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If the efficient markets hypothesis was a publicly traded security, its price would be enormously volatile. Following Samuelson's (1965) proof that stock prices should follow a random walk if rational competitive investors require a fixed rate of return and Fama's (1965) demonstration that stock prices are indeed close to a random walk, stock in the efficient markets hypothesis rallied. Michael Jensen was able to write in 1978 that "the efficient markets hypothesis is the best established fact in all of social sciences."

Such strong statements portend reversals, the efficient markets hypothesis itself notwithstanding. Stock in the efficient markets hypothesis lost ground rapidly following the publication of Shiller's (1981) and Leroy and Porter's (1981) volatility tests, both of which found stock market volatility to be far greater than could be justified by changes in dividends. The stock snapped back following the papers of Kleidon (1986) and Marsh and Merton (1986) which challenged the statistical validity of volatility tests. A choppy period then ensued, where conflicting econometric studies induced few of the changes in opinion that are necessary to move prices. But the stock in the efficient markets hypothesis—at least as it has traditionally been formulated—crashed along with the rest of the market on October 19, 1987. Its recovery has been less dramatic than that of the rest of the market.

This paper reviews an alternative to the efficient markets approach that we and others have recently pursued. Our approach rests on two assumptions. First, some investors are not fully rational and their demand for risky assets is affected by their beliefs or sentiments that are not fully justified by fundamental news. Second,

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arbitrage—defined as trading by fully rational investors not subject to such sentiment—is risky and therefore limited. The two assumptions together imply that changes in investor sentiment are not fully countered by arbitrageurs and so affect security returns. We argue that this approach to financial markets is in many ways superior to the efficient markets paradigm.

Our case for the noise trader approach is threefold. First, theoretical models with limited arbitrage are both tractable and more plausible than models with perfect arbitrage. The efficient markets hypothesis obtains only as an extreme case of perfect riskless arbitrage that is unlikely to apply in practice. Second, the investor sentiment/limited arbitrage approach yields a more accurate description of financial markets than the efficient markets paradigm. The approach not only explains the available anomalies, but also readily explains broad features of financial markets such as trading volume and actual investment strategies. Third, and most importantly, this approach yields new and testable implications about asset prices, some of which have been proved to be consistent with the data. It is absolutely *not true* that introducing a degree of irrationality of *some* investors into models of financial markets "eliminates all discipline and can explain anything."

The Limits of Arbitrage

We think of the market as consisting of two types of investors: "arbitrageurs"—also called "smart money" and "rational speculators"—and other investors. Arbitrageurs are defined as investors who form fully rational expectations about security returns. In contrast, the opinions and trading patterns of other investors—also known as "noise traders" and "liquidity traders"—may be subject to systematic biases. In practice, the line between arbitrageurs and other investors may be blurred, but for our argument it helps to draw a sharp distinction between them, since the arbitrageurs do the work of bringing prices toward fundamentals.

Arbitrageurs play a central role in standard finance. They trade to ensure that if a security has a perfect substitute—a portfolio of other securities that yields the same returns—then the price of the security equals the price of that substitute portfolio. If the price of the security falls below that of the substitute portfolio, arbitrageurs sell the portfolio and buy the security until the prices are equalized, and vice versa if the price of a security rises above that of the substitute portfolio. When the substitute is indeed perfect, this arbitrage is riskless. As a result, arbitrageurs have perfectly elastic demand for the security at the price of its substitute portfolio. Arbitrage thus assures that relative prices of securities must be in line for there to be no riskless arbitrage opportunities. Such riskless arbitrage is very effective for derivative securities, such as futures and options, but also for individual stocks and bonds where reasonably close substitutes are usually available.

