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Holding on to the Losers: Finnish Evidence

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Recent literature reports evidence on investor behavior that is inconsistent with traditional finance theory. One currently being debated is behavioral irrationality, the tendency of investors to hold losing investments too long and sell winning investments too soon, a phenomenon known as the disposition effect. We analyze the trading records of all individual investors in the Finnish stock market and document that capital losses reduce the selling propensity of investors. There is, however, no opposite effect identifiable with respect to capital gains. We also find, somewhat surprisingly, that both positive and negative historical returns significantly reinforce the negative association between the selling propensity of investors and capital losses. While these findings offer no direct support for the disposition effect, they do suggest that investors are loss averse.

It is widely acknowledged that investor behavior is often at odds with traditional finance theory. More importantly, the recent literature abounds with examples where investors *systematically* deviate from the tenets of such theories as rationality. One of the currently debated behavioral patterns arising from this line of research is the tendency of investors to hold losing investments too long and sell winning investments too soon. Shefrin and Statman [1985] have dubbed this phenomenon the "disposition effect."[1]

The disposition effect is commonly interpreted as a consequence of human behavioral theories, most notably prospect theory. Kahneman and Tversky [1979] developed this descriptive theory of decision under risk as an alternative to expected utility theory.[2] They formalized an S-shaped value function with three essential properties. First, instead of being defined over levels of wealth, the value function is defined in terms of gains and losses relative to a reference point. Second, the value function is concave above the reference point and convex below it, i.e., the marginal value of both gains and losses diminishes with their magnitude. Third, the slope of the value function is steeper for losses than for gains, which implies greater detriment from a loss than utility from an equal gain.

Jointly, these three properties cause risk aversion in the domain of gains and risk-seeking in the domain of losses. Consequently, an investor with preferences described by the prospect theory value function is inclined to sell an asset that has gained value and to hold an asset that has lost value. There may be behavioral reasons why investors prefer selling winners to selling losers. It is also conceivable that investors expect that prices will be mean-reverting, i.e., current losers will be future winners and vice versa.[3]

Yet other factors, such as liquidity reasons, life cycle considerations, or purely speculative motives, may also contribute to investor behavior. After a large price increase, investors may seek to restore diversification to their portfolios by selling a portion of the appreciated stock (Lakonishok and Smidt [1986]). Moreover, because trading costs are often higher for low-priced stocks, and losing stocks are more likely than winning stocks to be priced lower, investors' unwillingness to realize losses may simply be due to the higher trading costs associated with lower stock prices (Harris [1998]).

However, from the viewpoint of optimal tax planning, investors' tendency to realize gains rather than losses is anomalous. Tax considerations should induce investors to defer capital gains and realize capital losses. Constantinides [1984] considers optimal tax trading policies in various scenarios with different assumptions on tax rates and transaction costs. He finds that the optimal tax trading strategy, with annual taxation, transaction costs, and without distinction between short- and long-term tax rates, is to increase tax loss selling gradually as the year progresses. Dyl [1977] and others provide empirical evidence that investors realize proportionately more losses than gains in December.

We participate in the ongoing debate to explain this tendency by examining it above and beyond what is implied by pure rationales. We use highly extensive and detailed data on the Finnish stock market to analyze the stock holdings and market transactions of all individual investors in a stock market. Existing empirical research has heretofore focused predominantly on analyzing only investors in a single securities firm, or

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only a small subset of investors in a stock market. The only comprehensive work we are aware of that analyzes the trading behavior of all market participants—both institutions and individual investors—is Grinblatt and Keloharju [2001], which also focused on the Finnish market.

We make several other contributions to the existing literature. First, given that prospect theory deals with individual decision-making, using individual investor data seems the most appropriate way to test the theory. Also, our methodological approach is entirely different from those found in previous studies.

Finally, we believe our investigation is made even more interesting by the fact that during our sample period the Finnish stock market was on a steep downward trend. It is very likely that part of the selling occurred because of rational motives such as liquidity reasons. In these cases, it should not matter whether the stock is a winner or a loser. In a downturn, investors will tend to sell disproportionately more losers than winners because they will have more losing stocks in their portfolios. Consequently, we expect to find weaker evidence of the disposition effect in a downward-moving market.[4] In fact, finding evidence of the disposition effect in these data would suggest that behavioral motives additionally and independently contribute to investor behavior.

Overall, our results show that the propensity of investors to sell decreases with capital losses, which is consistent with existing evidence. There is, however, no opposite effect identifiable for capital gains. So, although the investors in our sample tend to hold losing stocks, they are not necessarily selling their winning stocks. Moreover, the negative association between losses and the selling propensity of investors persists after controlling for several investor- and stock-specific factors affecting trading behavior.

Finally, our results suggest that historical returns on stocks, both positive and negative, significantly reinforce the decreasing selling propensity of investors with respect to capital losses.

The remainder of the paper is organized as follows. Section 2 briefly reviews the relevant literature on the disposition effect. Section 3 describes the data, and Section 4 outlines our research design. We present the results in Section 5, and conclude with a discussion in Section 6.

