

Disposition Effect

MARKKU KAUSTIA*

Aalto University

Abstract

This paper reviews the literature on the disposition effect, i.e., investors tendency to sell their winning investments rather quickly while holding on to losing investments. Empirical studies conducted with stocks as well as other assets show strong evidence for the disposition effect. The effect varies by investor type. Household investors are more affected by the disposition effect than professional investors. Investors can also learn to avoid the disposition effect. The disposition effect underlies patterns in market trading volume and plays a part in stock market under reactions, leading to price momentum. A full understanding of the underlying causes of the disposition effect is currently lacking, but investor psychology appears to play an important part.

* Aalto University School of Economics, P.O. Box 21210, FI-00076 AALTO, FINLAND. Tel: +358 40 353 8042; Email: markku.kaustia@hse.fi.

1. Introduction

Cut your losses and let your profits run! That is one of the most frequent pieces of advice given in stock market trading guides. Among the personal finance and investment advice books published during 2008 alone, 19 contained this or a similar phrase. Cutting losses turned out to be especially good advice in 2008 with the plummeting stock market, but the advice has been equally prevalent in prior years. The adage has its origins in the early days of the stock market. It makes up two-thirds of the three Golden stock market rules used by the British economist David Ricardo (1772–1823), a successful stock broker and trader.

Many investors seem to have difficulty following this advice. Instead, they tend to quickly sell stocks that have appreciated in price since purchase and hold on to losing stocks. Financial economists use the term disposition effect for this tendency. The disposition effect is one of the most robust behavioral regularities documented in studies of trading behavior. It imposes substantial costs on investors. First, disposition investors pay more in capital gains taxes than necessary. Suppose an investor needs cash and must sell some stock, but has no information to suggest which of the stocks will be the worst performer going forward. In this case, the investor should liquidate stock in a way that minimizes taxes. This usually means realizing a loss if possible or realizing a combination of gains and losses. A failure to minimize taxes represents a wealth transfer from investors to the rest of society, so non-investors should be happy about the disposition effect. Second, focusing on the purchase price may interfere with rational forward-looking decision making and may result in inferior performance. The disposition effect may thus be harmful even without capital gains taxes.

Even the market as a whole can be affected if investors behave in a similar way regarding their gains and losses. Systematic disposition behavior by many investors can affect trading volume and drive a wedge between market prices and fundamental values. Understanding the disposition effect and when it is most likely to occur is useful in understanding market behavior. This can provide valuable information for financial advisers educating clients and for asset managers developing trading strategies.

This paper reviews the empirical evidence related to the disposition effect in trading behavior. Most of the research is done in the stock market, but studies dealing with other assets exist as well. The next section discusses the empirical findings regarding the disposition effect.

The implications of the disposition effect are then considered. The causes of the disposition effect are explored next. The last section summarizes the topic.

2. Empirical Findings

2.1. The Discovery

Shefrin and Statman (1985) provide the first formal analysis of the disposition effect. In arguing for the existence of the disposition effect, they appeal to the results from an earlier study by Schlarbaum, Lewellen, and Lease (1978). Using stock transaction data from 2,500 individual brokerage firm customers during the period 1964 to 1970, Schlarbaum et al. analyze the realized returns from round-trip trades for these investors by calculating the returns for stocks bought and subsequently sold. They do not consider the performance of stocks that were bought but not sold during the study period. Judging by these realized returns, the individual investors beat the market by 5 percent per year and about 60 percent of the trades resulted in a profit. This outperformance is not due to market timing and seems not to be due to higher risk. For comparison, other studies such as Sharpe (1966), Gruber (1996), and Fama and French (2010) show that the average mutual fund manager underperforms the market and even the very best professional investors struggle to obtain a 60 percent success rate. Based on their evidence, Schlarbaum et al. conclude that individual investors possess respectable stock selection skills.

Shefrin and Statman (1985) question this conclusion. They propose that the realized returns come disproportionately from stock picks that turn out to be the successful ones, while the unsuccessful picks remain in the investor's portfolio. Rational, tax conscious investors would realize more losses and avoid realizing gains at least until they receive a long-term tax status, which at the time required a holding period of six months in the United States. Instead, the data of Schlarbaum et al. (1978) show that a 60-40 split of the positive and negative realized returns holds for all categories of round-trip trade duration. In particular, this result is no different for stocks held less than six months versus more than six months.

Shefrin and Statman (1985) also carry out an analysis of aggregate mutual fund purchases and redemptions. They find that more redemptions occur during good stock market months than poor months. Taken together, these facts are consistent with a disposition effect. The main contribution of Shefrin and Statman, however, is to formally present the disposition hypothesis and to suggest a theoretical framework, which will be discussed later. The available evidence

itself is inconclusive. Accordingly, in his discussion of Shefrin and Statman's study, Constantinides (1985, p. 791) notes that "[the evidence] rejects neither the rational model nor the behavioral model in favor of the other."

Curiously, Schlarbaum et al. (1978, p. 323) raise the possibility that their investors' seemingly good performance could be due to a "disposition to sell the winners and ride the losers." They nevertheless quickly dismiss this hypothesis and favor the explanation based on stock picking skills. Since then, many studies have convincingly shown that individual investors do not have great stock picking skills, but significantly underperform (Odean, 1999; Barber and Odean, 2000; Grinblatt and Keloharju, 2000; Barber, Lee, Liu, and Odean, 2009), and that there indeed is a disposition effect (Odean, 1998 and others, discussed in the next section).

2.2. Hard Evidence

In addition to the study discussed above (Schlarbaum et al., 1978), the same authors published several other papers using the brokerage customers' trading data in the 1970s. A relatively quiet period of about 20 years in the use of individual investors' transaction data for research purposes followed. This was partly due to the scarcity of such data, but likely also reflected the values of financial economists in the 1980s and early 1990s. Namely, individual investors' behavior was simply deemed uninteresting. Things changed when Terrance Odean obtained a data set containing the transactions of a discount broker's clients in the mid-1990s. First in a series of highly influential articles by Odean and his co-authors using these data, Odean (1998) conducted a scrupulous test of the disposition effect hypothesis. His data contain the stock market investments of 10,000 accounts in a U.S. discount brokerage from 1987 through 1993.