Although riskless arbitrage ensures that relative prices are in line, it does not help to pin down price levels of, say, stocks or bonds as a whole. These classes of securities do not have close substitute portfolios, and therefore if for some reason they are

mispriced, there is no riskless hedge for the arbitrageur. For example, an arbitrageur who thinks that stocks are underpriced cannot buy stocks and sell the substitute portfolio, since such a portfolio does not exist. The arbitrageur can instead simply buy stocks in hopes of an above-normal return, but this arbitrage is no longer riskless. If the arbitrageur is risk-averse, his demand for underpriced stocks will be limited. With a finite number of arbitrageurs, their combined demand curve is no longer perfectly elastic.

Two types of risk limit arbitrage. The first is fundamental risk. Suppose that stocks are selling above the expected value of future dividends and an arbitrageur is selling them short. The arbitrageur then bears the risk that the realization of dividends —or of the news about dividends—is better than expected, in which case he loses on his trade. Selling "overvalued" stocks is risky because there is always a chance that the market will do very well. Fear of such a loss limits the arbitrageur's original position, and keeps his short-selling from driving prices all the way down to fundamentals.

The second source of risk that limits arbitrage comes from unpredictability of the future resale price (De Long, Shleifer, Summers and Waldmann, 1990a). Suppose again that stocks are overpriced and an arbitrageur is selling them short. As long as the arbitrageur is thinking of liquidating his position in the future, he must bear the risk that at that time stocks will be *even more* overpriced than they are today. If future mispricing is more extreme than when the arbitrage trade is put on, the arbitrageur suffers a loss on his position. Again, fear of this loss limits the size of the arbitrageur's initial position, and so keeps him from driving the price all the way down to fundamentals.

Clearly, this resale price risk depends on the arbitrageur having a finite horizon. If the arbitrageur's horizon is infinite, he simply sells the stock short and pays dividends on it in all the future periods, recognizing that the present value of those is lower than his proceeds from the short sale. But there are several reasons that it makes sense to assume that arbitrageurs have short horizons. Most importantly, arbitrageurs have to borrow cash or securities to implement their trades, and as a result must pay the lenders *per period* fees. These fees cumulate over the period that the position remains open, and can add up to large amounts for long term arbitrage. The structure of transaction costs thus induces a strong bias toward short horizons (Shleifer and Vishny, 1990). In addition, the performance of most money managers is evaluated at least once a year and usually once every few months, also limiting the horizon of arbitrage. As a result of these problems, resources dedicated to long-term arbitrage against fundamental mispricing are very scarce.

Japanese equities in the 1980s illustrate the limits of arbitrage. During this period, Japanese equities have sold at the price earning multiples of between 20 and 60 (French and Poterba, 1989), and have continued to climb. Expected growth rates of dividends and risk premia required to justify such multiples seem unrealistic. Nonetheless, an investor who believes that Japanese equities are overvalued and wants to sell them short, must confront two types of risk. First, what if Japan actually does perform so well that these prices are justified? Second, how much more out of line can prices get, and for how long, before Japanese equities return to more realistic prices?

Any investor who sold Japanese stocks short in 1985, when the price earnings multiple was 30, would have lost his shirt as the multiples rose to 60 in 1986.

These arguments that risk makes arbitrage ineffective actually understate the limits of arbitrage. After all, they presume that the arbitrageur knows the fundamental value of the security. In fact, the arbitrageur might not exactly know what this value is, or be able to detect price changes that reflect deviations from fundamentals. In this case, arbitrage is even riskier than before. Summers (1986) shows that a time series of share prices which deviate from fundamentals in a highly persistent way looks a lot like a random walk. Arbitrageurs would have as hard a time as econometricians in detecting such a deviation, even if it were large. An arbitrageur is then handicapped by the difficulty of identifying the mispricing as well as by the risk of betting against it. Are economists certain that Japanese stocks are overpriced at a price earnings ratio of 50?

Substantial evidence shows that, contrary to the efficient markets hypothesis, arbitrage does not completely counter responses of prices to fluctuations in uninformed demand. Of course, identifying such fluctuations in demand is tricky, since price changes may reflect new market information which changes the equilibrium price at which arbitrageurs trade. Several recent studies do, however, avoid this objection by looking at responses of prices to changes in demand that do not plausibly reflect any new fundamental information because they have institutional or tax motives.