Previous Research

Most of the early research on the disposition effect focused on the relationship between aggregate trading volume and stock prices. Lakonishok and Smidt [1986] study the turnover rates of U.S. stocks that had risen or fallen in price. They find higher abnormal volume for winners. Ferris, Haugen, and Makhija [1988] use price and volume data for thirty small-cap U.S. stocks to examine the relationship between current trading volume and historic trading volume at differential prices. Consistent with the disposition effect, current volume was negatively (positively) correlated with volume on those days when the stock price was higher (lower) than the current price. This line of empirical research is not, however, particularly relevant to our study, which aims to explore the behavior of individuals—not investors in aggregate.

Shefrin and Statman [1985] develop a positive theory of capital gain and loss realization in which investors tend to sell winners too early and hold losers too long relative to the prescriptions of Constantinide's [1984] normative theory. Their framework includes five major elements—prospect theory, mental accounting, regret aversion, self-control, and tax considerations.

1. Prospect theory predicts a propensity to sell winners and hold losers when the proceeds realized will be held as opposed to being rolled over into another gamble.
2. Mental accounting places the prospect theoretic treatment into a broader framework by clarifying conditions under which the disposition effect holds when realization proceeds are reinvested in a "tax-motivated swap."
3. Aversion to regret is an important reason why investors may have difficulty realizing gains as well as losses.
4. Self-control is used to explain the rationale for methods investors use to force themselves to realize losses.
5. Tax considerations may also be important, especially the potential gain from exploiting Constantinide's [1984] strategy and its interaction with the other four elements.

After introducing their theoretical framework, Shefrin and Statman [1985] consider empirical evidence. They use data from two sources, panel data on individual investor trading history from 1964–1970, and aggregate data on mutual fund trades from 1961–1981. Shefrin and Statman show that the disposition effect exists in real-world financial markets. Specifically, they find that tax considerations alone do not explain the observed patterns of loss and gain realization, which are consistent with a combined effect of tax considerations and the other four elements.

Weber and Camerer [1998] present an experimental investigation of the disposition effect.[5] The subjects of their experiment bought and sold shares in six risky assets. Asset prices fluctuated in each period. Weber and Camerer show that the subjects were inclined to sell fewer shares when the price fell than when it rose. They also sold less when the price was below the purchase price than when it was above. The presence of

both effects suggests that multiple reference points—both purchase prices and previous prices—affect choices. These findings are thus consistent with both a prospect theory-based explanation, and subjects' expectation that prices will mean-revert.

Odean [1998] tests the disposition effect by analyzing trading records from 1987 through 1993 for 10,000 accounts at a large discount brokerage house. He finds that, overall, investors prefer selling winners to selling losers. Even after controlling for rebalancing and share price, the disposition effect still exists. His analysis also indicates that many investors exercise tax-motivated selling, especially in December. Furthermore, over the following year, the average market-adjusted return for the winners investors chose to sell is 3.4% higher than for the unsold losers. In other words, if investors choose what to sell because they expect mean reversion in the future, they are most often incorrect.

Ranguelova [2001] analyzes daily trading records of 78,000 clients of a U.S. brokerage house over a six-year period, and reports that the disposition effect increases with the market capitalization of the underlying stocks. Trades in stocks at the bottom 40% of the market capitalization distribution display a reverse disposition effect: Investors sell losers rather than winners. The author suggests that investors may be conscious of the strong short-term price persistence of small-cap stocks.[6]

The paper closest to this study in terms of data set is Grinblatt and Keloharju [2001], who analyze the transactions of both individuals and institutions in the Finnish stock market. With a highly comprehensive data set, the authors identified the determinants of buying and selling activity over a two-year period, January 1, 1995, through January 10, 1997. With a variety of tests and control variables, they show that past returns, reference price effects, holding period return, tax loss selling, and the smoothing of consumption over the life cycle all affect trading.

Specifically, the disposition effect and tax loss selling were the major determinants of the propensity to sell. For both individual investors and institutions, the propensity to hold losers strengthened as losses exceeded 30%. The authors further show that the propensity to sell a stock is positively related to past returns, and that the disposition effect interacts with these past returns. The effect of past returns on the decision to sell appears to be much more important for positive market-adjusted returns than for negative market-adjusted returns.

The disposition effect is neither a solely U.S. phenomenon nor is it characteristic of just small individual stock traders. Bremer and Kato [1996] report evidence on the disposition effect in the Tokyo Stock Exchange, Grinblatt and Keloharju [2001] find it among participants in the Finnish stock market, and Shapira and Venezia [2001] document it for Israeli investors. Furthermore, evidence of the disposition effect has been found among professional futures traders (Locke and Mann [1999]), and in the behavior of home buyers and sellers (Case and Shiller [1988]; Genesove and Mayer [2001]).

Data Description

We use an extensive database consisting of all shareholdings registered in the Finnish paperless system of stock ownership called the book entry system. The data are provided by the Finnish Central Securities Depository (FCSD); by the end of our sample period it covered more than 99.99% of the market capitalization of stocks on the Helsinki Exchanges (HEX). The data comprise the initial positions in the shareownership records of the FCSD on January 5, 1995, and the daily changes in these records up to September 29, 2000. The data consist of information on investor identity,[7] date, stock (e.g., security code, share class), transaction (e.g., trade type, price, volume), and investor attributes such as ownership type, investor category, gender, and birth year. To be included in our analysis, each observation was required to have a full set of information available.

