

SHORT SALE CONSTRAINTS AND OVERPRICING

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Short sale constraints can allow stocks to be overpriced. Constraints include various costs and risks of shorting as well as legal and institutional restrictions. If these impediments prevent investors from shorting certain stocks, these stocks can be overpriced and thus have low future returns until the overpricing is corrected. By identifying stocks with particularly high short sale constraints, one can identify stocks with particularly low future returns.

Consider a stock whose fundamental value is \$100 (i.e., \$100 would be the share price in a frictionless world). If it costs \$1 to short the stock, then arbitrageurs cannot prevent the stock from rising to \$101. If the \$1 is a holding cost that must be paid every day that the short position is held, then selling the stock short becomes a gamble that the stock falls by at least \$1 a day. In such a market, a stock could be very overpriced, yet if there is no way for arbitrageurs to earn excess returns, the market is still in some sense efficient. Fama (1991) describes an efficient market as one in which “deviations from the extreme version of the efficiency hypothesis are within information and trading costs.”¹ If frictions are large, “efficient” prices may be far from frictionless prices.

In this chapter, I discuss evidence that supports the overpricing hypothesis. I start by briefly reviewing the various constraints that impede short selling. Since other chapters cover the mechanics of short selling and securities lending in more detail, I focus on some non-standard constraints, including the political and legal harassment of short sellers through the ages. I then discuss the predictions of the overpricing hypothesis, reviewing the literature and the various variables that one might be able to use to identify short sale constraints and overpricing. Then I review three striking cases where extremely high short sale constraints lead to extremely high overpricing and thus extremely low subsequent returns. These three cases are: short selling in the 1920s and 1930s; fights between short sellers and the companies they short;

and Palm/3Com in the year 2000. I conclude with a discussion of the tech stock mania of 1998-2000, and whether the entire market (and especially tech stocks) were identifiably overpriced.

SHORT SALE CONSTRAINTS

Mechanical impediments to shorting

To be able to sell a stock short, one must borrow it, and because borrowing shares is not done in a centralized market, finding shares can sometimes be difficult or impossible. In order to borrow shares, an investor needs to find an institution or individual willing to lend shares. Financial institutions, such as mutual funds, trusts, or asset managers, typically do much of this lending. These lenders receive a fee in the form of interest payments generated by the short-sale proceeds, minus any interest rebate that the lenders return to the borrowers.

This rebate acts as a price that equilibrates supply and demand in the securities lending market. In extreme cases, the rebate can be negative, meaning investors who sell short have to make a daily payment to the lender for the right to borrow the stock (instead of receiving a daily payment from the lender as interest payments on the short sale proceeds). This rebate apparently only partially equilibrates supply and demand, because the securities lending market is not a centralized market with a market-clearing price. Instead, rebates reflect individual deals struck among security owners and those wishing to short, and these actors must find each other. This search may be costly and time-consuming

The securities lending business can be dysfunctional at times. In some respects, it is actually harder to borrow stock today than it was in 1928 (I will discuss details later). The good news is that it appears to be getting somewhat better in the past decade, and there have been some recent attempts towards creating a more centralized market. For the time being, the

lending market does not work perfectly. Being simply unable to short is particularly likely for individual retail investors, although there is extensive anecdotal evidence of institutional investors unable to short no matter how much they are willing to pay for the ability to borrow shares. “Getting the borrow” (that is, obtaining the stock loan) can be difficult, since the securities lending market is some combination of a bureaucracy and a market. Favored customers stand a better chance of getting the borrow. There have been reports of short sellers exchanging drugs and sex in order to get the borrow (I do not recommend this procedure).² This is good clue that prices are not fully equilibrating this market.

Once a short seller has initiated a position by borrowing stock, the borrowed stock may be recalled at any time by the lender. If the short seller is unable to find another lender, he is forced to close his position. This possibility leads to recall risk, one of many risks that short sellers face.

There are several reasons that a shareholder might refuse to lend stock, or might withdraw his shares from the stock lending market. First, if the lender sells his stock, he must recall his stock loan so that he can deliver his shares to the buyer. Second, shareholders may refuse to lend their stock because they fear that by helping short sellers, they will be helping drive stock prices down (I discuss these cases later). Third, for individual investors, brokers typically only have the ability to lend out of margin accounts, not cash accounts. Fourth, some institutions do not have stock lending programs at all, perhaps because they feel their holdings are too small and the income generated by lending would not be enough to compensate for the fixed cost of setting up a lending program.

Generally, it is easy and cheap to borrow most large cap stocks, but it can be difficult to borrow stocks which are small, have low institutional ownership, or which are in high demand

for borrowing. A somewhat paradoxical description of the stock lending market is that it usually works very well, except when you want to use it, in which case it works terribly. By this I mean that it can be difficult or expensive to short stocks that many people believe are overpriced and many people want to short. Of course, this point is the essence of the overpricing hypothesis: stocks are only overpriced when informed investors are unable or unwilling to short them. No one would want to short them if they weren't overpriced, and they wouldn't be overpriced if they weren't hard to short.

Other Short Sale Constraints

In addition to the problems in the stock lending market, there are a variety of other short sale constraints. US equity markets are not set up to make shorting easy. Regulations and procedures administered by the SEC, the Federal Reserve, the various stock exchanges, underwriters, and individual brokerage firms can mechanically impede short selling. Legal and institutional constraints inhibit or prevent investors from selling short (most mutual funds are long only). We have many institutions set up to encourage individuals to buy stocks, but few institutions set up to encourage them to short. The growth of hedge funds is a welcome correction to this imbalance.

In addition to regulations, short sellers also face hostility from society at large. Policy makers and the general public seem to have an instinctive reaction that short selling is morally wrong. Short selling is characterized as inhuman, unAmerican, and against God (Proverbs 24:17: "Do not rejoice when your enemy falls, and do not let your heart be glad when he stumbles."). Hostility is not limited to America. In Malaysia in 1995, the Finance Ministry proposed mandatory caning as the punishment for short sellers. Governments often restrict short selling in an attempt to maintain high security prices. Meeker (1932) reviews the attempts by a

colorful cast of characters (from Napoleon to the New York state legislature) to ban short selling.³

Short sellers face periodic waves of harassment from governments and society, usually in times of crisis or following major price declines as short sellers are blamed. Short sellers are often thought to be in league with America's enemies. The general idea seems to be that short selling is bad, and when bad things happen (such as war) it probably involves short sellers in some way. For example, the New York Stock Exchange imposed special short selling regulations during World War I (in November 1917), in response to both a substantial market decline and a fear that the Kaiser would send enemy agents to drive down stock prices.

Jones and Lamont (2002) discuss the crackdown on short selling after 1929. Short sellers were extremely unpopular in 1930, and many politicians, journalists, and investors blamed them for the stock market crash.⁴ Press accounts in October 1930 contain reports that officials of the NYSE were quietly discouraging stock lending and that the lenders themselves (such as investment trusts) wanted to discourage short selling. President Herbert Hoover met with Richard Whitney, president of the NYSE, to discuss the situation. The FBI's J. Edgar Hoover was quoted as saying he would investigate the conspiracy to keep stock prices low. Numerous anti-shortening regulations stem from this period, such as the uptick rule and the Investment Company Act of 1940 which placed severe restrictions on the ability of mutual funds to short. Political and legal anti-shortening pressure, which arises periodically after major market declines, seem essential to understanding why we have so few institutions developed to allow shorting.

