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Shaneera Boolell-Gunesh, Marie-Hélène Broihanne, Maxime Merli

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Disposition effect, investor sophistication and taxes: Some French Specificities[*]

BOOLELL-GUNESH S., BROIHANNE M.H., MERLI M.[**]

1. Introduction

Recent research in behavioral finance has demonstrated that investment behavior is not always consistent with the assumptions of perfect rationality generally made in the field. More precisely, this behavior has sometimes been shown to be systematically different from what is implied by normative models of standard finance theory.

One of the most widely documented behavioral biases is the disposition effect. This effect describes the tendency, at any given point in time, to more readily sell winners than losers, winners and losers referring to assets that have appreciated or depreciated since purchase. In this framework, researchers have shown that investors who are prone to the bias earn poor subsequent returns on their portfolio [Odean (1998)]. Of course, rational reasons can justify this behavior: portfolio rebalancing or higher trading costs of low priced assets, for instance. However, none of these reasons has been found convincing enough by researchers.

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[**] LaRGE, EM Strasbourg Business School, Strasbourg University, E-mail: shaneera@unistra.fr / mhb@unistra.fr / merli@unistra.fr . We acknowledge the financial support of the European Savings Institute.

Starting with Shefrin and Statman (1985), a number of researchers among others have documented the effect: Lakonishok and Smidt (1986) on aggregate volumes, Odean (1998), Shapira and Venezia (2001), Dhar and Zhu (2006) on individual data[1].

However, if the presence of the disposition effect has been answered in some countries, no such research has yet been carried out in France.

Our paper fits this loophole by investigating the trading records of 90 244 individual investors at a French discount brokerage house between 1999 and 2006. As a result, the first contribution of this study is to be the first one on the French market and the most comprehensive in the European context[2]. We find that investors show a strong preference for realizing paper gains rather than their paper losses and that this behavior cannot be explained, for instance, by a desire to rebalance portfolios.

We expect some investors to be more sophisticated than others. To be precise, investors are ranked as sophisticated ones if they trade derivative assets, internationally diversify their portfolio or use short selling facilities (French SRD). Based on this original approach, our second contribution demonstrates that sophisticated traders are also subject to the bias which leads us to conclude that sophistication attenuates but does not eliminate the disposition effect.

At the aggregate level, we show that the impact of the tax year effect is clearly less important in France than in other countries. French specificities i.e the existence of PEA account (Plan d'Epargne en Actions) give a unique opportunity to investigate more deeply the global impact of tax on the selling behavior of investors on the financial market. Actually, these accounts offer an interesting tax framework to their holders in the sense that capital gains are tax free if the account has been kept for more than 5 years. In this framework, we study the disposition effect for holders of PEA accounts before and after the end of the 5-year period. We show that individual investors do not seem to

1. Note that Weber and Camerer (1998) and Weber and Welfens (2006) bring experimental evidence of this bias.

2. The only European research dealing with the disposition effect on individual data concerns 3 079 accounts [Weber and Welfens (2006)].

change their investment behavior according to the type of fiscal account held (PEA or traditional). This original result is our third important contribution.

The rest of the article is organized as follows. The second section presents an overview of previous research on the disposition effect. Section 3 describes the data and introduces the methodology. Section 4 is dedicated to the description of our main results and comments and finally we conclude in section 5.

2. The Disposition Effect

The disposition effect is the tendency of investors to hold losers (losing stocks) too long and sell winners (winning stocks) too soon. This phenomenon was first documented by Shefrin and Statman (1985) in a study of mutual fund performance. Subsequent papers based on market data [Lakonishok and Smidt (1986); Ferris, Haugen and Makhija (1988)] showed that volume for winning stocks on the NYSE and the Amex exceeds that for losers.