For example, Harris and Gurel (1986) and Shleifer (1986) examine stock price reactions to inclusions of new stocks into the Standard & Poor 500 stock index. Being added to the S&P 500 is not a plausible example of new information about the stock, since stocks are picked for their representativeness and not for performance potential. However, a stock added to the S&P 500 is subsequently acquired in large quantities by the so-called "index funds," whose holdings just represent the index. Both Harris and Gurel (1986) and Shleifer (1986) find that announcements of inclusions into the index are accompanied by share price increases of 2 to 3 percent. Moreover, the magnitude of these increases over time has risen, paralleling the growth of assets in index funds. Clearly, the arbitrage trade in which rational speculators sell the new stock and buy back close substitutes is not working here. And simply selling short the newly included stock on the theory that it is now overpriced must be too risky.

Further evidence on price pressure when no news is transmitted comes from Ritter's (1988) work on the January effect. The January effect is the name for the fact that small stocks have outperformed market indices by a significant percentage each January over the last 50 or so years. Ritter finds that small stocks are typically sold by individual investors in December—often to realize capital losses—and then bought back in January. These share shifts explain the January effect as long as arbitrage by institutions and market insiders is ineffective, since aggressive arbitrage should eliminate the price effects of temporary trading patterns by individual investors. Either risk or borrowing constraints keep arbitrageurs from eliminating the price consequences of year-end trading.

Less direct evidence also shows that news is not the only force driving asset prices, suggesting that arbitrage is not successful in eliminating the effects of uninformed

trading on prices. For example, French and Roll (1986) look at a period when the U.S. stock market was closed on Wednesdays and find that the market is less volatile on these days than on Wednesdays when it is open. By focusing on Wednesdays, they control for the intensity of release of public information. This result may reflect incorporation of private information into prices during open hours, but it may also reflect the failure of arbitrage to accommodate intraday demand shifts. Roll (1988) demonstrates that most idiosyncratic price moves in individual stocks cannot be accounted for by public news. He finds that individual stocks exhibit significant price movements unrelated to the market on days when there are no public news about these stocks. A similar and more dramatic result is obtained for the aggregate stock market by Cutler, Poterba, and Summers (1989a), who find that the days of the largest aggregate market movements are not the days of most important fundamental news and vice versa. The common conclusion of these studies is that news alone does not move stock prices; uninformed changes in demand move them too.

Investor Sentiment

Some shifts in investor demand for securities are completely rational. Such changes could reflect, for example, reactions to public announcements that affect future growth rate of dividends, risk, or risk aversion. Rational demand changes can also reflect adjustment to news conveyed through the trading process itself. Finally, rational demand changes can reflect tax trading or trading done for institutional reasons of the types discussed above.

But not all demand changes appear to be so rational; some seem to be a response to changes in expectations or sentiment that are not fully justified by information. Such changes can be a response to pseudo-signals that investors believe convey information about future returns but that would not convey such information in a fully rational model (Black, 1986). An example of such pseudo-signals is advice of brokers or financial gurus. We use the term "noise traders" to describe such investors, following Kyle (1985) and Black (1986). Changes in demand can also reflect investors' use of inflexible trading strategies or of "popular models" that Shiller describes in this journal. One such strategy is trend chasing. Although these changes in demand are unwarranted by fundamentals, they can be related to fundamentals, as in the case of overreaction to news.

These demand shifts will only matter if they are correlated across noise traders. If all investors trade randomly, their trades cancel out and there are no aggregate shifts in demand. Undoubtedly, some trading in the market brings together noise traders with different models who cancel each other out. However, many trading strategies based on pseudo-signals, noise, and popular models are correlated, leading to aggregate demand shifts. The reason for this is that judgment biases afflicting investors in processing information tend to be the same. Subjects in psychological experiments tend to make the same mistake; they do not make random mistakes.