The events following September 11, 2001, are consistent with this pattern. Following a major terrorist attack on the US, the SEC and various other regulatory bodies investigated the claim that terrorists had shorted stocks or had bought puts, armed with foreknowledge of the

attacks. This investigation turned up no evidence of terrorist shorting. As far as I know, there is no evidence that Osama Bin Laden, the Kaiser, Stalin, or any other major villain ever shorted stock. Enemies of freedom (for example, Napoleon) are more interested in suppressing short selling along with other forms of free expression.

More generally, the decline in equity prices in the early 2000's led governments to limit short selling. Press reports indicate that authorities in Britain and Japan have sought to discourage shorting and securities lending. A major lender of European stocks announced it was ceasing securities lending and urged others to do the same.

In addition to hostility from governments, short sellers also face hostility from the firms they short. Managers of firms don't like people who short sell their stock, especially if the short sellers are accusing the firms of fraud and even more especially when the fraud accusations are true. Consequently, sometimes companies fight with their short sellers (I detail these actions later).

In extreme cases, short sale constraints can include violence and intimidation. There are various reports of short sellers receiving death threats, requiring bodyguards, and arming themselves. In at least one case, someone may have been killed because of short selling. The case involves the Tel-Com Wireless Cable TV, whose official spokesperson was Ivana Trump. On 12/14/1998, Barron's reported that "several terrified investors told Barron's and the police that their families had been threatened by convicted criminals who accused the investors of selling short". A year later, 11/01/1999, Barron's reported that one of the threatened individuals had been found murdered, execution-style, in Colts Neck, New Jersey.

THE OVERPRICING HYPOTHESIS

Short sale constraints can prevent negative information or opinions from being expressed in stock prices, as in Miller (1977).⁵ Although constraints are necessary in order for mispricing to occur, they are not sufficient. Constraints can explain why a rational investor fails to short the overpriced security, but not why anyone buys the overpriced security. To explain that, one needs investors who are willing to buy overpriced stocks. Thus two things, trading costs and some investors with downward sloping demand curves, are necessary for substantial mispricing. This willingness to hold overpriced stocks can be interpreted either as reflecting irrational optimism by some investors, or rational speculative behavior reflecting differences of opinion.

A rational story: Harrison and Kreps (1978)

Harrison and Kreps (1978) construct a model with rational investors where differences of opinion, together with short sale constraints, create a “speculative premium” in which stock prices are higher than even the most optimistic investor’s assessment of their value.⁶ Short sale constraints generate a pattern of overpriced stock leading to subsequent low returns.

Here I give an example that illustrates Harrison and Kreps (1978). In the model of Miller (1977) short sale constraints cause stock prices to reflect only the views of the optimists. The Harrison and Kreps (1978) story goes beyond Miller (1977) to say that the stock can be priced even higher than the most optimistic assessment of its true value. In their model, everybody agrees that stocks are overpriced but are still willing to hold stocks.

Suppose investor A and investor B have different beliefs about the prospects for the level of NASDAQ. Each one knows what the other one believes, but they agree to disagree, so there is no asymmetric information. Assume a simple set up with three dates, date 0, 1, and 2, and for simplicity assume risk neutral agents behaving competitively, a discount rate of zero, and there

are sufficient numbers of type A and type B investors for each type to hold all of NASDAQ by themselves. Suppose it is currently date 0 and both A and B believe that NASDAQ is worth 2000 today. Specifically, they both believe that at date 2 it will be worth 3000 with 50% probability and 1000 with 50% probability. However, A thinks that at date 1 some news will arrive that will resolve all uncertainty, while B thinks there will be no relevant news released until date 2. This belief about when news gets released is the only disagreement between A and B (it is not necessary to state who, if either, is right in their beliefs). The Harrison and Kreps (1978) model has the remarkable property that in the presence of short sale constraints, both A and B would be willing to hold NASDAQ at 2500 at date 0, despite the fact they both think it is only worth 2000.

To get to this result, work backward from date 1, using the principle that with short sale constraints the optimist always sets the price. At date 1, if good news has arrived then A will value NASDAQ at 3000 while B still thinks it is worth 2000, thus the price will be 3000, A will hold all the asset, B will hold none of it. If bad news arrives at date 1, the price will be 2000 and B will hold all of it. Since these two states happen with 50-50 probability, the date 0 expected price for date 1 is 2500. Thus at date 0, both A and B are willing to hold NASDAQ at a price of 2500. Although everyone thinks it is overvalued at date 0, they are willing to buy at date 0 because they believe they are following a dynamic trading strategy that will take advantage of the other guy. This example formalizes the notion of the “greater fool” theory of asset pricing. Note that in this example, everyone agrees that long-term expected returns between date 0 and date 2 are low (as the value is expected to fall from 2500 to 2000), and thus a buy and hold strategy is a bad idea.

There are several ways to describe this result. First, you could say that the reason

NASDAQ trades at 500 above fundamental value at date 0 is that both A and B think there is a 50% chance they will be able to sell it at date 1 for 1000 more than it is worth. Equivalently, you could say that there is a valuable resale option that is bundled in with the security. Short sale constraints are crucial for this story. If traders were allowed to short at date 1, the price would no longer be set only by the optimist, so that there is no longer a 50% chance that one can sell the asset for 1,000 more than it is worth.

Several predictions emerge from the Harrison and Kreps (1978) story. First, if you took an opinion survey at date 0, both A and B would say NASDAQ was overvalued relative to date 2 but fairly valued relative to date 1. Both would say it is overvalued but not likely to fall in the near term. Second, volume is a key part of the story. Since everyone is following a dynamic trading strategy, you see lots of trading at date 1 as traders try to take advantage of one another. Without volume, there would be no overpricing. Volume indicates differences of opinion (more precisely, volume indicates changes in differences of opinion, as some switch from being the optimist to being the pessimist).

Third, securities that are less liquid will be less overpriced, and you might see apparent mispricings between seemingly identical securities. Suppose you introduced a derivative security (say, a bundle of puts and calls) that trades at date 0, doesn't trade at date 1, and gives exactly the same payoff at date 2 as NASDAQ. This security will be priced at 2000 at date 0. Thus there will appear to be a violation of the law of one price – assets having identical payoffs should have identical prices, but they do not. The derivative security is cheaper because it is less liquid, although this effect is not a “liquidity premium” in the traditional sense. Rather, it reflects the fact that you cannot follow a dynamic trading strategy with the derivative security, and so cannot try to exploit the other traders who disagree with you.

An irrational story: Overconfidence

In the Harrison and Kreps (1978) story, investors agree to disagree. Is this rational? There is a large literature in economics, starting with Aumann (1976), debating this point.⁷ Under some circumstances, it can never be rational for investors to agree to disagree: even if they have different information, they must reach a consensus if they are rational. This consensus reflects the fact that I know that other people have information that I do not have. Thus if they disagree with me, I infer that they have information that contradicts my information. So the mere fact that we observe strong disagreement (and resulting trade) between investors suggests that someone is not behaving rationally.

One form of irrationality that generates disagreement is overconfidence. There is ample evidence from the cognitive psychology literature that individuals overestimate their own abilities and tend to think they are above average. Thus overconfident traders are perfectly willing to disagree with other investors (since they think they are smarter than their trading partners), and to buy stock that others believe is overpriced. So this is one motivation for the Harrison and Kreps story.