Odean (1998) develops a method for measuring the disposition effect, which several later studies use. In this method, any time a particular investor sells a stock, the researcher records the number of stock positions (different firms in the portfolio) that are (1) sold for a gain, (2) sold for a loss, (3) not sold and showing a gain, and (4) not sold and showing a loss. Odean calculates gains and losses against the stocks' original purchase price. The realized gains (type 1) and losses (2) are actual trades in which the investor makes a realized profit or loss. Stocks that are not sold are so-called paper gains (3) and paper losses (4), also judged against the purchase price,

and using the day's closing price as their hypothetical sale price. All four types of stock positions are determinants of the actual development of investors' wealth.

Summing up the realized gains (1) and paper gains (3) gives a total count of gains available for realization. Summing up (2) and (4) gives the corresponding count for losses. The disposition effect predicts that investors realize more gains relative to the number of gains available for realization, and realize fewer of the losses relative to the number of losses available. Comparing the realized gains and losses to the corresponding gain or loss opportunities eliminates the influence of market conditions. For example, in a booming stock market an investor can potentially have many more gains than losses in his portfolio, so seeing more gains realized would not be surprising.

Odean (1998) calculates these figures individually for each investor and then aggregates over all investors and trading days within each month. He uses the aggregate figures in forming the following proportions:

$$\frac{\text{Realized Gains}}{\text{Realized Gains} + \text{Paper Gains}} = \text{Proportion of Gains Realized (PGR)} \tag{1}$$
$$\frac{\text{Realized Losses}}{\text{Realized Losses} + \text{Paper Losses}} = \text{Proportion of Losses Realized (PLR)}$$

Significant differences between PGR and PLR indicate that investors are, on average, more willing to realize either gains or losses. Specifically, the disposition effect is demonstrated when PGR is higher than PLR.

Odean (1998) finds strong evidence in favor of the disposition effect. On average, 14.8 percent of the gains available for realization are actually realized (PGR), while only 9.8 percent of the losses are realized (PLR). Investors are thus more than 50 percent more likely to realize gains than losses. Further evidence in support of Shefrin and Statman's (1985) behavioral theory comes from the investigation of seasonal patterns in the disposition effect. Shefrin and Statman's model predicts that the disposition effect should be weaker at the end of the year due to self-control on behalf of investors. The "rational half" of the investor's decision process recognizes that realizing losses can be advantageous for tax purposes. However, the "irrational half" discards the tax considerations, driven by positive thoughts associated with realizing gains and by the avoidance of negative thoughts associated with realizing losses. Investors should find

getting rid of loss-making stocks easier as the deadline for the end of the tax year approaches. Indeed, Odean finds that the disposition effect disappears in December when investors realize more losses and fewer gains compared to the rest of the year.

Another key study on the disposition effect is Grinblatt and Keloharju (2001). They use a regression method for assessing the disposition effect. This allows them to control for investor characteristics and market conditions. Different types of investors tend to react to past returns in different ways. Many institutions follow a momentum style: i.e., they are more likely to buy stocks with good prior performance (Grinblatt, Titman, and Wermers, 1995; Badrinath and Wahal, 2002), whereas individual investors appear to follow a contrarian style. That is, they are more likely to buy stocks with below-average past performance (Grinblatt and Keloharju, 2000).

Gains and losses are counted similarly to Odean (1998). That is, whenever an investor sells a stock, the other stocks held by the investor are coded as paper sales for that day. Grinblatt and Keloharju (2001) run logit regressions in which the dependent variable is one for sales and zero for paper sales. Independent variables include control variables relating to the stock (e.g., past returns), investor (e.g., portfolio value), calendar time (dummy variables for each month), and market conditions (e.g., market returns). The disposition effect is picked up by a dummy variable taking the value of one for realized and paper losses, and zero otherwise. The data cover all stock market investors in Finland. The results show a strong disposition effect while controlling for many other factors in the analysis.

Weber and Camerer (1998) conduct a laboratory experiment of the disposition effect that involves buying and selling 6 hypothetical stocks in the course of 14 trading rounds. They find that subjects are about 50 percent more likely to realize gains compared to losses. This confirms the results obtained with field data in a controlled environment.

2.3. Professional Investors

The study by Grinblatt and Keloharju (2001) finds the disposition effect for all types of investors studied: households, nonfinancial corporations, government institutions, not-for-profit institutions, and financial institutions. Financial institutions are arguably the most sophisticated of the investor types in their study. The differences in the economic magnitudes of the effect between the investor types are surprisingly small. For all investor types, the odds of selling a stock are roughly half for stocks with moderate losses (less than 30 percent) compared to those

with gains. Compared to other investor types, financial institutions appear somewhat more willing to liquidate larger losses (in excess of 30 percent).

Several studies document behavior consistent with the disposition effect among professional futures traders. Heisler (1994) studies a group of small speculators in the Treasury bond futures market and finds that they hold on to losses significantly longer than gains. Locke and Mann (2005) find similar results for 300 professional futures traders at the Chicago Mercantile Exchange. In a study of 426 proprietary Treasury bond futures traders at the Chicago Board of Trade, Coval and Shumway (2005) analyze how the traders' tendency to take risks in the afternoon trading session is related to their performance in the morning and whether this influences market prices. They also conduct a test of trade duration and find that traders who carry a losing position into the afternoon take longer to close the position than those with a winning position. Choe and Eom (2009) use Korean data covering stock index futures transactions of all market participants. They find the disposition effect for all investor types studied, which includes individuals, institutions, and foreign investors.

Barber, Lee, Liu, and Odean (2007) study all trading activity on the Taiwan Stock Exchange (TSE) for the years between 1994 and 1999. In aggregate, investors are about twice as likely to realize a gain rather than a loss. The authors find the disposition effect for individuals, corporations, and dealers, but not for mutual funds and foreign investors. Frazzini (2006) constructs a data set of all U.S. mutual funds' stock holdings for each quarter between 1980 and 2003. The average fund is about 20 percent more likely to realize gains than losses. Sorting the funds based on past returns shows that about a third of the funds (those with lower returns) are 50 percent more likely to realize gains and losses, comparable to the figures obtained with individual investors. Scherbina and Jin (2010) analyze the equity trades by mutual funds following changes in fund management. They find that the new managers tend to sell off the loser stocks in the fund's portfolio. This tendency is strong even after controlling for the trades of other mutual funds without manager changes that hold the same stocks. The funds' performance also improves under the new managers. O'Connell and Teo (2009) do not find any evidence of the disposition effect among large institutions in the foreign exchange markets. On the contrary, these investors are more likely to sell a currency after experiencing losses.

