because of increased basis risk and because the risk premium they pay may increase. Thus, the argument that higher margins on futures contracts will be beneficial because they costlessly curb speculative excesses is highly questionable.

In a recent empirical study of the effects of changes in futures margins, Michael Hartzmark examines trading in wheat, treasury bonds, pork bellies, and feeder cattle over several years. He finds that higher margin levels reduce open interest and trading volume, but that there is not '' . . . a statistically significant relationship between margin changes and price volatility.''[18] He acknowledges that it is not clear what the effects on price volatility would be if margins were to be increased substantially. (He could only observe small changes in margins.) He suggests, however, that '' . . . certain trader groups would be driven from the market, making the market thinner, . . . with the result being less stable futures prices.''[19]

This issue has been studied extensively in the context of the stock market as well. In general, past studies have been unable to con-

[18] **Michael L. Hartzmark, ''The Effects of Changing Margin Levels on Futures Market Activity, the Composition of Traders in the Market, and Price Performance,''** *Journal of Business,* **Vol.** *59,* **No. 2, part 2 (1986),** S. **147, pp. S151-S180.**

[19] *Op. cit.,* **p. S178.** See **also Geoffrey Heal, ''Margin Levels as a Regulatory Tool,'' Columbia Futures Center Working Paper #100, Columbia University (1984).**

clude that lower stock margins are related to price volatility.[20] In a recent Federal Reserve study, "A Review and Evaluation of Federal Margin Regulations," the Federal Reserve Board also investigates the question of whether low margins are the cause of instability in stock prices or of temporary speculative bubbles.[21] It concludes:

> "The evidence and arguments reviewed . . . do not indicate a need for margin regulation to curb short-term speculation . . . (p. 152); and

> The behavior of stock prices since the enactment of margin regulation also does not support the argument that controlled margin trading will tend to reduce stock volatility. Despite the relatively high federal margin levels and the very low levels of margin credit since the early 1930s . . . stock prices have continued to be about as volatile as they were in the 50 years preceding margin regulation." (p. 167)

There is, therefore, no reason to believe that higher margins will reduce price instability in either the stock or futures markets. The only certainty is that they will impose higher costs on investors and traders, and reduce trading volume and liquidity.

*Trading* halts. Trading halts, or the stopping of trading when certain pre-determined conditions occur, were first proposed in principle by the Brady Commission. Months later, the Administration's study group (the "Gould" Committee) endorsed them in the form

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[20] See e.g., R. Grube, O. Joy, and D. Panton, "Market Responses to Federal Reserve Changes in the Initial Margin Requirements," *Journal of Finance* (June 1979) pp. 659-675; T. Moore, "Stock Market Margin Requirements," *Journal of Political Economy* (April 1966) pp. 158-167; G. W. Douglas, "Risk in the Equity Markets: An Empirical Appraisal of Market Efficiency," *Yale Economic Essays* (Spring 1969) pp. 3-45; W.L. Eckards and D.L. Rogoff, "100 Percent Margins Revisited," *Journal of Finance* (June *1976*) pp. 995-1000; J.A. Largay, "100 Percent Margins: Combatting Speculation in Individual Security Issues," *Journal of Finance* (September 1973) pp. 973-986; J.A. Largay and R.R. West, "Margin Changes and Stock Price Behavior," *Journal of Political Economy* (March/April 1973) pp. 328-339; R. Officer, *op. cit.*

[21] The Federal Reserve Board, "A Review and Evaluation of Federal Margin Regulations" (1984).

of price limits. The Gould Committee recommended closing the market for one hour if the Dow Jones index moves by 250 points, and for two hours if the index moves by 400 points. In addition, subsequent to October 1987, the Chicago Mercantile Exchange (CME) and the Chicago Board of Trade (CBOT) both voluntarily imposed price limits on their stock index contracts. More recently, the New York Stock Exchange (NYSE) joined with the CME in adopting common price limits. They agreed that when the S&P 500 index falls 12 points (equivalent to 96 points on the Dow Jones index), the futures price would be limited, and futures trades could thereafter take place only at the "limit" price or higher for the next half-hour. (No limits would be set for increases in stock prices.) In addition, once this limit is triggered, the New York Stock Exchange would automatically segregate index arbitrage and asset allocation trades and attempt to resolve separately large order imbalances for these institutional traders.

The Brady Commission cites three benefits of "circuit breakers."

First, they limit credit risks and loss of financial confidence by providing a time-out amid frantic trading to settle up and ensure that everyone is solvent. Second, they facilitate price discovery by providing a "time-out" to pause, evaluate, inhibit panic, and publicize order imbalances to attract value traders to cushion violent movements in the market.

Finally, circuit breaker mechanisms counter the illusion of liquidity by formalizing the economic fact of life, so apparent in October, that markets have a limited capacity to absorb massive one-sided volume. Making circuit breakers part of the contractual landscape makes it far more difficult for some market participants — pension portfolio insurers, aggressive mutual funds — to mislead themselves into believing that it is possible to sell huge amounts in short time periods. This makes it less likely in the future that flawed trading strategies will be pursued to the point of disrupting markets and threatening the financial system.[22]

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[22] *Op. cit.*, **p. 66.**

Trading halts can take many different forms and be triggered by
different pre-determined conditions: price movements, volume limits,
order imbalances, prescribed times of the day, and so forth. The Brady
Commission did not recommend a specific type of circuit breaker,
only that such mechanisms be coordinated among exchanges and
'' . ·. . be formulated and implemented . . . ''[23]

Neither the SEC nor the NYSE reports embrace price limits as
a solution to volatility. The SEC says:

> '' . . . we do not believe, as a general matter, that price limits
> should be imposed on stock trading, although brief trading halts
> based on pre-set standards may warrant further consideration.
> The automatic closure of stock trading for the remainder of the
> day, in our view, imposes unacceptable burdens on those market
> participants who wish to liquidate their positions and increases
> the potential that a volatile market situation can slide into panic.''

Similarly, the NYSE report concludes that '' . . . the institution of
either position limits or price limits will not solve the problems that
exist . . .''[24]

There are several arguments against price limits. First, if new infor-
mation requires a price change larger than the allowable price range,
trading halts will delay the determination of equilibrium prices. This
may result in trading taking place at disequilibrium prices (off the
exchange), causing injury to some traders. It also interferes with the
price discovery function of markets, since quoted prices no longer
reflect existing economic information.

Second, if markets are closed, traders are deprived of their use
at the very time they would want to use them the most: when new
information dictates a substantial change in prices. At such times,
hedgers may want to put on new hedges or to "lift" prior hedges.
Price limits can both lock them out and in. The inability to trade at
these times could be a serious deterrent to the use of futures markets
by potential hedgers. The prospect of being locked-in is an anathema

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[23] *Op. cit.*, **p. VII.**

[24] *Op. cit.*

to speculators as well, as it prevents them from getting out when they need to the most. Discouraging speculation can result in less market liquidity.

It is also possible that, if market participants know that trading will be halted when prices reach a certain price level, price limits may become self-fulfilling. Traders may buy or sell frantically to beat the closing of the market so that they are not locked in. In doing so they will insure that the limits are hit.

The argument in favor of price limits rests upon the notion that large price movements may be the result of excessive (or irrational) speculation. In this case there may be a reason to slow things down, since market prices are "wrong" to begin with. However, even in this case it is not clear that trading halts will hasten the return to correct prices. Preventing prices from changing may increase the response time of rational traders to disequilibrium prices, slowing the return to more rational prices. Further, at times price limits may have the opposite effect from what we expect: they may increase uncertainty and cause even greater irrational market activity.

The dramatic rise and fall of silver prices from September 1979 to March 1980 again provides some evidence on how trading halts due to daily price limits worked in a situation of substantial price instability. During this period practically every day was a "limit-price" day—trading halted when prices moved up or down by the allowable daily range. On most days after a price limit halt, prices did not return to previous levels but continued rising or falling. The limits did not appear to dampen overall price movements in silver. Silver prices rose from about $8 to almost $55 an ounce, and then fell to almost $10. Trading halts did delay these price movements, but whether that was, on net, beneficial is not clear. The inability to trade clearly imposed costs on some traders, and probably had harmful market effects for some time afterward.

Another argument is that price limits are useful in slowing down large price movements which otherwise might inflict severe damage on the financial structure because of institutional rigidities. This argument raises two questions. First, would artificially slowing down price adjustments successfully insulate an institutional structure in the face of "true" changes in equilibrium prices? Second, if large price changes 'are due to infrequent speculative excesses,. do the social benefits of curbing these infrequent episodes outweigh the social costs

of interfering with markets on a regular basis? If speculative excesses are rare, the costs of having restrictive price limits may outweigh their benefits.

Price limits are only one of the many possible types of trading halts. Another that might be employed is to stop trading when large buy or sell order imbalances occur. Market-makers could, for example, delay changing prices for a pre-determined amount of time—say five or 10 minutes—to see if counterbalancing orders might arise during this time interval. Presumably, the existence and magnitude of the order imbalance would be disclosed to a broad range of traders, or even to the entire public. In this case, the market would remain open for trading at the quoted (or last) price, in contrast to the usual procedure for daily price limits. If the order imbalance were to persist, market-makers might then change prices according to a pre-determined schedule, waiting for a short time at each new price for new orders to surface. At all times, however, the market would remain open for counterbalancing orders.

Exchanges might also hold "single-price auctions" one or more times a day, where participants would be advised of order imbalances and where all buy and sell orders would be filled at one time and one price. If order imbalances were known, new bids might be forthcoming which would balance the market. In this system, markets could clear without specialists or market-makers having to risk their own capital. It is difficult, however, to endorse a general recommendation for trading halts until the institutional details of how and when such halts will be used are specified. Various types of trading halts have been employed for years in some foreign equity and futures markets. It would be useful to study how these have worked.

Whatever type of circuit breaker mechanisms are adopted, it is clear that such mechanisms should be imposed on the underlying stock markets as well as on the derivative markets. If only one market is closed, the natural trading links between the two will result in trading pressures and order imbalances being transferred to the market that is still open.[25] This distortion will exacerbate market pressures, which

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[25] This possibility also exists internationally. For example, when the CBOT T-bond futures market hit its price limit on October 20 and was closed, trading shifted to London, where the volume of trading in U.S T-bond futures rose eightfold.

is precisely what happened on October 19 when arbitrage between the futures and cash markets became impossible because of chaotic conditions on the NYSE.

Short *sale restrictions.* While the SEC report rejects the general extension of short sale restrictions (or the "uptick") rules to derivative markets, it suggests that it *may* be beneficial to eliminate the limited exemption to this rule that in the past it has granted to some short selling involving index arbitrage transactions. The SEC report says:

> "The absence of short sale restrictions in the derivative markets, coupled with the greater leverage of futures, arguably presents the potential for greater speculative selling than could occur in the stock market. Moreover, through index arbitrage, that selling activity can be transferred to the stock market, often without being subject to Rule 10a-1 under the Securities Exchange Act of 1934 ("Exchange Act"), the short sale rule. Accordingly, the Division believes the Commission should review whether reducing price volatility should remain a goal of the short sale rule and, if so, whether steps should be taken to increase its effectiveness."[26]

The SEC concludes, however, that " . . . it does not believe that the extension of short sale restrictions to the derivative markets is operationally feasible."[27] But in a somewhat cryptic statement, the SEC continues that it is concerned that " . . . the ability of institutions to engage in index arbitrage substitution activity without being subject to the short sale rule in combination with exchange for physical stock/futures transactions effected in London has impacted the effectiveness that rule may have had in reducing stock market volatility."[28]

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[26] *Op. cit.,* pp. 3-25. The SEC's is the only report on the crash that discusses this issue.

[27] *Ibid.* pp. 3-26. The SEC does not provide its rationale for this statement. A possible rationale is that much "short selling" of futures is hedging: the seller holds a related long position in another market or commodity. Applying the existing short-selling restrictions to futures markets would inhibit this intermarket arbitrage. For a discussion of this point, see John C. Coffee, Jr., "Trading Systems: Comment," *After the Crash,* American Enterprise Institute (1988) pp. 65-71.

Short selling has been a favorite target for centuries. More than three centuries ago, the Dutch banned short selling and subjected it to special taxation. Napoleon attacked the practice in 1802. In the United States a New York statute of 1813 prohibited short sales on stock and government bonds. None of these prohibitions lasted long. New York, for example, modified its 1813 statute in 1830 and repealed it entirely in 1858.[29]

It was not until 1938 that we adopted our present restrictions on short selling. The SEC's short sale rule, Rule 10a-1 under the Exchange Act, prohibits persons from selling stocks short at a price below the last sale price (''minus tick'') or when the last trade involving a change in price was a minus tick (''zero-minus tick'').[30] Supporters of restrictions on short selling assert that short selling unsettles the market, forces liquidation, depresses prices, accelerates declines, and has no economic value or justification.[31]

It is difficult to appreciate the logic behind these assertions. Restricting either selling or buying in any market places an artificial constraint on the determination of prices. To place restrictions only on selling (but not on buying) would seem to distort equilibrium prices. We have chosen not to impose such asymmetrical restraints with other regulations. For example, margin requirements are the same for both longs and shorts, and capital gains taxes are the same for short-selling gains as for gains from price appreciation. Short-selling restrictions also reduce market liquidity.

It is not obvious how short-selling restrictions reduce price volatility. To the extent that they are effective in curbing selling activity, they make the market more vulnerable to upward price pressures. Volatility arises from upward as well as downward price movements. It is also doubtful, in today's (and tomorrow's) world of global financial markets, that ''uptick'' rules can be effective in restricting short sell-

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[29] See Louis Loss, *Fundamentals of Securities Regulation,* Boston: Little Brown & Co. (1'983) pp. 711-717.

[30] See SEC report, *op. cit.,* pp. 3-25.

[31] Stock Exchange Practices, Report of the Senate Committee on Banking and Currency, Senate Report no. 1455, 73rd Congress, 2nd Session (1934) 50.

ing. If you are restricted in one market but not in another, business will flow to the unrestricted market.

Finally, since there is little reason to believe that short-selling restrictions dampen volatility in general, there is no reason to eliminate the current exemptions to the uptick rule for certain liquidations of index arbitrage positions.[32] To do so would only inhibit arbitrage and by doing so disconnect the futures and cash equity markets (just the opposite of what the Brady Commission thought our goal should be). If anything, short sale restrictions should be abolished.

## Evidence from international markets

An international comparison of stock market volatility provides some evidence about the effectiveness of regulations aimed at curbing volatility. Both the United States and Japan impose margins of 50 percent or greater on stock transactions, while the United Kingdom has no margin requirements. There is, however, no evidence to suggest that daily volatility is greater in London than in New York or Tokyo (see Table 2). Similarly, of the three countries, only Japan has trading halts in the form of pre-set price limits. In the 1986-88 period, however, the Japanese stock market generally was not less volatile than the others (see Table 2). Thus, a simple international comparison of volatility does not reveal any obvious relationship between volatility and regulation.

Further, the volume and importance of futures trading in equity indexes is much greater in New York than in either London or Tokyo. There is little portfolio insurance and index arbitrage futures trading in London, and virtually none in Tokyo. Volatility in London and Tokyo, however, generally is not less than it is in the United States.

These conclusions are supported by a recent study of stock markets in 23 countries. Richard Roll examines *monthly* percentage changes

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[32] The SEC has permitted the unwinding of existing index arbitrage positions involving long baskets of stock and short index futures or options without aggregating short positions in these stocks with other proprietary accounts if those short positions are fully hedged. See SEC Report, pp. 3-25.

in stock indexes in each of these countries during the period February **1981** to September **1987**.[33] Among other tests, Roll estimates the following regression for each market:

$$R_{j,t} = a_j + b_j R_{m,t} + e_{j,t}$$

where $R_{j,t}$ is the monthly percentage change in the index of country **j** for month t, $R_{m,t}$ is the world market index monthly percentage change for month t, $e_{j,t}$ is an unexplained residual, and $a_j$ and bj are fitted coefficients. The estimated "beta," or bj, therefore, is a measure of each market's relative volatility.

To determine the impact of various institutional and regulatory differences across countries, Roll estimates a cross-sectional regression using the estimated "betas" from the above equation as the dependent variable. The explanatory variables in this equation are the various institutional and regulatory characteristics (which take the form of zero/one variables) in each of the 23 countries. The estimates show, among other things, no relationship between relative stock volatility and either margins or price limits.[34] There also is no relationship between volatility and either futures or options trading.[35] Finally, if just the standard deviation of monthly percentage changes from February **1981** to September **1987** is compared (a standard measure of stock market volatility), the United States.has the *lowest level of volatility.*[36] Thus, an international comparison of volatility does not provide support for the belief that stock market volatility can be reduced by imposing various institutional rigidities on markets.[37]

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[33] **R. Roll, "The International Crash of October, 1987," (April 5, 1988) unpublished.**

[34] *Ibid.,***Table 5**

[35] **There is one institutional characteristic that shows marginal significance: the existence of continuous auction markets.** *Ibid.,* **p. 17.**

[36] *Ibid.,* **Table A-1**.

[37] **It should also be recognized that stock prices in different markets are not as highly related as is sometimes believed. For example, the correlation between monthly percentage changes in stock indexes is only .326 for the U.S. and Japan, and .513 between the U.S. and the UK.** *Ibid..* **Table 2.**

## Present and future market-making systems:
## Implications for policy proposals

Despite thousands of pages of analyses of the crash, and six lengthy reports, there has been little discussion of the adequacy of the existing market-making systems in securities, futures, and options markets. The steady growth of institutional trading, and of "basket" or "program" trading, has changed the character of equity markets, and raises the issue of whether the present institutional structure is appropriate for the future.

Large institutions now hold equity portfolios with a value equal to about 40 percent of all NYSE listed stocks, and they account for about 80 percent of the trading volume on the NYSE. Block transactions, or trades of 10,000 or more shares of a single firm, account for about 50 percent of NYSE volume. Further, in the last few years the value of "indexed" assets under management has grown to about $200 billion, which has resulted in an increase in program trading. Currently, as much as 25 percent of institutional trading may be in the form of program trades.

Stock index futures have become the "markets of choice" for these institutions. Trading volume in S&P 500 index futures alone has exceeded trading on the New York Stock Exchange. Institutions prefer futures markets because they provide greater liquidity and lower transaction costs. As a consequence, futures and cash equity markets have become inextricably linked. They are driven by the same economic fundamentals; pressures in one market are quickly transmitted to the other and their prices are tied together by index arbitrage.

Would changing the institutional structure of our market-making systems in these markets result in less volatility? Should, for example, a specialist on the New York Stock Exchange have responsibility for maintaining an orderly market (or stabilizing prices) in the face of huge institutional buying or selling? Is this realistic? Or, can an auction market where "locals" have little capital be expected to make a market for large institutions? Is there a problem with having one kind of market-making system for the cash market (a specialist system) and another kind for the futures markets (an open-outcry auction market)? The reports on the crash do not deal with these issues. It seems apparent that we need new trading systems capable of providing liquidity for the institutional trading of "baskets" of stock.