More generally, moving beyond the specific dynamic story of Harrison and Kreps, irrational traders might make other errors that can lead to overpricing in the presence of short sale constraints. They might get overexcited about certain stocks that have an interesting and dramatic story, or be beguiled by optimistic projections made by the issuers of the stock. Generally, short sellers like to target “fads, frauds, and failures.” If irrational investors are swept up in fads, bamboozled by frauds, or ignoring the possibility of failure, then they will buy overpriced stock.

Evidence

A variety of empirical evidence confirms the prediction that binding short sale constraints lead to low returns, although much of the evidence is circumstantial because it is hard to observe the level of short sale constraints for different stocks. Looking across stocks, the prediction is that when constraints bind more tightly, subsequent returns will be lower. One can test this hypothesis either by finding stocks with higher constraints (if constraints vary across stocks), or finding stocks with higher unexpressed shorting demand (if the demand for shorting varies across stocks). The basic idea of looking at shorting demand is that some investors want to short a stock but are impeded by constraints, thus the stock is overpriced. If one can estimate the size of this group of investors, one can measure the extent of overpricing. In practice, measures of shorting constraints and shorting demand tend to be highly correlated since both are reflecting the same mechanism that constraints prevent informed investors from immediately correcting overpricing.

One measure of shorting demand is short interest, that is, the level of shares sold short. Unfortunately, using short interest as a proxy for shorting demand is problematic, because the quantity of shorting represents the intersection of supply and demand. Demand for shorting should respond to both the cost and benefit of shorting the stock, so that stocks that are very costly to short will have low short interest. Stocks that are impossible to short have an infinite shorting cost, yet the level of short interest is zero. Thus it could be possible that short interest is negatively correlated with overpricing (we will see this issue arise below in the 3Com/Palm case). The problematic nature of short interest leads to weak empirical results.

An alternative measure of shorting demand is breadth of ownership. If short-sale constraints prevent investors from shorting overpriced securities, then all they can do is avoid owning overpriced stocks. With dispersed private information or differences of opinion,

overpriced stocks will tend to be owned by a few optimistic owners. Chen, Hong, and Stein (2001) find evidence in favor of this hypothesis.⁸

Overpricing is most likely when investor disagree most. Diether, Malloy, and Scherbina, (2001) examine one measure of disagreement, dispersion in analyst forecast about future profits.⁹ They find the stocks with high analyst disagreement have low subsequent returns, consistent with the overpricing hypothesis.

COSTS OF SHORTING

Jones and Lamont (2002) study a direct measure of shorting costs, coming from the securities lending market. Stocks that are expensive to short, as reflected in the rebate rate, should have low subsequent returns. It is difficult to test this hypothesis, however, because data on rebate rates is difficult to find. To test for overpricing, ideally one needs many years of data. Recently, several financial economists have begun collecting this data from proprietary sources, but so far only a few years of data have been collected.

Fortunately, there is a historical source that is publicly available. Jones and Lamont (2002) introduces a unique data set that details shorting costs for New York Stock Exchange (NYSE) stocks from 1926 to 1933. In this period, the cost of shorting certain NYSE stocks was set in the “loan crowd,” a centralized stock loan market on the floor of the NYSE. A list of loan crowd stocks and their associated loaning rates was printed daily in the *Wall Street Journal* (WSJ).

From this public record, we collected eight years of data on an average of 90 actively traded stocks per month, by far the most extensive panel data set on the cost of shorting ever assembled. There is substantial variation in the cost of shorting, both in the cross-section and

over time for individual stocks. Furthermore, new stocks periodically appear in the loan crowd, and we are able to track the behavior of these stocks both before and after they first appear on the list. Stocks appear on the list of loan crowd stock when shorting demand cannot be met by normal channels, and when stocks begin trading in the centralized borrowing market, they usually have high shorting costs. Thus the list conveys important information about shorting demand.

It is important to emphasize that these stocks are generally extreme cases representing only a small part of the universe of stocks. They are the stocks everyone wants to short. In our sample, a few of the stocks were astronomically expensive to borrow, with negative rebates and shorting costs of more than 50% per year. Modern equivalents would be highly controversial, highly priced, difficult-to-short stocks such as (in recent years) Krispy Kreme, Prepaid Legal, or Palm. These modern examples also had very negative rebates and shorting costs of up to 79% a year. D'Avolio (2002) reports that in modern data, just a handful of stocks have extreme negative rebates.¹⁰

Rebate rates reflect supply and demand of shares to lend. Stocks go on special when shorting demand is large relative to the supply of shares available for lending. Thus, specific stocks can be costly to short either because there is a large demand or a small supply. No matter what the reason for the high shorting costs, however, the consequences of the costs are clear. Stocks that are expensive to short can be overpriced since it is expensive to correct the overpricing. Thus, we do not need to identify the reason for the low rebate rate in order to test whether it results in overpricing.

Exhibit X.1 shows the time pattern of market-book ratios for stocks entering the list. The figure shows the change in a stock's market-book compared to when that stock is not on the loan

list. Quarter zero is the quarter that the stock first appears on the list. Looking at the figure, the time pattern of market-book is exactly what is predicted by the overpricing hypothesis. In the period prior to entering the loan rate list, market-book ratios rise, peaking at 30% above average in the quarter just before appearance on the loan list. After appearing on the loan list, market-book ratios fall, going down to just 5% above average three quarters later. This pattern suggests that stocks become overpriced over the course of several months, they are identified as overpriced by short sellers, and the demand for short-selling rises. Stocks appear on the loan list due to this demand, and subsequently fall as the mispricing is corrected.

Looking directly at the stock returns subsequent to appearing on the list, Jones and Lamont (2002) find that stocks that are expensive to short or which enter the loan list have low subsequent returns, consistent with the hypothesis that they are overpriced. Stocks that newly enter the borrowing market exhibit especially substantial overpricing. By itself, this return predictability is important because it shows that transactions costs keep arbitrageurs from forcing down the prices of overvalued stocks. However, we also find that loan crowd entrants underperform by more than the costs of shorting, so it appears that shorting these stocks is a profitable strategy even after paying the associated costs. Thus not only are these stocks overpriced, they are more overpriced than can be explained by measured shorting costs alone. It must be that unwillingness to short (perhaps due to some other unobserved shorting cost) is partially responsible for the low returns on stocks entering the loan crowd for the first time.

Put another way, a rational investor would not be willing to buy these stocks since they would not generate sufficiently high income from lending the stock out. Even if the magnitude of the returns was quantitatively equal to the shorting costs, in equilibrium all shares must be held by some investor who is not lending them out. Thus some investors were voluntarily

buying stocks with extremely low subsequent returns, despite the fact that the high shorting costs were publicly observable in the WSJ, and high shorting demand might be inferred by the first appearance of these stocks in the WSJ's list. Why these investors were willing to buy these overpriced stocks is a mystery.

The magnitude of the effect is huge, reflecting the fact that this is a very special sample of extremely overpriced stocks that have extremely low returns. In the period 1926 to 1933, loan crowd entrants have (in the year following their first appearance) average returns that are 1% to 2% per month lower than other stocks of similar size. So over the next year they underperform by about 12-24% in total. While this effect might seem implausibly large, it has recently been reproduced with modern data. Ofek, Richardson, and Whitelaw (forthcoming) look at a sample of stocks with negative rebate rates (high shorting costs) 1999-2002, and find similar underperformance.¹¹ In addition, similarly huge effects are seen in the next two sections: companies fighting with short sellers, and tech stock carve outs.