Many of these persistent mistakes are relevant for financial markets. For example, experimental subjects tend to be overconfident (Alpert and Raiffa, 1982), which makes them take on more risk. Experimental subjects also tend to extrapolate past time series, which can lead them to chase trends (Andreassen and Kraus, 1988). Finally, in making inferences experimental subjects put too little weight on base rates and too much weight on new information (Tversky and Kahneman, 1982), which might lead them to overreact to news.

The experimental evidence on judgment biases is corroborated by survey and other evidence on how investors behave. For example, extrapolation is a key feature of the popular models discovered by the surveys Shiller describes in this journal. He finds that home buyers as well as investors in the crash of 1987 seem to extrapolate past price trends. Similar results have been found by Frankel and Froot (1986) in their analysis of exchange rate forecasts during the mid-1980s: over the short horizon, professional forecasters expect a price trend to continue even when they expect a long run reversion to fundamentals.

A look at how market participants behave provides perhaps the most convincing evidence that noise rather than information drives many of their decisions. Investors follow market gurus and forecasters, such as Joe Granville and "Wall Street Week." Charging bulls, Jimmy Connors and John Houseman all affect where and how people entrust their money. When Merrill Lynch changed from their charging bulls ad (filmed in Mexico) to a single bull ad ("a breed apart"), many more people chose to take their advice. Financial gurus that attract large followings never claim to have access to inside information. Rather, they insist that they are following reliable models for forecasting future returns. They "make money the old-fashioned way," which is apparently not just by reacting to changes in fundamental economic factors.

So-called "technical analysis" is another example of demand shifts without a fundamental rationalization. Technical analysis typically calls for buying more stocks when stocks have risen (broke through a barrier), and selling stocks when they fall through a floor. "Adam Smith" (1968) refers to the informal theorem of chartism that classifies phases of price movements in terms of categories—accumulation, distribution and liquidation. The suggested trading strategies then respond to the phase of the cycle the security is supposed to be in. These trading strategies are based on noise or "popular models" and not on information.

There can be little doubt that these sorts of factors influence demand for securities, but can they be big enough to make a difference? The standard economist's reason for doubting the size of these effects has been to posit that investors trading on noise might lose their money to arbitrageurs, leading to a diminution of their wealth and effect on demand (Friedman, 1953). Noise traders might also learn the error of their ways and reform into rational arbitrageurs.

However, the argument that noise traders lose money and eventually disappear is not self-evident. First, noise traders might be on average more aggressive than the arbitrageurs—either because they are overoptimistic or because they are overconfident—and so bear more risk. If risk-taking is rewarded in the market, noise traders can earn higher expected returns even despite buying high and selling low on average.

The risk rewarded by the market need not even be fundamental; it can be the resale price risk arising from the unpredictability of future noise traders' opinions. With higher expected returns, noise traders as a group do not disappear from the market rapidly, if at all.

Of course, higher expected returns because of higher risk come together with a greater variance of returns. Noise traders might end up very rich with a trivial probability, and poor almost for sure. Almost for sure, then, they fail to affect demand in the long run. But in principle, either the expected return or the variance effect can dominate.

Learning and imitation may not adversely affect noise traders either. When noise traders earn high average returns, many other investors might imitate them, ignoring the fact that they took more risk and just got lucky. Such imitation brings more money to follow noise trader strategies. Noise traders themselves might become even more cocky, attributing their investment success to skill rather than luck. As noise traders who do well become more aggressive, their effect on demand increases.

The case against the importance of noise traders also ignores the fact that new investors enter the market all the time, and old investors who have lost money come back. These investors are subject to the same judgment biases as the current survivors in the market, and so add to the effect of judgment biases on demand.

These arguments suggest that the case for long run unimportance of noise traders is at best premature. In other words, shifts in the demand for stocks that do not depend on news or fundamental factors are likely to affect prices even in the long run.