From a theoretical point of view[3], many explanations of the disposition effect have been proposed in the literature. The most common explanation is based on the assumption of prospect theory preferences [Tversky and Kahneman (1979), Kahneman and Tversky (1992)] and, more precisely, on the S-shaped valuation function assumed in this model. According to this theory, investors evaluate gains and losses with respect to a reference point; the buying price is the most commonly used reference point. When a stock price is higher than the buying price (or more generally than the reference price), the investor is in the concave part of his valuation function and is hence risk averse. He may sell the stock if the expected return is perceived as too low. After a price drop, the investor is in the convex part and keeps the stock because he has become risk seeking. Following Shefrin and Statman (1985), some authors have used this argument to justify the existence of disposition investors [Odean (1998) and Weber and Camerer (1998),

3. For experimental studies of this bias, see for example, Weber and Camerer (1998), Chui (2001), Weber and Welfens (2006) and Rubaltelli *et al*. (2005).

for example]. In other words, when agents are risk-averse over gains and risk lovers over losses, they prefer to realize paper gains and to keep paper losses[4].

A second explanation is based on an irrational belief in mean reversion of stock prices, which states that investors believe poorer-performing stocks will rebound, and that better-performing stocks will decline in price. Briefly speaking, after a price increase, the investor believes that the probability of a price drop in the next period is higher than the one of another price increase [Shu *et al*. (2005), Weber and Camerer (1998)].

A third group of explanations argue that the disposition effect may be due to the desire to rebalance portfolios or to avoid higher transactions costs on low-priced assets. However, it has been shown in many studies that when controlling for rebalancing and share prices, the disposition effect is still observed and that the investments the investors choose to sell continue in subsequent months to outperform the losers they keep [see Odean (1998), Brown *et al*. (2006), for example].

A last explanation of the disposition effect is proposed by psychologists who work on the theory of entrapment or escalation of commitment [Staw (1979), Brockner (1992)]. In an investment context, the question is to know if it is better to keep a losing investment, to increase the stake (to break even), or to sell the losers and choose other stocks to invest in [Zuchel (2001)].

Finally, the disposition effect can also refer to preferences, including the idea that investors seek pride and want to avoid regret when choosing investment [Shefrin and Statman (1985)]. This interpretation has recently been developed by Muermann and Volkman (2006). The authors argue that loss aversion alone cannot explain the disposition effect as shown by Barberis and Xiong (2006) and Hens and Vlcek (2005) and they include the anticipation of regret and pride in a dynamic portfolio choice setting[5].

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4. Barberis and Xiong (2006) [see also Hens and Vlcek (2005)] show that the disposition effect is observed for some values of the expected stock return and the horizon of the investor, but they also find the opposite effect for other reasonable values of these parameters. Note that Barberis and Xiong (2008) give some new theoretical explanation of the disposition effect based on a "realization utility".

5. For experimental evidence, see O'Curry, Fogel and Berry (2006).

From an empirical point of view, the disposition effect is now well documented on individual data. Odean (1998) was the first to study the decision process of individuals on an important database of 10 000 accounts with a total of 97 483 transactions between 1987 and 1993.

He found that the proportion of realized gains is significantly higher than the proportion of realized losses (except in December), giving evidence of a disposition effect in individual investors' behavior.

Later studies on individual data gave rise to similar results for the behavior of employees [Heath *et al*. (1999)], and for stocks in other countries than the US [Shapira and Venezia (2001), for Israel, Grinblatt and Keloharju (2001), for Finland, Chen *et al.* (2004), for China, and Shu et al. (2005), for Taiwan, Brown *et al*. (2006), for Australia]. The disposition effect also appears to be positive on average but of different magnitude across countries and across investors. For example, Barber et al. (2007) show that Taiwanese investors are much more reluctant to realize their losses than U.S investors. They interpret their findings by the fact that Taiwanese traders exhibit a stronger belief in mean reversion than U.S traders.

Note that at the individual level, the disposition effect could vary across individual investors. Concerning this level of analysis, Dhar and Zhu (2006) confirm the presence of a significant disposition effect on average but show that one-fifth of the investors exhibit the opposite behavior and that the disposition effect is stronger for less sophisticated investors. Finally, the disposition effect is also detected in the investment decisions of professional traders [Shapira and Venezia (2001), Genesove and Mayer (2001), and Barber *et al*. (2007), for example][6].

The next section presents the original and proprietary dataset over which we analyze the disposition effect.