GO DOWN FIGHTING

Yet another form of short sale constraints are those deliberately engineered to hurt the short sellers. Lamont (2002) studies these cases.¹² Firms (either management or shareholders) can take a variety of actions to impede short selling of their stock. Firms take legal and regulatory actions to hurt short sellers, such as accusing them of illegal activities, suing them, hiring private investigators to probe them, and requesting that the authorities investigate their activities. Firms take technical actions to make shorting the stock difficult, such as splits or distributions specifically designed to disrupt short selling. Management can coordinate with shareholders to withdraw shares from the stock lending market, thus preventing short selling by

causing loan recall. These battles between short sellers and firms can be extraordinarily acrimonious. The following statement from the sample used in Lamont (2002) gives a flavor of attitudes toward short sellers: "Your activities are mean, shameful and loathsome. They are motivated by appalling avarice and greed, and they will not be permitted to go unanswered."

An example of the various anti-shortening strategies used by firms is provided by Solv-Ex, a firm that claimed to have technology for economically extracting crude oil from tar-laden sand. Short sellers claimed that Solv-Ex was a fraud. On 2/5/96, the management of Solv-Ex faxed a letter to brokers and shareholders: "To help you control the value of your investment...we suggest that you request delivery of the Solv-Ex certificates from your broker as soon as possible." This suggestion was essentially an attempt at market manipulation. The letter was an attempt to orchestrate a short squeeze using the stock lending system. One might think that such an attempt to manipulate prices would be illegal, but it is not. Things that hurt short sellers tend to be legal, because short sellers are a despised minority.

Any shareholder heeding Solv-Ex's suggestion would have withdrawn his shares from the stock lending market, potentially forcing short sellers to cover their positions. On 2/2/96, before the letter, Solv-Ex's price was at \$24.875. By 2/21/96, the price had risen to \$35.375, perhaps due to Solv-Ex's attempted squeeze. Solv-Ex took other action against short sellers as well. Later in 1996, Solv-Ex said that it had hired private investigators to find out who was (supposedly) spreading misinformation about the firm, and subsequently it filed suit against a well-known short seller, claiming he had spread false information.

However, in this case it was Solv-Ex which was engaged in illegal activities, not the short sellers. Solv-Ex delisted at 7/1/97 at \$4.25, amid an SEC investigation of whether Solv-Ex had defrauded investors. It entered Chapter 11 bankruptcy in 1997, and in 2000 the court ruled that

the firm had indeed defrauded investors. In this case, the evidence is consistent with the idea that Solv-Ex was overpriced in February 1996, since it subsequently fell sharply.

Lamont (2002) looks at long-term returns for a large sample over 25 years of 270 similar firms who threaten, take action against, or accuse short sellers of illegal activity or false statements. The sample is constructed using publicly observable actions from news reports and firm press releases. It turns out that (as in the Solv-Ex case) sample firms have very low returns in the year subsequent to taking anti-shortening action. Abnormal returns are approximately -2 percent per month in the subsequent year, and continue to be negative in subsequent years. Thus the evidence is consistent with the idea that short sale constraints allow very substantial overpricing, and that this overpricing gets corrected only slowly over many months.

An alternate interpretation of the results are that anti-shortening actions are a signal that insiders know that the firm is overvalued, so that the low returns reflect inside information instead of short sale constraints. While it is certainly true that anti-shortening actions may reveal negative inside information, this story does not explain why it takes so long for the information to be reflected in stock prices. With no frictions, the information should be immediately incorporated. In contrast, short sale constraints provide an explanation for the slow reaction of prices to information. Since the effect persists for years, the low returns are not primarily a short-term under-reaction to bad news. Rather, the low returns reflect persistent overpricing.

What should an investor do if he sees a firm taking an anti-shortening action? The evidence cannot say whether it is a good idea to short this stock. Although one can make large gross returns on average if one is able to maintain a short position for months, maintaining the short position might be difficult or expensive. Even if there are no problems borrowing the stock, a short seller may need to spend time and money dealing with lawsuits and investigations. It is

unclear how these costs and benefits net out. It is clear, however, that it is a bad idea in general to own stock in a firm that is taking these actions. Investors seeking high returns should look elsewhere.

A notable feature of the data is that many of the sample firms are subsequently revealed to be fraudulent. The evidence on subsequent stock returns suggests that in public battles between short sellers and firms, short sellers usually are vindicated by subsequent events. The evidence suggests that short sellers play an important role in detecting not just overpricing, but also fraud.

3COM/PALM

A third example of clear overpricing comes from 3Com/Palm, studied in Lamont and Thaler (2003).¹³ In this case, the driving force is not fraud but rather overoptimistic investors. Again, having some investors overoptimistic is not a problem, as long as there are more rational investors who can correct their mistakes by short selling. But add overoptimistic investors and short sale constraints together, and the result is overpricing.

On March 2nd, 2000, 3Com (a profitable company selling computer network systems and services) sold a fraction of its stake in Palm (which makes hand-held computers) to the general public via an initial public offering (IPO) for Palm. In this transaction, called an equity carve-out, 3Com retained ownership of 95 percent of the shares. 3Com announced that, pending an expected IRS approval, it would eventually spin off its remaining shares of Palm to 3Com's shareholders before the end of the year. 3Com shareholders would receive about 1.5 shares of Palm for every share of 3Com that they owned.

This event put in play two ways in which an investor could buy Palm. The investor could

buy (say) 150 shares of Palm directly, or he could buy 100 shares of 3Com, thereby acquiring a claim to 150 shares of Palm plus a portion of 3Com's other assets. Since the price of 3Com's shares can never be less than zero (equity values are never negative), the price of 3Com should have been at least 1.5 times the price of Palm. Since 3Com held more than \$10 a share in cash and securities in addition to its other profitable business assets, one might expect 3Com's price to be well above 1.5 times the price of Palm.

The day before the Palm IPO, 3Com closed at \$104.13 per share. After the first day of trading, Palm closed at \$95.06 a share, implying that the price of 3Com should have jumped to at least \$145 (using the precise ratio of 1.525). Instead, 3Com fell to \$81.81. The "stub value" of 3Com (the implied value of 3Com's non-Palm assets and businesses) was minus \$63. In other words, the stock market was saying that the value of 3Com's non-Palm business was minus 22 billion dollars!

This example is puzzling because there is a clear exit strategy. This spin-off was expected to take place in less than a year, and a favorable IRS ruling was highly likely. Thus, in order to profit from the mispricing, an arbitrageur would need only to buy one share of 3Com, short 1.5 shares of Palm, and wait six months or so. In essence, the arbitrageur would be buying a security worth at worst zero for -\$63, and would not need to wait very long to realize the profits. Exhibit X.2 shows the actual time pattern of the stub value of 3Com. As can be seen, the stub returned to a more rational level after several months. If one had been able to costlessly short Palm and buy 3Com, one could have made very substantial returns. Lamont and Thaler (2003) find abnormal returns for 3Com/Palm and five other similar cases to be about ten percent per month.

This mispricing was not in an obscure corner of capital markets, but rather took place in a

widely publicized initial public offering that attracted frenzied attention. The nature of the mispricing was so simple that even the dimmest of market participants and financial journalists was able to grasp it. On the day after the issue, the mispricing was widely discussed, including in two articles in the *Wall Street Journal*, one in the *New York Times*, and it even made *USAToday*!

