Stock-specific determinants of the disposition effect in fund managers

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Abstract

This paper approaches the disposition effect in Spanish equity portfolio managers. The disposition effect among mutual fund managers has traditionally been tested from a fund perspective; however, we include here new considerations that must be accounted for when disentangling fund managers' decisions. This study is the first to show that the disposition effect might not be a cognitive bias inherent to the person but as an alternative it mostly depends on the type of stock the selling decision is taken. Portfolios weights and stock domicile are considered. Domestic stocks are more prone to realize losses than gains. There is also a differential behaviour whether the manager trade partial sales or she closes a position on a stock.

Keywords

Disposition effect; mutual funds; manager decision; portfolio share, partial sales

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1. Introduction

The influence of psychology in business, especially in finance, has attracted increased interest among academics and practitioners in recent years. In this paper, we focus on the behavioural bias disposition effect defined by Shefrin and Statman (1985). The disposition effect involves the tendency to hold onto losses and to sell wins too soon, that is, the preference for realising winners rather than losers.

There are two main streams of research investigating the disposition effect: studies that approach the subject at the individual investor level and those that approach the topic from a portfolio manager perspective. Considering individual investors, the existence of a disposition effect is confirmed by analysing data from brokerage houses (Odean, 1998; and Feng and Seasholes, 2005, among others). There is a line of research related to the trading of mutual fund shares; for instance, in the US, Bailey *et al.* (2011) calculate several behavioural biases and test their influence on investors' mutual fund choices. Similarly, Calvet *et al.* (2009) show that in Sweden, the level of disposition effect varies according to whether household decisions are made on the stock market or the mutual fund market.

Additionally, Weber and Camerer (1998) propose an experimental design and confirm the existence of the disposition effect in securities trading. Weber and Welfens (2011) demonstrate on an artificial setup that the magnitude of the disposition effect varies across investors and can reverse. Furthermore, Dorn and Strobl (2011) propose a rational expectations model with asymmetrically informed investors to reconcile the disposition effect with rational behaviour.[1]

The individual investor decisions of selling or holding stocks have been tested worldwide. For example, in Portugal, Leal *et al.* (2010) investigate individual investors' stock selling decisions with data from a brokerage home. In Taiwan, Lee *et al.* (2013) analyse aggregate mutual fund redemptions and individual data records to find that

[1] The disposition effect is also documented among professional future trades in Locke and Mann (2005) and Choe and Eom (2009) and among T-bond futures trades in Coval and Shumway (2005).

investors redeem their mutual fund units more under a bear market than under a bull market when they have extreme capital losses. Finally, Duxbury *et al.* (2015) use investor-level data to analyse the disposition effect in the Chinese stock market.

There is less evidence from institutional investors; however, previous studies claim for the existence of some learning and experience components that reduce the disposition effect more for institutional investors than for individual investors. Some studies have conducted comparisons between individual investors and professional managers. Shapira and Venezia (2001) find that professionally and self-managed accounts in Israel display the disposition effect, although the effect is weaker for individual investors. Grinblatt and Keloharju (2001) also confirm the existence of disposition effect in the Finnish market for all types of investors. Barber *et al.* (2007) analyse the trades of the Taiwanese Stock Exchange and support the argument that individuals are reluctant to realise losses but that mutual funds are not. Chen *et al.* (2007) use Chinese brokerage account data to document that institutional investors suffer a weaker disposition effect.

Focusing on managers' trading behaviours, Frazzini (2006) shows a strong tendency among mutual fund managers to sell a higher proportion of winners than losers, thus confirming Wermers' (2003) finding that managers of underperforming funds appear reluctant to sell their losing stocks. In a recent paper, Cici (2012) finds that a substantial fraction of US equity mutual funds exhibit disposition effect, though not on aggregated terms.

Further investigation is thus needed to disentangle the attitudes of managers who are facing selling decisions. The main contributions of this paper are threefold. First, we analyse the fund manager perspective and compare it with other international studies justifying potential differences among markets. Second, we deepen the fund managers' disposition effect bias from a stock perspective. Third, we use a monthly holding portfolio dataset. When analysing investment decisions, higher frequency helps to minimise biases. Finally, we disentangle whether there are potential characteristics of the stocks related to the existence of disposition effect.

This paper examines the existence of disposition effect with a valuable monthly dataset in the Spanish market.[2] As shown previously, the disposition effect for individual investors has been tested in several countries; however, there is scarce research at the

[2] Using quarterly fund trades misses 18.5% of fund trades using monthly data in the US market (Elton *et al.*, 2010) and 38% of fund trades in the Spanish market (Ortiz *et al.*, 2015).

fund manager level.[3] An analysis of the Spanish market can provide a recent view of the European market with which the US can be compared and an analysis of a middle-sized market. The size of the market is especially interesting when exploring behavioural biases to detect potential differences. A characteristic of the Spanish market is its high concentration; the two largest management companies control almost 50% of the assets under management in Spain.[4]

This study confirms the existence of a preference for realising winners over losers in the Spanish funds, with a high proportion of mutual funds with positive disposition spreads for the entire period 2000-2016.

A study by Cici (2012) states that, in the US, learning effects have reduced the manifestation of the disposition effect over time. Similarly, Feng and Seasholes (2005) show that sophistication and trading experience reduce the propensity for realising gains in China. Lee *et al.* (2013) argue that investors can be affected by market conditions and vary depending on extreme or moderate losses as in Grinblatt and Keloharju (2001). Lee *et al.* (2013) find that investors redeem their mutual fund units more under a bear market than a bull market when experiencing extreme capital losses. On a yearly analysis, no significant patterns can be found in our sample through time, no significant learning effects are found.

Second, this study analyses whether a fund is managed by only one person or a team influences the likelihood that a fund will be more prone to realize gains than losses. Different explanations can be provided. On the one hand, making decisions together might reduce the attachment of a manager to a certain stock. On the other hand, however, the team management might also lead to "groupthink" defined as a potential bias in making optimal decisions due to the desire to reach an easy unanimity agreement. The results of Cici (2012) are related to the latter and suggest that team management cannot reduce the existence of a disposition effect among mutual funds. Contrarily, for Spanish equity fund management, there is a minor difference between both management organisations but slightly higher levels of disposition effect for individual managers.