3. Data and empirical design

The anonymous data for this study comes from Cortal Consors, a large French discount brokerage house. We obtained transaction data

6. Coval and Shumway (2005), Frino et al. (2005) and Locke and Mann (2003) obtain the same kind of results on different futures markets.

for all active[7] accounts over the period 1999-2006, that is a total of 9 619 898 transactions, with 5 074 732 buy orders and 4 545 166 sell orders, for 92 603 investors. Data are contained in three files: trades, investors and fees. The trades file combines the following information for each trade: ISIN code of the asset, type of asset (common stocks, bonds, certificates, warrants), buy-sell indicator, sell short indicator, date, quantity and amount in Euros, place of quotation, account type (taxable versus tax-free account or French "PEA"), media used to place the order, order type. In the investors file, some demographical characteristics of investors are gathered: date of birth, sex, date of entry in and exit of the database, opening and/or closing dates of all accounts, place of living, and yearly number of trades. Finally, the fees file contains monthly fees paid by each investor and indicates whether they are trade fees or short sales fees.

In order to study the disposition effect, we extracted a dataset that only includes trades for common stocks. This dataset contains 8 464 518 trades, with 4 447 678 buy orders and 4 016 840 sell orders, made by 90 244 investors over 4 377 assets. For each stock, we build a file containing historical daily prices over the period 1999-2006. In this respect, securities ISIN codes are used to collect price data and information on splits and dividends through Fininfo[8], the French data provider. At this step, some trades (less than 1%) were deleted from the dataset because, either we did not find data corresponding to the ISIN code (534 codes out of 4377 ones). The final database, for which all prices are available, gathers 8 438 885 trades (4 426 894 purchases and 4 011 991 sales) for 90 079 investors.

In the context of French markets, three points should be outlined. First, individual investors may trade shares on a tax-free account, called PEA (Plan d'Epargne en Actions), or, as in other countries, on a traditional asset account. PEA accounts are very popular because banks mainly distribute these accounts to their customers as a first experience with trading on the stock market. Moreover, and more importantly for the scope of this paper, PEA accounts allow to realize

7. Over the period 1999-2005, active accounts are those with at least one transaction over 2 years (consecutive or not). For the last year of the sample, accounts are active if they hold at least one transaction over the entire year.

8. www.Fininfo.com

tax-free capital gains if the account was opened at least 5 years ago. In our dataset, 10 911 investors hold only PEA accounts and 35 598 investors hold both PEA and traditional accounts.

The second point relies on the international diversification of investors' trades. Only 9,3% of trades deal with non-French shares. It is not a surprising result because of the well-documented home-bias [Huberman (2001)]. Figure 1 provides precisely the distribution of transactions across regions on our dataset. At the individual level, 54% of investors realize at least one trade on these foreign assets and we call them "international traders". Third, French individual investors have a very easy access to short sales and 1095 investors realize all trades using SRD orders; we call them "SRD investors"[9].

The typical investor is a male (86,42%) and is 42 years old on average. Table 1 provides descriptive statistics on trading behavior of investors. The average number of assets per trade is nearly[10] 460. During the period 1999-2006, investors realized more than 90 trades

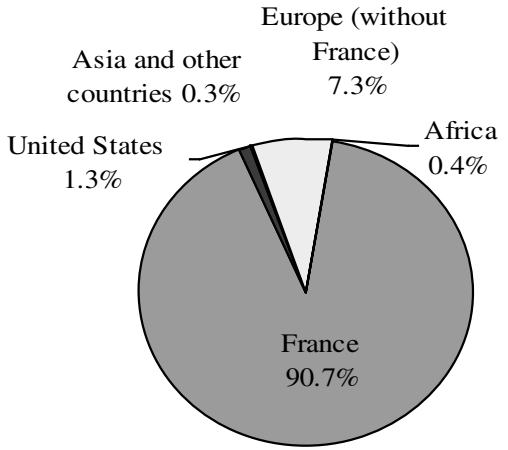

Figure 1. – Individual investors trades across the world

9. Note that SRD ("Système à Règlement Différé") is a French market specificity which allows investors to leverage and short sell.