We further restrict our sample size in a number of ways. First, because we are interested in the sell versus hold choices of investors, we exclude all the buy transactions. Second, although the data include the shareholdings of both institutional and individual investors, our focus here is on the individual investors. Third, our sample period is March 6, 2000, through September 29, 2000. On the first day of the period, the HEX Portfolio Index [8] reached a new all-time high, after which it decreased by 25% during our thirty-week time span.

The motivation for our sample period selection stems from the intuition that in a downward-moving market, one would expect the disposition effect to be less evident. This follows from the fact that in a downturn, investors will have disproportionately more losing investments in their portfolios, and may thus display a tendency toward realizing losses as well as gains. It will be most interesting to find out if the phenomenon can be detected under these circumstances.

We aggregate daily observations into weekly cumulative totals to reduce the burden on computing resources and avoid misspecification of the trading dates. The latter is a problem in a daily analysis, since a maximum three-day clearing lag means that the booking date of a transaction and its actual trading day do not always coincide. We further justify our choice of time unit by arguing that weekly rather than daily analyses generate more meaningful results for our purposes and widen our understanding of investor behavior.

The current database does not cover indirect ownership records. Investors may thus hold shares that are not part of the data set. For example, an investment through a mutual fund has an identification number that belongs to the fund itself, and is not traceable to an individual investor. Although mutual fund investments are currently gaining popularity among Finnish investors, they are far less common in Finland than in the U.S. Furthermore, considering the aim of this study, it is unlikely that the exclusion of indirect investments will bias our results.

The 1991 Act on the Book-Entry System made shareholding registration obligatory for Finnish investors, but voluntary for foreign investors, who may register their shares in a specific book-entry account administered by a nominee registration custodian. In such cases, the name and other details of the custodian will appear on the account records instead of the identification number of the individual investor. Since the majority of foreign investors have used this right, we lack adequately detailed data on this investor class. Consequently, we concentrate on domestic investors. Furthermore, due to the small number of observations in the lowest and highest ends of the investor age distribution, we restrict our sample to investors between the ages of twenty and eighty.

To conduct our analysis, we need information on the purchase price of each shareholding. Investors may own shares bought before January 5, 1995, for which this information is not available. We therefore exclude the initial positions from the analysis and focus on sales and shareholdings to which we can attach a known purchase price. For the same reason, we are unable to analyze the sales and holdings of shares acquired by some way other than ordinary stock trade or share issue.[9] Finally, we leave the shares of telephone companies outside the analysis.

After these adjustments, our final sample consists of 70,204 individual investors who make 258,547 weekly sell or hold decisions in 151 stocks. Similar data sets are uncommon in the literature, except, as we mentioned earlier, that of Grinblatt and Keloharju [2001]. However, our database is more recent.

There is a natural explanation for the paucity of such detailed data in the research. The current database is extremely large, yet the Finnish stock market is relatively small worldwide. Consequently, it would be computationally infeasible to conduct a conclusive test on the disposition effect using real market data from, say, the major U.S. exchanges. While the HEX certainly has its own distinct features, for the purposes of our study, it is improbable that it differs from larger exchanges in any critical respect.

We obtain additional price data from the HEX to supplement our database. We also use this data source to make proper adjustments for splits and dividends. Furthermore, we need data on subscription prices of share issues. We gather this information from company press releases and stock exchange announcements.

Methodology

Our primary aim is to investigate whether Finnish investors display a tendency to sell winning stocks while holding losing stocks. Obviously, talking about winners and losers is only meaningful with an explicit reference point. As Odean [1998] notes, any test of the disposition effect is a joint test of the hypothesis that investors sell their winners more easily than their losers, and of the specification of the reference point from which gains and losses are evaluated.

The concept of reference point is most commonly related to Kahneman and Tversky's [1979] prospect theory. Although the theory specifies the shape of the value function around the reference point, it is silent about where people set their reference points. Both experimental and empirical research has typically presumed that the reference point is the status quo, i.e., the purchase price of the stock. It is also possible that investors have other reference points and that reference points adapt over time, however.[10]

Consensus on a "true" reference point is lacking, and we do not attempt to disentangle the issue here. To maintain comparability with previous empirical work, we measure gains and losses in relation to the purchase price.

The majority of recent studies testing the disposition effect have replicated the method developed by Odean [1998]. In this method, two ratios are calculated: the proportion of gains realized of all gains at hand (PGR), and the proportion of losses realized of all losses at hand (PLR). A large difference between these two ratios reveals that investors tend to realize disproportionately more gains or losses. Specifically, a significantly higher PGR is evidence of the disposition effect. For the most part, studies using Odean's [1998] approach support the hypothesis that investors realize their gains at a much higher rate than their losses. These studies, however, generally cannot discriminate between the various motivations for such behavior.