[3] As far as we know, there are very few studies at the fund manager level beyond the US. We can cite the aforementioned papers which involve comparative studies between individual and institutional investors and a recent study on the Brazilian market in Lucchesi *et al.* (2015).

[4] Other behavioural issues related to the Spanish fund industry are analysed in recent papers: Gavriilidis *et al.* (2013) find intentional institutional herding in the mutual fund industry; Andreu *et al.* (2014) find herding in pension plans and Ortiz *et al.* (2015) document the existence of window dressing in domestic equity funds.

We examine fund characteristics that might lead to disposition-driven behaviour. Funds with high past performance might increase the probability of exhibiting a disposition effect that is in line with the dynamic loss aversion model (Barberis et al., 2001). Our results confirm this, past excess returns is significantly related to the probability of showing disposition effect. The size of a fund family seems to affect the propensity to realise losses more readily than gains. This finding is especially interesting in the highly concentrated Spanish equity fund industry and can be related to the results found for individual investors, i.e., unsophisticated investors, usually under-diversified, with higher levels of disposition effect.

Additionally, we examine the disposition effect from a new perspective. We hypothesise that the existence of a disposition effect varies according to the stock for which a manager is making selling decisions. For individual investors, Kumar (2009) shows that behavioural biases are stronger when stocks are more difficult to value.

This study provides a first approach to considering the disposition effect not only as a cognitive bias associated with fund managers but also in relation to the stocks considered. We focus on the type of stock-whether stocks are listed in the Spanish Stock Exchange or are international stocks. Second, we find interesting results by analysing the weight the stocks have in each portfolio and whether the decision implies a partial sale or a terminated position. We hypothesise that managers' level of attachment to a stock might vary depending on the portfolio share of that stock. The manager might have two different contradictory influences when evaluating selling decisions; on the one hand, the regret of realisation of losses, but on the other hand, reporting their portfolios given that investors would not welcome stocks with paper losses in their top ten positions. Secondly, the proximity and level of knowledge of the companies have shown to influence the cognitive biases on decisions. The results confirm that the attitude towards domestic or foreign stocks is different, domestic stocks have a higher propensity for realising winners than losers. The weight of a certain stock in the portfolio is relevant on a certain type of investment policies, and seems to be also related to the stock domicile.

Even further, disposition effect is shown only on partial sales, the well-known behavioural regret of aversion refrain managers to sell stocks with paper losses. However, once the manager recognise her mistake, she closes the position. Considering final sales, the proportion of realising losses is higher than realising gains.

A complimentary analysis would shed light on how managers are influenced by their level of attachment to decisions. Stocks that are only reported in a few funds are supposed to be a clear sign of a special bet of those managers who selected them.

In Section 2, we describe the data sample collecting process and the methodology to compute disposition effect. Section 3 shows the results of the analysis in Spanish equity funds and the analysis of fund-specific determinants of the disposition effect. Section 4 illustrates the stock-specific determinants of the disposition effect. A final section concludes.

2. Data and methodology

2.1 Data description

Portfolio holdings data for Spanish funds are initially provided by the Spanish Securities Exchange Commission (CNMV). The euro value of each position is provided. The data are monthly from December 1999 to December 2006, and quarterly thereafter. The quarterly information is merged, if possible, with Morningstar monthly portfolio holdings using the ISIN codes of both the funds and the individual assets. The final database comprises the period from December 1999 to December 2016. Stock information is obtained Datastream.

This study analyses the funds included in the CNMV category Euro equity funds, that means investing at least 75% of the portfolio in equities with a minimum of 60% of the equity allocation in euro zone domiciled companies; and a maximum currency risk of 30%. Index funds and EFT are excluded from the sample.

The final sample, which is free of survivorship bias, includes 283 funds with 23,397 fund month observations. We control price data information and splits, share increases, mergers and acquisitions for 2,438 different stocks with a total of 835,065 stock holdings positions across funds.

Individual brokerage houses provide complete information about the moment at which the transactions occur. However, in mutual fund transactions, the problem of frequency data may arise. The exact moment when mutual fund managers realise the trading is not known. This issue is partially solved in this paper with monthly portfolios holdings as opposed to previous literature analysing quarterly holdings, which implies the loss of interim trades as demonstrated by Elton *et al.* 2010.

Table 1 reports the summary characteristics of our Euro equity fund sample at four date points. There exist 154 equity funds in December 1999 and 81 at the end of 2016.

This outcome is not striking due to the reorganisation of the banking system in Spain during those years. During that time, there was an intense merging process at the institutional level, which also translated to fund mergers. After a period of dramatic drop in the assets under management in this category due to the downward trends of the financial crisis, the level of investment in mutual funds is recovering during the last years.

Within the Euro equity fund category established by the supervisor there are different investment policies that may affect the analyses through this paper. Therefore, we construct a subsample of funds which self-report their objective of investing in the Spanish market and we label this subsample as domestic equity funds, the rest of the funds of the category are labelled as Euro equity funds_others. The percentages of Spanish equity portfolio within domestic equity funds and Euro equity funds_others confirm the validity of the subsample generated.

Table 1 Mutual fund sample

This table reports summary characteristics of Spanish funds categorised as Euro equity funds at four date points: Dec1999, Dec2005, Dec2010 and Dec2016. The table shows the number of funds at each date, the total amount of assets together with the assets of the smallest and largest fund; the average number of stock positions at each date together with the minimum and maximum number of positions, the percentage of the portfolio for which assets are controlled with complete stock information necessary for the analysis, the percentage of the portfolio invested in equities, the turnover ratio, calculated for the last quarter of corresponding year; and the percentage of local equity portfolio (invested in Spanish domiciled companies) for the subsample of domestic equity and the rest of funds in Euro equity category.

