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ed., forthcoming.

[46] P. J. Cook and M. J. Moore, "Environment and Persistence in Youthful Drinking Patterns," in Risky Behavior among Youth: An Economic Analysis, J. Gruber, ed., forthcoming.

[47] P. Levine, "The Sexual Activity and Birth Control Use of American Teenagers," in Risky Behavior among Youth: An Economic Analysis, J. Gruber, ed., forthcoming.

[48] D. Card and T. Lemieux, "Dropout and Enrollment Trends in the Post-War Period: What Went Wrong in the 1970s?" in Risky Behavior among Youth: An Economic Analysis, J. Gruber, ed., forthcoming.

[49] J. Battycharya and J. Currie, "Youths at Nutritional Risk: Malnourished or Misnourished?" in Risky Behavior among Youth: An Economic Analysis, J. Gruber, ed., forthcoming.

[50] J. Gruber and J. Zinman, "Youth Smoking in the United States: Evidence and Implications," in Risky Behavior among Youth: An Economic Analysis, J. Gruber, ed., forthcoming.

[51] P. J. Cook and M. J. Moore, "Environment and Persistence in Youthful Drinking Patterns," in Risky Behavior among Youth: An Economic Analysis, J. Gruber, ed., forthcoming.

[52] D. Card and T. Lemieux, "Dropout and Enrollment Trends in the Post-War Period: What Went Wrong in the 1970s?" in Risky Behavior among Youth: An Economic Analysis, J. Gruber, ed., forthcoming.

Research Summaries

Stock Markets, Behavior, and the Limits of History

William N. Goetzmann*

Like many of my colleagues in financial economics, I have long been fascinated by the dynamics of the stock market. While the highs and lows of the Dow Jones Industrials Index are a topic of constant discussion in the financial press, the underlying forces behind its movements — both in the long and the short term — largely remain a mystery. For example, few scholars have a good explanation for why stock prices on a given day suddenly may be worth 20 percent less than the day before. By the same token, scholars disagree widely over the magnitude of the equity premium — that is, how much investors expect to be compensated for taking stock market risk over the long term. However, despite our lack of understanding of its daily and long-term motivating forces, most of us are willing to invest a substantial portion of our savings in the stock market.

I have conducted much of my research on the stock market in close collaboration with co-authors intrigued by the same questions. In one way or another, our work has been tied closely to the dominant, underlying model of stock market behavior, Brownian motion, otherwise known as the random walk. In simplest terms, we look at what causes the market's apparent Brownian motion, when the market violates the laws of Brownian motion, and what happens when Brownian motion interacts with the forces of history.

Biologist Robert Brown in 1827 first observed through his microscope the curious random dance of suspended pollen particles, but it took nearly a century for science to understand how the movement results from bombardment by unseen molecules. The impact of tiny particles only could be inferred from motion, not observed directly. Until recently, stock market researchers have confronted the same problem. While we can chart the path of the market on a minute-by-minute basis, we rarely observe who buys, who sells, and how demand and supply shocks affect price movements. We have many interesting theories about how the behavior of different investors moves prices, but empirical evidence on the critical link between observable investor decisions and price dynamics is hard to find.

Investor Behavior and the Brownian Price Process

Despite the dearth of direct empirical links between demand and price changes in asset markets, some interesting exceptions exist.[1] For example, when the composition of the widely held S&P 500 Index changes, investment funds that hold the index need to rebalance. It is now well established that on such rebalancing days, the prices of added stocks move up and the prices of deleted stocks move down.[2] This evidence recently led my co-author Massimo Massa and me to ask whether daily shifts in demand by index funds could move the value of the entire S&P 500 Index rather than moving just one stock. In our NBER Working Paper,[3] we document a positive relationship between daily demand shifts by investors in S&P 500 Index funds and broad movements in the stock market. We

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reject the hypothesis that the market causes investor behavior: demand shifts are associated only with late-day price dynamics. However, we find some evidence that market declines cause some panic: the outflows are higher following down days. Curiously, we also find that investors respond to measures of the dispersion of beliefs about the market. Thus, while the stock market process very nearly follows a random walk, its random movements in part reflect aggregate daily decisions about the prospects for the market and uncertainty about those prospects.

Although index fund flows are an interesting special case, Massa, K. Geert Rouwenhorst, and I document dramatic correlations between mutual fund flows across broad asset classes.[4] We find that on days when money flows out of bond funds, it flows into stock funds. In effect, individual investor portfolio decisions are correlated strongly in time, suggesting the existence of an aggregate behavioral structure behind price dynamics. Other investigators offer intriguing current research in this area.[5]

Using individual account data from one large index mutual fund, Massa and I have sought to understand investors' behavioral differences.[6] We classify investors according to their pattern of response to the market and then examine the relative salience in the demand effects of these investor types over time. We find some evidence suggesting that the marginal investor type shifts over time according to market conditions.