In addition, the internationalization of equity and futures markets is still in its infancy, but it will not be long before the most important U.S. instruments are traded on foreign markets and *vice versa.* Capital will move freely to the most liquid, least costly, and safest markets, wherever they are. Internationalization is likely to increase the institutionalization of markets, and perhaps, the role of the largest institutions as well.

In this world can each country have different regulations and expect them to be effective? I doubt it. Take, for example, price limits. The Chicago Board of Trade is, by far, the world's largest market in U.S. treasury bond futures. On October 19, trading was halted in U.S. treasury bond futures on the Chicago Board of Trade because bond prices hit their "limit up." The next day the volume of trading on the London International Financial Futures Exchange in *U.S. treasury bond contracts* was eight times the previous day's volume in *Chicago.* Restricted by a regulation in Chicago, traders simply shifted their business to London where there is no such regulation. Measures to curb stock market volatility must obviously be considered in the context of internationally competitive global capital markets.

**A** global movement toward the development of electronic, automated, auction markets is under way. The first totally electronic automated futures and options market just opened in Switzerland; and Toronto, London, and Tokyo are all well along in their plans to have 24-hour electronic "screen-trading." Last September, the Chicago Mercantile Exchange and Reuters entered into an agreement to create a global electronic automated-trading system (known as "GLOBEX", Global Electronic Exchange). Recently, Telerate, another giant in financial-information services, announced an agreement with Bermuda-based INTEX Holdings to market that exchange's automated-trading system. While it is too early to be certain, it seems inevitable that we will have fully automated screen-trading at some point in the future.[38]

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[38] For a discussion of electronic trading, see Moms Mendelson, Julius Peake, and R. Williams, Jr., "Toward a Modern Exchange: The Peake-Mendelson-Williams Proposal for an Electronically Assisted Auction Market," in Impending Changes for Securities Markets: What Role for the Exchanges? ed. by E. Block and R. Schwarts, Greenwich, Conn.: JAI Press, Inc. (1979) pp. 53-74.

Adherents of these systems claim that they will result in less price volatility than we have now, by providing better information about order flows and disseminating this information to a wider group of investors and traders. Market liquidity, it is argued, will increase, resulting in greater price stability.

It is my view that focusing on recent stock market volatility is not a constructive approach to the future. Our goal should be to provide an institutional and regulatory framework that facilitates the development of efficient and liquid international capital markets: in equity, futures, and options markets, as well as other financial markets. We must adopt a global perspective, especially with respect to our regulatory framework. International competition will be a driving force in the future, whether or not we like it. The key issue for the future is to determine what'kinds of global institutional arrangements can best facilitate the development of liquid, efficient, and competitive international securities markets. Attempting to curb stock market volatility in New York with improvised regulations is both myopic and dangerous.

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# Commentary on
# 'Policies to Curb Stock Market Volatility'

*Lawrence H. Summers*

Scholarly analysis of the October 1987 market crash sheds some interesting light on the sociology of economics. It was an event that no one predicted, a shocking and unprecedented surprise. Yet if one listens to what economists said before and after the crash, the collective analysis might best be entitled, "Now, More Than Ever." Economists of every persuasion pointed to the crash and said, "Aha! I told you so."

It didn't matter whether their policy prescription was deficit reduction or more stimulus, a more stable dollar or an end to arbitrary exchange rate management, or more or less regulation of financial markets.

Franklin's views can be characterized fairly, I think, by saying that now, more than ever, it is dangerous to interfere with the futures markets. My own views are that we need to reduce the budget deficit and interest rates; that there is no compelling case for working to increase liquidity, and that there is some case for more regulation of financial markets. In the interest of full disclosure, I must confess that my views have also been strengthened by the crash. It seems to me that economists should be properly disturbed by the magnitude of the event, and by the small extent to which they have changed their policy prescriptions.

When one considers policy interventions to solve a problem, one must determine whether there really is a problem and whether there is a cure which is not worse than the disease. Should we be worried about the volatility of today's financial markets? The efficient markets

hypothesis has a clear answer to this question. Prices always adjust so there are no free lunches; therefore, prices always correspond to fundamental values. If fundamental values move a lot, then prices move a lot. It is certainly better for fundamental values to be reflected in prices than not, so that if the efficient markets hypothesis holds, volatility *per* se is not a problem.

Robert Shiller, who is usually milder in his words than I, has called the efficient markets hypothesis "the greatest intellectual error in the history of economic thought." I can't do any better than that. I'm convinced that substantial parts of the volatility in the asset markets do not reflect changes in fundamental values. One type of evidence might be called the "Where's the news?" problem. We observed the volatility; we observed the news; yet who could find enough news to justify the kind of volatility that we observed? In other words, what news came to the financial markets between 9 o'clock Monday morning, October 19, and 4 o'clock that afternoon that would have led a sensible person to revise downward by 22 percent his assessment of the long-term value of all corporate America? It is difficult to imagine that kind of evidence.

Other, more micro-level evidence is even stronger. When people talk about how it is crucial to keep markets open all the time, I'm reminded of a very clever study by Ken French and Richard Roll. French and Roll looked at the volatility of the market between Tuesday afternoons and Thursday afternoons during two different periods: when the market was open on Wednesdays and when it was closed on Wednesdays but all other businesses were open. During the period when the market was open five days a week, as it usually is, French and Roll found what you would expect: the market typically moved about twice as much between Tuesday and Thursday as between Monday and Tuesday. That makes sense. The market got twice as much information and was open twice as long. Then they looked at the period in 1968 when the market was closed on Wednesdays. One would expect that since the world continued to spin on Wednesdays, the same amount of information would come in between Tuesday and Thursday evening, regardless of whether the market was open or closed on Wednesday. In other words, one would expect the movement in the market between Tuesday and Thursday to be twice as great as the movement between Monday and Tuesday. In fact, however, the movement between Tuesday and Thursday was almost

identical to the movement between Monday and Tuesday, suggesting that closing the market made a crucial difference to the total volatility over the period. The same phenomenon is observed if one looks at slightly longer periods—five days rather than four days. I conclude that it may be *noise* rather than *news* that is driving the market.

Another example comes from closed end mutual funds, one of the few assets whose value can be observed with substantial accuracy. Even though this asset is only a package of traded securities, closed end prices aren't equal to their fundamental values, and their relationship to fundamental values fluctuates substantially. This kind of evidence suggests that a large part of the volatility one observes in financial markets is due to the dynamics of the trading process, rather than to news about fundamental values.

It is helpful in thinking about volatility to think of two types of trading strategies that investors pursue in financial markets: negative-feedback and positive-feedback strategies. The former are based on some version of the gravity theory, which says that what goes up must come down. When an investor sees a price going up, he or she decides that the price is now further above the fundamental value, and sells. Negative-feedback strategies are obviously stabilizing.

There are also positive-feedback strategies which bet that ''the trend is your friend.'' Investors create positive-feedback when they put stop-loss orders on their portfolios, when they are forced to cover on margin, or when they follow a momentum strategy which bets on positive serial correlation.

Are these strategies rational? Let me record the suspicion that some part of positive-feedback trading is difficult to understand as rational. In any event, positive-feedback trading is likely to increase volatility substantially. If one wants to design regulatory interventions that will decrease volatility, one must think about measures that will discourage positive-feedback trading rather than negative-feedback trading. Positive-feedback trading is substantially discouraged when traders using that strategy suffer massive losses, which is what one observed after the crash. Everyone who had been pursuing positive-feedback strategies bought more and more as the market went higher and higher, thinking that their portfolio insurance would enable them to get out. They were wrong. It's clear that the crash reduced volatility by reducing the attractiveness of positive-feedback trading.

There may be other ways to tilt the balance toward stabilizing

trading. In this regard, I agree with Franklin that the regulatory measures frequently discussed are not well focused on any conception of the problem. But I think Franklin dismisses the case for tightening margin requirements too easily.

My first leading indicator that something like the crash was in the offing was a conversation I had at a party. A man said to me, "Larry, don't you always buy your stocks on margin? There's no reason not to do it because you get twice as much appreciation. It always works. I don't understand why everybody doesn't do it." This gentleman had to go home early on October 19, because his wife had explained to his children that they would be leaving their house and moving into an apartment, but that everything would be okay because they would each have their own rooms. This story illustrates the consumer protection argument for margin requirements.

More generally, the case for margin requirements raises a question. Instead of asking why the market fell 500 points in one day, it might be more important to know why the market reached 2700 in the first place. Low margin requirements, by encouraging positive-feedback trading, may well have encouraged the market increase, setting the stage for the crash. Given that the American economy has an entire range of deposit insurance systems and other backstops to liquidity, the idea that margin requirements should be the preserve solely of the futures exchanges and not subject to government regulations is an implausible one.

I do not think the case for circuit breakers is very strong. The market fell substantially on October 16, and then we had a terrific circuit breaker—two full days of no trading. A weekend is not the kind of circuit breaker that panics investors, but it certainly failed to prevent the crash on Monday.

There may be a case for a circuit breaker based on volume, not on price changes. This is for two reasons. First, it would prevent the kind of chaos that took place on Monday. Second, a circuit breaker based on volume is likely to kick in on the days when the largest price changes take place, and will kick in in a minimally threatening way. One of the big arguments against closing the market is that investors will panic at the thought of a closed market. A pre-set circuit breaker based on volume will at least reduce the risk of panic.

What about the broad issues of futures markets: increased liquidity

versus the need for more sand in the gears? I think greater liquidity probably facilitates positive-feedback strategies more than **negative**-feedback strategies and thus substantially increases volatility. There is also the issue of resource utilization. **Hirshleifer** pointed out years ago that economists assume that creating information is good because it creates positive externalities. This is not always the case. If I do research that lets me predict who will win the fifth race at Aqueduct, the private return to that research very substantially exceeds the social return to that research. It seems to me that a substantial part of the efforts that go on in financial markets, particularly those of **short**-horizon traders, have that character.

The stability and resource utilization arguments both make the case for putting a little sand in the gears, or at least, leaving the sand that is already there. Those who take the opposite position—who would like unfettered markets' that are open 24 hours a day—stress the *a priori* virtues of those markets. They have not been very effective in demonstrating tangible benefits of more liquid markets with lower transactions costs (such as a lower cost of capital or more insulation from risk) to participants in the real economy, at least not to my satisfaction.

Let me conclude with one minor comment. Franklin uses the example of the silver market twice in his paper to make the case against regulatory intervention. That surprised me. I'm not an expert on the Hunts' effort to corner the market and the instability that followed, but if one is arguing that markets should be left to their practitioners, this doesn't seem to be the best example to point to. At the end of the day, war is too important to be left to the generals. I suspect that regulation of financial markets is too important to be left purely to professionals in those markets. Broad issues of macroeconomic stability are at stake, and I think that these issues need to be considered in assessing our policies toward financial markets. In my opinion, these issues create a presumption, albeit a weak one, in favor of some form of intervention that interferes with perfect liquidity in financial markets.

# Commentary on
# 'Policies to Curb Stock Market Volatility'

*David D. Hale*

The Edwards paper provides a strong and generally effective critique of many of the proposals for financial market reform which have emerged as a consequence of the October 1987 stock market crash.

Its initial suggestion that we do not really understand financial volatility is not only correct, it deserves more elaborate discussion. In analyzing the causes and consequences of the 1987 stock market crash, for example, there has been heavy emphasis on the various technical factors which contributed to the equity crash but little focus on how all financial asset prices would have fared in the absence of the October 19 break in equity prices. As a result, we have not asked to question was the volatility of equity prices during October a problem in its own right or a solution to some other problem? As should now be obvious from the robust growth of the U.S. economy during recent quarters, the October 19 equity market crash was, in part, a high speed discounting process in which investors recognized that rising inflation was going to push interest rates sharply higher and ultimately, set the stage for a stock market decline. Because of a breakdown in the cash/futures arbitrage process, caused partly by heavy portfolio insurance selling and partly by the inadequacies of the specialist system in New York, the price correction was compressed into a few days rather than spread over the traditional six-to-nine-month bear market which has characterized the post-war period. But because of the sharp break in equity prices, several other potentially negative developments did not materialize. Inflation expec-

tations temporarily abated. Commodity prices ceased rising for a few months. Treasury bond yields did not rise over 11 percent. The Federal Reserve was not forced to increase short-term interest rates any further; in fact, it was able to cut interest rates. Other countries also reversed the interest rate hikes they had initiated during August and September. Indeed, one could argue that the 1987 stock market helped to set the stage for a robust economy during 1988 by lowering inflation fears and encouraging monetary policy to remain expansionary for much longer than would have been possible if equity prices had not fallen sharply.

It also could be argued that the October 1987 New York crash was the way global asset price distortions caused by the Louvre Accord were resolved. During the months after Louvre, foreign purchases of U.S. equities rose to the highest level since the end of the 19th century, both in dollar terms and as a share of GNP (see charts). This heavy buying of American equities reflected a variety of factors: investor perceptions that the dollar would be stabilized, the first wave of global equity diversification by Japanese investors, a large valuation discrepancy between New York and Tokyo equity multiples. In addition, share prices rose in most countries during 1987 because of an explosion in global liquidity resulting from central bank efforts to support the value of the U.S. dollar at unrealistically high levels. . Indeed, world foreign exchange reserves grew more rapidly during 1987 than at any time since the early 1970s.

As the charts indicate, the U.S. share prices multiple during much of 1987 was moving toward valuation parameters based on foreign bond yields rather than domestic ones until investors recognized that America's worsening trade deficit would force the dollar to decline. Hence, it was no surprise that the market's worse days during October coincided with the publication of bad trade data and threats by Treasury Secretary James Baker to abandon the Louvre Accord. Those events caused domestic investors to fear that foreign institutions, especially Japanese ones, would dump the large equity portfolios which they had accumulated earlier in the year. In fact, the real precedents for the October 1987 stock market crash were not the crashes of 1929 and 1962 so commonly referred to in the press last year, but the crashes of the late 19th century which usually resulted from concern about the dollar's links to the pound sterling and British capital flows into and out of New York. In that period, the United

# Chart 1

# Net Foreign Purchases of U.S. Corporate Equities*

Percent of GNP
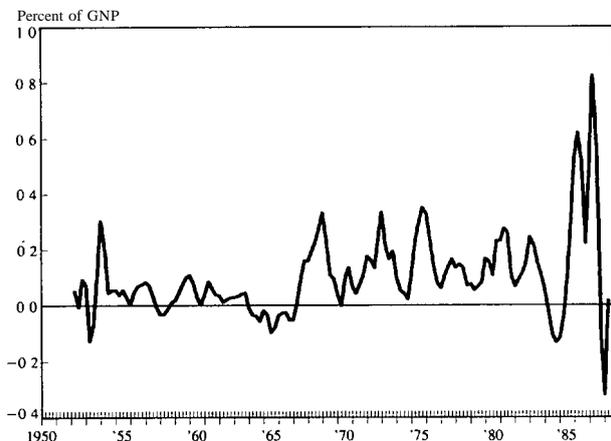


*2 quarter moving average.

One of the factors which helped to drive U.S. share prices sharply higher during 1987 was a large rise in foreign equity purchases. In fact, the pace of foreign buying as a share of GNP during the first half of 1987 was probably the highest since the late 19th century.

# Chart 2

# P/E Multiples for the United States and Japan*

Ratio
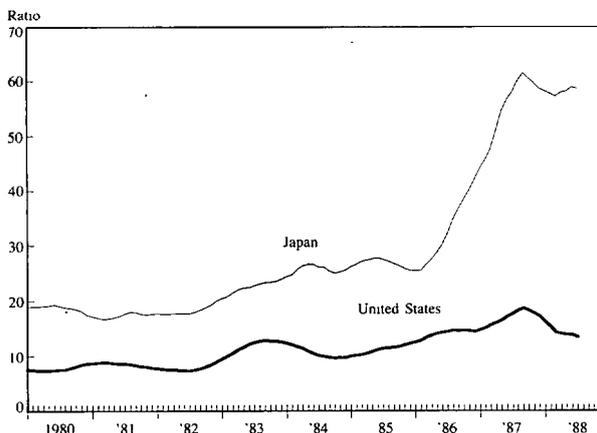


*Six-month moving average.

One of the attractions of the American equity market during 1987 was its relatively low ple multiple compared to foreign equity markets, especially Japan's.

# Chart 3

# Implied and Actual P/E Multiples for the United States*

Ratio

Using Japanese Bond Yields

Actual MSCI P/E

Using U S Bond Yields

1985  1986  1987  1988
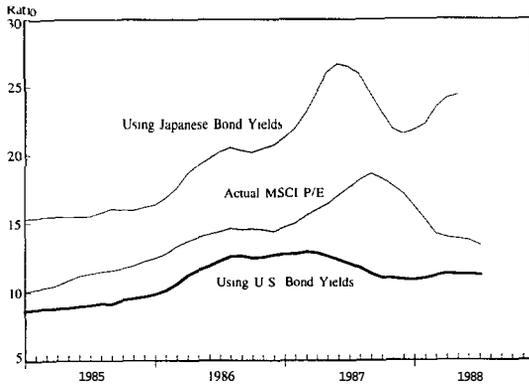
*Based on bond yields; 6-month moving average.

Foreign buying helped to push the American p/e multiple to levels above that which ordinarily would have been justified on the basis of domestic interest rates. But the interesting question raised by the global movement toward financial integration is whether share prices should be determined solely on the basis of interest rates in one country.

# Chart 4

## Total Reserves Minus Gold
### All Countries (+Taiwan)*

Percent Change. Year Ago

U S Dollar Denominated

SDR Denominated

1970  '72  '74  '76  78  '80  '82  '84  86  '88
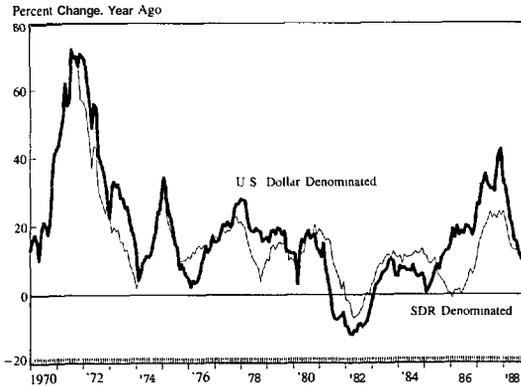
Source: IMF (which does not include Taiwan)

*Taiwan data from the Central Bank of China.

Global equity prices during 1987 also benefited from a large rise in monetary growth resulting from attempts by foreign central banks to stabilize the value of the U.S. dollar. The growth of global foreign exchange reserves shot up to the highest level since 1971.

States was importing capital on a scale equal to only 1-2 percent of GNP compared to 3-4 percent last year, but since practically all of the capital flows occurred through bond and equity purchases, financial volatility was heavily correlated with either actual changes in foreign demand for **U.S.** assets or perceived changes in foreign investor behavior by domestic investors. When one considers the economic policy backdrop to the 1987 stock market crash, one could easily conclude that the crash was not a problem but a solution to several other problems. It corrected financial asset price distortions caused by premature attempts to stabilize the dollar. It lowered **U.S.** inflation expectations. It reduced upward pressure on **U.S.** interest rates. As a result, the October crash helped to set the stage for an economic boom during 1988. If there had not been a crash on October 19, the Cow Jones Industrial Average might still be at 2000-2100 today, but interest rates would probably be 100-200 basis points higher and recession a far more imminent threat.