	Dec1999	**Dec2005**	**Dec2010**	**Dec2016**
Number of funds	154	165	141	81
Total assets (€millions)	12770.3	12008.5	4640.5	7422.9
Minimum per fund (€millions)	1.34	2.19	0.87	4.51
Maximum per fund (€millions)	1508.03	935.64	977.51	845.42
Average stock positions	50.47	44.41	38.18	42.2
Minimum per fund	17	16	17	20
Maximum per fund	168	132	91	82
% of the portfolio controlled	95.84%	99.41%	99.57%	98.52%
% of equity portfolio	88.40%	85.06%	85.16%	91.64%
Turnover ratio	N/A	8.94%	11.03%	10.24%
% of local equity portfolio – domestic equity funds	91.44%	94.23%	93.38%	91.69%
% of local equity portfolio – Euro equity funds_others	18.61%	23.08%	18.80%	21.56%

The percentage of the portfolio controlled is very high, with an average of 98.26% of the assets for the entire period. This demonstrate the quality of the database. We additionally check within the sample of Euro equity funds whether funds invest mostly in local equities, that is, in companies domiciled in Spain. This level of control provides robustness to the results of the evaluation of disposition effect.

2.2. Methodology

Investors suffer from different cognitive biases that influence portfolio management. Mental accounting refers to the inclination to focus on gains and losses from individual stock positions rather than focusing on the performance of the whole portfolio. The form of the Prospect Theory value function shows that investors are risk-averse for gains but risk-seeking for losses. Altogether with the regret to acknowledge mistakes, investors are prone to hold onto their losers to postpone or even avoid (i.e., hoping for a recovery in prices) admitting their mistakes. Stocks must, therefore, be treated individually in the computing process as follows.

As a first step, we must compute whether a sale takes place within a month. We compute the number of shares held by each stock in a portfolio as the money value of the position divided by the price of the stock on the last day of the month. We control for stocks that have been excluded from the market during the period. In this case, we cannot consider those trades as sales in our study because they are not manager's decisions.

As previously explained, the disposition effect is based on a combination of mental accounting and Kahneman and Tversky's Prospect Theory (1979), both of which are built upon the existence of a reference point. To determine the existence of a disposition effect, it is necessary to make assumptions about the cost basis of a particular stock, which will be the proxy for that reference point. Given that one can never know the exact moment a certain stock is traded within the month, we assume that trades occur at the end of the period, the purchase price is, therefore, the price as of the last day of the month. When additional stock purchases occur, the average purchase price is computed as inventory method. Early studies such as those of Odean (1998) and Cici (2012) confirm that the results are essentially the same for other considerations, including highest purchase price (HIFO), first purchase price (FIFO) and low purchase price (LIFO). For robustness, we also consider the purchase price as the average daily price of the stock since the last portfolio reported.

The comparison between that reference point for the cost and the actual stock price defines whether that stock position is a gain or a loss. Considering the two extents of calculations of the purchase price considered for robustness, the actual stock price is assumed either at the end of month or as the daily average price since the last portfolio reported.

As in previous studies, we use Odean's (1998) methodology to compute the proportion of gains realised, *PGR*, and proportion of losses realised, *PLR*, for each fund and each month:

$$PGR_t^i = \frac{RG_t^i}{RG_t^i + UNRG_t^i} \quad (1)$$

$$PLR_t^i = \frac{RL_t^i}{RL_t^i + UNRL_t^i} \quad (2)$$

where RG_t^i is the number of realised capital gains by fund *i* in month *t*, $UNRG_t^i$ is the number of unrealised gains, RL_t^i is the number of realised losses, and $UNRL_t^i$ is the number of unrealised losses. From the measures of equations 1 and 2, we can define the disposition spread as follows: $DISP_t^i = PGR_t^i - PLR_t^i$. This disposition spread will give us information about the proportion in which funds are affected by the disposition effect.

Realised gains, paper gains, realised losses and paper losses are aggregated for each fund date. A fund date is included only if the denominators for both *PGR* and for *PLR* are nonzero for that fund date. Next, we compute the time-series mean of *PGR*, *PLR* and *DISP* ratios for each fund.

Equations 1 and 2 gather the number of transactions, a similar procedure is followed computing the euro value of transactions. Finally, a third set of results is reported, as introduced in Odean (1998) for individual investors, on a period a certain stock is partially sold. In this case, paper gains or paper losses are also computed for that stock. In Barber *et al.* (2007) paper gains and paper losses are computed daily even if a stock is not trade, for individual investors in Taiwan.

3. Results of the fund level analysis

3.1 Overall results

Table 2 reports the *PGR*, *PLR* and the disposition spread (*DISP*) for Euro equity funds domiciled in Spain. These proportions are calculated for the number of transactions in Panel A. Results are similar considering that trades occur at some point during the month

or at the end of the month through different panels. Gains are realised at a rate of 34.5% and losses are realised at a rate of 32.6% for the entire sample period assuming that trades occurs at the end of the month. In aggregate, managers show approximately a 6% higher probability to sell a winner rather than a loser. Even disposition spread is significant, there is a low difference in proportions. For individual investors, Odean (1998) show that a stock with gains is 50 percent more likely to be sold than a stock with losses; in the analysis of Leal *et al.* (2010) for individual investors the ratio of *PGR* to *PLR* is almost 3. However, looking at the fund market, Frazzini (2006) for US managers (1980-2002) reported much lower disposition effect, the preference for selling winners rather than losers was 20%, even further, Cici (2012), do not find disposition effect among managers in the United States for the period 1980-2009. This last result, which is apparently contradictory for the same market, is explained by Cici (2012) as welcome news because managers have exhibited increased awareness of behavioural biases in recent years. Similarly, Barber *et al*. (2007) find that Taiwanese domestic mutual funds (1995-1999) are more willing to sell losers than winners; besides the comparison with other investors let them conclude that the level of sophistication of investors influences their preference for realising winning stocks while continuing to hold losing ones.

Considering the analysis through time, we find no significant changes in the yearly analysis, we cannot confirm the learning hypotheses or the influence of the market states at this point.