2.4. Are Mutual Fund Shares Different?

Calvet, Campbell, and Sodini (2009) use data from households in Sweden, where about 30 percent of all households have both individual stocks and equity mutual funds. They find that people are significantly more likely to exit from the stock market (sell all their stocks) after experiencing gains on their stock portfolio, which is consistent with the disposition effect. The probability of exiting from the mutual fund market is also positively related to the gain on the investor's mutual fund portfolio. The magnitude of the effect is about two thirds of the corresponding effect for stocks, but the relation is not statistically significant. On the other hand, the probability of selling mutual funds significantly increases after experiencing losses. Apparently, there is no disposition effect for mutual fund shares.

The results of Ivković and Weisbenner (2009) are also consistent with this conclusion. They find that people are reluctant to sell mutual funds that have appreciated in value and are more willing to sell losing funds, which is consistent with tax motivations. This finding comes from the same brokerage firm data set analyzed by Barber and Odean (2004), who find the disposition effect in the common stock trades of these investors. The sample of households used in the two studies is not entirely identical, however. The data set covers 78,000 households, of which 66,500 hold common stocks (Barber and Odean, 2000). Ivković and Weisbenner report that 32,400 households make at least one mutual fund purchase during the sample period. Based on these figures, most mutual fund investors also appear to hold some common stock, but the converse is not necessarily true. Further, the results of Ivković and Weisbenner are limited to mutual fund purchases in the month of January. Still, the time period and the investor segment analyzed are the same in these two studies, which prompts the following questions: Controlling for investor characteristics, does the disposition effect exist for mutual fund shares? If not, why?

Using the same data set, Bailey, Kumar, and Ng (2009) calculate several measures of behavioral biases for each investor and relate these to behavior regarding mutual fund shares. They find that investors suffering from the disposition effect in their common stock trades are less likely to invest in equity mutual funds. Conditional on investing in mutual funds, disposition investors select funds with higher expenses and time their purchases and sales poorly. These results indicate that mutual fund investors may be, on average, more sophisticated than those who hold only common stocks. Investor heterogeneity may thus explain some of the observed

difference in behavior regarding stocks versus mutual fund shares, but it is unlikely to be the whole explanation.

2.5. Investor Heterogeneity and Learning

Shapira and Venezia (2001) find disposition effects for both independent stock market investors and those advised by brokers in Israel. The effect is weaker for the advised group. Dhar and Zhu (2006) find that not all investors are prone to the disposition effect. About 20 percent show a reverse disposition effect. In other words, they tend to realize more losses than gains. Among measurable investor characteristics, income, wealth, professional occupation, and investor's age correlate with a diminished tendency for the disposition effect. They also find that investors who trade more frequently are more willing to realize their losses.

Feng and Seasholes (2005) find the disposition effect among Chinese investors. The disposition effect is significantly weaker for investors using multiple channels for placing trades (e.g., Internet and telephone orders), investors who begin their trading career with more than one stock, younger investors, and males. The authors argue that these qualities positively correlate with investor sophistication. Feng and Seasholes also find that trading experience attenuates the disposition effect. In addition, combining the aforementioned investor characteristics with trading experience eliminated the disposition effect. Chen, Kim, Nofsinger, and Rui (2007) also document the disposition effect with Chinese investors and find that it is weaker for institutional investors and individuals with more trading experience. In their study covering all stock index futures transactions in Korea, Choe and Eom (2009) report that higher trading activity and higher value of trade are associated with a weaker disposition effect, controlling for investor type (institution versus individual).

The studies cited above show that investors clearly differ with regard to the disposition effect and demonstrate its relation to investor characteristics that plausibly correlate with investor sophistication. However, based on this evidence, judging whether investors are learning to avoid the disposition effect is impossible. The results could be due to self-selection; more biased investors may learn that to stop trading altogether is better. This would result in a negative correlation between trading experience and the disposition effect in the data even if the disposition tendency remained constant for each investor. Seru, Shumway, and Stoffman (2010) present evidence showing that such self-selection is an important feature of household trading

behavior. Most of the correlation between sophistication and performance is due to self-selection. Some “learning by trading” nevertheless remains, but it is rather slow. For example, 10 years of trading experience reduces the likelihood ratio of realizing gains versus losses by 30 percentage points, after which the median investor would still remain almost twice as likely to realize gains versus losses.

2.6. Further Stylized Facts

Ivković, Poterba, and Weisbenner (2005) find the disposition effect for individuals’ stock purchases that are initially worth at least \$10,000. However, the disposition effect disappears and a capital gains tax lock-in effect starts to dominate when a stock’s holding period exceeds a year.

Kumar (2009) investigates stock level determinants of the disposition effect. Individual investors’ trading exhibits the disposition effect in most stocks, but for about 20 percent of the stocks it does not exist or is reversed. The disposition effect is stronger for stocks with higher idiosyncratic volatility, lower market capitalization, higher turnover, weaker price momentum, lower institutional ownership, lower prices, and higher bid-ask spreads. Kumar argues that this is consistent with the disposition effect being stronger among stocks that are more difficult to value. Behavioral biases in general should be stronger for such stocks.

Kumar and Lim (2008) find that investors who tend to execute several trades during the same day suffer less from the disposition effect. This result is obtained while controlling for overall trading activity and portfolio size. The authors argue that such investors are more likely to consider what is good for the overall performance of their stock portfolio instead of focusing on each stock separately.

3. Implications

This section discusses the implications of the disposition effect on financial markets as well as housing markets, and the associated welfare costs.

3.1. Trading Volume

Lakonishok and Smidt (1986) compare the turnover of stocks whose prices have increased (winners) with that of stocks whose prices have decreased (losers). They find that winners generally have higher turnover. However, the volume for losers increases in December.

Ferris, Haugen, and Makhija (1988) find some evidence that the historical volume in a particular price range predicts future volume on that price level. However, this result is based on a small sample of stocks with very low market capitalization. Statman, Thorley, and Vorkink (2006) find that the trading volume in a stock has a strong positive relation to past returns on the stock. The findings of these studies are consistent with the disposition effect having an impact on overall trading volume.

Kaustia (2004) conducts a more specific test. He notes that in initial public offerings (IPOs) all investors initially share a common purchase price, namely the offering price for new shares sold at the listing. He tracks the aftermarket price development and trading volume of a group of U.S. IPO stocks with a special feature—the stocks opened trading below their offer price and stayed below the offer price at least for a month. Controlling for various factors that affect trading volume, these stocks generate significantly more trading volume whenever they trade above versus below the offer price. The boost in trading volume is especially strong when the stock price first exceeds the offer price. These findings are difficult to reconcile with anything except a disposition effect in aggregate volume.