### *Specific proposals for reform*

Dr. Edwards is skeptical of most of the proposed remedies for curing the markets defects which are perceived to have contributed to the October 1987 stock market crash.

His opposition to higher margin requirements for futures contracts enjoys widespread support both in the financial industry and the academic community. Many of the institutional sellers on Black Monday would not have been constrained by higher margin requirements; moreover, higher margin positions would have reduced the amount of liquidity in the futures market and thus possibly worsened the scale of the downturn. In fact, the higher margin requirements introduced after the crash appear to have reduced retail participation in the futures market this year. What we don't know, though, is how the markets would have behaved over the course of the 1980s if margin requirements had been adjusted more frequently for cash and futures contracts. Would there, for example, have been less portfolio insurance in place during the autumn of 1987 if margin requirements had been higher in prior years? Would portfolio insurers have been less confident of using their programs effectively if the authorities had signaled a concern about market fragility by aggressively raising margin

requirements during 1987? There was a modest hike in margin requirements during January and October, 1987, but they did not dramatically alter investor perceptions of the authorities' intentions. Japan's more aggressive use of margin requirements, by contrast, suggests that they can play a useful role if the authorities actively develop them into an important **policy** signal. But in Japan the authorities are not only concerned with price volatility, they also sometimes seek to influence actual share prices.

Dr. Edwards' paper dismisses suggestions that we should regulate portfolio insurance and program trading. If one accepts the fundamental premise that investors should have the opportunity to hedge cash instruments with futures contracts, it is logical to oppose regulatory restrictions on effective arbitrage between the two markets. Indeed, it would be technically impossible to stop program trading without shutting the futures markets down. However, as we move from theory to market practice, it is important to understand that some institutions are opposed to program trading not because of market volatility, but because of concerns about large brokers taking advantage of their knowledge of order flows to manipulate futures prices. This practice is known as "front-running". As such abuses are already illegal, one of the best ways to reduce alarm about market manipulation would be to have more rigorous enforcement of existing laws. While it would be impossible to catch all violators, it would be difficult for large players to hide systematic abuses over a long period of time.

Dr. Edwards is correct to suggest that the poor performance of portfolio insurance during October 1987 will now discourage heavy reliance on the product in the future. But two points require further exploration. First, why did so many institutions believe there would be sufficient liquidity in the futures markets on a crisis day to absorb a large volume of sell orders?

As an article from *Intermarket Magazine* published in the days before the crash explains, there was a trading volume in the S&P 500 contract of 70,000 contracts per day worth $9 billion compared to outstanding portfolio insurance of $60-$100 billion during September, 1987. There also was sufficient concern about liquidity before October that many portfolio insurers resorted to "sunshine trading" (advertising their plans to place large orders) while one major portfolio insurance sponsor refused to take part in an industry survey

which would have disclosed the large volume of sell orders under its control. Critics of futures could argue that every institution pursued a strategy which made sense if only a few other institutions pursued it, but that the strategy became highly destabilizing once it was pursued by a wide number of organizations.

The second great question raised by the portfolio insurance experience last October is whether the product now makes more sense than it did last year? Since everyone says portfolio insurance cannot work, most players have dropped out of the market, but in actual fact it may now be more attractive than before. If institutions collectively decide that there are, advantages in experimenting with the product again, could there be a second crash in 1990 or 1991 resulting from circumstances comparable to last October's, or will the new PI strategies be so technically divergent as to lower the risk of massive stop loss sales on a single day? At a minimum, the October experience suggests that it may be prudent for the authorities to monitor the potential for order imbalances to develop because of the growth of a large volume of effective stop losses (portfolio insurance contracts) relative to the underlying volume of daily trading in the market.

Dr. Edwards' critique of trading halts is one of his most effective sections. The existence of price limits could trigger panic selling by players anxious to raise cash before the markets are shut down. The price limits on silver in the early 1980s did not protect that market from volatility and a subsequent collapse. Again, though, it is dangerous to focus upon the advantages or disadvantages of price limits solely within the context of last October's events. As with margin rules, one must ask the question of how the market would have functioned within a different regulatory structure, which might have included price limits, predating 1987. As Dr. Edwards suggests, we may need more information about the experience of other countries which have used price limits for a long period of time.

Dr. Edwards' critique of restrictions on short-selling is a good summary of both industry and academic opinion. In fact, no other country has an uptick rule. But while he is on strong theoretical ground, the discussion could benefit from an examination of other issues which reflect actual market practice. Does the size of market players and the market capitalization of companies, for example, make a difference to the application of an uptick rule? The question is important because one of the major scandals which occurred last October was short-

selling by market makers in the over-the-counter securities markets, where there is no uptick rule. Many companies in the OTC market also have been subject to bear raids during recent years, in part because there is no restriction on short-selling. Such raids would be difficult to stage on large companies (IBM, GM) but they are possible for companies with modest capitalizations. It is often argued that bear raids are staged only on companies with deteriorating fundamentals which deserve lower share prices, but the companies argue that a rapid fall in share prices has the potential to worsen their financing problems. It also would be interesting to know if the existence of futures contracts has prevented a loss of New York share trading to London, where it would be possible to short U.S. shares without the constraint of an uptick rule.

### International regulation

One of the recurring themes in the Edwards paper is that international competition will damage any market which imposes excessive regulation compared to others. Regulatory divergence could become a problem because the world is experiencing a proliferation of "financial freeports" anxious to establish a niche in the international financial service industry. While most of these "freeports" have emerged in response to **banking** restrictions, the growth of securitized forms of lending and investment could cause the same process to recur for stock and bond markets if some countries engage in regulatory **overkill**. Indeed, London is now emerging as the financial capital of Germany precisely because the Germans continue to erect barriers to the growth of financial trading activity in their own country.

Since divergences in security market practices are as great as those in commercial **banking**, there will be no simple way to prevent competition between various "financial freeports". As a result, the major countries should probably attempt to create some common guidelines for conduct in order to prevent abusive practices from developing. In fact, one of the most recent innovations in international financial regulation, the BIS **capital/asset** ratios for banks, could serve as a model for the next major thrust in securities industry regulation.

## *Capital adequacy*

One of the issues which the Brady Commission focused upon (but which is not covered by the Edwards paper) is the inadequate capitalization of stock market specialists. In fact, the events of October, 1987 suggest that we need a better understanding of the whole concept of capital in the modern investment banking industry as well as the relationship between banks and brokers in a rapidly deteriorating market environment.

Among the questions which need to be asked are: What role did commercial banks play in generating the stock market crash of 1987? Did they reinforce the plunge in share prices by curtailing credit to specialists who had suffered losses during the days before Black Monday? Should the Fed have intervened on the weekend to make sure that credit remained available to the specialists and thus prevented the plunge in prices which occurred on Monday's opening? How do we measure risk on the balance sheet of a specialist or a broker? Is it the cash exposure to equity holdings or is it the firm's net exposure to the equity market when hedging contracts are included?

Many players in the debate have been reluctant to comment about the behavior of the banks last October for fear that such comments would raise questions about their own credit quality, but the fact is, there was **a** lack of liquidity in the marketplace on Black Monday partly because of the weak capitalization of the specialist system and also the threat that capital might be forcibly withdrawn from the market by bank lenders. This aspect of the Black Monday crash suggests that we need to investigate the issue of brokerage house capital adequacy in all of its dimensions, just as we have recently done with commercial banks. Moreover, it is important to remember that during the last great age of securitized lending and global financial market integration, the late 19th century, the Bank of England often played the role of lender of last resort to investment banks rather than commercial banks. The same could happen again if securitized lending continues to grow rapidly.

## *Japan as a regulatory model*

One of the major gaps in both this symposium and the American

debate about financial market regulation is a comprehensive examination of how Japan was able to prevent its stock market from falling as sharply as other markets during the October 1987 crash. Ironically, in the weeks before Black Monday, many prominent figures in the investment community had warned that the next major stock market crash would be in Tokyo. But Japan fell only 15 percent on Black Tuesday and has enjoyed a healthy recovery since October, 1987.

It is often argued that the "tribal" nature of Japan's economic and political institutions limits the value of Japanese experience to other countries, but it is essential that we gain a better understanding of how Japan was able to protect its market if only because American financial institutions increasingly compete with Japan's. If Japan's brokers and government are able to guide the Tokyo stock market through regulatory customs and understandings which run contrary to practice in this country, it is not difficult to imagine which institutions will dominate world finance during the 1990s. In fact, one sign of this power shift is that Japan now has a stock market capitalization of nearly $3 trillion compared to just over $2 trillion here. The Japanese government has long employed a number of regulatory circuit breakers to restrain equity market volatility and guide share prices.

First, Tokyo has price limits which restrict the daily price movement of a share to 10-15 percent. Second, short-selling is illegal for foreign investors and not commonly practiced by domestic investors unless they own the stock. As large markets for equity options and futures do not yet exist, there is also a limited range of instruments available for shorting the market even if an institution wants to. Third, the Ministry of Finance (MOF) controls the supply of stock. Between 1977 and 1987, only 200 companies were allowed to go public. Fourth, the Tokyo Stock Exchange frequently adjusts its margin requirements in response to perceived changes in volatility and market risk. Margin requirements were increased several times prior to the October crash and quickly scaled back after the crash. Fifth, MOF has tried to reduce the volatility of funds flowing into and out of Japan's equivalent of the mutual fund industry by imposing strict guidelines on redemptions. Investors must leave their funds in an investment trust for at least two years; if they withdraw them during a period between two years and five years in length, they are compelled to pay a large penalty. As a result of these guidelines, mutual

fund redemptions do not reinforce a decline in equity prices starting elsewhere. In the United States, by contrast, some mutual fund groups now provide hourly quotes for their investment units and permit swapping between them on a daily basis. Finally, the Ministry of Finance uses moral suasion to guide the market during moments of crisis. In October 1987, for example, MOF discouraged institutions from dumping equities and encouraged the brokers to promote a retail buying campaign. At the end of the year, it rewarded the **Tokkin** funds for their cooperation in supporting the market by dropping accounting requirements that share portfolios be valued at the lower of cost or market. It is often argued by academics that central banks cannot simultaneously target divergent indicators such as exchange rates and interest rates. In Japan, it could be argued that the equity market is less volatile than in other countries partly because accounting standards are malleable instead.

It is commonly argued that Japan's circuit breakers cannot be transferred to this country because of the unique features of the Tokyo stock market. In Japan, nearly two thirds of all equity is tied up in corporate cross shareholdings. Four brokers control over half of all trading volume. Japanese households are accustomed to a less competitive financial marketplace when investing their savings. Japan seems to be unusual among the major industrial nations in combining corporatism and government intervention with seemingly efficient allocation of capital. But it is precisely because Japan's economic success poses a fundamental challenge to America's reigning free market ideology and institutions that the self-levitation properties of the Tokyo stock market should be studied as thoroughly as the well researched achievements of the Japanese manufacturing industry.' Indeed, financial protectionism could become a major policy issue in the 1990s precisely because of the Japanese government's success in using the stock market as an economic policy tool.

### Future research projects

One of the strongest points in the Edwards paper is the discussion of the need for a more thorough study of how the whole American financial marketplace is now evolving. Technology is rapidly transforming America's financial structure, but much of the substantive

debate about reform stems from regulatory competition between existing institutions such as the New York Stock Exchange and the Chicago Mercantile Exchange. While political tensions between rent-seeking interest groups enjoying regulatory privileges are unavoidable, it would be useful to examine how the modern marketplace might operate if we started from ground-zero. Would a 21st century market have specialists or even a trading floor? Would screen trading pro[2] duce a more level playing field in terms of information and thus increase trading activity by players who fear the current system is rigged? Because of the linkages between the cash market and futures, should the marketplace have only one regulatory authority? The danger now facing the American financial system is that the debate about reform will continue to be characterized by ''turf fights'' and ''guerrilla warfare'' over narrowly defined issues rather than a systematic appraisal of how technology, securitization, and globalization are altering the optimal parameters for regulation during the final years of the 20th century.

# 6
# Exchange Rate Volatility and Misalignment: Evaluating Some Proposals for Reform

*Jacob A. Frenkel and Morris Goldstein*

## Introduction

This paper analyzes several proposals for reducing the volatility and/or misalignment of key-currency exchange rates. The proposals examined are a system of target zones, the imposition of controls or taxes on international capital flows, and a strengthening of international coordination over economic policies. Our purpose is not to endorse one proposal and to dismiss others. For one thing, some of the proposals have common elements. For another, some features of each of the proposals are already present in the existing exchange rate system. Instead, we see evaluation of these proposals as a useful vehicle for identifying issues that merit attention in any serious examination of how the functioning of the international monetary system might be improved.

As the title implies, the proposals discussed here have been concerned with both volatility and misalignment of exchange rates. "Volatility" is interpreted as short-term fluctuations of nominal or real exchange rates about their longer-term trends, while "misalignment" refers to a significant deviation of the actual real exchange rate from its equilibrium level. Measures of volatility are usually motivated by the question of whether exchange rates have been too

noisy. In contrast, estimates of misalignment typically focus on the issue of whether markets and/or authorities have set exchange rates at the wrong level, and if so, by how much.

To set the stage for the ensuing discussion of policy proposals, we review key characteristics of the behavior of major currency exchange rates over the period of floating rates. In addition, various criteria or standards for making inferences about excess volatility and misalignment are examined. Later sections summarize central features of the proposals for target zones, for restricting international capital flows, and for stronger economic policy coordination, respectively, and introduce several considerations about each proposal that bear heavily on its advisability and practicality.

## Facts and inferences about volatility and misalignment

A logical, prior step to framing proposals for improving the functioning of the exchange rate system is the determination of what's wrong with the existing system. Put in other words, one has to deal with John Connally's "if it ain't broke, don't fix it," before one gets to Will Rogers' "even if you're on the right track, you'll get run over if you just sit there." We first turn to volatility and then to misalignment.

The short-term behavior of major currency exchange rates over the 1973-88 period can be compactly characterized by five features.

First, exchange rate volatility has been much greater—perhaps on the order of five times as great—during the floating rate period than during the last two decades of the Bretton Woods era of adjustable par values. [1]

Second, there has *not* been a tendency for the short-run variability of exchange rates to decline over time. If anything, variability appears to have been marginally greater in the latter half of the floating rate period than in the first half; see Table 1. This would seem to belie the notion that variability was a transitional manifestation of adjusting to a new set of exchange arrangements.

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[1] The qualitative nature of this conclusion holds for nominal and real exchange rates, for bilateral and effective rates, and for daily, weekly, monthly, and quarterly data; see Crockett (1984).

# Table 1
# Short-Term Variability of Asset and/or Auction Prices, 1973-88

| | Standard Deviation of Monthly Percentage Changes | | | Average Absolute Monthly Percentage Changes | | |
|---|---|---|---|---|---|---|
| | 1973-88 | 1973-80 | 1981-88 | 1973-88 | 1973-80 | 1981-88 |
| 1. **Nominal Effective Exchange Rate U.S. Dollar**[1] | 2.47 | 2.20 | 2.73 | 1.93 | 1.67 | 2.20 |
| 2. **Real Effective Exchange Rate U.S. Dollar**[2] | 2.56 | 2.27 | 2.86 | 2.04 | 1.79 | 2.31 |
| 3. **Index of Nominal U.S. Equity Prices**[3] | 3.98 | 3.99 | 3.98 | 3.01 | 3.08 | 2.94 |
| 4. **Index of Real U.S. Equity Prices**[4] | 4.07 | 4.04 | 4.05 | 3.03 | 3.11 | 2.95 |
| 5. **Index of Nominal Interest Rates**[5] | 8.24 | 9.15 | 7.04 | 6.25 | 6.88 | 5.58 |
| 6. **Index of Real Interest Rates**[6] | **113.93** | 157.47 | **14.99** | **48.01** | 82.27 | **11.06** |
| 7. Index **of Non-Oil Processing Commodity Prices**[7] | 2.86 | 3.41 | 2.10 | 2.17 | 2.67 | **1.64** |

[1] Nominal effective exchange rate vis-a-vis currencies of other large industrial countries.
[2] Nominal effective exchange rate deflated by consumer price indices.
[3] Standard and Poor's *500* composite index.
[4] Standard and Poor's *500* composite index, deflated by U.S. consumer price index.
[5] LIBOR on 6-month U.S. dollar deposits.
[6] LIBOR deflated by U.S. consumer price index.
[7] Index of 31 non-oil primary-commodity prices, using world export weights and expressed in SDRs.

Third, the short-term variability of nominal exchange rates has been significantly greater than the variability of national price levels, resulting in large deviations from purchasing power parities; that is, variability of *real* exchange rates has primarily reflected variability of nominal exchange rates.[2]

Fourth, most exchange rate changes during the period have been unexpected, as revealed both by market indicators of expected changes in exchange rates (such as interest rate differentials or the forward discount)[3] and by survey data on exchange rate expectations.[4] In general, the forward premium or discount has been a relatively quiet series that has explained little of the variability in actual exchange rates.[5]

Fifth, not only has the foreign exchange market been a weak predictor of exchange rate changes, there is also evidence that it has been a *biased* predictor.[6]

While all of this provides ample support for the claim that major currency exchange rates have been volatile, surely the more interesting questions are whether they have been *excessively* volatile, and if so, *why?* Here, the answers are not so straightforward and require grappling with a host of still largely unresolved problems.

To begin with, it is not obvious that the greater variability of exchange rates observed over the floating rate period derives principally from the exchange rate regime itself.' It has been found, for example, that the time-series properties of exchange rates (both spot and forward) have, on occasion, been strikingly similar across time periods (e.g., 1962-67 and 1973-75) that span *different* exchange rate regimes.[8] This naturally leads to the suggestion that the appropriate

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[2] See Frenkel and Mussa (1980), and Mussa (1987).

[3] See Mussa (1983).

[4] See Frankel and Froot (1987).

[5] See Levich (1985).

[6] See Tryon (1979), Hansen and Hodrick (1980), Frankel (1982), Dooley and Shafer (1983).

[7] On the difficulties of attributing observed differences between the *periods* of fixed and floating rates to the exchange rate regime, see Goldstein (1980).

[8] See Frenkel and Levich (1977).

way to judge excess volatility is to relate exchange rate behavior to the behavior of underlying economic variables—that is, to "fundamentals"—rather than to the exchange rate regime. The rub, however, with this eminently sensible approach is that the results have proved to be quite sensitive to the specification of the underlying model. A good case in point is the recent study by West (1987). In studying the variability of the dollar/deutsche mark rate over the 1974-84 period, he finds that observed variability is inconsistent (i.e., excessive) with the fundamentals generated by a monetary model, *if* one assumes both that purchasing power parity (PPP) holds and that there are no shocks to the demand-for-money function. On the other hand, if one incorporates the empirically more plausible assumptions of departures from PPP and of shocks to money demand, then observed variability is consistent with the model.