My co-authors and I hope that these three studies represent useful steps towards empirically documenting the direct effect of investor behavior on asset prices. Other research teams also are working with individual account and security data, most notably Brad M. Barber and Terry Odean;[7] Kenneth A. Froot, Paul G. J. O'Connell, and Mark S. Seascholes;[8] and Mark Grinblatt and Matti Keloharju.[9] Their research undoubtedly will lead to a more complete understanding of the previously nearly invisible economic forces driving asset price processes.

Brownian Motion and the Limits of History

Almost everything we know about financial markets comes from empirical studies of past data. At the same time, the existence of this data is conditioned on survival, or on the efforts of researchers to reconstruct the past. Continuing the analogy to modern physics, we cannot observe economic data apart from the effects of the observation itself. For example, our measures of the equity risk premium are based on the geometric return of the U.S. stock market from 1926 to the present. Indeed, we are fortunate to have 75 years' worth of U.S. capital market data on which to base this estimate. If not for the efforts of market researchers such as Alfred Cowles (1939),[10] Lawrence Fisher and James H. Lorie,[11] and Roger G. Ibbotson and Rex Sinquefield,[12] such long-term measures of market return might not even exist.

Yet while history provides rich information about the behavior of capital markets, we only analyze the data that exist. Unfortunately, more often than not, history is written by the winners. The very fact that quantitative data has survived to be analyzed by the econometrician, or is of interest to the current marketplace, may distort the lessons we draw from studying it.

In my 1995 paper with Stephen J. Brown and Stephen A. Ross,[13] we specify stock market dynamics in continuous time as a simple Brownian motion with drift and an absorbing lower bound. Our analysis shows that even very simple forms of market survival can bias inferences about the long-term expected return of the market. The higher the conditioning survival threshold, the greater is the positive bias in ex post equity returns. This analysis led us to a conjecture: could the well-known equity premium puzzle be attributed to the fact that we typically use U.S. data to measure it?

To address this question empirically, Philippe Jorion and I collected monthly returns on 39 of the world's equity markets over much of the twentieth century.[14] The results surprised us. We find that the United States has the highest uninterrupted real rate of capital appreciation of all countries, at 4.3 percent annually from 1921 to 1996 (excluding dividends, which added an average of more than 2 percent to the yield over the past 50 years). For other countries, the median real appreciation rate was only 0.8 percent. The high return premium obtained for U.S. equities therefore appears to be the exception rather than the rule. The real growth rate of a GDP-weighted world equity market over the period, excluding the U.S. market, was 3.39 percent. That is nearly 1 percent per year lower than the growth rate of the U.S. market. While this difference is not big enough to explain the equity premium puzzle, it does suggest that extrapolating past U.S. stock returns to forecast the future equity premium may be too optimistic.

Our survivorship analysis suggests in general that conditioning on market survival would have the greatest effect on econometric studies of markets that are in particular danger of disappearing. One clear example is emerging markets, defined as equity markets in developing countries. These markets have enjoyed a decade of popularity with U.S. investors because of their potential for high returns and their low correlation to markets in the developed countries. While investors regard most emerging markets as new opportuni-

ties, many of them have a long history of Western investment. As often as not, their recent emergence results from having been submerged at some time in the past. In our 1997 paper,[15] Jorion and I explore the implications of using data on a market only since its last emergence, that is, collecting data in an unbroken string as far back as possible and neglecting earlier periods in the market's history.

Through simulation and analysis of emerging market histories, we show that statistics about emerging markets may be strongly biased by survival bias and by "sorting" bias. A recently emerged market that has existed for a long time is more likely to be a market with a low expected rate of return. We also verify through simulation that a recently emerged market is likely to have low historical correlation to the market index. This evidence is consistent with the studies by Geert Bekaert and his co-authors[16] on the distinctive statistical characteristics of emerging markets.

The magnitude of the effects of analyzing only market data since emergence is striking. Of 11 emerging markets for which we have pre-emergence data — that is, data from the period before which they are deemed investible by the International Financial Corporation — we find pre-emergence returns to be 1.3 percent per year compared to 23.7 percent per year post-emergence. The implication for investors and researchers alike is that pre-emergence data may tell a very different story about the market. While a natural explanation for the difference between pre-emergence and post-emergence returns may be a fundamental economic shift in the economies of these countries, it would seem prudent to verify such changes in fundamentals before relying solely on post-emergence data for forecasting.