The Palm/3Com episode is not unique. Lamont and Thaler (2002) provide other examples during the 1998-2000 stock market bubble. These mispricings often involved technology and internet stocks, with the more exciting internet stock being overpriced and the more traditional stock underpriced. A somewhat older example comes from the 1920's. In 1923, a young man named Benjamin Graham, later to co-author a classic book on security analysis, was managing money. Graham noticed that although Du Pont owned a substantial number of GM shares, Du Pont's market capitalization was about the same as the value of its stake in GM. Du Pont had a stub value of about zero, despite the fact that Du Pont was one of America's leading industrial firms with other hugely valuable assets. Graham bought Du Pont, shorted GM, and profited when Du Pont subsequently rose.

Shorting Palm during this period was either difficult and expensive, or (for many investors) just impossible. Those who were able to borrow Palm paid a high price; D'Avolio (2002) reports maximum borrowing costs of 35 percent (in annual terms) for Palm in July 2000.

Exhibit X.3 shows data on short interest (expressed as a percent of total shares issued) and stub value (expressed in dollars per parent company stock price) for Palm (ignore the other line for now). The figures show that as the supply of shares available grows via short sales, the stub value gets more positive. One might interpret this pattern as roughly tracing out the demand curve for Palm. As the supply of shares grows via short sales, we move down the demand curve

of irrational investors and Palm's price falls relative to the parent.

At its peak, short interest in Palm was an amazing 147.6 percent of all shares issued. More than all the floating shares had been sold short. This is possible if shares are borrowed, then sold short to an investor who then permits the shares to be borrowed again. This multiplier-type process takes time to operate, due to frictions in the securities lending market. This peak level of short interest for Palm was reached on 7/14/00, two weeks before the announced distribution, at a time when the stub was positive but rising. Exhibit X.3 shows why short interest is at best a weak measure of shorting demand. Overpricing falls over time, while the level of short interest rises. Thus short interest can be negatively correlated with shorting demand and overpricing.

Outrageous options pricing

For pessimists, an alternative to shorting Palm would have been to buy puts (and write calls) on Palm. Exchange traded options were introduced about two weeks after the IPO. Would this have been a good way to profit from the overpricing? The answer requires a careful examination of option prices, specifically a relationship called put-call parity.

Put-call parity only holds exactly for European options with no transactions costs; with American options in the presence of transactions costs, put-call parity is a set of bounds on prices rather than an exact relationship. One can speak loosely of put-call parity holding for American options, meaning that the relationship between securities prices approximates the exact situation with European options. One way of expressing put-call parity for Palm is to say that synthetic shares of Palm (constructed using options and borrowing and lending) should have the same price as actual shares of Palm.

A weaker condition than put-call parity, which should always hold for non-dividend

paying American options, is the following inequality: $C - P > S - X$, where C is the price of a call, X is the strike price, P is the price of put, and S is the price of the underlying security. For options that are at-the-money (so that S is equal to X), this inequality says that call prices should be greater than put prices. Since Palm does not pay dividends, this inequality should hold for Palm options.

Most empirical studies of options prices have found that the inequality is almost always satisfied, with small violations due perhaps to transactions costs. Options on Palm proved to be a dramatic exception to this pattern. Exhibit 1 shows options prices for Palm for March 16th, on the first day that exchange options traded. Options on Palm display massive violations of put-call parity, and violate the weaker inequality as well. Instead of observing at-the-money call prices that are greater than put prices, we find puts were about twice as expensive as calls.

We also calculate the implied price of synthetic securities. For example, on March 17th one can create a synthetic short position in Palm by buying a November put (at the ask price), writing a November call (at the bid price), and borrowing dollars. Both the synthetic short and the actual short position, if held until November, give the same payoff of the negative of the price of Palm in November. These calculations are done using the assumption that one can borrow from March to November at the six month LIBOR rate. On March 16th the price of synthetic short was about \$39.12, far below the actual trading price of Palm of \$55.25. May and August options also showed substantial, though smaller violations of put-call parity.

The synthetic shorts at different horizons in Exhibit X.4 can be used to calculate the implied holding cost of borrowing Palm's shares. For an investor who is indifferent to shorting actual Palm shares from March until May, and creating a synthetic short, the holding costs must be 14 percent over two months or about 119 percent at an annual rate. For an investor planning

to short for 8 months, until November, the holding costs must be 29 percent or 147 percent at an annual rate. Thus the options prices suggest that shorting Palm was either incredibly expensive, or that there was a large excess demand for borrowing Palm shares, a demand that the market could not meet for some institutional reasons. Since the evidence from D'Avolio (2002) indicates a much lower 35 percent shorting cost for Palm during this period, it is clear that there must be other risks and costs associated with shorting Palm.

One can use the synthetic short price of Palm to create a synthetic stub value. On March 17, 2000, the actual stub value for Palm was -\$16.26 per share. The synthetic stub for Palm, constructed using the synthetic short price implied in six month at-the-money options, was positive at \$1.56. Although this value seems low (i.e., less than the cash 3Com held) it is at least positive and thus no longer so close to a pure arbitrage opportunity. Exhibit X.3 displays the time series of the actual stubs along with the synthetic stubs for the time period up to the distribution date (constructing synthetic stubs using options that are closest to six months and at-the-money). The solid line, the actual stub, goes from strongly negative at the beginning to positive \$10 a share. The dotted line, the synthetic stub, is positive in all but one week. By the distribution date, the difference between the two lines is close to zero, roughly consistent with put-call parity. The pattern shows that options prices adjust to virtually eliminate profitable trading opportunities. Put differently, the implied cost of shorting falls as the desirability of shorting falls.

Thus we have three ways of inferring Palm's true value: the embedded value reflected in 3Com's share price, the value reflected in options prices, and the actual price. The market for November options and the shareholders in 3Com seemed to agree: Palm was worth far less than its market price. The direction of the deviation from put call parity is consistent with the

difficulty of shorting Palm. To profit from the difference between the synthetic security and the underlying security, one would need to short Palm and buy the synthetic long. If shorting is costly, then the deviation can be interpreted as the cost of borrowing (shorting) Palm shares.

Again, although the prices here are consistent with very high shorting costs, one can turn the inequality around and ask why anyone would ever buy Palm (without lending it). On March 17th one can create a synthetic long Palm by buying a call and selling a put, and this synthetic long is 23 percent cheaper than buying an actual share of Palm and holding until November.

Arguments that the planned spin-off may not occur are irrelevant to the synthetic long constructed using options. Why are investors who buy Palm shares directly willing to pay much more than they could pay using the options market? One plausible explanation is that the type of investor buying Palm is ignorant about the options market and unaware of the cheaper alternative.

It is worth noting that the 3Com/Palm case is very unusual. In most cases, put call parity holds. Ofek, Richardson, and Whitelaw (forthcoming) study options prices during the tech stock mania period (a period where we would expect to find the most extreme cases of mispricing, such as 3Com/Palm). They find the average deviation between actual prices and synthetic prices to be very small. For a handful of firms, though, there are extreme violations. Confirming the 3Com/Pam results, for this handful of firms, Ofek, Richardson, and Whitelaw (forthcoming) find abnormal returns of about -2 percent per month, for the period 1999-2002.