10. This relatively high number of stocks per trade is mainly due to some huge trades on penny stocks.

amounting to an average of more than 3 800€ per trade (3 696€ for buy and 4 011€ for sell). As the median trade size, number and amount are respectively 60 assets, 22 trades and roughly 2 000 €, we conclude that there is a considerable heterogeneity in the trading behavior of investors. On average, investors are active half of the time (4 years over the 8).

Table 1. – Descriptive statistics on investors

This table contains results based on 8 438 885 trades (4 426 894 purchases and 4 011 991 sales) for 90 079 investors over 1999-2006. "Age" (in years) is computed on the 01/01/1999, "Activity over 1999-2006" is the number of investors active accounts : active accounts are those with at least one transaction over 2 years (consecutive or not). "trade amount / investor" [resp. Total Nb of trades/investor] is the total euro amount [Nb of trades] traded by investors over 1999-2006.

Variables	**Mean**	**Std Dev.**	**25%**	**50%**	**75%**	**99%**
Age	41.73	14.8	30	39	52	78
Assets / trade	460.24	4486.10	23	60	200	7000
Activity over 1999-2006	4.28	2.062	3	4	6	8
Trade amount/investor (€)						
Buy	3696.90	9373.90	1168.18	1961.28	4450.41	24299.19
Sell	4011.24	10387.02	1203.71	2188.86	4994.84	27327.46
Total Nb of trades/investor	93.68	354.45	6	22	74	1099

In this paper, we use the methodology given in Odean (1998) to compute the disposition effect and the following example provides an explicit example. Suppose that two investors (I and II) are active and that 3 stocks (X, Y, Z) are quoted on the financial market. Table 2 summarizes all investor's trades on the whole period of study (one month for this example). This table contains the dates (first column) when at least one of the two investors takes a position (Buy or Sell). "Asset" and "Price" indicate respectively the number of assets and the average price of the asset during the day. Columns "type" give the investor trade indicator: purchase (B for Buy), sale (S for sell) or nothing (NO). "Nber" indicates the trade volume.

Each day an investor sells securities, we determine whether the security is sold for a gain or a loss by comparing its selling price to its average purchase price. When the position changes and stocks are bought, the average purchase price is then adjusted.

Table 2. – Trades realized by investors

			Inv. I		**Inv. II**	
Dates	**Asset**	**Price**	**Type**	**Nber**	**Type**	**Nber**
10/1	**X**	**25**	B	40	B	50
	Y	**10**	B	50	B	65
	Z	**30**	B	20	NO	/
10/10	**X**	**40**	S	10	B	25
	Y	**15**	NO	/	B	15
	Z	**20**	NO	/	NO	/
10/31	**X**	**45**	S	10	S	40
	Y	**8**	S	5	S	10
	Z	**10**	NO	10	NO	/

Therefore, each sale is counted as a realized gain (*RG*) or a realized loss (*RL*). Each stock in the portfolio at the beginning of each day that is not sold during that day is considered to be an unrealized (paper) gain or loss. Paper gains or losses are defined by comparing the high and low daily price of the stock to its average purchase price. If these daily prices are above their average purchase price, the trade is counted as a paper loss (*PL*); in the opposite case, it is counted as a paper gain (*PG*); otherwise, neither a paper gain nor a loss is accounted for. All gains and losses are calculated after adjusting for splits. Following Odean, we choose the reference price to be the average purchase price.

To illustrate this methodology, in the example of table 2, on October the 10th, prices of X and Y are higher than their average purchase prices (contrary to the price of Z) and the first investor chooses to sell 10 stocks X and to keep his position on Y and Z.

Then, on this date and for this investor, we compute 1 realized gain (stocks X sold), 0 realized loss, 1 paper gain (stocks Y) and 1 paper loss (stocks Z). Table 3 summarizes for the two investors, the values of *RG*, *RL*, *PG*, *PL*, for all selling days.

It is important to notice that the four estimates, *RG*, *RL*, *PG* and *PL* could obviously not be computed for portfolios containing only purchases or only sales, and for sales for which no previous purchase was identified. In this article, the final number of trades for which the preceding methodology can be applied is 8 230 826.