Survival conditioning also may have other effects beyond bias in means. Brown, Ross, and I[17] find that survived series tend to appear more mean-reverting ex post. The intuition for this is straightforward. Economic time series that drift to extremes are less likely to survive than those that return to equilibrium. This issue is particularly relevant to tests of long-term reversion in stock market returns and reversion in dividend yields.

Deviations from Brownian Motion

Much empirical research in financial economics over the past two decades has focused on forecasting the stock market, something that would be impossible if it truly followed a random walk. For example, in broadly cited research, Eugene F. Fama and Kenneth R. French[18] investigate mean reversion in stock price indexes and the forecasting power of dividend yields in the U.S. market since 1926 and find evidence of predictability at multiple year horizons. The problem is that long-horizon price dynamics require very long time series to draw reliable inference. While some scholars, most notably James Stock and Matthew Richardson,[19] have made creative use of econometric procedures to fully exploit the U.S. time-series data, another approach — one that my co-authors and I have taken — is to collect more data from U.S. and global capital market history.

In a 1993 paper,[20] I extend the analysis of long-horizon mean reversion to earlier periods in the New York Stock Exchange (NYSE) and the London Stock Exchange using spliced price series. I find some long-horizon evidence of persistence in the London market. In a 1995 paper,[21] Jorion and I examine U.S. and U.K. dividend yields from 1870 to the present. We find that dividend yields forecast U.K. stock returns from 1926 to the present, although evidence for the United States is weaker. In recent research, Ibbotson, Liang Peng, and I[22] construct a monthly database of individual security prices and dividends for the NYSE through much of the nineteenth and twentieth centuries. We use it to test for deviations from the random walk in the U.S. market and find weak evidence of predictability for different subperiods.

In light of survival issues, of course, the availability of long-term U.S. and U.K. data is both a blessing and a curse. While the data represent long and nearly independent samples for testing predictability, they also owe their existence to the success of the markets. For example, much of the predictive power of U.K. dividend yields is associated with the early 1970s, when share prices plunged but yields did not. Was a bet on U.K. stocks at the nadir of the market a good one? Yes, ex post. Was recovery really a certainty for the London market? We will never know. To what extent are positive results on the predictability of dividend yields attributable to the survival of the U.K. market? To address this issue econometrically, Jorion and I[23] use simulations to evaluate the effects of survival on dividend yield regressions and on Dickey-Fuller tests of yield reversion. Survival makes a difference: the co-efficients from regressions based on survived markets are biased towards rejection of the null. This result is of potential interest to econometricians working on co-integration, and we hope that closed-form corrections to the problem will emerge.

Conclusion

In 1905, Albert Einstein was awarded a Nobel Prize for his work, which finally solved the puzzle of Brownian motion 78 years after its

discovery. Financial economists have puzzled over the motion of the stock market for nearly a century, and we are nowhere near a complete understanding of the complexities of the process. While Brownian motion is convenient for many practical problems in financial economics, the forces underlying market motion and the long-term implications of the market diffusion process are economically significant for research as well as for investment decisions. Perhaps the difficulty we face is that the asset price process ultimately is driven by people rather than by particles, and our ability to observe it is sometimes an accident of history.

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[1] *J. Lakonishok, A. Shleifer, and R. W. Vishny, "The Impact of Institutional Trading on Stock Prices,"* Journal of Financial Economics, *32 (August 1992), pp. 23–43.*

[2] C.f. *A. Shleifer, "Do Demand Curves for Stocks Slope Down?,"* Journal of Finance, *41 (July 1986), pp. 579–90; L. Harris and E. Gurel, "Price and Volume Effects Associated with Changes in the Standard and Poors 500 List — New Evidence for the Existence of Price Pressure,"* Journal of Finance, *41 (July 1986), pp. 815–29; R. W. Holthausen, R. W. Leftwich, and D. Mayers, "Large Block Transactions, the Speed of Response, and Temporary and Permanent Stock Price Effects,"* Journal of Financial Economics, *26 (July 1990), pp. 71–95; M. Garry and W. N. Goetzmann, "Does De-listing from the S&P 500 Affect Stock Price?,"* Financial Analysts Journal, *42 (March 1986), pp. 64–9; U. S. Dhillon and H. Johnson, "Changes in the Standard and Poor's 500 List,"* Journal of Business, *64 (January 1991), pp. 75–85; M. D. Beneish and R. Whaley, "An Anatomy of the 'S&P Game': The Effects of Changing the Rules,"* Journal of Finance, *51 (July 1996), pp. 1909–30; A. W. Lynch and R. R. Mendenhall, "New Evidence on Stock Price Effects Associated with Changes in the S&P 500 Index,"* Journal of Business, *70 (July 1997), pp. 351–83.*