The 3Com/Palm case reflect several elements of the Harrison and Kreps (1978) story. First, Lamont and Thaler (2003) find that volume on the overpriced subsidiaries (such as Palm) to be far higher than volume on the underpriced parents (such as 3Com). Volume is key part of the story. Second, the story predicts that otherwise identical securities which cannot be traded at

date 1 should have lower prices. Puts and calls are illiquid assets (especially compared to the highly traded Palm) with high bid/ask spreads. Thus, the difference between the price of Palm and the synthetic shares of Palm constructed from November options can be interpreted as a measure of the “speculative premium” of Harrison and Kreps (1978). Third, Palm was a young company with a short operating history, and great uncertainty about its future. Thus it is easier to disagree about the true value of Palm than about 3Com, a mature company with less uncertainty.

The case of 3Com and Palm, while special, is interesting because it is a situation in which it is particularly easy for the market to get things right. To price Palm correctly vs. 3Com requires investors to merely multiply by 1.5. If the market is flunking these no-brainers, what else is it getting wrong?

TECH STOCK MANIA AND SHORT SALE CONSTRAINTS

Can short sale constraints explain the amazing gyrations of stock prices in recent years? Prices seemed absurdly high in the period 1999-2000, especially for technology-related stocks. The Palm example shows that for some specific stocks, short sale constraints relating to mechanical problems in stock lending are surely the answer. More generally though, difficulty in borrowing stock cannot be the answer. Although Ofek and Richardson (2001) report that Internet stocks had higher average short interest and were more expensive to short than non-internet stocks in this period, the average difference in cost was only one percent per year.¹⁴ And one can always easily short NASDAQ or the S&P using futures or exchange traded funds.

So if short sale constraints do play a wider role, it is not because of the stock lending difficulties, but because of more generic short sale constraints. It must be that investors are

unwilling to establish short positions because of risk (such as fundamental risk or noise trader risk) or institutional constraints (such as the fact that mutual funds are mostly long only).

Perhaps many investors thought that Internet stocks were overpriced during the mania, but only a small minority were willing to take a short position, and these short sellers were not enough to drive prices down to rational valuations.

Looking now at the aggregate market instead of individual stocks, there is a variety of evidence that is consistent with the short sale constraints story. Many of the factors leading to differences of opinion and thus to overpricing were present in this period. Reading Miller (1977), it is hard not to be impressed with the eerie similarities between his descriptions and the events of 1998-2000. The first factor that creates differences of opinion is that the firm has a short track record, or has intangible prospects: “The divergence of opinion about a new issue are greatest when the stock is issued. Frequently the company has not started operations, or there is uncertainty about the success of new products or the profitability of a major business expansion.” (p.1156).

The second is that the company has high visibility, so that there are many optimists: “Some companies are naturally well known because their products are widely advertised and widely consumed...Of course, the awareness of a security may be increased if the issuing company receives much publicity. For instance, new products and technological breakthroughs are news so that companies producing such products receive more publicity.” (p.1165).

Tech stocks certainly fit both of these criteria. Stocks like Amazon or AOL were familiar to the investing classes who used them, but unlike other familiar products (such as Coca-Cola) had a short operating history, so that optimists could construct castles in the sky without fear of contradiction by fact. Vissing-Jorgensen (2004) reports survey data on internet use that seems to

fit in with this story.¹⁵ Investors who had actually used the internet thought internet stocks had higher expected returns than other stocks, and were more likely to include internet stocks in their portfolio.

Recall in the Harrison and Kreps model, overpricing is associated with high volume, high dispersion of opinion, and widespread agreement that the market is overpriced in the long run but is unlikely to decline in the short run. Each one of these predictions is born out in the data. First, volume on NASDAQ more than doubled between January 1999 and its peak in January 2001. Second, Vissing-Jorgensen (2004) finds that measures of investor disagreement with each other peaked in early 2000 around when stock prices peaked. Third, Exhibit X.5, from a continuing survey conducted by the Yale School of Management, shows that about 70% of those surveyed thought the market was overvalued in early 2000. Remarkably, Exhibit X.6 shows that simultaneously, 70% of those surveyed also thought market would continue to go up. If everyone agrees the market is overvalued, but expects it to continue to go up amid high volume – this is the essence of the greater fool theory, and in particular the Harrison and Kreps (1978) version.

Another fact explained by the overpricing hypothesis is the very high level of stock issuance that occurred 1998-2000. One interpretation is that issuers and underwriters knew that stocks were overpriced and so rushed to issue. Evidence arising out of subsequent legal action against underwriters (such as emails sent by investment bank employees) is certainly consistent with the hypothesis that the underwriters thought the market was putting too high a value on new issues. One way to think about issuance as a mechanism for overcoming short sale constraints. Both short selling and issuance have the effect of increasing the amount of stock that the optimists can buy; both are examples of supply increasing in response to high prices. Suppose

you think lamont.com is overpriced in 1999. One way to take advantage of this fact is to short the stock. In doing this, you are selling overpriced shares to optimists. This action is very risky, however, as lamont.com might well double in price. A safer alternative action is for you to start a new company that competes with lamont.com, call it lamont2.com, and issue stock. This IPO is another way to sell overpriced shares to optimists.

SUMMARY

The overpricing hypothesis says stocks can be overpriced when something constrains pessimists from shorting. In addition to short sale constraints, there also needs to be either irrational investors, or investors with differences of opinion. This chapter has shown a variety of evidence consistent with the overpricing hypothesis. First, I have discussed three studies of extreme overpricing leading to extremely low subsequent returns. Second, I have discussed some suggestive evidence that the tech stock mania period that peaked in March 2000 may also have been overpricing due to the reluctance of pessimists to go short.

Footnotes

¹ Eugene F. Fama, "Efficient Capital Markets: II," *Journal of Finance* (December 1991), pp. 1575-1617.

² Jon Friedman, "The Business Nobody Wants To Talk About," *Business Week* (09/25/1989), P. 196.

³ J. Edward Meeker, *Short Selling* (Harper & Brothers Publishers, New York, 1932).

⁴ Charles M. Jones and Owen A. Lamont, "Short Sale Constraints and Stock Returns," *Journal of Financial Economics* (November 2002), pp. 207-239.

⁵ Edward M. Miller, "Risk, uncertainty, and divergence of opinion", *Journal of Finance* (September 1977), pp. 1151-1168.

⁶ J. Michael Harrison and David M. Kreps, "Speculative investor behavior in a stock market with heterogeneous expectations," *Quarterly Journal of Economics* (May 1978), pp. 323-336.

⁷ Robert Aumann, "Agreeing to Disagree," *The Annals of Statistics* (November 1976), pp. 1236-1239.

⁸ Joseph Chen, Harrison Hong, and Jeremy C. Stein, "Breadth of ownership and stock returns," *Journal of Financial Economics* (November 2002), pp. 171-205.

⁹ Karl B. Diether, Christopher J. Malloy, and Anna Scherbina, "Differences of opinion and the cross-section of stock returns," *Journal of Finance* (October 2002), pp. 2113 - 2141.

¹⁰ Gene D'Avolio, "The market for borrowing stock," *Journal of Financial Economics*, (November 2002), pp. 271-306.

¹¹ Eli Ofek, Matthew Richardson, and Robert F. Whitelaw, "Limited Arbitrage and Short Sales Restrictions: Evidence from the Options Markets," *Journal of Financial Economics*, forthcoming.