The normative significance of the greater variability of nominal exchange rates vis-a-vis national price'levels also hardly speaks for itself. After all, aggregate price indices are sticky, backward-looking variables that, typically, largely reflect past contracts, whereas nominal exchange rates are jumpy, auction prices that anticipate future events. Indeed, the case for exchange rate flexibility is precisely that you need enough "flex" in exchange rates to compensate for the excessive "fixity" of nominal wages and prices.[9] Absent that flex, it would be more costly to generate the changes in real exchange rates needed to adjust to changes in real economic conditions.

This line of argument points directly toward the view that it is to other asset or auction prices—rather than to goods prices—that one should look for the appropriate standard of comparison for exchange rates.[10] And the bottom line of such a comparison—as shown in Table 1—is that the short-term variability of nominal and real exchange rates during the floating rate period has been *smaller* than that of interest rates, or'of indices of stock market prices, or of indices of (non-oil) primary commodity prices.[11] One interpretation is that the

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[9] The relative fixity of national price levels vis-a-vis nominal exchange rates is also at the heart of explanations for "overshooting" of exchange rates in the short run in response to, say, unanticipated changes in monetary policy; see Dornbusch (1976a).

[10] See Frenkel and Mussa (1980).

[11] See also Bergstrand (1983).

floating rate period has been a turbulent one in which all asset prices have been volatile. A different one is that all asset prices have been too volatile during this period (but that judgment would have to rely on some other standard).[12]

A third route to appraising exchange rate variability is to appeal to the *costs* or *effects* of this variability on the targets of policy (i.e., growth, consumption, inflation, an open trading system, etc.). This approach has a number of distinct strands.

One strand—quite popular during the first decade of floating—argues that highly variable and unpredictable exchange rates are costly because they inhibit the volume of international trade. Empirical evidence, however, has not been very cooperative. Specifically, it has generally proven difficult to identify a significant influence of short-term exchange rate variability or uncertainty on trade volumes, once the influence of other factors (i.e., real incomes, relative-traded goods prices) is held constant.[13] Whether this reflects increasing availability and utilization of hedging mechanisms against exchange rate risk, or the adaptability of multinational corporations, or other factors, is not established.

A second more recent tack—best represented in Krugman (1988)—is that exchange rate fluctuations are excessive not because they matter so much but rather because they now matter so *little.* Krugman (1988) argues that the substantial sunk costs associated with entering a foreign market and the volatility of exchange rates have combined to render trade prices and volumes unresponsive to exchange rate fluctuations—in effect, "delinking'' the real sector from floating rates.

In support of this thesis, Krugman notes that much less of the large depreciation of the dollar over 1985-87 has been ''passed-through'' onto U.S. import prices than would be expected on the basis of earlier experience. He interprets this as demonstrating the dominance of ''pricing-to-market''strategies by foreign producers—especially by Japanese exporters.[14] A recent IMF study (1988), however, suggests

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[12] See Shiller (1981).

[13] Crockett (1984); see, however, the findings of Cushman (1983) and De Grauwe (1988).

[14] See also Hooper and Mann (1987) on this topic.

that the unusual behavior of U.S. import prices during 1985-87 largely reflects "special" factors, particularly a decline in computer prices, the growing importance of computers in U.S. trade, and swings in commodity prices. Once these special factors are taken into account, recent import-price behavior does not emerge as much out of line with earlier experience. The apparent implications of the delinking hypothesis for trade-price elasticities of demand—namely, that such elasticities should be smaller during periods of high exchange rate variability, and that the price elasticity should be greater for "large" price changes (that overcome sunk costs) than for small changes— are likewise open to challenge.[15] We are, for example, unaware of any significant decline in estimated price elasticities for industrial country trade in moving from the Bretton Woods period to the period of floating rates.[16] In a similar vein, we know of only one study, Goldstein and Khan (1976), that tested the dependence of the price elasticity on the magnitude of the relative price change and that study utilized data from the adjustable peg period.[17] We expect the "jury to be out" on the delinking thesis until more empirical evidence is in hand.

Yet a third strand of the costs-of-variability approach looks at the relative costs of alternative degrees of exchange rate variability in the face of different shocks to the system. Even if exchange rate fluctuations impose costs on the economy, one needs to compare them to the costs that would ensue under greater fixity of exchange rates, including those associated with greater variability of other prices (e.g., interest rates, non-traded goods prices, nominal wages, etc.). Costs are usually evaluated by reference to the (squared) deviation of output or consumption from its target value. Again, however, implica-

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[15] See Dixit (1987) for an analysis of the sunk cost model

[16] See Goldstein and Khan (1985). In addition, we have compared estimates of trade volume price elasticities for each of the G-7 countries for the periods 1963-76 versus 1963-83, where the estimates are taken from the IMF World Trade Model. In three cases, the elasticity was lower in the more recent period; in one case there was no change; and in three cases, the elasticity was larger.

[17] Goldstein and Khan (1976) did *not* find evidence either that price elasticities were greater for large than for small price changes, or that the speed of adjustment of actual to desired trade volumes was faster for large price changes. To the extent, however, that exchange rate changes under floating are viewed as less "permanent" than those under Bretton Woods, one would not be able to generalize the findings to a floating rate regime.

tions for the observed degree of exchange rate variability are far from clear cut. To make a long story short, the punch line of this literature is that the optimal degree of exchange rate flexibility depends on the nature of the shocks (e.g., monetary versus real, permanent versus transitory) and on the structural characteristics of the economy (e.g., the degree of real wage flexibility, the degree of capital mobility, etc.).[18] When there is a variety of shocks, an intermediate degree of flexibility is optimal, but there is no straightforward way of knowing whether this optimal degree of flexibility is less or more than that actually observed. Note also that this literature does not consider the case where shocks are generated or exacerbated by the foreign exchange market itself (say, via destabilizing speculation).[19]

The fact that exchange rate changes have, for the most part, been unexpected during the floating rate period is often viewed as reinforcing the basic forward-looking nature of financial asset prices. Analogous to the case of a security whose current price reflects the discounted value of future cash flows, an asset market approach to exchange rate determination posits that the current spot exchange rate should depend on the current expectation of all the variables that drive exchange rates.[20] From here, it is only a short skip to the proposition that exchange rates will change only in response to unexpected movements in those driving variables, that is, to "news."

But it is not sufficient to know that news matters. We need to know *what* news matters. There have been some attempts in the literature to relate exchange rate changes to news about current account positions, cyclical income movements, and interest rate developments—and with some success.[21] Yet this approach cannot help but be loosely grounded in the absence of a reliable model of exchange rate determination that spells out what news should matter. As is well known, this has proved elusive, as empirical work has found that structural exchange rate models have poor out-of-sample forecasting properties—no better than those of "naive models"—and this even

[18] See Aizenman and Frenkel (1982).

[19] See Nurkse (1937).

[20] See Mussa (1983).

[21] See Dornbusch (1980), and Frenkel (1981b).

when market fundamentals have already been observed.[22] This makes it difficult to ascertain which sources of news could be influenced in a stabilizing way by policy actions, and if so, by how much.

More serious than the existence of frequent forecast errors is the finding that errors in forecasting changes in exchange rates are systematically biased. This is because the latter opens up the possibility that the foreign exchange market is an inefficient processor of information.

But we stress the word "possibility" because there is a serious problem of interpretation. All tests of market efficiency are **joint** tests of the model specifying equilibrium prices and of the hypothesis that the market efficiently processes information so as to set actual prices equal to equilibrium ones.[23] Since there is no widely accepted model of equilibrium prices for exchange rates, we cannot tell whether the biased pattern of forecast errors is reflecting market efficiency or instead, whether we merely have specified the wrong model for that time period.

For this reason, there is little consensus in the profession about whether large and biased forecast errors for exchange rate changes reflect large, shifting risk premia; or "peso problems"; or a series of collapsing speculative bubbles; or time-varying coefficients on the fundamentals driving exchange rates; or some combination of these factors.[24] Yet knowing why forecasts have systematically gone off track can be important not only for judging whether exchange rates are too noisy but also for knowing what to do about it. For example, if forecast errors reflected risk premia, and if risk premia were directly influenced by relative asset supplies, then there would be an enhanced potential role for sterilized exchange market interaction in influencing exchange rates—but there would be no presumption that the foreign exchange market was inefficient. On the other hand, if the culprit were speculative bubbles, then inefficiency would be indicated and the case for relying on market forces to set exchange rates would be weakened.

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[22] See Meese and Rogoff (1983).

[23] See Levich (1985).

[24] See Isard (1987).

Moving from the short run to the medium to long term, there are a few additional characteristics of exchange rate behavior worthy of explicit mention.

One is that real exchange rates of major currencies have been subject to pronounced medium-term swings. The real effective exchange rate of the U.S. dollar appreciated by more than 50 percent between 1980 and 1985, before falling by a roughly equivalent amount in the period to January of this year; see Chart 1.[25] Between 1975 and 1976, the pound sterling fell by 20 percent in real effective terms, only to rise by nearly 75 percent between 1976 and 1981. There are many more examples.[26]

## Chart 1

## Major Industrial Countries
Real Effective Exchange Rates, 1980–88*



A  Plaza Agreement, September 22, 1985
B  Tokyo Economic Declaration, May 4–6, 1986
C  Louvre Accord, February 22, 1987
D  Venice Summit, June 8–10, 1987
E  Group of Seven Statement, December 22, 1987
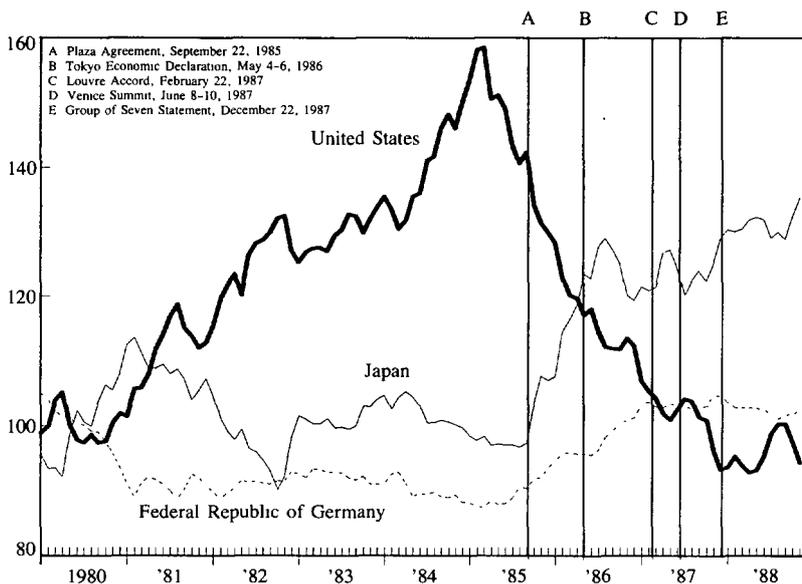
*Real effective exchange rates based on normalized unit labor costs in manufacturing.

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[25] The figures refer to real effective exchange rates based on normalized unit labor costs in manufacturing.

[26] See Mussa (1987).

Accompanying—and many would say responsible for—these large swings in real exchange rates have been marked divergencies across countries in the macroeconomic policy mix.[27] More specifically, during the 1981-85 period of dollar appreciation, fiscal policy in the United States was much more expansionary than that in either the Federal Republic of Germany or Japan; see Table 2. Also, the real exchange rate swings of the first half of the 1980s left in their wake huge current imbalances for the three largest industrial countries which have only recently begun to narrow. Overlaid on all of this have been recurrent pressures for protectionism, particularly in the United States.

This much is fact. Most observers go further and argue that large and persistent misalignments of real exchange rates have also been part and parcel of the floating rate experience—and with costly consequences. To take a representative estimate, Williamson (1985) places the misalignments of the U.S. dollar and the Japanese yen as of end-1984 at 39 percent and 19 percent, respectively. Misalignments on the order of, say, 30-40 percent would be larger, both than those estimated for countries who currently participate in the exchange rate mechanism of the European Monetary System (EMS),[28] and those estimated for major currencies during the latter part of the Bretton Woods period.

As noted in the introduction, misalignment is simply a quantitative judgment about how far a given (real) exchange rate is out of line. Given the prominent place that misalignment occupies in the alleged flaws of the present system, it is instructive to review the leading methodologies that have been used to estimate it. Since many of the broad issues here are similar to those that arose in assessing volatility, we focus on specific elements that address the correct *level* of the exchange rate.

Perhaps the most durable method of calculating the equilibrium exchange rate is the ***purchasing power parity*** (PPP) approach. In brief, if one can identify a base period when the country was in external balance, then the equilibrium value of the nominal exchange rate in

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[27] *See* Branson (1985).

[28] *See* De Grauwe and Verfaelle (1987).

# Table 2
## Major Industrial Countries: General Government Fiscal Balances and Impulses, 1980-87[1]

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|
| **(In billions of U.S. Dollars)** | | | | | | | | |
| Fiscal balance (+ surplus, − deficit) | | | | | | | | |
| United States | −34.50 | −29.60 | − 110.80 | −128.60 | − 105.00 | − 133.60 | − 147.80 | − 107.30 |
| Japan | −46.94 | −44.86 | −39.15 | −43.23 | −26.25 | − 13.77 | −11.52 | − 19.38 |
| Federal Republic of Germany | −23.68 | −25.17 | −21.65 | − 16.60 | −11.87 | −7.25 | . − 10.87 | − 19.06 |
| **(In percent of GNP)** | | | | | | | | |
| United States | −1.26 | −0.97 | −3.50 | −3.78 | −2.78 | −3.33 | −3.49 | −2.39 |
| Japan | −4.41 | −3.84 | −3.60 | −3.66 | −2.09 | − 1.03 | −0.58 | −0.81 |
| Federal Republic of Germany | −2.89 | −3.67 | −3.29 | −2.52 | −1.90 | −1.15 | −1.21 | − 1.69 |
| Fiscal impulse[2] (+ expansionary, − contractionary) | | | | | | | | |
| United States | 0.65 | −0.50 | 0.55 | 0.57 | 0.60 | 0.67 | 0.22 | − 1.00 |
| Japan | −0.40 | −0.78 | −0.52 | −0.19 | − 1.22 | −0.71 | −0.87 | −0.16 |
| Federal Republic of Germany | −0.19 | −0.51 | −1.87 | −0.42 | 0.55 | −0.79 | 0.21 | 0.23 |

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[1] Data are on a national income accounts basis.
[2] For definitions, see IMF World Economic Outlook.

the current period is the base-period value adjusted for the inter-country difference in inflation rates between the current and base period.[29]

Three problems have limited the usefulness of the PPP approach. First, it is not easy to find an equilibrium base period. For example, while Krugman (1985) regards 1980 as a reasonable base period for the dollar because the measured U.S. current account balance was near zero, Mussa (1985) does not because the real value of the dollar was then below the average level recorded in all but three of the past 40 years. *Second,* when real disturbances that alter relative prices occur between the base and current period, it will be desirable to have a departure from PPP, in order to take these changes in real economic conditions into account. Three such factors are particularly relevant in the context of the 1970s and 1980s: (1) permanent changes in the terms of trade (including changes in the real price of oil),[30] (2) sectoral inter-country differences in labor productivity that are masked by aggregate price indices and that are biased, not just between tradable and non-tradable goods,[31] but also among tradable goods industries,[32] and (3) shifts from net creditor to net debtor positions and vice versa. Suffice to say that the size of the necessary adjustments to PPP is subject to considerable dispute. *Third,* PPP does not seem to work, certainly not in the short run, and perhaps not in the long run either.[33]

A second increasingly popular alternative is the so-called ***underlying balance*** approach. Here, the equilibrium exchange rate is defined as the rate that makes the "underlying" current account (i.e., the actual current account adjusted for temporary factors) equal to normal net capital flows over the next two to three years, given anticipated real output and inflation paths, and the delayed effect of past exchange rate changes. The fly in the ointment is how to calculate normal (net)

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[29] For a recent application of the PPP approach to the yen/dollar exchange rate, see McKinnon and Ohno (1988).

[30] See McGuirk (1983).

[31] See Balassa (1964).

[32] See Marston (1986) and Baldwin and Krugman (1987).

[33] See Frenkel (1981a), Edison (1987), and Dornbusch and Frankel (1987).

capital flows.[34] For one thing, the general equilibrium nature of the exercise is daunting. For example, normal net capital flows for the United States are hard to define without reference to desired and/or likely savings versus investment trends in Europe, Japan, and in the developing world; yet those savings/investment trends, in turn, depend on demographic trends, tax laws, and even on the manner by which the existing debt problem of the developing countries is eventually resolved.[35] Indeed, anything that has a non-transitory effect on the ex-ante savings/investment balance will affect the equilibrium exchange rate. There is also the sizable global current-account discrepancy to allocate among countries.[36] In addition, since normal net capital flows is a flow rather than a stock concept, it does not lend itself easily to sustainability criteria. Finally, current account or balance-of-payments positions do not seem to explain actual exchange rate changes any better than other factors. In the end, we wonder how many economists would be willing to "go the stake" to defend a normal net capital inflow figure for the United States of say $10 billion (as in Williamson in 1985) versus say, an estimate of $50-75 billion? Yet such a change in assumptions could have a large effect on one's estimate of misalignment.

Next we come to what might be called the sustainability approach. The basic idea is to identify the market's implicit forecast for the future path of the exchange rate, based on the current exchange rate, interest rate differentials, and other data; and to assess the consequences of this forecast exchange rate path for the balance of payments and external indebtedness.[37] If this exercise suggests that it will take "many" years before the debt-to-GNP ratio stabilizes, and that the eventual debt-to-GNP ratio will be "high" when it does, then the market's implicit exchange rate forecast is judged to be "unsustainable".[38]

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[34] This is not to say that the underlying balance approach is without several significant attributes; see Goldstein (1984).

[35] See Mussa (1985).

[36] IMF (1987).

[37] See Krugman (1985).

[38] For an analysis of alternative concepts of sustainability, see Horne (1988).

This approach is less ambitious than the others in the sense that it seeks only to identify an unsustainable rate, and by implication, the likely future direction of exchange rate changes (that is, the sign of misalignment). To get an estimate of the equilibrium exchange rate, one would have to specify an equilibrium debt-to-GNP ratio and then solve the model for the exchange rate that, ceteris *paribus,* would yield that outcome. Still, even in its less ambitious form, the conclusions can be quite sensitive to the assumptions made about the real interest rate paid on foreign debt; the real interest differential between home and foreign securities; the share of the initial current account imbalance that is due to reversible, temporary factors; and the effect of the debtor's "reputation" on the willingness of creditors to put a sizable share of their portfolios in further claims on that country.[39] In addition, sustainability is not synonomous with optimality. An exchange rate path that yields a sustainable debt-to-GNP ratio could be undesirable because it implies an unsatisfactory outcome for other policy objectives, such as unemployment.[40]

A less direct approach is not to estimate misalignment at all but rather infer its existence from its adverse *effects*—much in the same spirit as outlined earlier in connection with inferring excess volatility. Two such effects are most frequently cited as being induced by misalignment: the generation of boom and bust cycles in tradable goods industries that leave unemployment in their wake; and the encouragement of protectionism.