Grinblatt and Keloharju [2001] introduce an alternative approach, which enables an analysis of the various factors potentially affecting investor behavior. They estimate logit regressions to examine the determinants of the propensity to sell versus hold. The dependent variable is a dummy variable with the value of 1 when an investor sells a stock. Each sell is then matched with all stocks in the investor's portfolio that are not sold on the same day. For these unsold stocks, the dependent variable takes the value of 0.

Independent variables include an exhaustive set of control variables expected to influence investors' sell

versus hold decisions. The disposition effect is captured by two dummy variables representing moderate and extreme capital losses. Grinblatt and Keloharju's [2001] results are consistent with Odean [1998] and many others: Capital losses significantly reduce the selling propensity of investors. Moreover, the disposition effect is strong even after controlling for the effect of past returns and tax loss selling.

Using a somewhat different measure of investor selling propensity, we also allow for various motivations investors may have when selling their stocks. Our methodological approach, however, is new. We also control for the overall selling propensity due to stock-specific factors. But our method allows us to cope with the large sample size while avoiding the problems inherent in this type of data. We proceed as follows.

Over all stocks, weeks, and investors, we first calculate the return distribution of the shareholdings with respect to their weighted average purchase price. We then divide this distribution into separate deciles for gains and losses. This gives us the reference values for ten winner and loser classes, i.e., twenty return categories to be used in the subsequent analysis.

In the next phase, within each return category, we form separate portfolios for men and women in six different age categories (in ten-year intervals ranging from twenty to eighty years). Week by week and separately for each stock we then assign each investor into one of the resulting 240 portfolios.[11] Our data points are thus portfolios of investors, who have either sold shares of a certain stock in a particular week or kept their holdings intact. For each individual portfolio, we calculate the proportion of investors who have been selling their shares. We term this ratio the selling propensity (SELLPR), and use it as our dependent variable in the subsequent analysis.

The main explanatory variable of interest is the return on a stock as defined above. Obviously, whether a stock is a winner or a loser is only one factor possibly affecting an investor's selling propensity. One potentially important set of variables includes other investor-specific factors. Barber and Odean [2001] analyze the common stock investments of U.S. households and find that, in general, men trade more than women. To control for potential gender differences, we include a gender dummy coded as male = 1 and female = 0.

The traditional life cycle hypothesis (see, e.g., Ando and Modigliani [1963] and Modigliani [1986]) posits a relationship between age and investments: Individuals invest during their working years and disinvest during their retirement years. To adjust for life cycle effects, we include investor age as a categorical variable. As in the portfolio formation, we measure age in ten-year intervals ranging from twenty to eighty years, with the seventy- to eighty-year category as the omitted reference category. For each portfolio we also calculate investors' average holding period length (HPL) in years, and their average selling activity (ACT). The selling activity of each individual investor is measured by calculating the number of weeks the investor has sold any shares between the beginning of 2000 and the end of our sample period. The number of these active weeks is then divided by the total number of weeks in that period.

Because there are separate portfolios for each stock, we can further assign several other measurements to each portfolio. For each stock, we calculate the market value of equity (MVAL) and the book-to-market ratio (BTOM), both measured at the end of 1999 in billions of euros, as well as the one-month historical return preceding each sample week. These are all variables found in the existing literature to affect the trading behavior of investors. Specifically, we are interested in the potential interactions of these variables with the loss and gain variables. Finally, to account for the individual effects of the stock-specific factors, we enter separate dummies for each stock.

Panel A of Table 1 shows the mean values of selected variables calculated over the stock- and week-specific portfolios in the different return categories. The first column reports the number of each return category, and the second reports the mean return of the portfolios assigned into each category. The relatively high returns in the most profitable portfolios stand out here. These are probably due to the significant holdings of Nokia's shares, and shares acquired via numerous initial public offerings at the end of the 1990s.[12]

The selling propensities reported in the third column appear quite stable, with the winner portfolios somewhat more actively being sold. There is also a sudden increase in selling propensity as one moves from the smallest loss category to the lowest gain category. The fourth column shows the average number of stocks (STOCKS), and the fifth column shows the average number of investors (INV) included in the portfolios in each return category.

The average age of investors is given in the sixth column, and the average proportion of male portfolios in each return category is given in the seventh column. Both variables appear rather constant across return categories, with the average age around fifty and slightly more men than women in all return categories.

The average selling activity of investors is reported in the eighth column, and the average holding period length in the ninth column. Generally, the most active sellers are found in the loss categories. This is somewhat surprising, because the selling propensities for the loser portfolios are lower than those for the winner portfolios. The average holding period length, on the other hand, is shortest in the smallest loss and lowest gain categories, as would be expected.