¹² Owen A. Lamont, "Go down fighting: Short sellers vs. firms," working paper, 2002

¹³ Owen A. Lamont and Richard H. Thaler, "Can the market add and subtract? Mispricing in tech stock carve-outs," *Journal of Political Economy* (April 2003), pp. 227-268.

¹⁴ Eli Ofek and Matthew Richardson, "DotCom Mania: The Rise and Fall of Internet Stock Prices," *Journal of Finance* (June 2003), pp. 1113 - 1138.

¹⁵ Annette Vissing-Jorgensen, "Perspectives on Behavioral Finance: Does Irrationality Disappear with Wealth? Evidence from Expectations and Actions," in Mark Gertler and Kenneth Rogoff

(eds.), *NBER Macroeconomics Annual 2003* (Cambridge, MA: MIT Press, 2004)

Exhibit X.1

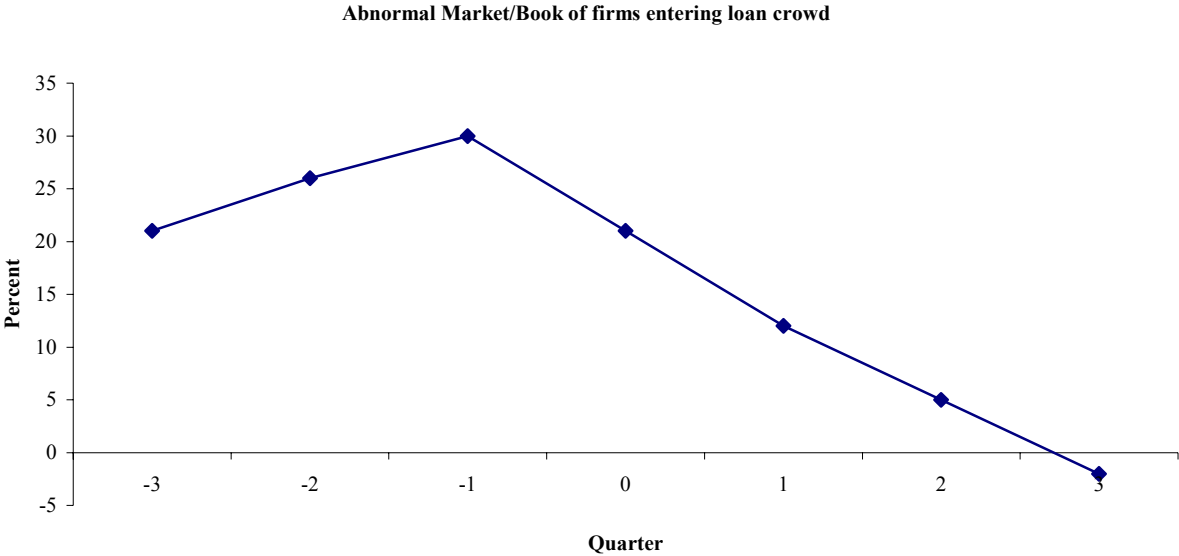


Exhibit X.2

3Com/Palm Stub
3/2/00 - 9/18/00

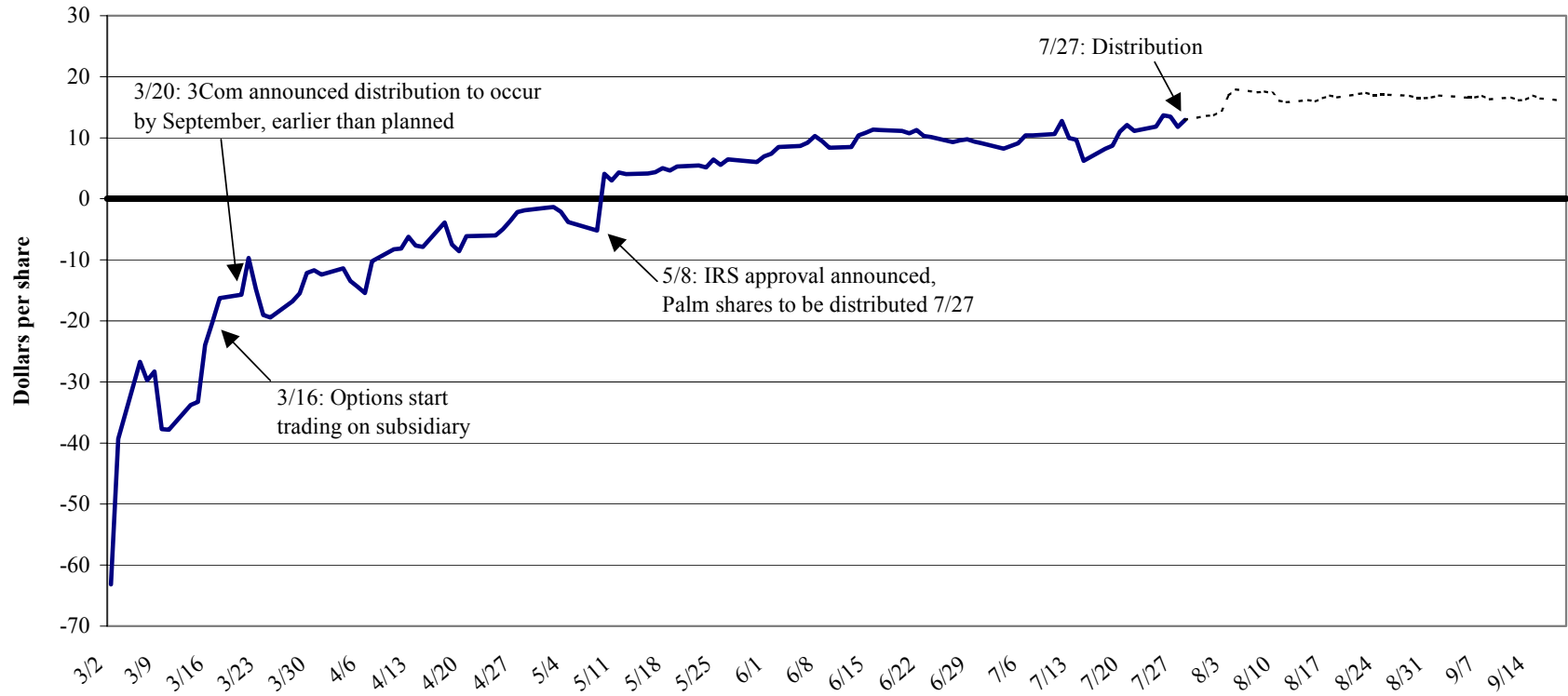


Exhibit X.3

3Com/Palm: Actual Stub, Synthetic Stub, and Short Interest
3/3/00 to 7/21/00

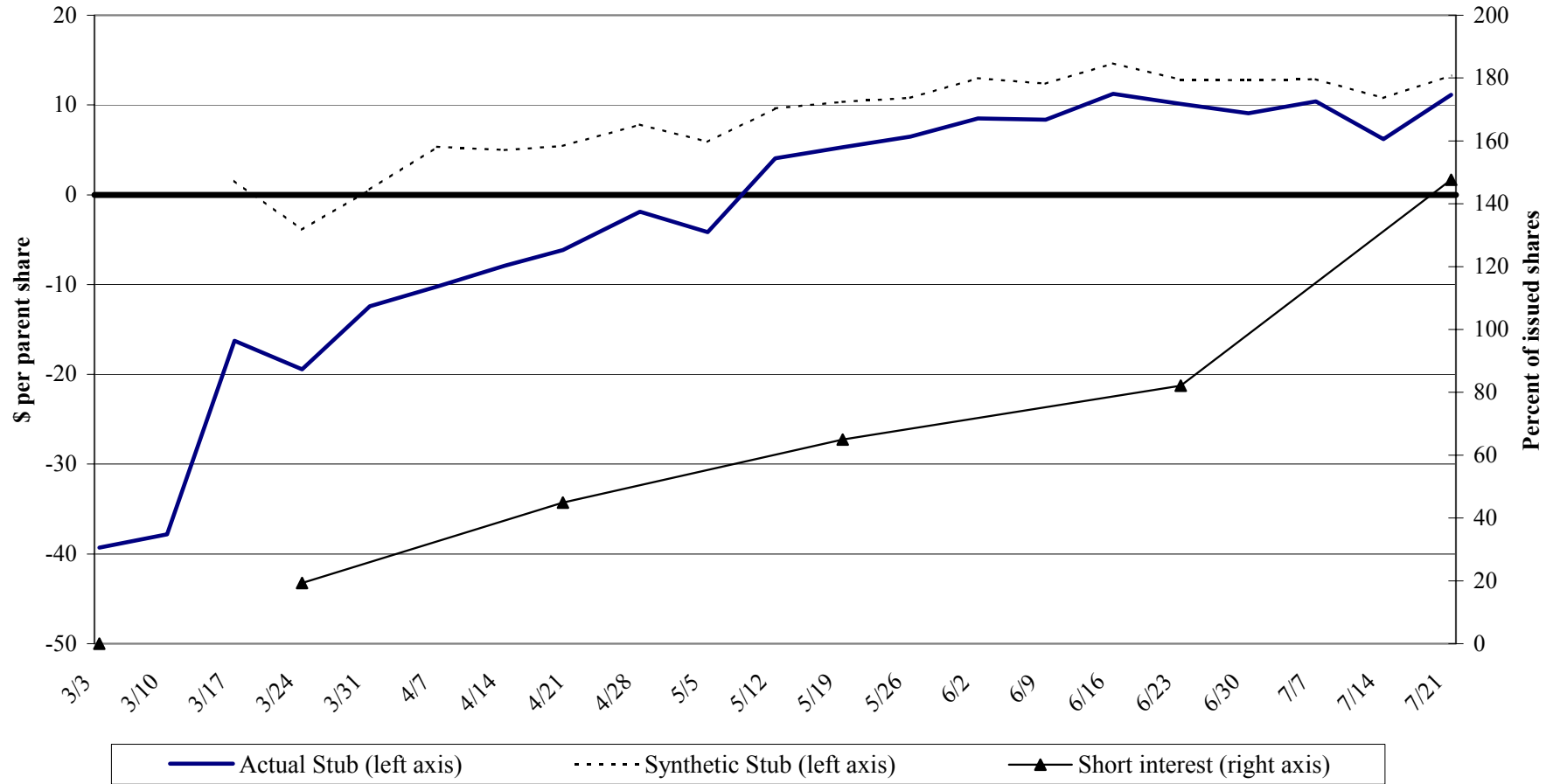


Exhibit X.4
Palm options on 3/17/00

LIBOR

three month	6.21
six month	6.41

Stock prices

Palm	55.25
3Com	68

Options Prices