Early work on the sectoral employment consequences of the 1981-85 dollar appreciation suffered from the post-hoc-propter-hoc fallacy. It took the sharp decline in the U.S. ratio of manufacturing employment to total non-agricultural employment in 1979-83 as a direct consequence of large overvaluation. Yet this same ratio declined in 1969-71 when the real exchange rate of the dollar was depreciating, and rose in 1984 when the dollar was appreciating sharply. In fact, this ratio has declined in all periods of recession since 1969.[41] This suggests three caveats. First, one has to control for other determinants

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[39] See Mussa (1985).

[40] See Nurkse (1945) and Frenkel (1987).

[41] See Obstfeld (1985).

of employment changes—both cyclical and sectoral—before the independent effect of the real exchange rate on sectoral employment patterns can be isolated. Branson and Love (1987) have, in fact, recently done just that and estimate that the 1981-85 real appreciation of the dollar cost about one million jobs in U.S. manufacturing. *Second,* the link between the real exchange rate and the sector allocation of resources depends on the type of disturbance moving the real exchange rate. Restrictive monetary policy can induce both currency appreciation and manufacturing contraction, while an increase in foreign demand for manufacturing will elicit currency appreciation and manufacturing expansion. Third, even when one knows the independent contribution of the real exchange rate to the change in employment, the judgment still needs to be made if the costs would have been less under some alternative exchange rate regime.

The effects of misalignment on protectionism are subject to the same kinds of caveats. While it is hard to dispute Bergsten's (1988) claim that an overvalued currency is the best leading indicator of protectionist legislation, other factors—including long-lasting shifts in competitiveness with non-exchange rate origins—also have played an important role.

We have trotted out these multiple criteria for inferring excess volatility and misalignment—and have highlighted the weaknesses of each of them—to make a point. But that point is *not* that "only God knows the equilibrium exchange rate",[42] or that the market rate is always the right rate, or that economists will seldom be able to recognize unsustainability, or even that there is little scope for improving the present exchange rate system. It is, instead, that inferences about excess exchange rate volatility and misalignment are subject to wide margins of error and that the exchange rate experience of the past 15 years is subject to multiple interpretations. For that reason, reasonable men have legitimate grounds to differ, both on diagnosis and on prescription. With this in mind, we proceed to examine three proposals for improving the functioning of the exchange rate system.

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[42] Quote attributed to former Japanese Prime Minister Nakasone; see Haberler (1987).

## Target zones

The G-10 has characterized target zones as an exchange rate system where the authorities " . . . define wide margins around an adjustable set of exchange rates devised to be consistent with a sustainable pattern of balances of payment."[43] Unlike an adjustable peg system, there need not be a formal commitment to intervene in all circumstances to keep actual exchange rates within the zone. On the other hand, unlike a pure floating system, authorities are permitted to intervene and indeed, are typically encouraged "to take a view" on the desirable level of the exchange rate. Two features that distinguish target zones from managed floating in a broader sense are: the establishment of a target zone for the exchange rate for some future period; and the greater influence of the exchange rate on the conduct of monetary policy so as to keep the actual rate within the zone.

It is possible to distinguish several variants of target zones.[44] "Loud" zones, for example, entail public announcement of the zones, whereas "quiet" zones imply confidential disclosure in official circles (for reasons of exchange rate surveillance, joint intervention, and policy coordination). In a similar vein, "hard" zones would be characterized by a monetary policy that is geared to maintaining the exchange rate within a narrow and infrequently revised zone. "Soft" zones can be defined analogously. As with any hybrid exchange rate system, there is a spectrum along the fix-flex axis.

Three questions about target zones merit particular attention. Will they help to discipline errant fiscal policies? What policy instruments will be responsible for internal balance? Would wide and moving zones be capable of acting as a medium-term anchor for exchange rate expectations?[45]

One of the strongest claims made for target zones by their supporters is that they will help to restore discipline and coordination to the conduct of macroeconomic policies. In light of the experience

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[43] See Crockett and Goldstein (1987).

[44] See Frenkel and Goldstein (1986)

[45] Another key issue is now to calculate the equilibrium exchange rate, but that was covered earlier. For a more comprehensive examination of target zones, see Frenkel and Goldstein (1986).

in the first half of the 1980s, the area where discipline and coordina-
tion are probably most sorely needed is *fiscal policy;* see Table 2.
Here, advocates of target zones argue that: (1) a threatened breach
of the zone—be it induced by errant fiscal or monetary policy—will
initiate a multilateral review of all that country's policies, with strong
peer pressure for adjustment and coordination; and (2) even if the
authorities opt to alter the target zone rather than fiscal policy, the
domestic political cost of repeated exchange rate adjustments will
impart its own discipline. The influence of EMS considerations in
helping to turn around French macroeconomic policy in 1983 is often
cited as supporting evidence.[46]

Opponents base their skepticism on a number of grounds. One is
the fact that the EMS—with its "harder" exchange rate commitments
and higher political stakes—has not been able to produce fiscal policy
convergence, to say nothing of its 11 exchange rate realignments.[47]
Second, if the target zone is defended by monetary policy, then the
exchange rate can send a "false signal" that would actually exacer-
bate the fiscal problem.[48] Specifically, a fiscal expansion that puts
appreciating pressure on the exchange rate would prompt a *loosen-
ing* of monetary policy to keep the rate from leaving the zone. Feld-
stein (1988) conjectures that this—and not a cut in the budget deficit—
would have indeed been the response if the U.S. had been operating
under a target zone regime in the early 1980s. Third, fiscal policy—
with its long lags and its implementation in the hands of legislatures—
is often regarded as the most difficult policy to coordinate effectively
on an international basis.[49]

It is probably no accident that whereas first-generation target zone
proposals spoke mainly of monetary policy, second-generation pro-
posals have added a specific rule to rein in fiscal policy; contrast
Williamson (1985) with Williamson and Miller (1987). In any case,
we need to think more about if and how the exchange rate regime
can discipline fiscal policy.

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[46] See Sachs and Wyplosz (1986).

[47] See Holtham et al. (1987).

[48] See Frenkel and Goldstein (1988).

[49] See Tanzi (1988).

To the extent that monetary policy is the primary instrument assigned to keeping actual exchange rates within target zones, one has to ask what policy instruments will be responsible for internal balance?[50] Consider the candidates.

The leading one is fiscal policy. But fiscal policy in most industrial countries is hardly flexible enough, rightly or wrongly, to be used for stabilization policy. It is, instead, geared to longer-term objectives, like reducing the share of government in economic activity or improving the efficiency of the tax system. A second candidate could be sterilized exchange market intervention. Yet whatever its usefulness in dampening short-term volatility or in sending a signal about policy commitment to markets, its influence on the level of the exchange rate over the medium to long term is highly suspect.[51] Finally, Meade's (1984) candidate is labor market policy, specifically, greater wage flexibility to stabilize employment. The problem is that no one knows how to bring it about without a substantial reform of labor market institutions.

If other policy instruments are constrained, then monetary policy may face the prospect of having to wear two hats—one for external and one for internal balance.[52] If that is asking too much, then one should ask how a target zone system can be structured to ease that dilemma.

Another key objective of target zones is to provide an ***anchor*** for (medium-term) exchange rate expectations as a means of reducing both volatility and misalignment. The anchor is said to derive from two sources: the authorities' announced collective estimate of equilibrium exchange rates (under loud zones), and the information that the target zone implies about the future course of monetary policy

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[50] Note that there is nothing sacred about the traditional solution to the assignment problem. In fact, Genberg and Swoboda (1987) and **Boughton** (1988) argue that, under flexible rates, it would be better to assign fiscal policy to external balance and monetary policy to internal balance. This is because the expenditure-switching and expenditure-reducing effects on the current account offset each other with monetary policy, but reinforce each other with fiscal policy.

[51] See the Jurgensen Report **[1983]**

[52] A good illustration of monetary policy faced with seemingly conflicting internal and external requirements is the U.K. situation in the first quarter of 1988, when there was both inflationary pressure and upward pressure on the exchange rate.

in participating countries. In considering whether target zones can, in fact, establish an anchor, the following factors seem relevant.

First, there is the width of the target zone. Most analysts have suggested that zones should be wide to reflect our substantial uncertainty about the equilibrium central rate, to provide a buffer against transitory disturbances that don't alter the long-run equilibrium rate, and to provide better protection against one-way speculative bets. Williamson **(1985)** speaks of initial zones on the order of 10 percent on each side of the central rate. Krugman **(1988)** is even more cautious and suggests initial zones for the deutsche **mark/dollar** and **yen/dollar** rates of **1.5** to 2.0 and 100 to 150, respectively. In contrast, most adjustable peg systems (including the EMS) have operated with considerably narrower bands. A wide zone cannot, of course, provide a very precise anchor but it would help to identify very large misalignments; also, it is likely to prove more durable than a narrow zone.

**A** second factor is the *frequency* with which the zones are revised. The larger the size of inflation differentials, the more frequent the changes in real economic conditions, and the less flexible are other policy instruments, the better the case for frequent revisions. An offsetting concern is that frequent revision can endanger the credibility of the zones. But as the later years of Bretton Woods demonstrated, risks don't lie in only one direction. Official exchange rate targets can also lose credibility when they are rigid in the face of fundamental changes.

A third, and to our minds, dominant factor for the anchor debate is the strength of the authorities' commitment to the zone—as evidenced by their willingness to alter other policies to make their exchange rate forecasts come true. This is what should tip the balance between regressive and extrapolative expectations, and between target zones as an anchor and target zones as a one-way bet for speculators. But, as suggested earlier, this commitment to the exchange rate may not come cheaply. In fact, one selling point for quiet zones is that it makes it easier for authorities to climb down from previous forecasts when conflicts with other objectives become too costly, or when economic conditions change.

Finally, if the anchor stems from the signal that target zones send about future policies, one might ask why it would not be preferable to announce the future course of policies themselves? One answer is that it may be easier to renege on a money supply target than an

exchange rate **target**.[53] Another is that the authorities may have superior information on the model linking exchange rates to policies. More food for thought.

## Restrictions and taxes on international capital flows

One of the recurring themes in open economy macroeconomics is that policymakers who seek to simultaneously achieve independent monetary policy, fixed exchange rates, and free international capital markets will wind up frustrated. The best they can do is to achieve any *two* of the three. International monetary reform is basically about which two to pick. For the three largest industrial countries during the 1973-84 period, the odd man out was fixed exchange rates. In the EMS, there has been more of a mixed strategy but maintenance of capital controls by some members has allowed them to, at least, get closer to fixed rates and monetary policy **independence**.[54] And in the EMS of 1992, the orphan is to be independent monetary policy.

Seen in this light, the case for throwing "sand in the wheels" of the international capital market—be it via direct controls or a **Tobin** (1978) worldwide round-tripping **tax** on foreign exchange—is the case against the alternatives. This suggests three important questions. What is being foregone by opting for less monetary independence? When open capital markets and fixed rates are paired with monetary integration, how will real shocks be handled? Would attempts to restrict capital flows be effective in stabilizing exchange rates and what benefits of financial liberalization might be lost in the process?

It is countries with either relatively high or relatively low inflation rates that are typically most worried about reduced monetary independence. In the former, lower monetary independence is seen as handicapping efforts to reduce the cyclical component of unemployment. What's more, many high-inflation countries suffer from weak fiscal systems with relatively heavy reliance on the inflation tax. They are concerned that a lower inflation rate will reduce the revenue from seigniorage, run up against tax evasion in seeking to compensate for

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53 See Canzoneri **(1985).**

54 See Giavazzi and Giovannini **(1986).**

it by raising other taxes, and thus, complicate what are already difficult fiscal problems.[55] Even if one argues (as we do) that a reduced take from the inflation tax would generate pressures to make corrective adjustments in the fiscal position that would be beneficial in the long run, there is a transition **problem**.[56] In low-inflation countries, the concern is with price stability objectives and the preservation of hard-won anti-inflationary reputations. The memory of the latter days of Bretton Woods when disequilibrium exchange rates, heavy exchange market intervention, and massive capital flows combined to wrestle control of the money supply away from the authorities, remains vivid.

When monetary independence is sacrificed so that fixed exchange rates and open capital markets can survive, there is another issue that needs to be faced squarely: how to respond to real shocks that impact more severely on some regions of the currency area than on others? One popular reply is that this concern should not be given much weight, as evidenced by the lack of serious regional problems in the vast U.S. economy under precisely such institutional arrangements. This misses the point. The interesting question is **why** the U.S. economy is able to accommodate regional shocks relatively well. The answer, we think, goes back to factors that were emphasized in the literature on optimal currency areas: factor mobility, real wage flexibility, and a tax and transfer system that operates at the level of the exchange rate union without the need for direct negotiations among **regions**.[57] It is a lesson that should not be lost sight of in thinking about further European financial integration.

So much for background. What will be the likely effects of capital controls or taxes **themselves?**[58] Again, a number of factors will bear heavily on the outcome.

One is whether speculation in the foreign exchange market is stabilizing or destabilizing. Proposals that tax or regulate capital flows

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[55] See Frenkel (1975) and Dornbusch (1988).

[56] See Goldstein (1988).

[57] See Mundell (1961).

[58] The restrictions on taxes can take various forms, ranging from allocation of trade credit, to restrictions on outflows of short-term capital, to restrictions on forward cover, to interest rate equalization taxes, to a worldwide transactions tax on foreign exchange.

take as a point of departure that there is too *much* speculation. But that view is not universally shared. McKinnon (1976), for example, also decries the short-run volatility of exchange rates, but attributes it to too *little* (stabilizing) speculation. Indeed, early advocates of floating rates built much of their case on the proposition that speculation would be stabilizing.[59] Suffice to say that faith in that proposition has been undermined by at least two developments: first, the development of models of rational speculative bubbles that show that profitable speculation can be destabilizing;[60] and second, episodes of exchange rate movements that seem to be unrelated (or even counter) to fundamentals.[61] Still, "episodes" are not the same as "usually" and even those episodes — as suggested earlier — are subject to multiple interpretations.[62]

A second key question is whether it is appropriate to draw *a priori* distinctions between "productive" and "unproductive" capital flows, by reference, say, to the maturity of these flows. The Tobin tax, for example, is designed to penalize short-term flows more than long-term ones. If it were possible to so separate the wheat from the chaff, then one might get the best of both worlds — more exchange rate stability and capital flowing to its most productive use. But we see a potential for throwing out the baby with the bath water. A country, for example, that wants, for legitimate reasons, to engineer a capital inflow would have to raise its interest rate much more than otherwise to overcome the effects of the tax, thereby increasing variability of interest rates. Good speculators who see through the "J curve" could be casualties of the tax, with adverse implications for the stability of the market. Short-term flows can help to discipline bad policies just as they can upset good ones.

Feasibility of implementation is another important consideration. This is particularly relevant for proposals that require *worldwide* implementation to be effective. Given the progressive globalization

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[59] See Friedman (1953).

[60] See Blanchard (1979).

[61] See Solomon (1988).

[62] Mussa (1985), for example, dismisses much of the findings of speculative bubbles because their underlying theories lack well-defined limits on the behavior of exchange rates.

of capital markets, there is always an incentive for some area—and it need not be a large one—to capture a larger share of the world's business by *not* imposing the tax, i.e., by engaging in what has come to be known as "regulatory arbitrage." Clearly, if the taxes or restrictions only change the geographical location of speculation but not its volume, or nature, little will be gained.

Finally, in view of the continuing trend toward liberalization of capital markets, it is relevant to factor in the benefits that might be given up by halting or reversing that trend. These benefits include lower spreads between lending and deposit rates, increased returns to savers, a lower cost of capital to firms, and better hedging instruments against a variety of risks.[63] Also, one cannot dismiss the possibility that restrictions on capital flows will weaken the support for "outward-looking" policies more generally and spread to other areas, especially the foreign trade sector. This would, ironically, run directly counter to the original aim of these capital-flow proposals, namely, to protect the real sector from the financial one.

## Stronger institutional coordination of economic policies

International coordination means different things to different people. A broad definition, due to Wallich (1984), is " . . . a significant modification of national policies in recognition of international economic interdependence."[64] A narrower but more ambitious concept, taken from Bryant (1987), is ·· . . . jointly designed, mutual adjustments of policy actions."[65] In most discussions of coordination, it is assumed that explicit bargaining occurs and that governments agree to behave differently than in the absence of the agreement.

The basic rationale for coordination is that economic policy actions, especially those of larger countries, create quantitatively significant spillover effects or *externalities* for other countries, and that a global optimum requires that such externalities be taken into account in the

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[63] See Folkens-Landau and Mathieson (1987).

[64] See Wallich (1984), p. 85.

[65] See Bryant (1987), p. 5.

decision-making calculus. Coordination is simply a facilitating mechanism for *internalizing* these externalities.[66] The influence that large countries can exercise over their real exchange rates, the role of "public goods" in the resolution of inconsistencies among policy targets, and the potential for joint action to be more effective in reaching objectives (e.g., by overcoming individual balance-of-payments constraints) have all been identified as reasons why it can be optimal to depart from independent decentralized policy making in the world economy.[67]

The recent upsurge of interest in coordination derives, however, not so much from any reappraisal of the theoretical case for it as from the march of events over the past three years. The implicit contract that governed the first dozen years of floating was one that called for each country to adopt stable policies at the national level, with the expectation that exchange rate stability would emerge as an important by-product. By the fall of 1985, it was apparent that such stability was not forthcoming. There had been several years of undisciplined and uncoordinated national policies; huge current account imbalances had emerged, and there was a sizable misalignment of the dollar with attendant protectionist pressures. The response—which began in earnest with the Plaza Agreement of September 5, 1988 and has evolved since then through the Tokyo Economic Summit, the Louvre Accord, the Venice Economic Summit, a few episodes of coordinated reductions in interest rates, the Toronto Economic Summit, and a series of meetings of both the *G-7* and the IMF Interim Committee—was the ongoing process of stronger international coordination of economic policies.

As suggested earlier, the literature has identified two potential sources of misalignment and excess volatility: bad policies and market inefficiencies. Successive coordination agreements have attempted to deal with both sources by specifying policy commitments for each participant, by expressing a *concerted* view on the existing pattern of exchange rates (albeit stopping short of loud target zones), and

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[66] See Frenkel, Goldstein and Masson (1988).

[67] See Cooper (1987) and Frenkel, Goldstein and Masson (1988).

by pledging closer cooperation on exchange market intervention policy. The approach is a judgmental, rather than rule-based, one.[68]

The process of coordination is assisted by a set of economic indicators that includes GNP and domestic demand growth, inflation, trade and current account positions, monetary conditions, fiscal balances, exchange rates, and a basket of primary-commodity prices.[69]

Three issues are particularly relevant for assessing the practice and the desirability of enhanced coordination.[70] Should coordination be a regular, ongoing process that encompasses a wide range of policies, or would an episodic, narrower approach be preferable? How can the interests of those not sitting at the table be represented? Are the gains to coordination likely to be worth the effort?.