There is an overall evidence in the Spanish fund market that managers show preferences for realizing gains than losses. The percentage of funds that show disposition effect is usually reduced in terms of euro value of transactions (Panel B), which means that small funds show higher level of disposition.

In the three panels of Table 2, *PGR* and *PLR* are higher during the years 2007, 2008 and 2009, which indicates that there was more selling activity among equity funds during the financial crisis.

The results are robust in Panel C, where partial sales are computed both as a proportion of paper and as realised values, but the levels of disposition are not significant. Barber *et al.* (2007) find that domestic mutual funds display a modest preference for selling losers rather than winners using the same methodology of partial sales.

Table 2: PGR and PLR for the entire sample and yearly analysis

This table reports the proportion of realised gains (*PGR*), proportion of realised losses (*PLR*) and difference in proportions (*DISP*). The disposition effect is computed using the number of transactions in Panel A and the euro value of the transactions in Panel B. Panel C includes the euro value paper gains or losses in partial sales. In Panels A.1, B.1 and C.1 we assume a trade takes place at some time during the month. In Panels A.2, B.2 and C.2 we assume trades occur at the end of the month. Each statistic is computed every reporting month for each fund, its yearly time-series mean and its complete time-series mean is computed for each fund. The *p*-values test the null hypothesis that the differences in proportions are equal to zero. Each panel also reports the fraction of funds with a positive equally average disposition ratio and with positive average disposition ratio weighted by fund size.

Panel A: Number of transactions																		
Panel A.1: Number of transactions. Av.price																		
	Entire period	2000	2001	2002	2003	2004	2005	20006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
PGR	0.344	0.356	0.345	0.311	0.326	0.299	0.339	0.332	0.486	0.558	0.429	0.399	0.361	0.329	0.273	0.240	0.287	0.288
PLR	0.328	0.326	0.322	0.332	0.324	0.337	0.330	0.312	0.296	0.302	0.301	0.302	0.310	0.324	0.336	0.328	0.337	0.316
DISP	0.017	0.027	0.019	0.015	0.021	0.011	0.003	0.011	0.022	0.018	0.022	0.015	0.010	0.012	0.020	0.000	0.007	0.023
p-value	0.000	0.013	0.038	0.099	0.903	0.006	0.485	0.182	0.000	0.000	0.000	0.000	0.003	0.954	0.002	0.000	0.025	0.262
% funds > 0 (eq.weig)	64.7%	59.5%	54.7%	59.3%	57.5%	60.1%	50.6%	50.3%	60.7%	54.4%	58.8%	55.3%	56.0%	53.1%	58.4%	52.5%	50.5%	57.6%
% funds > 0 (€ weig)	46.1%	58.9%	45.0%	65.7%	57.7%	68.0%	48.2%	53.3%	73.2%	56.3%	64.1%	54.7%	32.9%	60.3%	67.2%	49.0%	50.2%	52.9%
Panel A.2: Number of transactions. End price																		
PGR	0.345	0.358	0.350	0.319	0.331	0.299	0.340	0.333	0.486	0.556	0.422	0.396	0.363	0.327	0.271	0.240	0.287	0.284
PLR	0.326	0.324	0.317	0.333	0.325	0.334	0.322	0.313	0.298	0.296	0.302	0.299	0.310	0.321	0.342	0.323	0.331	0.320
DISP	0.021	0.028	0.028	0.016	0.022	0.016	0.016	0.010	0.017	0.020	0.017	0.017	0.019	0.019	0.013	0.005	0.021	0.023
p-value	0.000	0.003	0.003	0.324	0.660	0.011	0.148	0.165	0.000	0.000	0.000	0.000	0.002	0.949	0.000	0.000	0.056	0.159
% funds > 0 (eq.weig)	65.7%	59.5%	59.7%	57.6%	57.5%	60.1%	55.7%	57.1%	59.0%	56.4%	60.0%	56.6%	56.0%	57.8%	49.6%	45.5%	48.4%	59.3%
% funds > 0 (€ weig)	54.2%	57.4%	46.8%	63.7%	53.3%	50.5%	58.9%	63.0%	67.9%	60.9%	60.7%	58.6%	56.5%	61.4%	60.0%	45.7%	47.3%	54.8%

Table 2: PGR and PLR for the entire sample and yearly analysis (continued)