Historical maximum and minimum stock prices can also be relevant for the disposition effect. Until this point, the purchase price has been considered to be the relevant metric against which investors judge gains and losses. Investors can also have other benchmarks. Suppose an investor is considering a sale of a stock at a profit, but decides against it. If the price then goes down, the investor might be counting his losses against that hypothetical sale price. Several studies find evidence consistent with this idea. Heath, Huddart, and Lang (1999) discover that employee stock options are exercised substantially more often when new highs in stock prices are attained. Poteshman and Serbin (2003) find similar results for standardized exchange traded stock options. Grinblatt and Keloharju (2001) observe that monthly new stock price highs and lows increase investors' likelihood of selling. Kaustia (2004) finds that IPO stocks experience substantially higher trading volume as they attain new maximum or minimum price levels. Huddart, Lang, and Yetman (2009) find the same result for stocks in general.

3.2. Asset Pricing

First documented by Jegadeesh and Titman (1993), return momentum, or the tendency of the prior 3- to 12-month stock returns to continue, is one of the strongest asset pricing anomalies.

Grinblatt and Han (2005) show that this momentum effect may be connected to the disposition effect. They present a model with two types of investors: disposition investors and rational traders. Momentum arises from underreaction to new information in the model. Specifically, when many investors have gains on a particular stock, some of them are more eager to sell due to the disposition effect. As positive news hits the market, the price goes up, but the advance is stalled by the selling pressure from the disposition investors. Analogously, consider a stock in which many investors have losses. As negative news hits the market, disposition investors will not sell at a loss and the rate of decrease in the price slows down. Over the longer term, the market price will equal the underlying fundamental value. In the short term, there will be momentum in the direction of the initial market reaction to the new information. Conversely, there will be no underreaction in a stock if most investors have losses and the new information is positive or when most investors have gains and the new information is negative. In these cases the disposition investors do not have a motive to react against the information. Grinblatt and Han find empirical support for their model, showing that stocks with large aggregate unrealized capital gains have higher returns than stocks with large aggregate unrealized capital losses. Their measure of unrealized gains and losses appears to be the key driver of momentum profits: The classic momentum predictor (past 12-month return) becomes insignificant when unrealized gains and losses are used in forecasting returns.

Frazzini (2006) conducts a specific test of whether there really is underreaction to new information due to the disposition effect. He uses data on mutual funds' stock holding to measure the extent of unrealized gains and losses across stocks. He finds that the markets take longer to incorporate positive earnings news in prices for stocks with unrealized capital gains. More generally, the post-earnings-announcement drift is greater when earnings surprises and unrealized returns have the same sign, i.e., both are either positive or both negative. The magnitude of the drift is directly related to the amount of unrealized gains or losses. The market responses are asymmetric, as predicted by the disposition effect. Specifically, stocks with large unrealized gains underreact to positive earnings surprises, but react normally to negative surprises. Similarly, stocks with large unrealized losses underreact to negative earnings news, but react normally to positive surprises.

Goetzmann and Massa (2008) derive additional implications from the Grinblatt and Han (2005) model. They find that a stronger disposition effect is associated with lower returns,

smaller trading volume, and less volatility at the stock level. Their evidence is also consistent with the existence of a common disposition effect-related factor. The exposure of a stock to this factor is associated with lower returns.

Clustering of purchase prices could give rise to what technical analysts call resistance and support levels. Technical analysis proposes that the market price should not easily cross these levels, but once it does, a trend would continue in the short term. For example, Brock, Lakonishok, and LeBaron (1992) find some predictability for the Dow Jones Index based on the index reaching new record high or low levels. Osler (2000) identifies resistance and support levels in the foreign exchange market, and Osler (2003) documents clustering in currency stop-loss and take-profit orders. Whether investors can profitably exploit these trading rules is still debatable, as Ready (2002) and other authors show.

The disposition effect can also be a factor in a classical seasonal stock market anomaly called the January effect. Evidence shows that stock returns are, on average, higher in January than in other months. This applies particularly to stocks with negative returns during the previous year. Tax-loss selling rather than window dressing by institutions appears to be driving this phenomenon (Poterba and Weisbenner, 2001; Grinblatt and Moskowitz, 2004). If investors have an inherent aversion to realizing losses, but nevertheless recognize the tax benefits available, this would cause tax-loss harvesting activities to cluster at the year end, rather than occurring throughout the year. Such behavior would be consistent with the asset pricing patterns.

3.3. Welfare Costs

The disposition effect increases investors' capital gains taxes. Poterba (1987) documents that about two-thirds of investors realized only gains in their tax returns during the years 1982 and 1983. Based on this information, calculating exactly how much extra taxes these investors paid is impossible. The amount depends on the availability of losses that they could have used to offset some of the gains and whether they could have postponed the sales. In any case, many of these investors probably failed to minimize their taxes.

Barber and Odean (2004) analyze equity trading in normal taxable accounts as well as tax-deferred accounts for clients of a discount broker and a large retail broker, for a total of almost half a million households. The gain and loss realization patterns show a strong disposition effect similar to the one documented in Odean (1998) for both brokerage firms' customers. The

results for taxable and tax-deferred accounts are remarkably close throughout the year, except toward the year's end. For taxable accounts the pattern reverses in December when clients of both firms realize more losses than gains. The behavior in tax-deferred accounts does not change in December.

In addition to increasing taxes, the disposition effect may also hurt investors' returns in other ways. There is some degree of momentum in stock returns, and by selling too early the disposition investors would miss these profits. Odean (1998) finds that the losing stocks that investors hold subsequently underperform the winning stocks that they sell by 3.4 percent per year. Seru et al. (2010) find that this adverse effect is greater for investors who are especially prone to the disposition effect. Investors who are free from the disposition bias do not suffer this penalty. Stocks sold for a gain by these investors actually underperform those that could have been sold at a loss.

Heisler (1994) finds that more successful futures traders, as defined by the realized profit per contract traded, are less prone to the disposition effect. Locke and Mann (2005) show that an important success factor for a professional futures trader is the ability to promptly close the open positions. Holding on to a losing position can thus hurt performance. However, Locke and Mann find that holding winning positions open for too long also negatively affects future performance. The tendency of new mutual fund managers to dispose of losing stocks "inherited" from the old manager improves the fund's future performance (Scherbina and Jin, 2008 and 2010). This is consistent with the disposition effect imposing a cost on professional investment management, perhaps through its detrimental effect on the quality of trading decisions.