Explaining the Puzzles

When arbitrage is limited, and investor demand for securities responds to noise and to predictions of popular models, security prices move in response to these changes in demand as well as to changes in fundamentals. Arbitrageurs counter the shifts in demand prompted by changes in investor sentiment, but do not eliminate the effects of such shifts on the price completely.

In this market, prices vary more than is warranted by changes in fundamentals, since they respond to shifts in investor sentiment as well as to news (Shiller, 1981; 1984). Stock returns are predictably mean-reverting, meaning that high stock returns lead to lower expected stock returns. This prediction has in fact been documented for the United States as well as the foreign stock prices by Fama and French (1988) and Poterba and Summers (1988).

The effects of demand shifts on prices are larger when most investors follow the finance textbooks and passively hold the market portfolio. In this case, a switch in the sentiment of some investors is not countered by a change of position of all the market participants, but only of a few arbitrageurs. The smaller the risk bearing capacity of arbitrageurs, the bigger the effect of a sentiment shift on the price. A simple example highlights this point. Suppose that all investors are sure that the market is efficient and

hold the market portfolio. Now suppose that one investor decides to hold additional shares of a particular security. Its price is driven to infinity.

This approach fits very neatly with the conventional nonacademic view of financial markets. On that view, the key to investment success is not just predicting future fundamentals, but also predicting the movement of other active investors. Market professionals spend considerable resources tracking price trends, volume, short interest, odd lot volume, investor sentiment indexes and numerous other gauges of demand for equities. Tracking these possible indicators of demand makes no sense if prices responded only to fundamental news and not to investor demand. They make perfect sense, in contrast, in a world where investor sentiment moves prices and so predicting changes in this sentiment pays. The prevalence of investment strategies based on indicators of demand in financial markets suggests the recognition by arbitrageurs of the role of demand.

Not only do arbitrageurs spend time and money to predict noise trader moves, they also make active attempts to take advantage of these moves. When noise traders are optimistic about particular securities, it pays arbitrageurs to create more of them. These securities might be mutual funds, new share issues, penny oil stocks, or junk bonds: anything that is overpriced at the moment. It also pays to carve up corporate cash flows in ways that make the securities with claims to these flows most attractive to investors. After all, the Modigliani-Miller theorem does not apply in a world where sentiment affects security prices and noise traders themselves do not see through the corporate veil. In such a world, securities that would otherwise be fundamentally perfect substitutes no longer are, and therefore arbitrage that undoes changes in corporate leverage is no longer riskless. Just as entrepreneurs spend resources to build casinos to take advantage of gamblers, arbitrageurs build investment banks and brokerage firms to predict and feed noise trader demand.

When they bet against noise traders, arbitrageurs begin to look like noise traders themselves. They pick stocks instead of diversifying, because that is what betting against noise traders requires. They time the market to take advantage of noise trader mood swings. If these swings are temporary, arbitrageurs who cannot predict noise trader moves simply follow contrarian strategies. It becomes hard to tell the noise traders from the arbitrageurs.

But saying that a market affected by investor sentiment looks realistic is hardly a rigorous test. To pursue this line of thought, we must derive and test implications that are not obvious and perhaps that are new. We consider first the implications of unpredictability or randomness of changes in investor sentiment. Second, we look at implications of strategies followed by investors who buy when prices rise and sell when prices fall, possibly because their expectations are simple extrapolations.

Implications of Unpredictability of Investor Sentiment

Even without taking a position on how investor sentiment moves, we can learn something from the observation that it moves in part unpredictably. Even if arbitrageurs know that noise traders are pessimistic today and hence will on average become less pessimistic in the future, they cannot be sure when this will happen. There

is always a chance that noise traders become even more pessimistic first. This unpredictability contributes to resale price risk, since the resale price of an asset depends on the state of noise trader sentiment. If investor sentiment affects a broad range of assets in the same way, this risk from its unpredictability becomes systematic. Systematic risk has a price in equilibrium. Consequently, assets subject to whims of investor sentiment should yield higher average returns than similar assets not subject to such whims. Put differently, assets subject to unpredictable swings in investor sentiment must be underpriced in the market relative to their fundamental values.