One position is that, given the constraints, true coordination cannot be expected to be more than an episodic, regime-preserving effort. Dini (1988), for example, has recently argued that international considerations still play only a small role in policy making, and that only at times of crisis is a common interest in coordinated action clearly recognized. Some might even go further and argue that the reservoir of international compromise should be conserved for situations when there is a high probability of a policy deal and when failure to reach an agreement would carry a high cost.

A different view, which we support, is that both the likelihood and effectiveness of coordination will be enhanced when it is a regular, ongoing process, and for at least three reasons. First, the potential for multi-period bargaining expands the opportunities for policy

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[68] In this sense, the gold standard with its automatic specie flow mechanism, the adjustable peg system with its clear implications for the subordination of domestic monetary policy to the exchange rate (except during fundamental disequilibria), the EMS with its parity grid and divergence indicator, target zone proposals with their trigger for coordination discussions whenever the actual exchange rate threatens to breach the zone, and pure floating with its complete prohibition on all official intervention in the exchange market—all can be considered less discretionary than the present system.

[69] These indicators are employed to help gauge the international implications of domestic policy changes; to spot likely inconsistencies among policy objectives—both within and across countries; to monitor whether short-term developments are "on-track" in terms of longer-term objectives; and as early-warning signals of emerging global inflationary or deflationary trends.

[70] For more comprehensive appraisals of coordination. see Frenkel, Goldstein, and Masson (1988), Artis and Ostry (1986), and Fischer (1988).

bargains (by facilitating, for example, phasing of policy measures). Second, as suggested in the game-theoretic literature, the existence of repeated bargaining strengthens the role of *reputational* considerations in coordination. In contrast, when coordination is a once-and-for-all or episodic exercise, there is a higher risk that agreed policies will never be implemented because of the temptation to renege on earlier policy commitments when it later becomes advantageous to do so. Third, once coordination is established as a routine ongoing process, there is apt to be more freedom of policy maneuver for all participants than when negotiations are conducted in a crisis atmosphere and when disagreements—which, after all, are inevitable—may be inappropriately seen as signaling the collapse of coordination itself.

Enough for when to coordinate. Next one needs to ask *what* to coordinate.[71] The case for supporting a wide-ranging, multi-issue approach to coordination is that it increases the probability of concluding some policy bargains that benefit all parties; that favorable spillover effects are generated across negotiating issues; and that improved economic performance today depends as much on trade and structural policies as on exchange rate and demand policies. The defense of a narrower approach to coordination rests on the arguments that negotiation costs rise rapidly with the spread of issues under consideration; that prospects for implementation of agreements dim as the number of jurisdictional spheres expands (i.e., finance ministers can negotiate agreements but fiscal policy is typically the responsibility of legislatures; trade policy is handled by trade ministries; and monetary policy is the province of independent central banks); and that heated disputes on some issues (such as the stance of monetary and fiscal policies) can frustrate the chance for agreements in other areas (like defense and foreign assistance) where coordination might be more fruitful.

In view of these conflicting considerations, it is hard to fault present institutional practices on the range of coordination. Those practices entail high-frequency coordination on narrow issues in a

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[71] A related issue to whether to coordinate around a *single indicator* (like the exchange rate) or around a set of *indicators* (as in the ongoing G-7 coordination exercise); see Frenkel, Goldstein, and Masson (1988).

multitude of fora, such as the International Monetary Fund (IMF), the Organization of Economic Cooperation and Development (OECD), the Bank for International Settlements (BIS), and the General Agreement of Tariffs and Trade (GATT); less frequent (say, biannual) and wider coordination at a higher level in more limited fora, such as the IMF's Interim Committee, or the Group of Seven major industrial countries; and even less frequent (annual), wider yet coordination at the highest level (heads of state and of governments at the economic summits). Thus, there are occasional opportunities for multi-issue bargaining, but without the exponential increase in negotiation costs that might ensue if this were the order of the day. All things considered, probably not a bad compromise.

Since the policies of the largest countries generate the greatest externalities, and since the costs of negotiation may increase significantly with the number of players, there are some economic reasons for favoring a relatively small coordinating group. Yet pointing in the opposite direction is the consideration that a small group could conclude policy agreements which are beneficial to the direct participants, but which are not satisfactory to those countries not sitting at the coordination table.

In this context, it is worth mentioning two features of recent coordination efforts by the G-7. One of them, proposed at the Venice Economic Summit of 1987 and incorporated in subsequent coordination meetings, is the addition of ***aggregate indicators*** for the Group of Seven as a whole to the list of individual-country indicators. Aggregate indicators for the group may include such variables as the growth rate of real GNP and of domestic demand, the interest rate, the current account position, and the real exchange rate. A strong motivation for such aggregate indicators is that they can be helpful in gauging the impact of G-7 coordination agreements and actions among the Group of Seven on the rest of the world, with particular reference to the developing countries. For example, it has been estimated that each 1 percent change in real GNP in the industrial countries is associated, ***ceteris paribus,*** with approximately a **3** percent change (in the same direction) of export earnings in developing countries. Similarly, a 1 percent change in "world" interest rates implies roughly a **$3-4** billion change in net interest payments by capital-importing developing countries.

A second notable feature is that the managing director of the Inter-

national Monetary Fund participates in these Group of Seven coordination meetings. Since the fund's membership includes not only the larger industrial countries but also the smaller industrial countries, as well as most of the developing countries, one rationale for the managing director's participation is that it provides a *systemic* perspective and evaluation on proposed policy agreements, while still keeping the meeting small enough for administrative efficiency.

No one should assume that it is straightforward to achieve effective coordination of economic policies, or that the coordination process, by itself, somehow reduces the importance of sound policies at the national level.

It is only realistic to acknowledge that there are at least three troublesome *barriers* to coordination. First, international policy bargains that involve shared objectives can be frustrated if some policy instruments are treated as objectives in themselves. Schultze (1988), for example, offers the view that it would have been difficult to have reached a bargain on target zones for exchange rates in the early 1980s given President Reagan's twin commitments to increased defense spending and cutting taxes. In some other countries, the constraints on policy instruments may lie in different areas (including structural policies) but the implications are the same. Second, there can, at times, be sharp disagreements among countries about the effects that policy changes have on policy targets. In some cases, these differences may extend beyond the size to even the sign of various policy-impact multipliers. The harder it is to agree on how the world works, the harder it is to reach agreement on a jointly designed set of policies. Third, the compromise of growth and inflation objectives that emerges after difficult domestic bargaining may leave little room for further compromise on demand measures at the international level.[72]

As an example of how coordination can take place around an inappropriate set of policies,[73] Feldstein (1988) points to the potential risk that a coordinated attempt to stabilize a pattern of nominal or real exchange rates could result in an excessive *global* rate of inflation. The proposals put forward by U.S. Treasury Secretary

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[72] See Polak (1981).

[73] Also see Rogoff (1985) on a related point.

Baker and U.K. Chancellor **Lawson** at the 1987 annual meetings of the Fund and The World Bank, for a commodity-price-basket indicator as a potential ''early-warning'' signal of emerging aggregate price developments, attempt to meet such a concern.[74]

Finally, there is the bottom line: will coordination actually be worth the effort? In this connection, some of the recent empirical literature on the effects of coordination has yielded two controversial findings. One is that the gains from coordination are likely to be ''small'' for the larger countries.[75] The second is that welfare effects can even be negative if countries coordinate using the ''wrong'' model of the world economy.[76]

In our view, these findings should not be used as an indictment of coordination for at least five reasons. First, a comparison of optimal uncoordinated with optimal coordinated policies may not be generalizable to the more relevant comparison of suboptimal uncoordinated with suboptimal coordinated policies. In particular, the link between pressures for protectionism on the one hand, and recession and exchange rates on the other, could result in quite a different ''counterfactual'' (i.e., what would happen in the absence of coordination) from that assumed in these studies.[77] Second, some of the gains from coordination may be unobservable (unwritten pledges to alter policies in the future), or difficult to separate from less ambitious forms of cooperation (exchange of information across countries), or extend beyond the realm of macroeconomic policy (joint measures to combat terrorism, to harmonize international fare schedules for air travel, and so on). Third, a judgment that gains from coordination are small presupposes some standard of comparison. Would the gains from international coordination be small relative to the gains from coordination of policies across different economic agencies within a national government? Fourth, empirical estimates of gains from coordination have typically compared policies that do not exploit the

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[74] On the possible use of commodity-price indicators in the conduct of monetary policy, see Heller (1987).

[75] See Oudíz and Sachs (1984).

[76] See Frankel and Rockett (1987).

[77] See Schultze (1988) and Bryant (1987).

incentive governments have to adhere to agreements in order to enhance their reputations for consistency. A comparison of ''reputational'' policies shows larger gains.[78] Fifth, the danger that coordination may reduce welfare because policymakers use the wrong model(s) is greatest if they ignore model uncertainty. If, however, policymakers recognize that they do not know the true model and take this uncertainty into account, policy may be set in a more cautious fashion with positive effects on the gains from coordination.[79]

When all is said and done, we think Tobin's (1987) recent assessment of coordination puts the issue in proper prospective:

> ''Coordination of macroeconomic policies is certainly not easy; maybe it is impossible. But in its absence, I suspect nationalistic solutions will be sought—trade barriers, capital controls, and dual exchange-rate systems. War among nations with these weapons is likely to be mutually destructive. Eventually, they too, would evoke agitation for international coordination.''[80]

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[78] See Currie et al. (1987).

[79] See Ghosh and Masson (1988)

[80] See Tobin (1987), p. 68.

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# Commentary on 'Exchange Rate Volatility and Misalignment: Evaluating Some Proposals for Reform'

*Paul* **Krugman**

This paper is an admirably comprehensive survey of the issues surrounding exchange rate volatility, giving an excellent overview of both theory and some of the practical issues. It is also an extremely judicious paper—or let me be less polite and say an infuriatingly judicious paper. The caution and agnosticism of the discussion seem to me to be extraordinary and unwarranted.

When reading the paper, I found myself engaging in a fantasy. I imagined bringing my automobile in for servicing at Morris and Jacob's Auto Garage, complaining to them about the roughness of the ride. Jacob and Morris examine the car carefully, and then ask to discuss the matter with me. Their remarks go as follows:

First, they ask, "How are you sure your car's ride is rough? We've calculated some measures of its roughness, and it's not exceptional when compared with other kinds of motor vehicles. For example, it's actually a much smoother ride than you get on a dirt bike or a harvester-combine, so that it isn't clear by what standard you should consider roughness to be a special issue in this case."

Second, they make a concession: "It's true that your ride is about five times as rough as it was when you were driving your old Bretton Woods car. But that isn't necessarily due to the car. There are a number of reasons for believing that the environment has changed. For example, Boston streets may be in worse repair than they used to be."

Third, they raise a question, "How do you know you even want a smoother ride? After all, there's a tradeoff. If your ride is too

smooth, you can't feel the road, and that's not good. So there's an optimal degree of roughness in the ride. We don't feel that we have enough information at this point to decide whether your car's ride is actually rougher than this optimum."

Finally, they make a suggestion: "Given the uncertainties, it's hard to propose any particular course of action for your car right now. But we suggest that we have regular consultations. Why don't you bring your car in once a week? That way, we'll have a framework in place should we decide on some action at a future date."

I leave the garage deeply impressed with their intelligence and carefulness, but somehow feeling that I didn't get what I wanted.

So let me look more carefully at the four issues that Morris and Jacob raised at the garage. These were:

*(1) Is there a special problem of exchange rate volatility?* The authors point out that the exchange rate is not especially volatile when compared with other financial markets.

(2) *Is increased volatility due to the exchange regime?* The authors suggest that larger shocks rather than the shift to floating rates may explain much of the rise in volatility.

*(3) Are exchange rates excessively volatile?* The authors suggest that the exchange rate volatility of the last 15 years may serve a useful economic function.

(4) *Do we need policy coordination*? The authors question explicit exchange rate arrangements, but are unambiguously for explicit coordination of macroeconomic policy.

My view is that the authors are unjustified in their agnosticism about the first three questions, and oddly convinced about the utility of policy coordination, which actually has a fairly weak case.

Let's start with the volatility of the exchange market. It is true that it is relatively calm as compared, say, with stock markets, but there is a fundamental difference. Why advocate policies to stabilize exchange rates but not stock prices? One answer is to advocate policies for the stock market too—but let's leave that aside, and focus on another answer. The exchange rate, unlike the stock market, is not a price of a "natural" asset: it is the relative price of national monies, which are created assets. Precisely because the division of the world into currency areas is an arbitrary choice by governments, we have no reason to suppose that the behavior of relative currency prices is in any way optimal. Or let's put it differently. If advocates of

floating rates in the 1950s and 1960s had known that exchange rates would behave like stock prices, only a little less so, would they have been so enthusiastic? I doubt it.

Can the changes in the world explain the volatility of exchange rates? A little bit, but surely not a fivefold increase. Oil shocks explain some of what happened to the pound sterling and yen at various times; fiscal divergences explain some more. But the abrupt increase in volatility at the moment that fixed rates were abandoned suggests that the regime, not external shocks, was the cause. Or look at the contrast between the EMS and the rest of the world: fiscally prostrate Italy manages a fairly stable exchange rate with Germany, even as Germany and Japan, with nearly identical net trade patterns, similar fiscal stances, and similar current account performances fluctuate widely against one another.

Are exchange rates too volatile? A reasonable case for not worrying about the exchange rate could be made if financial markets were basing their decisions rationally on the information available, and if we felt that exchange rate volatility were not impairing the ability of firms to make good decisions. However, neither is the case. An extensive literature has now demonstrated, about as convincingly as any literature in economics, that asset markets in general, and the exchange market in particular, move much more than justified by "news"; that market forecasts are consistently biased; that the market neglects long run considerations. On the other side, I would argue strongly that exchange rate volatility does, in fact, degrade the ability of firms to make location and sourcing decisions because they cannot tell fundamental shifts in relative costs apart from transitory shifts due to financial bubbles. Exchange rates *are* too volatile.

Finally, what should we do?: The paper is a little cagey on this, but as I read it, it is skeptical about explicit (or at least public) arrangements on exchange rates, but enthusiastic about the process of policy coordination. I am a little puzzled by this. The analytical work on policy coordination that I am aware of always seems to suggest that the potential gains are very modest—not that it's a bad thing, but hardly that it's a priority. Meanwhile, shouldn't we look at history? The crude fact is that fixed exchange rate regimes have, in fact, worked, often for extended periods. That is, while the paper offers many analytical cautions about the feasibility of tying down exchange rates—cautions that I share—fixed rates seem to be one of those things

that work in practice but not in theory. On the other hand, policy coordination has never really happened. Whether this is because of bad economics or bad politics I don't know, but I would be hesitant to place great hopes on something that has no successful precedent.

I suspect that the authors of the paper either have or could develop stronger views than they offer here. Given how much they know, it would have been nice also to hear what they think.

# Commentary on
# 'Exchange Rate Volatility
# and Misalignment:
# Evaluating Some Proposals for Reform'

*Robert D. Hormats*

I will first address the character of the individual currency markets and then describe what I consider to be the best "test tube" for considering a "harder" type of target zone system—the European Monetary System (EMS)—after which I shall discuss what it shows us, or doesn't show us, about whether a "hard" system can work. In conclusion, I will describe where I think we're moving with respect to currency coordination and changes in the international monetary system.

The paper lays out a very useful framework for analysis. The question now, I believe, is whether we can build on that analysis to try to develop the germ of the next generation of global monetary systems. A number of elements brought out in this paper can lead us to better understand the tradeoffs that we are going to have to make in order to modernize the monetary system and bring it to the point where it has greater credibility in markets, and perhaps greater credibility as a mover of fiscal and monetary policy within countries.

One interesting characteristic of currency markets in the last several years is that they have been heavily "expectation" driven. This paper points out what types of expectations drive the market. There's really no widely accepted equilibrium model. Even if there were such a model, it is not clear that it would govern day-to-day decisions by the participants in the market. Roughly 5 to 10 percent of transactions are trade or investment driven; that is, they have some relationships to goods markets or direct investment. Most of the other portion of the market is either derivative of some other financial transaction

or a transaction made by a trader for the purpose of making money or avoiding losing money on a very short-term basis. So even if the trader had the view that somehow the dollar was going to decline 20 percent over the next two years, he might still be buying dollars if he thought that between today and tomorrow he could make a profit on that trade. So you get a major discontinuity frequently between the short-term and the medium-term currency market.

Now what drives the market obviously differs from time to time. The currency market relates, in part, to the outlook for'assets. And one would have to say that if you had to pick one variable that most determined individual currency decisions, it was that. Trade, which was the major factor moving currencies 20 years ago, plays a much smaller role now.

And then there is the underlying question of confidence. Obviously political confidence is very important. However, particularly in the last couple of years, it has been the markets' view of the policies of central banks that has been most critical. If you picked one reason among all the others—recognizing that there are many others—for the rise of the dollar in the early part of this decade it was confidence in Fed policy. Although interest rates played a very key role, it is useful to recall that the dollar went up even at a time when interest rate differentials between the United States and other countries narrowed—when interest rates were going down in the United States. This was true largely because there was a decline in inflation and substantial confidence that the Fed was committed to reducing the rate of inflation. And even though there was a very substantial amount of government financing, and even though the trade deficit was increasing, it was the credibility and the perceived direction of Fed policy that was the single most significant element in the dollar's strength. Therefore, if one looks at what the market pays attention to, that tends more often than not to be its perception of the direction of policy of central banks vis-a-vis one another. There's obviously, as I say, relative political risks, and then event risk, **e.g.** the prospects for oil prices in the Middle East. They play a role in determining whether the dollar or the yen or some other currency is a good buy at any given point.

Now I would like to address the question of whether it is possible to find some type of "test tube" to determine how a system of more fixed rates might work. Today we have globally what, in effect, is

a pragmatic "holding zone system" or, put another way, a very, very *soft* "target zone system." The European Monetary System is a "hard-target zone system" or as close as we come at this point. It's useful to look at how well it has done in order to give us a sense of where we might be going globally, or at least, what we should be avoiding. Obviously, there are certain characteristics of the EMS that are somewhat unique. And there are many reasons why we cannot simply transpose the EMS into an international monetary system. But it is useful to consider how a system of this sort works.

The first point is that the system, at its heart, is based on borrowed credibility from the Bundesbank. And without the credibility of the Bundesbank, it would be very hard for the EMS to operate in the stable, essentially noninflationary, way it has for the last several years.

What has the system done?

First, it has reduced volatility among the currencies in the EMS. Certainly when you compare volatility within EMS with volatility between EMS countries and outside countries, there's less within the EMS.

Second, there has been a convergence on a lower rate of inflation in Europe largely because other EMS countries have tried to come down to, or close to, the rate of inflation of Germany, and that rate of inflation is largely based on Bundesbank policy.