Seru et al. (2010) find that the disposition effect is a relatively stable individual trait. This observation, combined with investors' slow learning, implies that the disposition effect can have negative long-term consequences. Disposition investors must first become aware of their tendency. Of course, investors could eliminate the disposition effect by selling all marketable assets and investing everything in a bank account. This is hardly the optimal solution, but it is nevertheless a genuine risk for bitter investors who have experienced losses. Investors tend to overweight personal experience (Kaustia and Knüpfer, 2008). The challenge is therefore to correct a behavioral bias without leaving investors with too bad a taste about investing in general.

3.4. Real Estate Market

Evidence also shows the presence of the disposition effect in the housing market. This can have important welfare effects. First, housing is an integral component of household wealth, far more significant than stocks for many people. Second, the functioning of the housing market has important spillover effects for the rest of the economy. Third, financial economists generally view the housing market as considerably less efficient than the stock market.

Genesove and Mayer (2001) are the first to document the disposition effect among individual home owners. They find that sellers facing a loss set higher asking prices relative to comparable property, have longer selling times, and are less likely to close a deal. Einiö, Kaustia, and Puttonen (2008) provide further evidence from a larger sample and analyze 79,483 repeat sales in the Finnish (greater Helsinki area) apartment market from 1987 to 2003. Controlling for general real estate market trends as well as area-specific trends, Einiö et al. show that sellers are more than twice as likely to sell an apartment for a gain compared to a loss. A home value that is too low relative to the mortgage balance may prevent selling even if the optimal (unconstrained) decision is to move (Stein, 1995). Genesove and Mayer nevertheless find the aversion to realize losses to be strong even after taking these equity constraints into account. In addition, Einiö et al. find this aversion when the constraint is unlikely to be binding.

The real estate markets exhibit a strong correlation between trading volume and price levels. The disposition effect is probably responsible for much of that correlation. The disposition effect can lead to suboptimal decisions in the housing market and consequently in the labor market. Liquidity in the housing market could dry up in an economic downturn. This could hinder labor mobility when the economy most needs it. In a severe recession such as occurred in the 2007 to 2009 real estate market, a mortgage balance exceeding home equity can have a much stronger lock-in effect, but the disposition effect may be of first-order importance in a milder downturn.

4. What causes the disposition effect?

4.1. Shefrin and Statman's Framework

Shefrin and Statman (1985) compose a theoretical framework with four ingredients that underlie the disposition effect. The first ingredient is prospect theory (Kahneman and Tversky,

1979). An investor with preferences given by prospect theory would become more risk-averse after experiencing gains and more risk-seeking after experiencing losses. This means that holding on to the investment becomes more attractive than selling if the value of the investment goes down because the investor is willing to tolerate more risk.

The second ingredient is mental accounting, a concept developed by Thaler (1980, 1985) and Tversky and Kahneman (1981). It describes people's tendency to organize some sources and uses of money in different psychological accounts in their mind. For example, people may treat differently money received as salary versus money saved on a purchase. This is often harmless. However, as people tend to consider these mental accounts separately, they may occasionally lose sight of what is best for their overall financial well-being. Shefrin and Statman (1985) argue that when investors buy a stock, they create a new mental account for that stock. Investors would then consider the value of each stock separately and compare it to the purchase price.

The third ingredient that Shefrin and Statman (1985) propose is regret aversion. Closing a stock position at a loss and thus having to admit a mistake may cause regret over the initial decision to buy the stock. This idea is also related to a motive based on self-justification, which will be discussed later.

The fourth ingredient is self-control. Self-control explains why the disposition effect is weaker at the end of the year. Investors may find getting rid of loss-making stocks easier when faced with explicit self-control mechanisms, such as the end of the tax year.

4.2. Rational Explanations

Could there be any rational reason for selling winning stocks and holding on to losing stocks? As previously discussed, the disposition effect not only causes many investors to pay more taxes but also may degrade investment performance even without considering taxes. The disposition effect could be justified if it brought some benefit or if avoiding it entailed some costs.

Given the fixed nature of some trading costs, proportional costs decrease as the value of the investment grows. More valuable stock positions are likely those that have appreciated since purchase. Transaction cost considerations could thus prompt investors to trade appreciated stocks. However, Odean (1998) does not find evidence in support of this hypothesis. Transaction

costs should be particularly high for stocks with low nominal prices, but the disposition effect is not consistently stronger for these stocks.

Portfolio rebalancing is another rationale to trade that could explain a tendency to realize gains (Lakonishok and Smidt, 1986). An investor who is committed to maintaining portfolio weights of individual securities within some limits must sell some of the stock if its weight exceeds those limits. Correspondingly, the investor may buy more of the stock that has depreciated. Odean (1998) argues that partial sales (i.e., not selling the entire position in a stock) should be more likely motivated by rebalancing. Excluding partial sales, Odean still finds essentially the same results; investors realize gains much more than losses. To carry out portfolio rebalancing one must also purchase stocks, so sales that are not followed by any purchases are less likely to be due to rebalancing. Odean eliminates sales from investors who do not purchase anything in the following three weeks and still finds the disposition effect. These findings do not support the rebalancing hypothesis.

This discussion on rebalancing also ignores taxes. In the presence of capital gains taxes, rebalancing and minimizing taxes are conflicting objectives. Assuming both zero transaction and short selling costs, Constantinides (1983) shows that the optimal strategy is to realize all losses as they occur and defer all capital gains. When there are short selling restrictions, Dammon, Spatt, and Zhang (2001) show that the optimal decision is to realize some gains and still realize all losses. This means that explaining the disposition effect is difficult using the portfolio rebalancing argument when considering taxes.

To reap the full benefits of loss realization, one must be able to repurchase sold assets. The tax code may put limits on this activity. For example, in the United States the so-called wash-sale rule prohibits investors from repurchasing substantially identical securities for 30 days after the sale. With a wash-sale rule, the rational response is no longer to realize losses immediately because there is a tradeoff between receiving a tax rebate and not decreasing the equity exposure too much (Jensen and Marekwica, 2009). While having a wash-sale rule provides a motive to hold on to some losses, it generally does not lead to realizing gains.