De Long, Shleifer, Summers and Waldmann (1990a) describe two applications of this argument. First, stocks are probably subject to larger fluctuations of investor sentiment than bonds. In this case, equilibrium returns on stocks must be higher than warranted by their fundamentals—the latter being given by dividends and by covariation of dividends with consumption. In particular, the difference between average returns on stocks and on bonds—the risk premium—must be higher than is warranted by fundamentals. Such excess returns on stocks are in fact observed in the U.S. economy, and are known as the Mehra-Prescott (1985) puzzle. We can even reverse the argument to say that the high average risk premium is evidence of unpredictability of investor sentiment about stocks.

The second application we examined involves the pricing of closed-end mutual funds. These funds, like open-end funds, hold portfolios of other securities, but unlike open-end funds, have a fixed number of shares outstanding. As a result, an investor who wants to liquidate his holdings of a closed-end fund must sell his shares to other investors; he cannot just redeem his shares as with an open-end fund. Closed-end funds present one of the most interesting puzzles in finance, because their fundamental value—the value of the assets in their portfolios—is observed, and tends to be systematically higher than the price at which these funds trade. The pervasiveness of discounts on closed-end funds is a problem for the efficient markets hypothesis: in the one case where value is observed, it is not equal to the price.

De Long, Shleifer, Summers and Waldmann argue that investor sentiment about closed-end funds changes, and that this sentiment also affects other securities. When investors are bullish about closed-end funds, they drive up their prices relative to fundamental values, and discounts narrow or turn into premiums. When investors in contrast are bearish about closed-end funds, they drive down their prices and discounts widen. Any investor holding a closed-end fund bears two kinds of risk. The first is the risk from holding the fund's portfolio. The second is the resale price risk: at the time the investor needs to sell the fund the discount might widen. If investor sentiment about closed-end funds affects many other securities as well, bearing the resale price risk should be rewarded. That is, closed-end funds should on average sell at a discount. Put differently, the reason there are discounts *on average* is that discounts fluctuate, and investors require an extra return for bearing the risk of fluctuating discounts.

This theory explains why arbitrage does not effectively eliminate discounts on closed-end funds. An arbitrageur who buys a discounted fund and sells short its portfolio runs the risk that at the time he liquidates his position the discount widens

and so his arbitrage results in a loss. An arbitrageur with an infinite horizon need not worry about this risk. But if the arbitrageur faces some probability of needing to liquidate his position in finite time, the risk from unpredictability of investor sentiment at the time he liquidates prevents him from aggressive betting that would eliminate discounts.

This theory of closed-end funds has a number of new empirical implications, investigated by Lee, Shleifer and Thaler (1989). First, it predicts that discounts on different closed-end funds fluctuate together, since they reflect changes in investor sentiment. This prediction is confirmed. Second, the theory predicts that new funds get started when investors are optimistic about funds, which is when old funds sell at a small discount or a premium. It is indeed the case that discounts on seasoned funds are much narrower in years when more new funds start. Perhaps most interestingly, the theory predicts that discounts on closed-end funds reflect the investor sentiment factor that also affects prices of other securities, which may have nothing to do with closed-end funds. Consistent with this prediction, Lee, Shleifer and Thaler find that when discounts on closed-end funds narrow, small stock portfolios tend to do well. This suggests that discounts on closed-end funds reflect an individual investor sentiment that also affects returns on small stocks held largely by individuals. These findings bear on previously untested implications of the investor sentiment approach, and so dispel the notion that this approach puts no restrictions on the data.

Implications of Positive Feedback Trading

One of the strongest investor tendencies documented in both experimental and survey evidence is the tendency to extrapolate or to chase the trend. Trend chasers buy stocks after they rise and sell stocks after they fall: they follow positive feedback strategies. Other strategies that depend on extrapolative expectations are "stop loss" orders, which prescribe selling after a certain level of losses, regardless of future prospects, and portfolio insurance, which involves buying more stocks (to raise exposure to risk) when prices rise and selling stocks (to cut exposure to risk) when prices fall.