Panel B: Euro value of transactions																		
Panel B.1: Euro value of transactions. Av.price																		
PGR	0.191	0.181	0.174	0.170	0.174	0.118	0.139	0.148	0.318	0.429	0.326	0.252	0.226	0.231	0.166	0.140	0.169	0.168
PLR	0.180	0.170	0.169	0.178	0.180	0.198	0.192	0.167	0.161	0.166	0.165	0.154	0.160	0.163	0.184	0.182	0.182	0.156
DISP	0.012	0.011	0.005	0.002	0.004	0.001	0.000	0.021	0.017	0.012	0.011	0.006	0.000	0.000	0.006	-0.014	0.005	0.018
p-value	0.010	0.471	0.737	0.530	0.704	0.000	0.000	0.088	0.000	0.000	0.000	0.000	0.001	0.005	0.300	0.062	0.491	0.590
% funds > 0 (eq.weig)	52.3%	53.6%	50.3%	55.8%	52.9%	52.4%	52.3%	55.9%	55.2%	53.9%	53.5%	48.0%	45.4%	46.9%	55.8%	42.4%	48.4%	54.1%
% funds > 0 (€ weig)	45.6%	48.6%	45.8%	63.0%	53.5%	56.5%	51.6%	47.7%	66.4%	49.6%	57.6%	62.6%	33.9%	63.9%	65.2%	26.7%	39.4%	60.8%
Panel B.2: Euro value of transactions. End price																		
PGR	0.194	0.186	0.177	0.179	0.175	0.120	0.139	0.149	0.316	0.434	0.314	0.251	0.235	0.235	0.168	0.141	0.168	0.171
PLR	0.179	0.172	0.166	0.188	0.177	0.197	0.187	0.171	0.159	0.162	0.163	0.151	0.162	0.171	0.191	0.182	0.181	0.159
DISP	0.016	0.011	0.013	-0.004	0.011	0.003	0.010	0.014	0.015	0.018	0.017	0.014	0.006	-0.009	0.001	-0.013	0.015	0.016
p-value	0.002	0.337	0.386	0.564	0.894	0.000	0.000	0.068	0.000	0.000	0.000	0.000	0.000	0.014	0.179	0.060	0.473	0.589
% funds > 0 (eq.weig)	53.0%	54.8%	51.4%	54.7%	53.4%	51.8%	52.3%	55.4%	57.4%	51.9%	49.4%	52.6%	49.6%	45.3%	53.1%	41.4%	53.8%	53.5%
% funds > 0 (€ weig)	47.5%	46.2%	57.4%	60.7%	53.3%	43.6%	50.7%	45.2%	68.1%	56.0%	54.4%	64.5%	56.8%	59.3%	61.9%	29.5%	47.2%	46.3%
Panel C: Euro value of transactions including paper gains or losses in partial sales																		
Panel C.1: Euro value of transactions including paper gains or losses in partial sales. Av.price																		
	Entire period	2000	2001	2002	2003	2004	2005	20006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
PGR	0.114	0.110	0.110	0.108	0.103	0.076	0.076	0.083	0.174	0.198	0.196	0.150	0.130	0.132	0.105	0.091	0.101	0.094
PLR	0.115	0.105	0.102	0.112	0.109	0.119	0.125	0.107	0.105	0.107	0.101	0.095	0.093	0.098	0.106	0.114	0.104	0.095
DISP	0.000	0.001	0.001	-0.009	-0.005	-0.003	-0.010	0.005	0.005	-0.001	0.003	-0.003	-0.001	-0.005	0.000	-0.015	0.001	-0.001
p-value	0.856	0.674	0.331	0.615	0.591	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.003	0.024	0.834	0.100	0.793	0.921
% funds > 0 (eq.weig)	44.5%	49.4%	48.1%	48.8%	50.0%	51.8%	50.0%	52.0%	54.6%	50.0%	55.9%	46.1%	44.0%	40.6%	47.8%	42.4%	50.5%	50.6%
% funds > 0 (€ weig)	31.6%	42.0%	40.8%	46.6%	36.2%	54.2%	52.3%	47.9%	58.6%	45.1%	63.5%	41.9%	36.3%	59.9%	58.6%	33.1%	38.0%	54.4%
Panel C.2: Euro value of transactions including paper gains or losses in partial sales. End price																		
	Entire period	2000	2001	2002	2003	2004	2005	20006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
PGR	0.116	0.111	0.112	0.113	0.104	0.077	0.075	0.084	0.173	0.210	0.186	0.151	0.133	0.134	0.108	0.092	0.099	0.096
PLR	0.115	0.106	0.104	0.115	0.110	0.121	0.123	0.110	0.102	0.106	0.103	0.096	0.094	0.101	0.109	0.113	0.103	0.098
DISP	0.001	0.000	0.000	-0.011	-0.004	-0.003	-0.006	0.002	0.002	0.003	0.006	-0.001	0.003	-0.009	0.001	-0.009	0.009	0.000
p-value	0.783	0.721	0.361	0.889	0.515	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.002	0.045	0.719	0.148	0.723	0.915
% funds > 0 (eq.weig)	43.1%	47.0%	45.3%	47.7%	52.9%	48.2%	46.6%	52.5%	56.3%	55.2%	52.9%	52.6%	44.0%	40.6%	43.4%	45.5%	51.6%	46.5%
% funds > 0 (€ weig)	29.4%	37.7%	39.6%	46.1%	39.8%	40.1%	42.8%	47.9%	65.4%	56.9%	56.8%	63.0%	36.2%	57.1%	57.7%	42.2%	38.4%	38.1%

The results of the analysis of the disposition effect in equity funds are inexorably connected to the purchase reference point, which determines whether a position is a gain or a loss. The cost basis of a given stock computes from a certain date starting point, however, it is not possible to know the exact price a stock enters the portfolio unless you only consider stocks bought for the first time. However, this procedure would exclude from the analysis stocks gathered in portfolio holdings from the inception period of the fund. The large sample period of our database minimizes this problem but in order to capture the potential disruption in selecting reference points for the stocks, we compute separately the disposition spread for those funds launched to the market at the same time that they appear in our sample period. These funds have therefore more precise reference points. The results are shown in Appendix 1 and show a stronger tendency to hold on to losses than for the whole sample of funds. This robustness check lets us conclude that the results obtained are robust, in case of a potential bias wold be in the sense of underconsideration of disposition effect.

We further investigate whether the intentionality of realising gains and losses may depend on the type of sale decision, specifically, whether it is a partial or a final sale (the sale terminates the position of the stock holding). Table 3 shows the results.

Table 3: PGR and PLR in final and partial sales

This table reports the proportion of realised gains (*PGR*), proportion of realised losses (*PLR*) and difference in proportions (*DISP*). Each statistic is computed every reporting month for each fund and its complete time-series mean is computed for each fund. The *p*-values test the null hypothesis that the differences in proportions are equal to zero. Each panel also reports the fraction of funds with a positive equally average disposition ratio and with positive average disposition ratio weighted by fund size. Trades are assumed to occur at the end of the month.

	Final sales		**Partial sales**	
	Number of transactions	**Euro value of transactions**	**Number of transactions**	**Euro value of transactions**
PGR	0.075	0.075	0.271	0.119
PLR	0.081	0.085	0.245	0.095
DISP	-0.009	-0.013	0.028	0.026
p-value	0.012	0.010	0.000	0.000
% funds > 0 (eq.weighted)	33.22%	33.57%	84.10%	79.15%
% funds > 0 (€ weighted)	23.48%	23.62%	82.08%	73.14%

According to the results of Table 3, managers realise partial gains more frequently than final sales, both PGR and PLR are higher in partial gains. There exists a regret of realising losses in partial sales, the proportion of selling in gains is around 10% higher

than the proportion of selling in losses. Once a manager decides to realize losses, it seems that the position is completely closed. Results are similar for number of transactions and euro value, the size of the position is not the relevant issue but whether the position is still open or not.