	--- Call ---		--- Put ---		Synthetic Short	Percent Deviation	Synthetic Long	Percent Deviation
	Bid	Ask	Bid	Ask				
May 55	5.75	7.25	10.625	12.625	47.55	-14	51.05	-8
August 55	9.25	10.75	17.25	19.25	43.57	-21	47.07	-15
November 55	10	11.5	21.625	23.625	39.12	-29	42.62	-23

May options expire 5/20/00. August options expire 08/19/00, November options expire 11/18/00. A synthetic short position buys a put (at the ask price), sells a call (at the bid price), and borrows the present value of the strike price. A synthetic long position sells a put (at the bid price), buys a call (at the ask price), and lends the present value of the strike price. We discount May cash flows by three month LIBOR and August and November cash flows by six month LIBOR. Source of options price data: CBOE. Source of LIBOR: Datastream

Exhibit X.5

Yale School of Management Stock Market Confidence Indexes™

The percent of the population who think that the market is not too high.

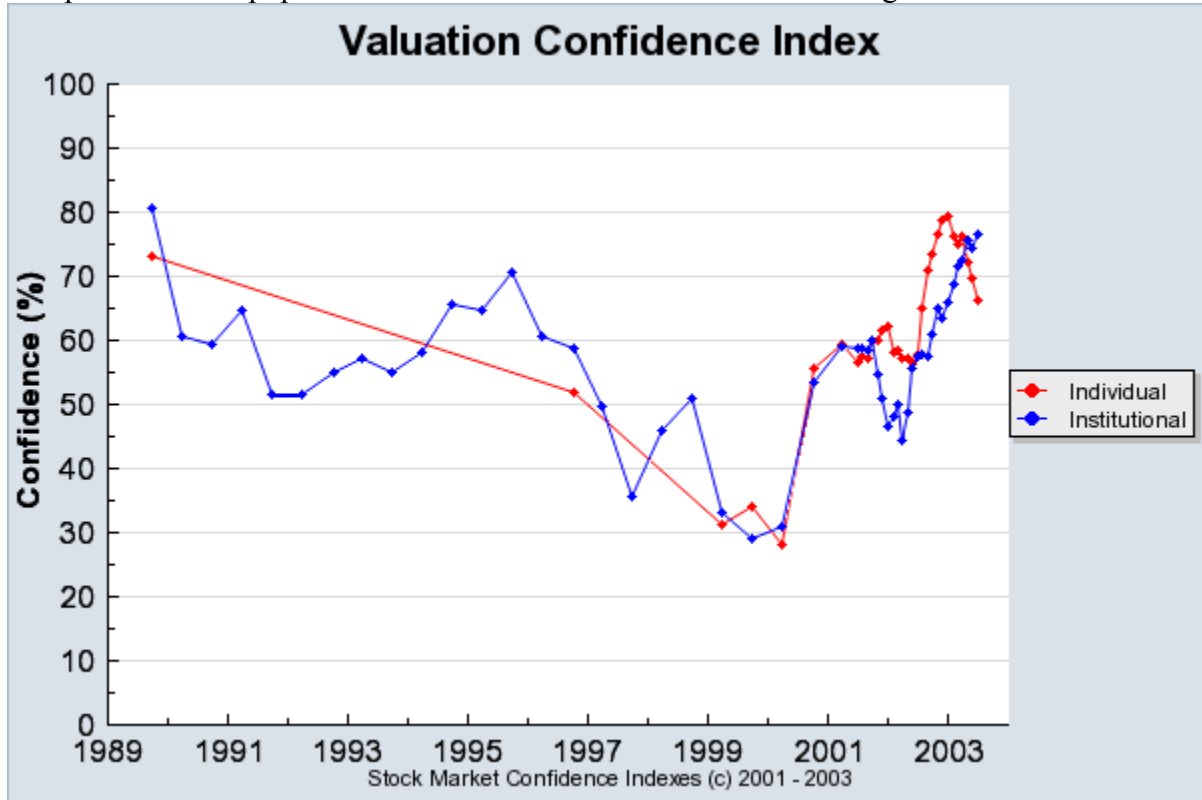


Exhibit X.6

The percent of the population expecting an increase in the Dow in the coming year.