[3] *W. N. Goetzmann and M. Massa, "Index Funds and Stock Market Growth," NBER Working Paper No. 7033, March 1999.*

[4] *W. N. Goetzmann, M. Massa, and K. G. Rouwenhorst, "Behavioral Factors and Mutual Fund Flows," Yale International Center for Finance Working Paper No. 00-14, 2000.*

[5] See, e.g., *R. M. Edelen and J. B. Warner, "Why Are Mutual Fund Flows and Market Returns Related?" Evidence from High-Frequency Data, University of Pennsylvania Working Paper, 1999.*

[6] *W. N. Goetzmann and M. Massa, "Daily Momentum and Contrarian Behavior of Index Fund Investors," NBER Working Paper 7567, February 2000.*

[7] *B. M. Barber and T. Odean, "Trading Is Hazardous to Your Wealth: The Common Stock Investment Performance of Individual Investors,"* Journal of Finance, *55 (April 2000), pp. 773–806; T. Odean, "Are Investors Reluctant to Realize Their Losses,"* Journal of Finance, *53(5) (October 1998), pp. 1775–98; "Volume, Volatility, Price, and Profit When All Traders Are Above Average,"* Journal of Finance, *53 (December 1998), pp. 1887–1934; "Do Investors Trade Too Much?,"* American Economic Review, *89 (December 1999), pp. 1279–98.*

[8] *K. A. Froot, P. G. J. O'Connell, and M. S. Seasholes, "The Portfolio Flows of International Investors," NBER Working Paper No. 6687, August 1998.*

[9] *M. Grinblatt and M. Keloharju, "The Investment Behavior and Performances of Various Investor Types: A study of Finland's Unique Dataset,"* Journal of Financial Economics, *January 2000; "Distance, Language, and Cultural Bias: The Role of Investor Sophistication," UCLA Working Paper, February 2000; "What Makes Investors Trade?," UCLA Working Paper, January 2000.*

[10] *A. Cowles,* Common Stock Indices. *Bloomington, IN: Principia Press, 1939.*

[11] *L. Fisher and J. Lorie, "Rates of Return on Investments in Common Stocks: The Year by Year Record (1926–65),"* Journal of Business, *41 (July 1968), pp. 408–31;* A Half-Century of Returns on Stocks and Bonds. *Chicago: University of Chicago Press, 1977.*

[12] *R. G. Ibbotson and R. Sinquefield, "Stock, Bonds, Bills and Inflation: Year-by-Year Historical Returns (1926–74),"* Journal of Business, *49 (January 1976), pp. 11–47.*

[13] *S. J. Brown, W. N. Goetzmann, and S. A. Ross, "Survival,"* Journal of Finance, *50(3) (July 1995), pp. 853–73.*

[14] *P. Jorion and W. N. Goetzmann, "A Century of Global Stock Markets," NBER Working Paper No. 7565, February 2000.*

[15] *W. N. Goetzmann and P. Jorion, "Re-emerging Markets," NBER Working Paper No. 5906, January 1997.*

[16] *G. Bekaert and C. Harvey, "Time-Varying World Capital Market Integration,"* Journal of Finance, *50 (June 1995), pp. 952–52; G. Bekaert and M. S. Urias, "Diversification, Integration and Emerging Market Closed-End Funds, "* Journal of Finance, *51 (July 1996), pp. 835–69.*

[17] *S. J. Brown, W. N. Goetzmann, and S. A. Ross.*

[18] *E. F. Fama and K. R. French, "Permanent and Temporary Components of Stock Prices,"* Journal of Political Economy, *96 (April 1988), pp. 246–73; "Dividend Yields and Expected Stock Returns,"* Journal of Financial Economics, *22 (October 1988), pp. 3–26.*

[19] *M. Richardson, "Temporary Components of Stock Prices, a Skeptic's View,"* Journal of Business Economics and Statistics, *11 (April 1993), pp. 199–207.*

[20] *W. N. Goetzmann, "Patterns in Three Centuries of Stock Market Prices,"* Journal of Business, *66 (April 1993), pp. 249–70.*

[21] *W. N. Goetzmann and P. Jorion, "A Longer Look at Dividend Yields,"* Journal of Business, *68 (October 1995), pp. 483–508.*

[22] *R. G. Ibbotson, L. Peng, and W. N. Goetzmann, "A New Historical Database for the NYSE 1815 to 1925: Performance and Predictability,"* Journal of Financial Markets, *forthcoming.*

[23] *W. N. Goetzmann and P. Jorion, "A Longer Look at Dividend Yields."*