3.2. Fund-specific determinants of the disposition effect: management organisation

The existing literature discusses differential management behaviour whether a certain fund is managed by only one person or by a team of managers. Information on the history of the managers is provided by Morningstar.[5] Rau (2015) uses an experimental study to find that subjects investing jointly exhibit more pronounced disposition effects than individuals.

Table 4: Disposition effect on management organisations

This table reports the proportion of realised gains (*PGR*), proportion of realised losses (*PLR*) and difference in proportions (*DISP*). Panel A computes the number of transactions and Panel B computes the euro value of the transactions. Each statistic is computed every reporting month for each fund and its complete time-series mean is computed for each fund. The *p*-values test the null hypothesis that the differences in proportions are equal to zero. Each panel also reports the fraction of funds with a positive equally average disposition ratio and with positive average disposition ratio weighted by fund size. Trades are assumed to occur at the end of the month. The DIFF column is the difference of *PGR* and *PLR* ratios for one manager or a team-managed fund and the *p*-value of the difference in means. A fund is included in the analysis only when information on management organisation is available. Overall, 173 funds are included.

	Panel A: Number of transactions			
	One manager	Team managed	DIFF	*p*-value
PGR	0.325	0.362	0.037	0.072
PLR	0.309	0.352	0.043	0.032
DISP	0.017	0.011		
p-value	0.022	0.308		
% funds > 0 (eq.weighted)	61.61%	60.19%		
% funds > 0 (€ weighted)	67.24%	60.96%		
	Panel B: Euro value of transactions			
	One manager	Team managed	DIFF	*p*-value
PGR	0.206	0.237	0.043	0.141
PLR	0.193	0.246	0.053	0.014
DISP	0.015	-0.008		
p-value	0.158	0.525		
% funds > 0 (eq.weighted)	50.89%	51.46%		
% funds > 0 (€ weighted)	42.00%	54.35%		

[5] The name of the managers is not always historical; a fund is only included in this analysis when manager information is available. The number of funds is then reduced to 173 funds.

Table 4 shows the results of the analysis of the influence of the management structure. The ratios *PGR* and *PLR* are larger in team-managed funds, which indicates that the latter trade more actively. In Panel A of Table 4, we report significant differences between *PGR* and *PLR*, though in terms of disposition spread, the differences are smaller. In general terms, funds that are managed individually show a slightly higher level of disposition effect. Further investigation is needed in this field because there are many doubts about the true management organisations both within a fund and within fund families.

3.3. Fund-specific determinants of the disposition effect: logit regression methodology

In the previous section, we have only isolated the effect of management structure considering team-managed portfolios. This section presents a multivariate approach to investigate fund characteristics that can lead to a different attitude toward selling in gains or losses, in line with the logit regression methodology by Cici (2012). Grinblatt and Keloharju (2001) also employ logit regressions to identify the determinants of sell versus hold decisions to conclude on the tendency to be reluctant to realize losses.

Table 5 summarises the results of a panel logistic regression on the likelihood of the presence of disposition effect in funds. Regarding the fund-specific determinants of the disposition effect, funds' past performance is significantly and positively related to disposition-driven behaviour. This result is in line with the dynamic loss aversion described by Barberis *et al*. (2001). We show that higher fund past performance increases the probability of the disposition effect's presence, which indicates that from an aggregate portfolio perspective, managers' utility function is affected by previous gains and losses.

Additionally, according to Duxbury *et al.* (2015), it is important to distinguish prior outcomes across two dimensions; unrealised/realised and stock/portfolio levels. They conclude that the disposition effect is related to prior unrealised outcomes at the stock level, thus leading us to deepen our disposition effect in the following section, which analyses the stock characteristics that drive the disposition effect.

A selling decision within a fund portfolio can be due to liquidity decisions. In such a circumstance, the predisposition to sell winners over losers might change. Dror *et al.* (1999) show, in a psychological experiment, that participants in higher levels of risk states were more prone to take risks. We hypothesise that a fund manager who experiences outflows in a portfolio might suffer from this time pressure effect on her decisions to attend clients' redemptions demands. However, the results of Table 5 cannot confirm a

variation in the propensity for a disposition effect due to liquidity decisions. Ever further, in our sample, funds that experience outflows of money show a higher probability to suffer disposition effect.

Table 5: Logit regression to model the likelihood of the presence of a disposition effect

This table reports the results of a logit regression that aims at finding fund characteristics that induce the existence of a disposition effect.

Model: P(Positive disposition spread)= f(month dummies, excess return, outflow dummy, number of stocks, Herfindahl Index, fund assets, family fund assets, fund turnover, fund fees, load). In the left part of the table disposition spread is calculated on the number of transactions and in the right part is calculated on the euro value of transactions. Panel data indicates the variables at a fund level at every reported period. POSITIVE_DISP is an indicator variable that takes the value of 1 for an observation with a positive disposition spread, and 0 otherwise. Explanatory variables are month dummies (not reported), EXC_RET as the fund excess return of the past twelve months over the index, OUTFLOW is the dummy that takes value 1 when the fund experienced outflows and 0 otherwise. #STOCKS is the natural log of the number of stocks held in the fund portfolio, HERFINDAHL_INDEX is the sum of the squares of the portfolio weights in each stock, multiplied by 100.[6] Additional independent variables in the regression are FUND_TNA as the log of total net assets of the fund, FAMILY_TNA as the log of total net assets of the corresponding fund family, TURNOVER as the fund's turnover rate in percentage terms, FUND_FEE as the fund's management and deposit fee, LOAD is a dummy that takes the value of 1 when the fund charges redemption fees. All independent variables are lagged by one period. Marginal probabilities are reported along with the associated *p*-values in parentheses. Standard errors are clustered by fund.