The remaining four columns give the means of the stock-specific variables. Column 10 shows that the

Table 1. *Descriptive Statistics*

Return Category	RETURN	SELLPR	STOCKS	INV	AGE	MALE	ACT	HPL	MVAL	BTOM	PRET	NRET
Panel A. Means												
1	–0.6862	0.0129	40.43	65.91	49.07	0.53	0.0978	1.2012	6.82	1.01	0.0332	–0.0980
2	–0.4814	0.0176	58.57	39.74	49.38	0.55	0.0960	1.2848	5.62	1.16	0.0268	–0.0912
3	–0.3682	0.0129	74.37	33.64	49.32	0.54	0.0903	1.1742	4.73	1.03	0.0268	–0.0836
4	–0.2931	0.0131	85.40	29.28	49.15	0.55	0.0958	1.0809	4.28	0.94	0.0267	–0.0780
5	–0.2422	0.0148	88.83	30.08	49.03	0.57	0.1001	0.9985	3.86	0.92	0.0256	–0.0756
6	–0.1980	0.0149	99.37	23.47	49.03	0.56	0.1039	0.9420	3.67	0.97	0.0276	–0.0705
7	–0.1503	0.0137	108.23	21.95	49.09	0.56	0.1042	0.8851	3.49	1.00	0.0281	–0.0653
8	–0.1042	0.0137	114.10	21.90	48.93	0.56	0.1075	0.8048	3.56	1.03	0.0292	–0.0611
9	–0.0612	0.0154	118.17	21.09	48.84	0.56	0.1108	0.7264	3.58	1.05	0.0298	–0.0572
10	–0.0206	0.0182	119.47	19.15	48.82	0.56	0.1129	0.6773	3.70	1.05	0.0310	–0.0544
11	0.0239	0.0287	119.40	19.27	48.88	0.56	0.1119	0.7282	3.88	1.05	0.0346	–0.0533
12	0.0844	0.0290	113.87	21.61	49.05	0.56	0.0965	0.9422	4.00	1.00	0.0383	–0.0533
13	0.1729	0.0244	106.97	23.52	49.26	0.55	0.0842	1.1827	4.25	0.95	0.0413	–0.0542
14	0.3095	0.0196	98.40	23.22	49.64	0.55	0.0697	1.5370	4.86	0.80	0.0432	–0.0585
15	0.5331	0.0156	86.39	24.91	49.69	0.55	0.0574	1.9409	5.50	0.65	0.0459	–0.0609
16	0.7816	0.0125	71.14	18.81	49.60	0.57	0.0523	2.0856	7.52	0.53	0.0500	–0.0629
17	1.0618	0.0132	64.97	28.52	49.53	0.57	0.0503	2.2537	8.12	0.50	0.0500	–0.0661
18	1.5390	0.0127	55.43	62.54	49.86	0.56	0.0508	2.3400	9.15	0.50	0.0502	–0.0721
19	3.0080	0.0227	39.13	52.47	50.32	0.56	0.0417	2.6868	10.35	0.56	0.0557	–0.0754
20	9.0136	0.0204	18.83	191.40	50.03	0.54	0.0382	2.6060	19.47	0.26	0.0539	–0.0872
Panel B. Standard Deviations												
1	0.0607	0.0084	2.73	11.40	0.27	0.01	0.0149	0.2014	2.94	0.26	0.0322	0.0660
2	0.0640	0.0154	5.36	8.93	0.22	0.01	0.0085	0.1116	2.06	0.23	0.0210	0.0584
3	0.0563	0.0102	6.61	7.24	0.23	0.01	0.0085	0.1100	1.52	0.20	0.0195	0.0531
4	0.0436	0.0095	8.46	11.51	0.24	0.02	0.0121	0.1336	1.39	0.20	0.0186	0.0449
5	0.0312	0.0096	8.00	9.72	0.28	0.03	0.0137	0.1091	1.06	0.18	0.0183	0.0410
6	0.0262	0.0103	5.67	6.97	0.28	0.02	0.0135	0.1046	0.93	0.14	0.0180	0.0400
7	0.0239	0.0086	5.23	5.13	0.19	0.01	0.0136	0.1101	0.85	0.12	0.0177	0.0345
8	0.0181	0.0075	4.93	5.37	0.17	0.01	0.0125	0.1077	0.79	0.10	0.0177	0.0313
9	0.0126	0.0075	5.78	4.65	0.20	0.01	0.0123	0.1218	0.65	0.08	0.0178	0.0278
10	0.0056	0.0072	6.68	4.53	0.15	0.01	0.0085	0.1112	0.59	0.07	0.0170	0.0264
11	0.0069	0.0114	7.29	2.85	0.24	0.01	0.0126	0.1278	0.45	0.07	0.0185	0.0275
12	0.0223	0.0107	6.85	2.10	0.22	0.01	0.0126	0.1400	0.26	0.09	0.0211	0.0288
13	0.0416	0.0096	6.97	2.58	0.27	0.01	0.0104	0.1829	0.38	0.08	0.0240	0.0306
14	0.0722	0.0095	10.94	6.21	0.22	0.01	0.0103	0.2366	0.89	0.10	0.0265	0.0340
15	0.1640	0.0093	7.63	9.03	0.24	0.01	0.0066	0.1581	0.86	0.11	0.0296	0.0380
16	0.3445	0.0093	9.91	12.81	0.40	0.03	0.0055	0.1755	2.35	0.10	0.0369	0.0471
17	0.4906	0.0105	11.87	16.30	0.63	0.02	0.0092	0.3294	2.68	0.06	0.0366	0.0457
18	0.4618	0.0137	12.10	29.87	0.39	0.02	0.0114	0.4651	3.59	0.08	0.0382	0.0520
19	0.5055	0.0192	6.65	15.35	0.45	0.01	0.0077	0.2419	1.35	0.09	0.0447	0.0573
20	1.7191	0.0315	3.35	38.89	0.35	0.01	0.0087	0.2946	2.77	0.07	0.0545	0.0713

highest market values are in the highest gain categories, and the lowest ones in the smallest loss categories. There is no systematic pattern identifiable with respect to the average book-to-market ratio reported in the next column. However, the stocks with the lowest book-to-market ratios, i.e., the growth stocks, seem to dominate the highest gain categories.