Certain types of stock return expectations could also give rise to the disposition effect. People may believe in mean-reverting returns and hence judge the expected return to be better for investments that have fallen (Andreassen 1988; Odean 1998). An investor who is acting on mean-reversion would tend to sell stocks with paper losses if the stocks have been performing

well. Correspondingly, the mean-reversion investor would hold on to stocks with paper gains if they have been performing poorly. This would produce a reversed disposition effect for these stocks. However, Kaustia (2010) finds that this is not the case. He shows that in contrast to the mean-reversion hypothesis, recent appreciation actually decreases selling for loss-making positions.

Finally, investors could buy stocks based on private information and sell them once the market incorporates this information into prices (Lakonishok and Smidt, 1986). This strategy would result in trading patterns similar to the disposition effect. However, this hypothesis is not consistent with the fact that the disposition effect is prevalent among individual investors who do not possess valuable private information, and is stronger for the least sophisticated investors. Kaustia (2010) also reports further evidence inconsistent with this hypothesis. In sum, the disposition effect remains difficult to explain rationally, at least with standard assumptions about investors' preferences.

4.3. Prospect Theory

Studies on the disposition effect typically refer to Kahneman and Tversky's (1979) prospect theory as the underlying cause of the disposition effect. Prospect theory implies the use of a reference point against which investors would code their gains and losses. The converse is not true. Reference points can also be relevant outside the context of prospect theory. An investor with prospect theory preferences becomes more risk averse after experiencing gains and risk seeking after experiencing losses. This change in risk perception may cause the disposition effect.

Barberis and Xiong (2009) and Kaustia (2010) investigate this argument more thoroughly and find that it does not so easily lend itself to the disposition effect. According to Kaustia, prospect theory can predict holding on to losses but it also predicts holding on to gains. So the likelihood of a sale occurring should actually decrease as the stock moves away from the purchase price in either direction. Kaustia's empirical results, on the other hand, show that the propensity to sell a stock does not decline as gains or losses increase. Rather, the propensity to sell a stock is increased or constant in the domain of gains and quite insensitive to return over wide segments of losses. There is a jump in the propensity to sell exactly at zero profit. This pattern is not predicted by reasonable parameterizations of prospect theory. Barberis and Xiong

show in a multi-period model that prospect theory faces great difficulty in predicting the ratios of realized gains and losses found in empirical studies. They propose a new theory in which investors derive prospect theory utility only from realized gains and losses and ignore paper gains and losses. Barberis and Xiong find that this specification more readily predicts the disposition effect.

4.4. Self-Justification

Selling a stock at a loss may be unpleasant for investors due to admitting an error. A psychological theory of cognitive dissonance says that a discrepancy between one's actions and attitudes creates discomfort, and changing an attitude involves psychological costs (Festinger, 1957). Applied to the disposition effect, investors would want to hold on to a positive attitude about their ability to make investment decisions and fit their actions to be consistent with those attitudes. This is easier to do when allowing a little self-deception—judging the value of past investment positions based on realized returns. This mechanism of coping with cognitive dissonance is called self-justification. Some authors have expressed these ideas using slightly different terminology (Shefrin and Statman, 1985; Hirshleifer, 2001). Barber et al. (2007, p. 425) remark: “For some investors, the tendency to hold losers may be driven on a more basic level than probabilities of gains and losses. We live in a world in which most decisions are judged ex post and most people find it psychologically painful to acknowledge their mistakes.” The new model proposed by Barberis and Xiong (2009) assumes that investors derive utility only from realized profits, which also fits the idea of self-justification.

The findings in the existing literature are consistent with self-justification and some facts are hard to reconcile with other hypotheses. For example, consider Weber and Camerer's (1998) laboratory experiment. This experiment allowed one group of subjects to trade freely at all times, but required the second group of subjects to automatically sell all stocks at the end of each trading round. The subjects in this automatic selling condition were then freely allowed to buy back all the shares they wanted. Because transaction costs were zero, standard economic theory predicts no difference in the behavior of the two groups. Weber and Camerer nevertheless found a significant difference. The subjects without automatic selling executed 69 percent of their sale orders after the share price had just increased. For the subjects with automatic selling, only 54 percent of net sales occurred after a price increase. With automatic selling, the subjects would

have had to actively repurchase the losing stocks to make their portfolio holdings similar to the free trading group. They did some of that, but far less than the amounts required to bring their portfolios in line with the free trading group. Weber and Camerer (p. 177) conclude: “It appears that while subjects are reluctant to have their hopes of getting their money back extinguished, they are especially reluctant to blow out the flame of hope with their own breath.”

The results on mutual fund shares permit an interesting interpretation in terms of self-justification. The available evidence for mutual fund shares, though limited in scope compared to that for common stocks, does not show a disposition effect. Self-justification involves escaping the personal responsibility of a poor investment outcome. In the case of mutual funds, this may be more easily accomplished by blaming the mutual fund manager for the losses. This would allow liquidating the shares without suffering a blow to self-image.

5. Summary and Conclusions

The disposition effect, which is a tendency to realize gains and defer the realization of losses, increases the capital gains taxes that investors pay and reduces returns even before taxes. This effect underlies patterns in market trading volume, contributing to, for example, the positive correlation between housing market liquidity and price levels. The disposition effect plays a part in stock market underreactions, leading to price momentum.

Researchers have documented many stylized facts about the disposition effect, of which the following four seem most robust. First, individual investors have a consistent tendency to realize about 50 percent more gains compared to losses in January through November. Second, this pattern disappears or reverses for the month of December (near the end of the tax year). Third, there is a substantial increase in the tendency to realize even very small gains compared to small losses. Fourth, heterogeneity exists among investors and the disposition effect is weaker for more sophisticated investors. A successful theoretical model for the disposition effect should account for these key patterns.

Focusing on realized returns instead of total portfolio returns can give a false impression of investment performance. The disposition effect may help explain why investors are overly optimistic about their future performance (Barber and Odean, 2001), but do not appear to know their actual historical performance (Goetzmann and Peles, 1997; Glaser and Weber, 2007). Investors may be judging their performance based on realized profits. The causality, however, is

complex. The realized returns may be better than portfolio returns precisely because investors want to have an overly optimistic picture of their investment performance and realizing more gains allows them to achieve this self-justification.