Explanatory variables	Number of transactions		Euro value of transactions	
Intercept	0.068	(0.859)	1.171	(0.004)
EXC_RET	0.777	(0.003)	1.074	(0.000)
OUTFLOW	-0.087	(0.012)	-0.113	(0.001)
#STOCKS	0.189	(0.019)	-0.014	(0.868)
HERFINDAHL_INDEX	0.009	(0.535)	0.009	(0.573)
FUND_TNA	0.010	(0.580)	0.036	(0.072)
FAMILY_TNA	-0.058	(0.000)	-0.090	(0.000)
TURNOVER	0.286	(0.177)	0.061	(0.780)
FUND_FEE	-0.003	(0.919)	-0.029	(0.366)
LOAD	0.117	(0.010)	0.223	(0.000)
N	16710		16710	

[6] Team effects are analysed separately in Section 3.2. The explanatory variable is not included because managers' information is not always disclosed and the number of observations of the panel is reduced.

The size of the fund family is a factor that should also be analysed in greater depth, especially in the Spanish mutual fund market, which shows a high level of concentration. Fund families that manage less assets show a higher probability of display disposition effect, the degree of sophistication of the company may justify this result.

The sign of the market conditions results are in line with the hypotheses but are not significant and are therefore not included in Table 4.[7] Our results are not robust with Lee *et al.* (2013), who find that market states affect investor psychology and the disposition effect. One reason might be, however, that Lee *et al.* (2013) analyse individual investors.

4. Stock-specific determinants of the disposition effect

Further analysis on the source of the disposition effect is needed. Our results show that the disposition effect is not a generalised bias among equity fund investors; one explanation might rely on the existence of different propensities to realise losses, depending on whether decisions must be made for different types of stocks. Kumar (2009) follows a similar approach and examines the disposition effect at stock level for individual investors to conclude that stocks that are more difficult to value exhibit stronger disposition effect.

We focus our attention on the domicile of stocks and categorise them as either domestic or internationally based. Investment attitudes have usually been shown to be different in regard to the enterprises' proximity and level of information. Additionally, we hypothesise that the level of attachment to a stock might vary depending on the weight that a particular stock has on one's portfolio. The manager might have two different influences: the regret of realising losses, or the feeling that investors would not welcome stocks with paper losses in their top ten positions when reporting their portfolios.

From the total number of stocks for which we control full information, we examine stocks which at least three dates where *RG*, *UNRG*, *RL* and *UNRL* are computed. The final sample for this analysis comprises 1,902 stocks. Realised gains, paper gains, realised losses, and paper losses are summed for each stock date to compute *PGR* and *PLR* ratios. *DISP* spread is the difference between the average *PGR* and average *PLR* for each stock.[8]

[7] Two variables were included in the analysis. We calculate monthly return series of the Ibex35 or Eurostoxx50 from December 1999 to December 2016 and introduce in the model a dummy variable that takes on the value of 1 in a month with positive index returns and 0 otherwise. Finally, we include a dummy variable that takes on the value of 1 when the level of volatility is above the median of the sample horizon and 0 otherwise. The results are available from the authors upon request.

[8] Please note that on a cross-section analysis is not possible to take euro value statistics.

Table 6: Disposition effect by stocks

This table reports the proportion of realised gains (*PGR*), proportion of realised losses (*PLR*) and difference in proportions (*DISP*). Number of transactions are computed. Trades are assumed to occur at the end of the month. Each proportion is computed every reporting month for each stock and its complete time-series mean is computed for each stock. Panel A exhibits the results for the entire sample and the sample split between domestic (1) and international stocks (2). Similarly, the results are split for domestic equity funds (3) and the rest of funds in the Euro equity funds category. Panel B shows the results for quintile portfolios of stocks according to the weight a certain stock has in the previous portfolio. Q1 gathers stocks with the highest portfolio weight, while Q5 gathers stocks with the lowest portfolio weight. Panel C and D show the results for quintiles calculated only for domestic equity funds and Euro equity funds_others, respectively. Overall, 1,902 stocks are included in the analysis.

	Panel A: Disposition spread at stock level				
	Entire sample	Spanish listing (1)	Foreign listing (2)	Domestic equity (3)	Euro equity_others (4)
PGR	0.446	0.332	0.484	0.458	0.439
PLR	0.415	0.298	0.456	0.412	0.415
DISP	0.031	0.034	0.028	0.046	0.025
p-value	0.000	0.007	0.000	0.000	0.001
# stocks	1902	263	1639	1143	1734
	Panel B: Stock weight in fund portfolios				
	Q1	Q2	Q3	Q4	Q5
PGR	0.471	0.451	0.419	0.428	0.452
PLR	0.431	0.415	0.399	0.397	0.427
DISP	0.040	0.036	0.020	0.031	0.025
p-value	0.001	0.003	0.080	0.006	0.047
	Panel C: Stock weight in fund portfolios-domestic equity funds				
	Q1	Q2	Q3	Q4	Q5
PGR	0.406	0.392	0.431	0.438	0.436
PLR	0.398	0.393	0.361	0.402	0.397
DISP	0.008	-0.002	0.070	0.035	0.040
p-value	0.975	0.285	0.000	0.024	0.006
	Panel D: Stock weight in fund portfolios-Euro equity funds_others				
	Q1	Q2	Q3	Q4	Q5
PGR	0.479	0.433	0.415	0.422	0.432
PLR	0.442	0.406	0.409	0.391	0.417
DISP	0.037	0.027	0.006	0.031	0.014
p-value	0.015	0.025	0.392	0.002	0.033

We split the 1,902 stocks of our analysis into quintiles according to their portfolio weight in the previous reported portfolio because the decision of a potential sale in period *t* may vary according to the weight a certain stock has in the portfolio the previous period. Then we measure the average *PGR* and *PLR* for stocks in the quintile portfolios.

Table 6 reports the results of the analysis of the disposition effect at a stock level. A stock that is up in value is around 7% more likely to be sold than a stock that is down. Similar results than in Panel A2 of Table 2. However, we are more interested in the different stock characteristics that may be related to different levels of disposition. Regarding the domicile of stocks (Panel A), the results indicate that *PGR* and *PLR* are higher for foreign listed stocks, that means that the probability to sell is higher in foreign stocks. This result, could be related with the well-known home bias effect. The ratio of *PGR* to *PLR* is, however higher for Spanish than for foreign stocks. Apparently, domestic stocks usually hold in losses at a higher proportion than in gains.