The last two columns give the average one-month historical returns of the stocks in the different return categories. Positive (PRET) and negative (NRET) lagged returns are considered separately. Overall, the positive lagged returns are smaller in absolute magnitude than the negative ones. This is due to our sample period, which relates to a time when the Finnish stock market experienced a steep decline. Panel B of Table 1 reports the respective standard deviations.

We use the generalized least squares (GLS) method to examine whether Finnish investors sell winning stocks and hold losing stocks. We choose the GLS because it allows for the specific nature of panel data by controlling for autocorrelation among the time series errors and heteroscedasticity of cross-sectional errors. Litzenberger and Ramaswamy [1979] demonstrate that when the periodic estimators are serially uncorrelated, the regression coefficients can be estimated by pooling the time-independent periodic estimates obtained from cross-sectional regressions. In each week, we regress our dependent variable on different sets of explanatory variables. The pooled GLS estimator of each regression coefficient γ_k can be obtained by pooling the periodic estimates $\hat{\gamma}_{k1}, \hat{\gamma}_{k2}, \ldots, \hat{\gamma}_{kT}$, obtained from cross-sectional regressions in periods $1, 2, \ldots, T$. Specifically, our pooled GLS estimator of γ_k is determined as the weighted mean of the weekly estimates, where the weights are inversely proportional to the variances of these estimates:

$$\hat{\gamma}_k = \sum_{t=1}^{T} Z_{kt}\hat{\gamma}_{kt}, \tag{1}$$

and

$$\operatorname{var}(\hat{\gamma}_k) = \sum_{t=1}^{T} Z_{kt}^2 \operatorname{var}(\hat{\gamma}_{kt}), \tag{2}$$

where

$$Z_{kt} = \frac{\left[\operatorname{var}(\hat{\gamma}_{kt})\right]^{-1}}{\sum_{t}\left[\operatorname{var}(\hat{\gamma}_{kt})\right]^{-1}}. \tag{3}$$

This procedure also allows us to evaluate the statistical significance of the regression coefficients within a reasonable number of observations. Our original portfolio data include approximately 15,000 observations to be used in each weekly cross-sectional regression. Of course, having a sample this large can virtually assure statistically significant results. We consider our approach more conservative in this sense. Indeed, we estimate the original regression coefficients as weekly cross-sections with a huge number of observations. Our test of statistical significance evaluates whether the weekly coefficients are different from zero within thirty weekly observations. "Everything" is not necessarily statistically significant anymore.

Empirical Results

Table 2 shows the pooled GLS estimates from four alternative specifications of Equations (1)–(3). Before we discuss the results, note that each weekly cross-sectional regression is run with individual dummies fitted for each stock. The coefficient estimates for the stock dummies are not reported. We leave these coefficients unanalyzed partly for brevity, but also to avoid misleading interpretations, as it is rather ambiguous whether they make sense. We would like to learn from the coefficients how each stock deviates from some meaningful norm; what we actually see, however, is how each stock differs from an arbitrarily chosen reference stock.

In the first column of Table 2, we regress the selling propensity of investors on the loss and gain variables and on a set of investor characteristics. Note that capital losses reduce the selling propensity of investors, as evidenced by the negative and statistically significant coefficient on the loss variable.[13] On the other hand, the statistically significant and positive coefficient on the loss squared suggests this effect is moderated by sufficiently large losses. There is no statistically significant association between capital gains and the selling propensity of investors. The coefficient on the gain squared, by contrast, is statistically significant and positive. Although the effect of this variable appears only marginal, this finding implies that large enough gains induce investors to sell.

To sum up, our results only partially support existing evidence that investors hold losers and sell winners. They do show, however, that investors are loss averse, the fundamental assumption of prospect theory.

Column 1 also reveals that, other things being equal, selling propensity is related to age, consistently decreasing at least up to the forty- to fifty-year category. After that, the coefficients, while still of the same sign, are no longer statistically significant. This finding is in contrast to the life cycle hypothesis, which posits a hump-shaped association between age and investment. Regarding the coefficient on the male dummy, there appears to be no identifiable effect of gender on investor selling propensity. Not surprisingly, both selling activity and holding period length play an important role