What are the implications for financial advice? People sometimes need comforting when their investments have gone bad. They can try to comfort themselves by projecting the actual loss in the values of their holdings as “only a paper loss.” Should they do this? Some argue that acknowledging the facts is the first step in the process of making rational decisions. In most situations a paper loss is as real as a realized loss in economic terms. On the other hand, holding onto losses could be likened to perseverance, which is considered to be a virtue in investing. As discussed at the beginning, the advice “cut your losses and let your profits run” is meant to help people engage in disciplined investment management. But what if investors have not cut their losses in time? “It’s only a paper loss—it’ll come back” could perhaps then be the appropriate advice? However, even if losing investments sometimes do come back, that reliance represents buying comfort at the cost of interfering with realistic expectations and a neutral forward-looking approach to investing. That will increase the chances of making bad decisions.

References

- Andreassen, Paul, 1988, "Explaining the price-volume relationship: The difference between price changes and changing prices", *Organizational Behavior and Human Decision Processes* 41:3, 371–89.
- Badrinath, Swaminathan G., and Sunil Wahal, 2002, "Momentum trading by institutions", *Journal of Finance* 57:6, 2449–78.
- Bailey, Warren, Alok Kumar, and David Ng, 2009, "Behavioral biases and mutual fund clienteles", Working paper, Cornell University.
- Barber, Brad M., and Terrance Odean, 2000, "Trading is hazardous to your wealth: The common stock investment performance of individual investors", *Journal of Finance* 55:2, 773–806.
- Barber, Brad M., and Terrance Odean, 2001, "Boys will be boys: Gender, overconfidence, and common stock investment", *Quarterly Journal of Economics* 116:1, 261–92.
- Barber, Brad M., and Terrance Odean, 2004, "Are individual investors tax savvy? Evidence from retail and discount brokerage accounts", *Journal of Public Economics* 88:1-2, 419–42.
- Barber, Brad M., Yi-Tsung Lee, Yu-Jane Liu, and Terrance Odean, 2007, "Is the aggregate investor reluctant to realise losses? Evidence from Taiwan", *European Financial Management* 13:3, 423–47.
- Barber, Brad M., Yi-Tsung Lee, Yu-Jane Liu, and Terrance Odean, 2009, "Just how much do individual investors lose by trading?" *Review of Financial Studies* 22:2, 609–32.
- Barberis, Nicholas, and Wei Xiong, 2009, "What drives the disposition effect? An analysis of a long-standing preference-based explanation", *Journal of Finance* 64:2, 751–84.
- Brock, William, Josef Lakonishok, and Blake LeBaron, 1992, "Simple technical trading rules and the stochastic properties of stock returns", *Journal of Finance* 47:5, 1731–64.
- Calvet, Laurent E., John Y. Campbell, and Paolo Sodini, 2009, "Fight or flight? Portfolio rebalancing by individual investors", *Quarterly Journal of Economics* 124:1, 301–48.
- Chen, Gongmeng, Kenneth A. Kim, John R. Nofsinger, and Oliver M. Rui, 2007, "Trading performance, disposition effect, overconfidence, representativeness bias, and experience of emerging market investors", *Journal of Behavioral Decision Making* 20:4, 425–51.
- Choe, Hyuk, and Yunsung Eom, 2009, "The disposition effect and investment performance in the futures market", *Journal of Futures Markets* 29:6, 496–522.
- Constantinides, George, 1983, "Capital market equilibrium with personal taxes", *Econometrica* 51:3, 611–36.
- Constantinides, George, 1985, "Discussion of Shefrin and Statman", *Journal of Finance* 40:3, 791–2.
- Coval, Joshua D., and Tyler Shumway, 2005, "Do behavioral biases affect prices?" *Journal of Finance* 60:1, 1–34.

- Dammon, Robert M., Chester S. Spatt, and Harold H. Zhang, 2001, "Optimal consumption and investment with capital gains taxes", *Review of Financial Studies* 14:3, 583–616.
- Dhar, Ravi, and Ning Zhu, 2006, "Up close and personal? An individual level analysis of the disposition effect", *Management Science* 52:5, 726–40.
- Einiö, Mikko, Markku Kaustia, and Vesa Puttonen, 2008, "Price setting and the reluctance to realize losses in apartment markets", *Journal of Economic Psychology* 29:1, 19–34.
- Fama, Eugene F., and Kenneth R. French, 2010, "Luck versus skill in the cross section of mutual fund returns", *Journal of Finance*, forthcoming.
- Feng, Lei, and Mark Seasholes, 2005, "Do investor sophistication and trading experience eliminate behavioral biases in financial markets?" *Review of Finance* 9:3, 305–51.
- Ferris, Stephen, Robert A. Haugen, and Anil K. Makhija, 1988, "Predicting contemporary volume with historic volume at differential price levels: Evidence supporting the disposition effect", *Journal of Finance* 43:3, 677–97.
- Festinger, Leon, 1957, "A theory of cognitive dissonance", Stanford, CA: Stanford University Press.
- Frazzini, Andrea, 2006, "The disposition effect and under-reaction to news", *Journal of Finance* 61:4, 2017–46.
- Genesove, David, and Christopher Mayer, 2001, "Loss aversion and seller behavior: Evidence from the housing market", *Quarterly Journal of Economics* 116:4, 1233–60.
- Glaser, Markus, and Martin Weber, 2007, "Why inexperienced investors do not learn: They do not know their past portfolio performance", *Finance Research Letters* 4:4, 203–16.
- Goetzmann, William N., and Massimo Massa, 2008, "Disposition matters: Volume, volatility and price impact of a behavioral bias", *Journal of Portfolio Management* 34:2, 103–25.
- Goetzmann, William N., and Nadav Peles, 1997, "Cognitive dissonance and mutual fund investors", *Journal of Financial Research* 20:2, 145–58.
- Grinblatt, Mark, and Bing Han, 2005, "Prospect theory, mental accounting, and momentum", *Journal of Financial Economics* 78:2, 311–39.
- Grinblatt, Mark, and Matti Keloharju, 2000, "The investment behavior and performance of various investor types: A study of Finland's unique data set", *Journal of Financial Economics* 55:1, 43–67.
- Grinblatt, Mark, and Matti Keloharju, 2001, "What makes investors trade?" *Journal of Finance* 56:2, 589–616.
- Grinblatt, Mark, and Tobias J. Moskowitz, 2004, "Predicting stock price movements from past returns: The role of consistency and tax-loss selling", *Journal of Financial Economics* 71:3, 541–79.
- Grinblatt, Mark, Sheridan Titman, and Russ Wermers, 1995, "Momentum investment strategies, portfolio performance and herding", *American Economic Review* 85:5, 1088–105.
- Gruber, Martin J, 1996, "Another puzzle: The growth in actively managed mutual funds", *Journal of Finance* 51:3, 783–810.