Regarding the investment policy of the fund, we control for funds which are self-classified as oriented to domestic equity and the rest of the funds contained in the category of Euro equity funds. The results are very similar, the ratio of *PGR* to *PLR* at stock level is higher considering stocks in domestic equity funds than for stocks included in the rest of the Euro equity fund portfolios. The results are consistent taking into account the percentage of invesment in Spanish stocks in the two subsamples. Table 1 reports an average 91.69% % of investment in Spanish stocks for domestic funds and an average of 21.56% for the rest of the funds in December 2016.

Panel B of Table 6 reports further analysis of the relation of the stock characteristics with the level of disposition effect. No significant differences are shown across quintiles based on portfolio weights. Interesting results are found, however, in Panel C that reports the results for fund with the investment policy in domestic stocks. No disposition effect is found in stocks with high weight in the portfolios. Stocks that are representative of the portfolio are not hold in losses.

The results of Table 3 show the importance of whether a decision is a partial or a final sale, we deep in those results also in the analysis of stock-level, as shown in Table 7. Consistent with the results of Table 3, there are different attitudes when the decision implies the termination of the position or not. Final sales seem to be more rational in the sense that no disposition effect is found, contrarily, we find that managers are not prone to close position when there is a paper gain. Panel B of Table 7, shows the results by quintiles based on the weight of the stock in a portfolio. We only report quintiles in final sales because they are more precise. When realising a partial sale, the stock weight of that stock in the portfolio varies and may bias the results. There is an interesting conclusion, the percentage of realising losses when managers close a position increases when the weight of that stock in the portfolio is reduced. That is the regret aversion to realise a loss

and close managers' mental account is much lower when that stock supposes a small share of the portfolio.

Table 7: Disposition effect by stocks: partial and final sales

This table reports the proportion of realised gains (*PGR*), proportion of realised losses (*PLR*) and difference in proportions (*DISP*). Number of transactions are computed. Trades are assumed to occur at the end of the month. Each proportion is computed every reporting month for each stock and its complete time-series mean is computed for each stock. Panel A exhibits the results for sample split between final and partial sales. Panel B shows the results for quintile portfolios of stocks in final sales. Q1 gathers stocks with the highest portfolio weight, while Q5 gathers stocks with the lowest portfolio weight. Overall, 1,902 stocks are included in the analysis.

	Panel A: Disposition spread at stock level				
	Final sales			Partial sales	
PGR	0.029			0.416	
PLR	0.156			0.146	
DISP	-0.126			0.270	
p-value	0.000			0.000	
	Panel B: Stock weight in fund portfolios-final sales				
	Q1	Q2	Q3	Q4	Q5
PGR	0.023	0.026	0.022	0.024	0.023
PLR	0.120	0.129	0.140	0.161	0.214
DISP	-0.097	-0.1046	-0.118	-0.137	-0.191
p-value	0.000	0.000	0.000	0.000	0.000

This results confirms our initial proposal of that paper, to investigate whether the fact of presenting disposition stock within a fund, depends not only on the information based of fund characteristics, but also, on the stock level characteristics.

Following this results, as further research, we might consider the number of funds that hold a certain stock. We hypothesise that the regret of realising losses is most likely not the same when everyone makes the same mistakes. One might hate to make a loss when one's best ideas are not working out. Therefore, we would expect that the level of the disposition effect is higher for those stocks that appear in a smaller number of fund portfolios.

5. Conclusions

The tendency of investors to hold losses too long and sell winners too soon has widely been tested and confirmed for individual investors, but there are assorted results for professional investors.

The results of this study show that on aggregate, there is significant disposition effect among managers, who have a propensity to realise gains 6% higher than to realise losses. The results cannot confirm the existence of learning in the analysis through time.

A fund's management organisation may also play an important role in the prevalence of the disposition effect. Making decisions in the frame of a team reduces this behavioural bias.

We analyse some fund characteristics that influence the probability that funds will exhibit a disposition effect. Funds with higher past performance are more prone to exhibit a disposition effect. Fund family size also seems to be affecting the propensity to realise losses more readily than gains. This finding is especially interesting in the Spanish equity fund industry, which is very concentrated and thus calls for more research to shed light on fund management at the family level.

As far as we know, this is the first paper to approach the disposition effect in professional investors from a stock level. The tendency to hold onto losses might be driven by a certain type of stocks; domestic stocks are more prone to be sold in losses than foreign stocks.

The regret aversion is an important fact to be considered, this regret aversion would be higher when the stock position is terminated, therefore, partial of final sales may show different levels of disposition effect. In fact, on a fund level, disposition effect is only present on partial sales. Consistent results are found for the analysis at stock level, even further, the percentage of realising losses when managers close a position increases when the weight of that stock in the portfolio is reduced. That is the regret aversion to realise a loss and close managers' mental account is much lower when that stock supposes a small share of the portfolio.

Further research is ongoing on the different disposition effects on stocks that are considered to be special bets, that is, stocks that managers have included in their portfolios but are not usual in other funds.

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Appendix 1:

Table A.1: PGR and PLR in newly listed funds

This table reports the proportion of realised gains (*PGR*), proportion of realised losses (*PLR*) and difference in proportions (*DISP*). Each statistic is computed every reporting month for each fund and its complete time-series mean is computed for each fund. The *p*-values test the null hypothesis that the differences in proportions are equal to zero. Each panel also reports the fraction of funds with a positive equally average disposition ratio and with positive average disposition ratio weighted by fund size. Trades are assumed to occur at the end of the month. 71 funds newly listed during our sample period are analysed.

	Number of transactions	**Euro value of transactions**
PGR	0.341	0.219
PLR	0.305	0.185
DISP	0.039	0.036
p-value	0.000	0.005
% funds > 0 (eq.weighted)	77.46%	63.38%
% funds > 0 (€ weighted)	62.91%	52.41%