Table 2. *Determinants of Selling Propensity*

	(1)	(2)	(3)	(4)
LOSS	–0.0457	–0.0547	–0.0534	–0.0444
	(–5.4306)***	(–4.0806)***	(–3.9286)***	(–3.1304)**
LOSS squared	0.0494	0.0491	0.0496	0.0531
	(3.5578)**	(3.5346)**	(3.5674)**	(3.7698)***
GAIN	–0.0020	–0.0028	–0.0028	–0.0018
	(–1.6182)	(–1.3398)	(–1.3304)	(–0.7741)
GAIN squared	0.0001	0.0001	0.0001	0.0001
	(2.9919)**	(2.9126)**	(2.2632)*	(1.0887)
AGE 20–30	0.0082	0.0101	0.0100	0.0099
	(4.2248)***	(4.2317)***	(4.1962)***	(4.1627)***
AGE 30–40	0.0069	0.0084	0.0083	0.0082
	(3.6660)***	(3.8473)***	(3.8115)***	(3.7771)***
AGE 40–50	0.0041	0.0052	0.0051	0.0051
	(2.1999)*	(2.5529)*	(2.5187)*	(2.4781)*
AGE 50–60	0.0017	0.0024	0.0024	0.0023
	(0.9015)	(1.2508)	(1.2243)	(1.1892)
AGE 60–70	0.0001	0.0005	0.0005	0.0004
	(0.0497)	(0.2587)	(0.2379)	(0.2163)
MALE	0.0020	0.0031	0.0030	0.0031
	(1.9002)	(2.2134)*	(2.1715)*	(2.1847)*
ACT	0.1050	0.1049	0.1048	0.1049
	(24.2278)***	(24.1841)***	(24.1550)***	(24.1800)***
HPL	–0.0015	–0.0015	–0.0015	–0.0016
	(–2.4662)*	(–2.4310)*	(–2.3656)*	(–2.5203)*
AGE x LOSS		0.0003	0.0003	0.0002
		(1.3206)	(1.2686)	(1.2307)
AGE x GAIN		0.0000	0.0000	0.0000
		(0.6018)	(0.6189)	(0.6278)
MALE x LOSS		–0.0075	–0.0072	–0.0074
		(–1.1954)	(–1.1416)	(–1.1801)
MALE x GAIN		–0.0006	–0.0006	–0.0006
		(–0.5650)	(–0.5793)	(–0.5884)
MVAL x LOSS			0.0028	0.0025
			(1.7031)	(1.4867)
MVAL x GAIN			–0.0000	–0.0001
			(–0.0495)	(–0.2683)
BTOM x LOSS			0.0019	0.0011
			(1.0224)	(0.5530)
BTOM x GAIN			0.0000	0.0001
			(0.0575)	(0.0781)
PRET x LOSS				–0.1289
				(–3.2097)**
PRET x GAIN				–0.0155
				(–2.6680)*
NRET x LOSS				–0.0837
				(–2.4788)*
NRET x GAIN				0.0014
				(0.2481)

Note: *t*-values are given in parentheses. ***, **, and * indicate statistical significance at 0.1%, 1%, and 5%, respectively.

in explaining investor selling propensity. The coefficients on both variables are statistically significant, positive for the former and negative for the latter.

Column 2 is similar to column 1, except we interact the age and male dummies with the loss and gain variables. The results indicate that none of the interaction coefficients is significant, so neither the age nor gender of an investor influences the negative association between selling propensity and capital losses. With the inclusion of the interaction terms, however, the positive coefficient on the male dummy becomes statistically significant, which is in line with Barber and Odean [2001]. All other inferences are unchanged, with the coefficient on the loss variable remaining negative and statistically significant and actually increasing slightly in absolute magnitude.

Column 3, which includes four additional interaction terms, reveals results similar to column 2. At this stage, we interact the market value and the book-to-market ratio with the loss and gain variables. As in the previous specification, there is no evidence of a significant association between any of the interaction

terms and the selling propensity of investors. The statistically insignificant coefficient on the interaction term (BTOM x LOSS) suggests that whether a stock is growth or value does not affect the decreasing selling propensity of investors with respect to capital losses. Moreover, the positive and statistically insignificant coefficient on the interaction term (MVAL x LOSS) is inconsistent with Ranguelova [2001], who finds that the tendency of investors to hold their losing stocks is concentrated primarily in large-cap stocks.

Note here that although both the market value and the book-to-market ratio of a firm have been found to affect investor trading behavior, they should not play any role in a prospect theory context. In other words, an investor with a prospect theory value function would hold on to a losing stock and sell a winning stock regardless of firm characteristics. This is just what the last two findings suggest—behavioral motives, over and above other motives, play a significant part in explaining investor selling propensity.

In column 4, we introduce four more interaction terms, the one-month historical returns with the loss and gain variables. For the most part, the results discussed in the previous paragraph continue to hold, except for the coefficient on the gain squared, which is now insignificant.

In column 4, it is interesting and somewhat peculiar that the lagged returns, both positive and negative, significantly reinforce the negative association between the selling propensity of investors and capital losses. When the stock market has turned bearish and there is no sign of a near recovery, one would expect investors to cut their losses. However, investors actually keep holding their losing stocks, even when the prices of these stocks continue to decline. The coefficient on the interaction term (PRET x GAIN) is also statistically significant and negative, so whether a stock is a winner or a loser, positive lagged returns significantly decrease the selling propensity of investors. Finally, the coefficient on the interaction term (NRET x GAIN) turns out to be statistically insignificant.