When some investors follow positive feedback strategies—buy when prices rise and sell when prices fall—it need no longer be optimal for arbitrageurs to counter shifts in the demand of these investors. Instead, it may pay arbitrageurs to jump on the bandwagon themselves. Arbitrageurs then optimally buy the stocks that positive feedback investors get interested in when their prices rise. When price increases feed the buying of other investors, arbitrageurs sell out near the top and take their profits. The effect of arbitrage is to stimulate the interest of other investors and so to contribute to the movement of prices away from fundamentals. Although eventually arbitrageurs sell out and help prices return to fundamentals, in the short run they feed the bubble rather than help it to dissolve (De Long, Shleifer, Summers and Waldmann, 1990b).

Some speculators indeed believe that jumping on the bandwagon with the noise traders is the way to beat them. George Soros, the successful investor and author of *Alchemy of Finance* (1987), describes his strategy during the conglomerate boom in the

1960s and the Real Estate Investment Trust boom in the 1970s precisely in these terms. The key to success, says Soros, was not to counter the irrational wave of enthusiasm about conglomerates, but rather to ride this wave for awhile and sell out much later. Rational buying by speculators of already overvalued conglomerate stocks brought further buying by the noise traders, and enabled the speculators to make more money selling out at the top. Soros is not alone in trading this way; John Train (1987), in his book on successful U.S. investors, calls the strategy of one of his protagonists "Pumping Up the Tulips."

Trading between rational arbitrageurs and positive feedback traders gives rise to bubble-like price patterns. Positive feedback trading reinforced by arbitrageurs' jumping on the bandwagon leads to a positive autocorrelation of returns at short horizons. Eventual return of prices to fundamentals, accelerated as well by arbitrage, entails a negative autocorrelation of returns at longer horizons. Since news results in price changes that are reinforced by positive feedback trading, stock prices overreact to news.

These predictions have been documented in a number of empirical studies. Cutler, Poterba and Summers (1989b) find evidence of a positive correlation of returns at horizons of a few weeks or months and a negative one at horizons of a few years for several stock, bond, foreign exchange, and gold markets. They report the average first order monthly serial correlation of more than .07 for 13 stock markets, and positive in every case. Evidence on overreaction of stock prices to changes in fundamentals is presented for individual securities by DeBondt and Thaler (1985, 1987) and Lehmann (1990), and for the aggregate stock market by Campbell and Kyle (1988). The last paper, for example, decomposes stock returns into the fundamental and noise components and finds that the two are strongly positively correlated, meaning that prices overreact to news.

The finding of a positive serial correlation at short horizons implies that a substantial number of positive feedback traders must be present in the market, and that arbitrage does not eliminate the effects of their trades on prices.

The presence of positive feedback traders in financial markets also makes it easier to interpret historical episodes, such as the sharp market increase and the crash of 1987. According to standard finance, the market crash of October 1987 reflected either a large increase in risk premiums because the economy became a lot riskier, or a large decrease in expected future growth rate of dividends. These theories have the obvious problem that they do not explain what news prompted a 22 percent devaluation of the American corporate sector on October 19. Another problem is that there is no evidence that risk increased tremendously—volatility indeed jumped up but came back rapidly as it usually does—or that expected dividend growth has been revised sharply down. An examination of OECD long-term forecasts shows no downward revision in forecasts of long run growth rates after the crash, even though the crash itself could have adversely affected expectations. Perhaps most strikingly, Seyhun (1989) finds that corporate insiders bought stocks in record numbers during and after the crash, and moreover bought more of the stocks that later had a greater rebound. Insiders did not share the view that growth of dividends will slow or that risk

will increase and *they were right*! Fully rational theories have a clear problem with the crash.