With respect to trade, and here's one of the interesting points that's brought up in the paper, and the EMS experience confirms it, there has not been as large an increase in trade within the EMS countries as there has between EMS countries and the rest of the world. One argument had been that if you have more stable exchange rates within Europe, that would create a greater degree of stability and, therefore, it would be easier for people to trade. In fact, it hasn't occurred. There are a lot of reasons for that, of course, which have little to do with the issue of exchange rates. The dynamic economies of East Asia, for example, are major and growing factors in world trade with the European Community (EC). And the most dynamic growth in intra-EC trade had occurred in the 1960s and 1970s. But the point, nonetheless, stands.

We've also seen that there's been no transfer of volatility from currency markets to the interest rate market within Europe. The argument had been made that if governments try to stabilize currencies, the volatility will come out on the fixed income markets. It hasn't

happened in Europe, largely because, in general, underlying fiscal and monetary policies in Europe have been designed to reduce inflation, and that has had a stabilizing effect on the interest rate markets. There's far less convergence on fiscal policy than on monetary policy, however. But one can make the argument that Italian fiscal policy and French fiscal policy (particularly in the early Mitterand period) were tightened up as a result of membership in the EMS, as well as recognition that overstimulation would lead to a sharp deterioration of their trade accounts.

There had been a feeling within Europe that to the extent the EC could be credible about currency stability, and about converging down to a lower rate of inflation, it might, through that additional credibility, reduce the unemployment costs and the foregone output costs associated with the fight against inflation. In fact, that has not occurred. Bringing down the rate of inflation in Europe has entailed a higher rate of unemployment and higher loss of output than in the United States, Japan or other countries. In part, this results from structural problems in Europe. This illustrates another point—if you're going to stabilize exchange rates, you can't simply do it with monetary policy or fiscal policy; there is need to increase the mobility of labor and create a system of internal resource transfer to help move economies toward greater equilibrium.

The last point regarding the EMS is that it has enabled the Germans to avoid the sort of domestic adjustment that the Japanese have undertaken. As a result of the higher yen, the Japanese have tried to stimulate greater domestic demand so that export reliance could be reduced. The Germans, as a result of the fact that other Western European currencies have floated upward along with the deutsche mark, have not had to go through domestic internal adjustment on the same scale as Japan; they have transferred some of that adjustment to their trading partners. They are running very substantial surpluses with most of their European trading partners, so that the higher deutsche mark vis-a-vis the dollar has not led to the sort of fiscal correction in Germany that it has led to in Japan. It's buffered the Germans from having to make that type of correction.

Where does the global monetary system go from here, recognizing that it's simply not possible to translate the EMS experience into a global experience. The first point essentially goes back to the most important strength of the EMS—that is, that the Bundesbank has

credibility in the markets, and others have tried to have their policies converge around that of the Bundesbank. Without some similar ''rock'' internationally, it's going to be very hard to make a system of ''hard zones'' work very effectively. There needs to be something to build around, some stabilizing feature. And that can be either the Fed or some type of very hard arrangement between the Bundesbank and the Fed and the Bank of Japan. Without that focus of global stability, without that center, it's going to be very hard to make a lot of the other elements work.

Second, within the European Community there is a greater recognition of the need to internalize the cost of volatility and distortions in currency markets than there is on a global scale. Trade is so closely intertwined within the European Community that Europeans understand the internal consequences of currency instability and divergent national economic policies. If they did not, they wouldn't be quite so willing to make the sort of policy changes that they have made to accommodate themselves to one another and to the degree of market integration required to establish a single internal market by the end of **1992.** So that the EMS really goes hand in hand with a lot of other internal changes that are under way; it is not simply the end point of the process.

Then one gets to the question so often discussed in these sessions: what criteria do you use to determine whether an exchange rate is out of line? So far, in a global sense, the general judgment of an appropriate currency rate has been based on ''**optimality-sustainability**'' assumptions. That is to say, finance ministries and central banks try to determine what set of exchange rate relationships is going to lead in the medium term toward current account equilibrium. That judgment wasn't necessarily the triggering point for the Plaza Agreement in **1985.** That was largely stimulated by the desire to avoid protectionism in the United States. But it gets you to the same type of judgment. The system is going to have to find a sustainable way of reducing the U.S. current account deficit and the very large surpluses of some of America's trading partners. This, of course, leads you to the question of what the right exchange rate is to do this and the right system for maintaining that rate. So far we've got a target zone system of sorts, or what I call a ''holding zone'' system that is based on the judgments of financial authorities as to what the right rate is for the moment in light of market circumstances, the pace of

adjustment, and domestic policies in the key countries. It's based on pragmatic criteria, e.g., a judgment as to what is reasonable. The problem with setting a "harder zone" is that we really are not sure that the zone we've got today is going to lead to the reduction in imbalances that is required. People say they want a target zone, but not yet. Even if such a system is deemed the best among other alternatives, there is the question of when you put it into place. Do you do it after a greater degree of convergence has been realized, i.e. after the big disequilibria in the system have been eliminated or dramatically reduced? Or do we do it now, with the objective of using that as a lever to get countries to take domestic policy actions to narrow these imbalances over a reasonable period of time?

My own guess is that at this point it would be very difficult to put a "hard target zone" system into place in light of the very large imbalances that exist in the global economy. But at some point—perhaps after the dollar has fallen farther—if we see sustained trade improvements and if the generally high level of public support that we've seen for more stability continues, and if there is a higher level of confidence in the then existing exchange rate relationships, the world can move toward a hardening of the system.

My last point is that we have learned over the last couple of years that exchange intervention can play a much greater role than we thought it could at the beginning of the floating rate process. When floating rates began, there was almost a sense of desperation that governments really could not do very much to control exchange rates even if they wanted to. This was probably true when exchange rates were way out of line; then it was hard for governments to exercise a significant role in moving currencies. But we've seen, over the last several years, a major increase in the sophistication of central banks about how to intervene. The more doubt there is in the market as to what the right exchange rate is, the greater the degree of influence central bank intervention can have.

Early in 1985, when the market was beginning to turn against the dollar, about $10 billion of exchange rate intervention had an enormous impact on the market. That gave the market the signal that central banks were interested in pushing the dollar down. If we combine the general notion of a greater effort to harmonize national policy with a continued effective coordination among central banks with respect to exchange rates, a lot of the instability that we've seen in

past years can be reduced. It's not the question of trying to create some kind of automatic formula for stabilizing rates because I don't think it's possible in this environment. A measure of flexibility is going to be required. But we can take some of the erratic character out of markets. And more importantly, we can use exchange rates as a prism which we can look through to try to influence domestic policies in the direction of a greater degree of convergence.

# Overview

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*Louis I. Margolis*

Any speaker on an "overview" panel is faced with a dilemma: Should he try to summarize the remarks of previous speakers, attempting to discern a consensus? Should he attempt to evaluate conflicting proposals, advocating those he finds appealing? Or, should he try to provide a different and perhaps unifying perspective on the issues?

My remarks combine all three approaches, but my primary effort is to provide a different perspective on what has been happening in the financial markets, specifically in the equity markets. I view the events of last October as a symptom of a larger problem, as an important step in an evolutionary process. And, as I view that process, I am reminded of Adam Smith's "invisible hand" and of the process of creative destruction that Joseph Schumpeter described.

I have labored in the trenches of the equity and equity options and futures markets for 20 years. I believe that I see and understand the trees from everyday contact. 1 leave it to you to judge whether I can see the forest. While I acknowledge that there are some structural changes that would help my business, I believe that I have avoided any urge to give in to parochial interests. If you find my description of the markets to be accurate, the policy implications will seem obvious.

## The significance of October 19

October 19, 1987, has become the most completely dissected and

analyzed day in the history of world financial markets. However, for a thorough understanding of what happened that day, we need to look at changes in the stock market that have been evolving for some time rather than pinpoint a particular trigger.

Why has there been such an incredible proliferation of options and futures? Why has the movement to alternative trading strategies accelerated? Indexation, portfolio trading, and electronic trading systems all are trying to tell us something about the structure of the market.

On October 15 of last year, at an evening speech to 70 pension plan sponsors, Dr. Henry Kaufrnan spoke about the potential for "lurches" in the equities markets, fixed-income markets and currency markets; that is, for substantial movements to different price levels with very little trading activity. This timely warning foreshadowed our principal concern about the equity market decline of 1987—that it was so abrupt, not that it went down. Secondary to this is why the market went so high. I believe that these events are a manifestation of an incomplete transition to a new equity market structure.

The year, 1987, marked the end of a 13-year bull market, which had been a unique period in American history. In the 1960s, most pension fund assets were managed in balanced accounts. With the help of pension plan consultants, sponsors began to select specialized active managers for their equity assets and, eventually, for their fixed-income assets, as well. In the early 1970s, the pension officer emerged as an investment manager; he was no longer simply an administrator. Consequently, we saw the concentration of equity assets in fewer hands, creating a new structure that was slower to respond to dramatic changes in price.

The speed of communication—electronic data and verbal communication—meanwhile accelerated the exchange of information. We've seen the traditional swings between optimism and pessimism compressed into very short periods of time, and we've seen markets go too far in both directions. Futures have facilitated the linkages between markets, encouraging globalization.

In 1987, we believe that the market approached its private-market value: The S&P 500 was trading at three times book value, yet over the past 80 years, it had generally traded in a range of one to two times book value. The price/earnings ratio on trailing earnings in 1987 peaked for the post World War II period, and dividend yields

reached their lowest levels in 60 years, or since the third quarter of 1929. In August and September, we began to see a substantial change in the way that people perceived equities. Finally, the market moved from its private-market value to the high end of its traditional valuation range *after* the October break.

### Changes in asset allocation

As the traditional role of investment managers changed from **full**-spectrum investment advisers to equity specialists or fixed-income specialists, investment horizons shortened.

Today, most active equity managers avoid market timing. Their stated policy is to stay as fully invested as possible. This approach is dictated by their employers, the plan sponsors, because pension plan sponsors want to control asset allocations.

A few years ago, plan sponsors discovered residual, unwanted cash in their accounts. These unintended cash balances naturally interfered with the plan's asset allocation objective. One multibillion dollar pension plan now allocates 105 percent of its normal commitment to equities as one way of dealing with residual cash. The plan administrators conducted a survey and found that they always ran about 8 percent "extra" cash. So the plan simply hired another manager to invest the residual cash that was already allocated to other managers. Another development was the creation of sweep funds by the banks, which swept unintended cash into a separate fund where stock index futures were used to equitize that cash. Instead of the short-term money market return, the plan received an equity market return. Until recently, few managers needed to be tactical asset allocators. We estimate that pension fund assets in tactical asset allocation programs were 1 to 2 percent of total assets in early 1987. The four largest asset allocators were all more than 90 percent in bonds in the summer of 1987.

In addition, many users of portfolio insurance had really become closet market timers. They were unwilling to commit to selling stocks because of the often hard philosophy that they'd never met anyone who could time the market successfully over numerous market cycles.

The portfolio insurers had a plan, as well. It had the vulnerability of any stop-loss strategy, but it was a clearly defined plan. **Unfor-**

tunately, the buyers had no countervailing plan. In fact, structural inhibitions, as I mentioned, left most would-be buyers without a strategic reserve. In the week of October 19, we saw some very sizable buying, but not from the active managers, because they had no cash. They were fully invested by mandate or couldn't respond. The tactical asset allocators, however, bought more than $7 billion in stocks.

## The decline in liquidity

The traditional providers of liquidity in the marketplace had been the specialists and the block traders. They had suffered during the 1974-87 period from a dramatic diminution in their margins because of the contemporaneous decline in commissions. These firms have gradually shifted assets, both capital and human, away from block trading. The ad hoc joint venture between the block trading houses and the specialists that evolved from 1965 to roughly 1985 is being disbanded. The reduced profitability of the secondary trading of stocks, as distinguished from the new issuance of shares, is unique in Wall Street history.

This shrinking profitability is causing the marketplace to seek alternative structures to find the liquidity needed by the increasingly concentrated holders of stock. The policy that forced negotiated rates and encouraged the use of commissions to buy goods and services from nontraditional sources other than the securities houses is having a dramatic effect on the structure and composition of the resources dedicated to facilitating this secondary trading of stocks. We are not complaining about these changes, though. We have the flexibility to adjust to these new equity market structures.

My purpose today is to alert you to what may be the unintended consequences of moving to a deregulated commission environment, where large financial entities are causing basic structural changes in the way securities are traded in the United States. These changes were never intended by the Congress, the Securities Exchange Commission or the U.S. Department of Labor. Furthermore, the volatility of the markets and the events of October 1987 are both manifestations of this incomplete restructuring process. I believe that the market is trying to substitute alternative methods of trading within the traditional framework of the exchanges. I suggest that we view the pro-

liferation of alternatives—options, futures, electronic systems, portfolio trading, one-price auctions, and excessive volatilities during periods of stress—from this perspective.

### *The decline of commissions*

After a number of modest changes in commission rates which began about 20 years ago, fully negotiated commission rates were implemented in 1975. A transaction that would have brought a brokerage firm $0.40 a share in the 1960s might bring in less than $0.04 a share today. The fixed commissions of two decades ago were used to pay for the traditional services of the securities houses. Today, an investment manager can use commissions almost like cash to buy nearly anything he needs to run his business. We believe that approximately one-third of institutional commissions are committed to soft dollar purchases of goods and services, other than traditional brokerage firm research and *the ongoing commitment of capital for liquidity when needed.* At least one major institution uses 70 percent of its commissions for the purchase of goods and services from alternative sources. These commissions are never "recycled" through the block trading mechanism, and they are not available to provide liquidity when it is needed.

The decline in commission rates was accompanied by a dramatic surge in volume, which has temporarily obscured the substantial changes in the traditional methods of trading equity and providing liquidity. This is understandable. As the cost of trading declined, investors and investment managers became more willing to trade in response to modest shifts in company or industry prospects. The increase in volume, combined with declining revenue per unit and the inexorable growth of expenses, has led to dramatic changes. Twenty years ago the commission brokerage business was profitable. Today, secondary trading of equities is *not* a significant source of profits for any major securities firm. For years, the dominant source of earnings for brokerage firms dealing with the individual investor has been profits from interest charges or credit balances in margin accounts, but institutional firms lack this cushion. Currently, most institutional firms use equity sales, research and trading to support other businesses. Deteriorating profitability of the basic brokerage

business explains the redeployment of resources away from secondary trading and block trading to new security issues, mergers and acquisitions, and leveraged buyouts. These new activities, together with specialized securities services such as asset management, arbitrage and derivative trading, have become the major profit sources.

*Higher* commissions in the past may have *discouraged trading* activity, but they also provided a *kind of insurance.* Block traders and exchange specialists had incentives to make bids and offers that would stabilize the market. At old commission levels, they could *afford* to *provide liquidity during periods of stress,* even if it meant losing money on a specific trade. They relied on the financial incentives of a historic and future flow of commissions at a profitable level. At current levels of commissions, however, the financial incentive is insufficient to cover the risks of significant block positions. **A** block trader cannot afford to lose money on even a few trades. Likewise, the specialist has seen a sharp drop in his floor brokerage. In the early 1970s, about two-thirds of the typical specialist's income came from floor brokerage and the balance from trading. In 1983, the relationship was reversed, with two-thirds of income from trading. Although more recent figures are not available, we believe that this trend has become even more pronounced.

During past market breaks, the public has expected Wall Street to come to the rescue. In 1987, announcements of corporate stock buybacks were the functional equivalent, because reduced profitability rendered general market support from brokers impractical. Salomon Brothers and other firms offered to stand with the specialists on difficult openings and reopenings, but the impact of this effort was limited. New York Stock Exchange specialists in the aggregate had approximately $1 billion in capital on October 19. While their historic return on capital has been excellent, this capital is not a meaningful contribution to liquidity on a day when nearly $25 billion in stock is changing hands on the New York Stock Exchange. At low commission levels, block traders and specialists cannot *accumulate a cushion* to provide the liquidity that is essential for smoothly functioning equity markets during periods of stress.

It is interesting to contrast the ability of the U.S. securities industry to respond to the demand for liquidity with the corresponding response in Japan. Japanese brokers were a major stabilizing factor last October, partly because high fixed commissions have been retained in

the system. Although the profits of Japanese brokers come from sources as diverse as in the United States, the secondary trading of Japanese equities is highly profitable. Average commission levels on large trades are between five and 10 times U.S. levels. Nomura Securities, the largest Japanese broker, has a market value larger than that of any U.S. company other than IBM and Exxon and larger than all the U.S. brokers combined.

It is tempting to use the Japanese experience to illustrate another point: the impact of volatility on the corporate cost of capital. I doubt if our **price/earnings** multiples or capital costs would approach Japanese levels even if volatility disappeared completely, but there are clear theoretical and empirical relationships between volatility and cost of capital. Lack of liquidity and consequent volatility reduces the effectiveness and raises the cost of the capital-raising mechanism. In describing this situation, I am not hinting that we need regulations or legislation to restore our profitability or that we should return to fixed rates. I am simply describing the reality of a powerful trend.

### New providers of liquidity

As Adam Smith would have predicted, new providers of liquidity are springing up. In contrast to Frank Edwards, I believe that the locals or floor traders in the futures pits make an important contribution to liquidity; but I certainly concur with Frank that they cannot do the job alone. Fortunately, different types of economic incentives have attracted other traders, including firms that perform option and futures arbitrage both domestically and internationally. **GLOBEX**, SOFFEX, INTEX, and screen-based trading in Japan are alternatives to the exchange floor system.

### Portfolio trading

Just as asset allocation strategies of various kinds have grown in popularity, major institutional investors of all stripes have changed their trading policies. They have responded to the changes in market structure, to the changes in transaction costs, and to the fact that investors who have focused on individual stock selection have not been conspicuously successful in recent years. Indexing in various

guises has become increasingly popular. Indexing is the creation of a fund designed to track one of the popular stock market indexes, most commonly the S&P 500. The growth of indexing and asset allocation and the relative decline of stock selection have led to a shift in emphasis among institutional managers from block trading to portfolio trading. The ad hoc joint venture between the block positioning firms and the exchange specialists that worked well during the past two decades in handling block trades cannot meet the need for portfolio trading in the present environment. Exchange rules prohibit member firms from trading portfolios *as portfolios* during normal market hours.

Consequently, trades are executed in individual stocks or portfolio risk is adjusted in the futures markets. Portfolio trades do occur offshore, outside normal U.S. market hours. As Adam Smith would have predicted, if a market structure will not adapt, a new market structure will be created. Exchange rules have not only forced portfolio trading into the futures markets and offshore, they have encouraged a massive reallocation of personnel and capital in response to changing market structures. More and more U.S. equity trading is taking place away from the New York Stock Exchange floor. Some of the volume is going to the third market or other exchanges, and some is going outside the United States. The success of the U.S. stock index futures markets is, in substantial measure, due to the demand to trade portfolios or portfolio risk packages combined with the reluctance of the older marketplaces to meet the need. Barring dramatic rule changes, the trend away from the New York Stock Exchange is inexorable. The securities industry cannot stop it. U.S. regulators cannot stop it. The marketplace is adjusting to the incomplete transition away from the traditional providers of transaction liquidity and moving toward a new structure.