- Heath, Chip, Steven Huddart, and Mark Lang, 1999, “Psychological factors and stock option exercise”, *Quarterly Journal of Economics* 114:2, 601–27.
- Heisler, Jeffrey, 1994, “Loss aversion in a futures market: An empirical test”, *Review of Futures Markets* 13:3, 793–822.
- Hirshleifer, David, 2001, “Investor psychology and asset pricing”, *Journal of Finance* 56:4, 1533–97.
- Huddart, Steven, Mark Lang, and Michelle Yetman, 2009, “Volume and price patterns around a stock’s 52-week highs and lows: Theory and evidence”, *Management Science* 55:1, 16–31.
- Ivković, Zoran, and Scott Weisbenner, 2009, “Individual investor mutual fund flows”, *Journal of Financial Economics* 92:2, 223–37.
- Ivković, Zoran, James Poterba, and Scott Weisbenner, 2005, “Tax-motivated trading by individual investors”, *American Economic Review* 95:5, 1605–30.
- Jegadeesh, Narasimhan, and Sheridan Titman, 1993, “Returns to buying winners and selling losers: Implications for stock market efficiency”, *Journal of Finance* 48:1, 65–91.
- Jensen, Bjarne Astrup, and Marcel Marekwica, 2009, “Optimal portfolio choice with wash sale constraints”, Working Paper, Copenhagen Business School, Department of Finance.
- Kahneman, Daniel, and Amos Tversky, 1979, “Prospect theory: An analysis of decision under risk”, *Econometrica* 47:2, 263–91.
- Kaustia, Markku, 2004, “Market-wide impact of the disposition effect: Evidence from IPO trading volume”, *Journal of Financial Markets* 7:2, 207–35.
- Kaustia, Markku, 2010, “Prospect theory and the disposition effect”, *Journal of Financial and Quantitative Analysis*, forthcoming (June issue).
- Kaustia, Markku, and Samuli Knüpfer, 2008, “Do investors overweight personal experience? Evidence from IPO subscriptions”, *Journal of Finance* 63:6, 2679–702.
- Kumar, Alok, 2009, “Hard-to-value stocks, behavioral biases, and informed trading”, *Journal of Financial and Quantitative Analysis*, 44:6, 1375–401.
- Kumar, Alok, and Sonya S. Lim, 2008, “How do decision frames influence the stock investment decisions of individual investors?” *Management Science* 54:6, 1052–64.
- Lakonishok, Josef, and Seymour Smidt, 1986, “Volume for winners and losers: Taxation and other motives for stock trading”, *Journal of Finance* 41:4, 951–74.
- Locke, Peter R., and Steven C. Mann, 2005, “Professional trader discipline and trade disposition”, *Journal of Financial Economics* 76:2, 401–44.
- O’Connell, Paul G. J., and Melvyn Teo, 2009, “Institutional investors, past performance, and dynamic loss aversion”, *Journal of Financial and Quantitative Analysis* 44:1, 155–88.
- Odean, Terrance, 1998, “Are investors reluctant to realize their losses?” *Journal of Finance* 53:5, 1775–98.
- Odean, Terrance, 1999, “Do investors trade too much?” *American Economic Review* 89:5, 1279–98.

- Osler, Carol, 2000, "Support for resistance: Technical analysis and intraday exchange rates", *Federal Reserve Bank of New York Economic Policy Review*, July, 53–68.
- Osler, Carol, 2003, "Currency orders and exchange-rate dynamics: Explaining the success of technical analysis", *Journal of Finance* 58:5, 1791–1819.
- Poterba, James M., 1987, "How burdensome are capital gains taxes? Evidence from the United States", *Journal of Public Economics* 33:2, 157–72.
- Poterba, James M., and Scott Weisbenner, 2001, "Capital gains tax rules, tax-loss trading, and turn-of-the-year returns", *Journal of Finance* 56:1, 353–68.
- Poteshman, Allen M., and Vitaly Serbin, 2003, "Clearly irrational financial market behavior: Evidence from the early exercise of exchange traded stock options", *Journal of Finance* 58:1, 37–70.
- Ready, Mark J, 2002, "Profits from technical trading rules", *Financial Management* 31:3, 43–61.
- Scherbina, Anna, and Li Jin, 2010, "Inheriting losers", *Review of Financial Studies*, forthcoming.
- Scherbina, Anna, and Li Jin, 2008, "Inheriting Losers", Working Paper, Harvard Business School and University of California, Davis.
- Schlarbaum, Gary G., Wilber G. Lewellen, and Ronald C. Lease, 1978, "Realized returns on common stock investments: The experience of individual investors", *Journal of Business* 51:2, 299–325.
- Seru, Amit, Tyler Shumway, and Noah Stoffman, 2010, "Learning by trading", *Review of Financial Studies* 23:2, 705–39.
- Shapira, Zur, and Itzhak Venezia, 2001, "Patterns of behavior of professionally managed and independent investors", *Journal of Banking and Finance* 25:8, 1573–87.
- Sharpe, William F, 1966, "Mutual fund performance", *Journal of Business* 39:1(Part 2), 119–38.
- Shefrin, Hersh, and Meir Statman, 1985, "The disposition to sell winners too early and ride losers too long", *Journal of Finance* 40:3, 777–90.
- Statman, Meir, Steven Thorley, and Keith Vorkink, 2006, "Investor overconfidence and trading volume", *Review of Financial Studies*, 19:4, 1531–65.
- Stein, Jeremy C, 1995, "Prices and trading volume in the housing market: A model with down-payment effects", *Quarterly Journal of Economics* 110:2, 379–406.
- Thaler, Richard H, 1980, "Toward a positive theory of consumer choice", *Journal of Economic Behavior and Organization* 1:1, 39–60.
- Thaler, Richard H, 1985, "Mental accounting and consumer choice", *Marketing Science* 4:3, 199–214.
- Tversky, Amos, and Daniel Kahneman, 1981, "The framing of decisions and the psychology of choice", *Science* 211:4481, 453–458.
- Weber, Martin, and Colin F. Camerer, 1998, "The disposition effect in securities trading: An experimental analysis", *Journal of Economic Behavior and Organization* 33:2, 167–84.