The crash is much easier to understand in a market with significant positive feedback trading. Positive feedback trading can rationalize the dramatic price increase during 1987, as more and more investors chase the trend. Positive feedback trading, exacerbated by possible front-running by investment banks, can also explain the depth of the crash once it has started. One still needs a theory of what broke the market on October 19, but the bad news during the previous week might have initiated the process, albeit with some lag. A full theory of the crash remains to be developed: prospects for such a theory look a lot brighter, however, if it incorporates positive feedback trading.

Conclusion

This paper has described an alternative to the efficient markets paradigm that stresses the roles of investor sentiment and limited arbitrage in determining asset prices. We have shown that the assumption of limited arbitrage is more general and plausible as a description of markets for risky assets than the assumption of perfect arbitrage which market efficiency relies on. With limited arbitrage, movements in investor sentiment are an important determinant of prices. We have also shown that this approach yields a large number of implications about the behavior of both investors and speculative prices which are consistent with the evidence. Perhaps most importantly, we have shown that this approach yields some new testable implications about security returns. Some of these implications, such as the ones on closed-end funds, have been tested and confirmed. It is thus not the case that the investor sentiment approach deprives finance of the discipline to which it is accustomed.

Assuming that our approach has some explanatory power and therefore intellectual merit, what are its implications for welfare and for policy? There are two normative issues relevant to the evaluation of noise trading. First, should something be done to prevent noise traders from suffering from their errors? Second, do noise traders impose a cost on the rest of market participants and, if so, how can this cost be reduced? Although answers to these questions ultimately turn on open empirical problems, both theory and empirical work permit some tentative remarks.

Investors who trade on noise or on popular models are worse off than they would be if their expectations were rational (if welfare is computed with respect to the correct distribution of returns). They need not lose money on average, as the simplest logic might suggest. But even if they earn higher average returns, it is because they bear more risk than they think. And even if they get rich over time, it is only because they underestimate the risk and get lucky. If investors had perfect foresight and rationality, they would know that noise trading always hurts them.

Whether the government should do anything to save noise traders from themselves depends on the social welfare function. People are allowed to participate in state lotteries, to lose fortunes in casinos, or to bet on the racetrack even though benevolent

observers know that they are being taken to the cleaners. The case for making it costly for investors to bet on the stock market to protect them from their own utility losses is in principle identical to the case for prohibiting casinos, horse races, and state lotteries.

Noise trading, however, can also affect the welfare of the rest of the community. One effect is to benefit arbitrageurs who take advantage of noise traders. These benefits accrue both to those who bet against noise traders and those who feed their demand by providing financial services. Interestingly, the combined receipts of the NYSE member firms amounted to a sixth of the total U.S. corporate income in 1987 (Summers and Summers, 1989). Of course, some of these benefits to arbitrageurs are also a social *opportunity* cost as valuable human and other resources are allocated to separating noise traders from their money.

But noise trading also has a private cost, as it makes returns on assets more risky, and so can reduce physical investment. The overall impact of noise trading on the rest of the market participants and society can be negative (De Long, Shleifer, Summers and Waldmann, 1989). Some have also argued that noise trading in foreign exchange markets distorts the flow of goods between countries and leads to inefficient choice of production. Others have argued that noise trading forces managers to focus on the short term, and to bias the choice of investments against long-term projects. The policy reaction to noise trading can be dangerous as well; for example, sharp contractions of money supply by the Federal Reserve have often been justified as responses to excessive speculation. In this case, the consequences of such policies are more costly than the speculation itself.

Awareness of these costs of noise trading raises the question of what (if anything) should be done about it. Some businessmen and economists have proposed short term capital gains taxes as a way to cripple noise trading, while others, including Summers and Summers (1989) have advocated transaction taxes to the same end. It is not our goal in this paper to evaluate these proposals. We note, however, that one benefit of the research on markets where investor sentiment matters is to allow a more systematic evaluation of these proposals.

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