Discussion

Our aim here was to examine whether individual investors in the Finnish stock market exhibit the disposition effect, the tendency to hold losing stocks and sell winning stocks. Overall, our results suggest that capital losses reduce the selling propensity of investors. There is, however, no opposite effect identifiable with respect to capital gains. While these results offer no direct support for the disposition effect, they do suggest that investors are loss averse.

People are hardly fully rational, nor do investors always behave in accordance with traditional finance theory. But why does it matter if investors are loss averse? The answer is twofold.

First, there is the matter of scientific relevance and overall economic consequences. The tendency of investors to hold losing stocks may have an effect on prices, in which case our results may have important implications for market efficiency and asset pricing. Until now, relatively little has been written about the impact of investor behavior on asset prices. Grinblatt and Han [2001] provide preliminary evidence that the disposition effect may account for the so-called momentum effect, the tendency of past winners to subsequently outperform past losers. But further research in this area is clearly needed.

An equally interesting question is: what are the practical consequences of investor behavior? Loss aversion may be a common feature of investor behavior, but it generally produces bad decision-making and directly affects investor wealth (see, e.g., Odean [1998]). For example, consider pension investors. A large and steadily increasing pot of pension money is being managed by investors who, for the most part, have only little investing ability or knowledge. Since the errors in their decisions are likely to seriously impact their pension incomes and qualities of life, research in this area is of increasing importance.

Given our results, a logical next step would be an examination of whether investor behavior is harmful to portfolio performance. And, over which gains and losses is this harm detectable? We have shown that capital losses on individual stocks reduce the selling propensity of investors. It could be worthwhile to investigate whether this phenomenon holds when gains and losses are defined more broadly, e.g., at the portfolio level.

Finally, we have used the purchase price of a stock as a reference point against which investors evaluate their gains and losses. As we noted earlier, it is possible that investors have other reference points instead of or in addition to the status quo. Consequently, it would be informative to repeat this study with different reference prices.

Notes

1. Throughout this paper, winning and losing investments are defined from the point of view of individual investors. This being the case, a stock that has increased in market value is not necessarily considered a winner by an individual investor. Correspondingly, a stock that has decreased in market value may not necessarily be considered a loser.
2. More recently, authors have continued to elaborate on this early work to show how prospect theory is applied to certainty situations (prospect theory under certainty, Tversky and Kahneman [1991]), and to prospects with more than two outcomes (cumulative prospect theory, Tversky and Kahneman [1992]).

3. Psychological research shows that people often see patterns in random processes and expect trends to revert (e.g., Tversky and Kahneman [1971]; Andreassen [1987, 1988]). Just as in a series of coin flips, where people easily exaggerate the likelihood of a tail after a sequence of heads, investors may believe that a price increase is more likely following a price decline.
4. The disposition effect in upward-moving markets is well documented in the literature. For example, Grinblatt and Keloharju [2001] find a strong disposition effect in the Finnish stock market during the period 1995-1996 using a similar database to the current one.
5. For further evidence on the disposition effect in experimental markets, see Kogut and Phillips [1994], Heilmann, Lager, and Oehler [2000], and Chui [2001].
6. Jegadeesh and Titman [1993], among others, demonstrate that trading strategies, which buy past winners and sell past losers, yield significantly positive returns over three- to twelve-month holding periods. Hong, Lim, and Stein [2000] establish further that once one moves past the very smallest-capitalization stocks, the profitability of momentum strategies sharply declines.
7. Individual investors are initially identified by their social security number. In our data, for security reasons, a specific running number is assigned to each original identification number.
8. The Portfolio Index includes all stocks listed in the HEX main list. It differs from the All-Share Index in terms of a weight limitation: If a company's market capitalization exceeds a limit of 10%, its weight in the index is limited to exactly 10%.
9. These include gifts, inheritances, wills, distributions of matrimonial assets, forced auctions, forfeitures of shares, redemptions, mergers, subscription rights, share series conversions, shares subscribed with options or convertible bonds, and miscellaneous activities relating to the maintenance of the register.
10. Heath, Huddard, and Lang [1999] consider several potential reference points and find that the maximum stock price reached over the previous year has the strongest effect on investors' decision to exercise stock options. Gneezy [2000] examines the trading behavior of investors in an experimental setting, and finds the maximum stock price to be a significant reference point. Grinblatt and Keloharju [2001] report that monthly highs and lows affect investors' propensity to sell a stock. Reference price dynamics is considered in, e.g., Grinblatt and Han [2001].
11. Note that all twenty return categories are not available for every stock or in every week. The deciles for gains and losses are calculated over the whole sample. Consequently, the variation within a stock or a week does not necessarily cover the whole return distribution. Our approach, however, enables us to examine the phenomenon in absolute terms, and not with respect to the relative performance of individual stocks. Similarly, both men and women portfolios or all age categories do not exist for every stock and week.
12. To check the robustness of our results, we also run the subsequent models without the three most profitable portfolios, as well as excluding the Nokia shares. In both cases, the results remain substantially the same as those reported in Table 2.
13. When interpreting the signs of the coefficient estimates, note that both losses and gains are measured in absolute terms.

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