Although the interest equalization tax was the proximate cause of the development of the Eurodollar markets, a substantial contributing cause was the inflexibility of U.S. securities regulation. When offshore security markets were undeveloped and unsophisticated, U.S. regulators could make rules that applied worldwide. They no longer have that luxury. October 19, 1987, illustrated the impact of an unrealistic demand for liquidity on a market structure that has not evolved to the point where new providers of liquidity are in a position to offer sufficient liquidity.

## What are the policy implications?

Despite the Brady Commission's more narrow focus on October 19, its recommendations are generally appropriate, though occasionally committed to slowing down inevitable changes. If my view of what is going on in the marketplace is correct, we are in the middle of a massive market-driven restructuring of the financial markets. The creative destruction of the capitalist system which Schumpeter described is building a new structure to meet needs that were not envisioned as recently as 10 years ago. The regulatory and policy implications seem clear. The concept of deregulation in the United States has restored vitality and initiative to corporate America. Yet, it is an open question whether a highly regulated industry can go from fixed prices to open competition without concurrent deregulation in other areas. These are tough political issues for which we see no support for slowing or reversing the trend. Turning back the clock on negotiated commissions is politically difficult. The only feasible choice is to remove regulatory obstacles to the development of a new market structure. As long as these obstacles delay the still incomplete restructuring process, volatility will be a problem.

# Overview

*Robert V. Roosa*

The organizers of this symposium have made a unique contribution by bringing together for study so many of the forms in which volatility occurs in different financial markets. For my overview assignment, which I take to mean interpreting the many excellent papers on a plane of generality, I have tried to identify some common elements in the causes, the consequences, and in the potentials for control of volatility in the financial markets. My own reflection has brought me to look for any fundamental patterns of economic behavior that underlie the performance of these markets. Stimulated by the Gertler-Hubbard paper, I have looked first for analogies with Schumpeter's classic formulation of the overlays of differing cyclical patterns, alternately of shorter term, medium, and longer term cycles within cycles. When Jim Tobin and I were among those studying with Schumpeter nearly 50 years ago, some of us then in our own thinking also wove into the Schumpeterian structure the influence of Keynesian multipliers and acceleration principles.

My sense is that the underlying causes of the various manifestations of volatility are to be found in the kinds of dynamic analyses that Schumpeter and Keynes visualized. But neither of them could have foreseen the tremendous change in financial markets that has occurred in countries across the globe since World War II, nor what has developed in the interrelations among these markets. The markets are now inextricably intertwined with the worldwide actions of savers and investors who have developed a fixation on seeking opportunities for capital gains through trading among financial assets as described

in Professor Goodhart's paper. Moreover, paralleling the internationalizing of commercial banking, all of the institutions serving financial markets have developed instruments to assist the fine tuning of arbitrage and asset swapping—not only around the world but also around the clock. The participation of all credit granting or credit creating institutions in these intricately interrelated markets has led not only to a proliferation of credit availability to support burgeoning activity but also to the widened use of a vast catalog of instruments, including trading in futures and options and indexed securities.

This evolving complex of new financial activities has, in effect, been superimposed upon the real goods transactions within and among the national economies and whatever cyclical variations occur among them. The counterpart has become a capacity or tendency for bandwagon swings to accelerate whenever attractive opportunities for gain appear through newly committing some of the ample supplies of liquidity, with which the world has become awash, into new potentials for appreciation and profitability.

What I am suggesting is that the great proliferation of markets, instruments, and financial investors over the past two decades has had a dual role. One of these roles, to be sure, has been to enlarge those active markets in which equities and bonds denominated in various currencies could be traded. Such markets have provided the supportive environment in which a vast growth of equity financing and debt financing could occur, making possible the remarkable growth in productive enterprise that has developed around the world during the past generation. The other role or aspect of this proliferation of markets has been to open opportunities for continuous switching among financial assets by investors or business firms in pursuit of greater gains. This acute sensitivity to greater prospects, on the part of increasingly active individual and institutional investors, almost inevitably creates volatility in the form of oscillations of varying magnitude in all manner of financial instruments.

I suspect that these oscillations only partly mirror the underlying real goods cycles under way in the various national economies. But they do seem to involve a characteristic pattern. I think I see that pattern most clearly in the foreign exchange markets. I have no problem, however, in seeing patterns in other securities markets for which the description I am about to suggest of the exchange rate relation between the dollar and other currencies may serve as an illustrative proxy.

What might be called the underlying cycles in the real goods and services fundamentals seem to me to lead the dollar along sustained paths of increase until one or more of the cycles crests, and then there comes a succeeding pattern of sustained decline in the dollar. When the dollar has been near a sustainable peak, a typical sideways trading range of relatively minor fluctuations prevails. Correspondingly, when the dollar has moved into a lower phase, a new trading range emerges. If volatility were to be measured only as the deviations around the gradient of a calculated regression, much of the significance of the customary use of the term volatility would be lost. What matter most in the widespread concerns over volatility are the longer swings, which are often punctuated by sudden and sharp drops or climbs (until a trading plateau is reached). It is these trend-like patterns which (when extreme) the Frenkel-Goldstein paper would call ''misalignment.''

To be sure, even while the dollar is resting for a time in a trading range, there is still a high volume of trading activity. Traders become so sensitized to prevailing fads that the markets go through successive fits and starts as traders interpret the comments or actions of financial officials, or they react to new data on commodity prices, or interest rates, or balance of payments developments, or shifting forecasts of change in the GNP of the United States and other leading countries. Even so, it is often during an apparently quiet trading range phase that a convergence of opinion in the foreign exchange markets of various leading countries, stimulated by underlying cycles in the real goods economies, begins to produce a prolonged rise in the dollar, or then later, a sustained decline.

It is when the dollar is moving along cyclical lines of this nature, as indeed it seems to have done thus far in 1988, that it takes on a new significance for economic policy formulation—not only within the United States but within the other countries whose currencies form the principal influence on the dollar's exchange rate. The longer swings characteristic of the dollar during the decade and a half of fully flexible exchange rates have generated great concern around the world over what is described as the disruptive volatility of the dollar. Concern of that kind has, of course, given rise to a succession of sometimes euphemistic communiques as to the state of the foreign exchanges that have been issued following the summits of the heads of state of the seven leading industrial countries. Not only

the expressions of the heads of state, but also those of all of us who view growth with stability as the proper objective for economic policy, have led to widespread comment about a supposed need to "stabilize" the dollar.

It is from the aroused anxieties of Treasury and central bank officials, and from the genuine critical expressions of many of us in the economics profession, that the leading countries have now been persuaded to join together in a G-7 or G-5 grouping, in order to bring finance ministers and central bank governors periodically together to cope with a perceived problem. Indeed, the disruptive consequences flowing from what was widely recognized early in 1985 as an overvalued dollar caused some of us to begin expanding our earlier proposals that two or more of the leading countries should try to agree on target zones for their exchange rates.

As one of the early proponents of target zones, I have always tried to be careful to avoid creating the impression that artificially contrived exchange rate stability was an objective to be desired. Instead, it has seemed to me that exchange rate movements focusing in the dollar serve as essential signaling devices, calling attention to unsustainable imbalances that have emerged in the balance of payments and international indebtedness positions of the leading countries and indeed, of many others as well. That is why I, as so many of us, have welcomed eagerly the fresh approach initiated by Secretary Baker at the Plaza in September three years ago. The arrangements, happily, have subsequently been formalized, with the full endorsements of the heads of state, for continuous appraisal of the indicators that describe the causes of unsustainable imbalances in the external accounts or foreign indebtedness of the United States and other leading countries.

The new procedures, on a scale extended far beyond the typical OECD consultations, promote intensive and continuous mutual interchange of appraisals among the G-5 (or G-7) countries, along with negotiations as to possible courses of action. This new approach offers a uniquely promising area of experimentation through which to introduce meaningful harmonization among the economic policies of those leading countries whose combined impact dominates the environment for trade and development throughout the world economy. And a special role is implied for the G-5 countries (France, Germany, Japan, the United Kingdom, and the United States) because their curren-

cies have been designated by the entire membership of the International Monetary Fund to provide the basis for determining the value of the SDR.

Having been forced by the development of speculative asset switching and massive capital flows to abandon the rigidity of the par value system in the early 1970s, and consequently experiencing the uncertainties of a floating rate system, the leading countries have now come upon a creative approach, through negotiation and mutual interaction, to begin approximating the kind of stabilizing influence in the world economy that once could be provided through the par value system under the IMF. All of the overlay of new financial institutions, investments, and facilities that transformed and displaced the older system have, paradoxically, created a need for a new approximation of what that older system aimed to provide.

The testing and the experimentation now going on within the framework of the G-5 and G-7 grouping give the world a promising opportunity to learn whether or not it can be possible, in reaction to the various forces that have been creating long term swings in exchange rates, for the financial authorities of the leading industrial countries to find a workable process for achieving a degree of stability, particularly among those five countries whose currencies form the SDR. Effective coordination among them can recreate conditions similar to those of the Bretton Woods years which were conducive then to remarkable worldwide growth and reasonable stability. The conditions now attainable among these five countries (or the seven) can provide a center of gravity for the world monetary system with a stabilizing influence throughout much of the world economy.

To be sure, as Dr. Frenkel suggests, much of the hope for achieving these stabilizing results depends on the quality and continuity of the sustained contacts among the officials of the leading countries, as well as upon their ability to influence specific action—and these contacts and actions may be vulnerable to frequent changes in governments. But my faith in and hope for the new framework, as it becomes institutionalized over the years to come, is that traditions of compelling force will emerge in the various finance ministries that ,will correspond to the tradition of institutional continuity and memory that is characteristic of the central banks. I trust, too, that a lasting role in this process will be found for the IMF in a new reincarnation to serve as the monitor of the forces and factors that are taken into

account by the G-5 countries in their coordinated effort to perform a stabilizing role for the international monetary system.

# Overview

*James Tobin*

Our Kansas City Fed friends not only know a good place to hold a summer conference but also have a good nose for challenging and timely topics. This year the topic is quite new and still incompletely defined. We don't know the answers, and we're not even very sure of the questions.

Volatility itself is a slippery concept. How should price volatility be measured? Variance within the day? From day to day? Week to week? Month to month? Year to year? Various measures are used in the papers at this symposium, evidently differing with the purposes of the authors. Since the questions under investigation are not well defined, it is not clear what measure is appropriate for what purpose.

Shiller plots yearly standard deviations of month-to-month percentage changes. Frenkel and Goldstein compute such standard deviations for eight-year periods, 1973-80 and 1981-88. Edwards reports several measures: standard deviations of day-to-day percentage changes over periods of varying lengths; series of such standard deviations for months. Goodhart computes variances of hour-to-hour (!) percentage changes for periods before and after the October crash, comparing them to random-walk variances.

Worries about volatility, and about the possibility that it is increasing, stem from belief that volatility adds to risk. If so, the kind of volatility that matters for an individual investor depends on the investor's circumstances, attitudes toward risk, and holding period. These vary a great deal. Some market participants like risk, two-

sided risk of course. In discussion at yesterday's session, Scott Pardee
pointed out that some finance houses are in the business of buying
and selling volatility. Options straddlers gain if the market moves
enough in either direction. Day traders seek a casino with "action."

Most of us have longer holding periods. For us, risk is **unpredict-
ability** of value over months or years, not over minutes and hours.
For most holders of equities the damage of the stock market decline
last October 19 would have been no less if it had been spread over
a longer time. The exceptions are people who just had to sell on
October 19.

Most of us are risk-averters with diversified portfolios. For us,
risk is not the variance of prices of particular assets or classes of
assets but their covariances with the values of our entire portfolios.
Businessmen often complain that volatility of exchange rates deters
international commerce and investment. Maybe so, but volatility of
nominal exchange rates would actually reduce risk if it simply offset
differential movements in nominal prices.

As several speakers noted, we do not have a good theory of vola-
tility, however measured, much less an empirically verified theory.
Volatility is a phenomenon in search of a theory. It is not the only
striking omission in the accounts of asset markets standard in both
economics and finance. Those accounts do not explain the volume
of *transactions.* Indeed, they don't explain the existence of any trans-
actions at all. That is because the theories—efficient markets
hypothesis, capital asset pricing model, arbitrage pricing, what have
you—anthropomorphize "the market." They simplify reality by
assuming a single "representative" agent, a Robinson Crusoe. Since
there cannot be any transactions, prices always move to eliminate
Crusoe's desire either to buy or to sell.

For real-world markets with heterogeneous participants, theory pro-
vides no *a priori* expectation how volatility and transactions volume
should be correlated. We might see lots of volatility with few trans-
actions, or we could observe the reverse. In practice, I guess, the
two are positively correlated. But this subject is conspicuously absent
from the empirical investigations and theoretical speculations of the
symposium.

The proximate "cause" of a crash like that of October 19 seems
to be that many investors want to sell, more are induced to want to
do so by extrapolating the price decline itself, and willing buyers

do not appear until they see bargain-basement prices. Diversity of opinions—of independent, autonomous opinions—conduces to stability. Herd-like behaviors and faddish strategies lead to instability and volatility. Some observers believe that asset markets are increasingly dominated by a small number of large institutions, advised by financial wizards all schooled in the same prevailing theories and methodologies.

Another impression, which I share, is that traders are increasingly preoccupied with macroeconomic news items, statistical releases or nuances in statements of policy-making officials. Speculators are not watching all such items, just those they think other traders watch—and those they think the Federal Reserve watches. Reactions seem frequently to be out of all proportion to the statistical or economic significance of the news. Traders seem to be waiting around for some newsy reason to buy or sell, a reason each thinks will make others buy or sell. Keynes's beauty contest metaphor applies. It can explain positive association of speculative transactions and price volatility.

Several papers concern "propagation" of volatility across markets in different assets and in different locations. Here too we lack a good theory or model to guide statistical calculations. Where assets are close portfolio substitutes, we obviously expect their prices to be highly correlated, and the second moments of their price series likewise. But reverse cases would not be surprising, the results of macroeconomic relationships and policy responses. For example, stabilizing the dollar's value in other currencies could mean greater volatility in U.S. bond and stock prices.

From a societal point of view, the essential problem is not stock price volatility *per se*. The essential problem is Robert Shiller's *excess* volatility. After all, the stock market is the central institution of capitalism. The stock market is supposed to mobilize saving for productive investment, to pool various social risks and to distribute them optimally among savers and investors, and to allocate savings efficiently among competing enterprises and projects. Shiller's findings are quite devastating. Stock market prices fluctuate altogether too much to be reliable signals of the fundamental values of 'investment in aggregate and of specific investments. Instead of optimally packaging the irreducible social risks inherent in nature, technology, and the human condition throughout the world, the market magnifies them by its self-generated instabilities.

I realize that Bob Shiller's findings are controversial in the fraternity of academic finance. His challenge has given rise to a flourishing industry, contriving models that make it conceivable that the volatility Shiller examines, the volatility that motivated this conference, is after all variance in rational estimates of long-run fundamental values. These models are too clever by half. Common sense says Shiller's results will withstand these attacks.

By the way, Shiller's findings are not the only doubts of the social beneficence of financial markets and corporate institutions encountered at this symposium. The Berle-Means heresy of the 1920s—that managers run corporations and do not run them in the interests of the owners—has been resurrected and exalted into mainstream economics in the 1980s. Consider the **Gertler-Hubbard** paper, and especially its exegesis by Bob Hall. Gertler and **Hubbard** meant to reassure us that financial activities, policies, and shocks are actors in the real macroeconomic circus, not just in a nominal sideshow. (The authors were, for some reason, looking over their shoulders at "real business cycle" theorists, notably Kydland and Prescott, who would have us believe that our society copes optimally with the unavoidable exogenous and external shocks it receives, just like a rational Crusoe on his island.) But their reasons for **reassurance**— for example, the importance of internal funds (rather than asset markets) in the saving-investment process—can give little comfort to those who would extend Invisible Hand arguments to financial markets. With characteristic eloquence and exaggeration, Hall drove this message home.

Shiller's results imply that managers obsessed by short-run performance of their company's shares are doing long-term holders of the shares no favors. Hall tells us that managers don't care about shareholders anyway.

I still think capitalism would function better if share prices better tracked long-run fundamental values. This should be the objective of policy interventions—to reduce volatility, yes, but to reduce it in a particular direction.

Franklin 'Edwards criticized a number of the regulatory reforms that have been proposed in the wake of the market crash last October. I am not endorsing those proposals. Bob Shiller quoted my observation that society cannot afford the resources to operate all the markets that might be set up. I am not, however, advocating the

wholesale elimination of futures markets. I, am skeptical of the multiplication of largely redundant markets, which absorb resources by artificially enlarging arbitrage opportunities. I am worried about the priorities of a society that allocates the cream of its educated youth to the paper economy.

My major proposal is a tax on the value of transactions in stock markets, foreign exchange markets, and perhaps other financial markets. The point is to discourage speculative transactions, in and out the same day or week, and to encourage holdings for long periods of time, based on calculations of **fundamental** values. A one percent tax each way is a big bite into rates of return on funds at risk if it is paid twice in a day, but a negligible consideration if it is paid twice in a decade.

Keynes suggested this device in 1936, looking back on the excesses of speculation and volatility in 1928-31. He thought the market (especially the American market) was insufficiently oriented to long-term fundamentals. His metaphor, that we need to "marry" investors to their securities, does not seem as apt today.

An auxiliary proposal to build in stronger incentives for long-term holdings is to scale taxes on realized gains to the length of holding time, moving gradually from 100 percent of ordinary income tax for realizations before one year to zero for gains realized after 30 years. The reverse would apply to losses. No loss would be deductible in calculating income subject to **tax** if realized before one year, while the entire loss would be deductible if realized after 30 years.

We cannot be absolutely certain, I recognize, that these taxes will work in the desired direction. The taxes would deter destabilizing trades, but they also would deter stabilizing trades. If the market were dominated by fundamentalists who bring it to its senses when myopic speculators throw it off, the proposed taxes would be counter-productive. But then Shiller would not find excess volatility, Summers would not have those other anomalous findings to report, and volatility would not be correlated with volume of transactions.

As Keynes saw, there is a **tradeoff** between the liquidity the market provides and its orientation to fundamentals. Any transactions costs make the affected assets less attractive as a "temporary abode of purchasing power" (Milton Friedman's definition of money), or as a vehicle for precautionary balances (one of Keynes' triad of demands for money). Stock market practitioners are very impressed with the

market's liquidity and very worried that it might be impaired. But when extreme technical liquidity brings excess volatility, that liquidity destroys itself, as happened last October.

I first suggested the transactions tax for foreign exchange. It would have to be an internationally agreed tax; the proceeds might be given to the World Bank. One purpose was to diminish speculative distortions of exchange rates. Another was to give national central banks more autonomy by allowing larger deviations of short rates between currencies. Frenkel and Goldstein point out the other side of that coin, namely that more domestic interest rate change would be needed to achieve a given desired capital movement. I think the balance of advantage is in my favor; they do not say why it is not.

In summary, I believe there is a strong case for throwing a little sand in the wheels. Anyway, even a small transactions tax will raise a great deal of needed government revenue, capturing some rents that now draw too many human resources into activities of dubious social value.

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