The last step of the methodology consists of using these key values (*RG*, *RL*, *PG* and *PL*) to compute the proportion of realized gains

Table 3. – Key values for the two investors

	RG	***RL***	***PG***	***PL***
INV I				
10/10	1	0	1	1
10/31	1	1	0	1
Total I	**2**	**1**	**1**	**2**
INV II				
10/31	1	1	0	0
Total II	**1**	**1**	**0**	**0**
TOTAL (I +II)	**3**	**2**	**1**	**2**

(*PGR*) and the proportion of realized losses (*PLR*) according to the following rules:

$$PGR = \frac{N_{RG}}{N_{RG} + N_{PG}}$$

$$PLR = \frac{N_{RL}}{N_{RL} + N_{PL}}$$

$$DE = PGR - PLR$$

where N_{RG}, N_{PG}, N_{RL}, N_{PL} denote the number of realized gains, the number of potential gains (paper gains), the number of realized losses and the number of potential losses (paper losses).

In this paper, the measure of the disposition effect is defined as the difference *DE = PGR – PLR*. When this difference takes a positive value, it indicates that investors are more prone to realize gains than losses. In our example, the last row of Table 3 (TOTAL) gives $N_{RG} = 3, N_{RL} = 2, N_{PG} = 1$ and $N_{PL} = 2$. Finally, *PGR* = 0.75, *PLR* = 0.5 and *DE* = 0.25.

It is important to notice that these values are computed across investors assuming that each sale for a gain (or a loss) and paper gain (or paper loss) on the day of the sale are separate independent observations. In this context, we test the following hypothesis:

H_0: Proportion of Gains Realized ≤ Proportion of Losses Realized

The Z-statistic (distributed normally) is applied to test this hypothesis where:

$$Z = \frac{PGR - PLR}{\sqrt{\frac{PGR(1-PGR)}{N_{RG}+N_{PG}} + \frac{PLR(1-PLR)}{N_{RL}+N_{PL}}}}$$

Note that assuming the independence at an account level (instead of at a transaction level) *PGR*, *PLR* and *DE* could be measured for each investor (instead of at an aggregate level)[11]. The global disposition effect is then defined as the average account disposition effect. In our example, Total I and Total II give the values of N_{RG}, N_{PG}, N_{RL}, N_{PL} that are used to compute the disposition effect at an individual level. After basic calculations the value of the average disposition effect is 0.165 (0.33 for the first investor and 0 for the second)[12].

This simple illustration shows that the two measures of *DE* give obviously different results and even if at an aggregated level investors seem to suffer from the disposition effect, the disparity between investors may be very important.

In the following sections, the disposition effect is first studied globally based on the assumption on independence at the transaction level. Then we study the presence of the disposition effect among sub-groups of traders. In the last section, we measure the impact of the tax account type on the behavior of investors and then use an individual measure of the disposition effect.

11. For a discussion on the limits of these measures, see for example Feng and Seasholes (2005).

12. Contrary to our simple illustration, in order to control for independence at an account level, the sale of a stock is counted only if no sale has been previously counted for that stock in any account within a week before or after the sale date [Odean (1998)].

4. General results and discussion

4.1. Disposition effect and sophistication

In this section, we present the results at the aggregate level, based on 4 011 991 sales for 57 153 investors. For sake of simplicity, investors for whom a disposition effect is computed are called "investors" in the rest of the paper. We study the aggregate disposition effect (see tables 2 and 3 for an example) by considering that each sale that results in a realized or paper gain/loss constitutes an independent observation. Table 4 provides the values of *PGR*, *PLR* and *DE* on the whole period and by years. An alternative way to study the disposition effect is to consider that realized/paper gains and losses are independent, not at the transaction level, but at the account or investor level[13].

On the entire sample, the null hypothesis ($PGR \leq PLR$) is rejected with a high degree of statistical significance. Investors are prone to the disposition effect over our sample period. Note that the results differ across years. For example, in 1999 the aggregate disposition effect is the highest (0.1078) whereas 2006 exhibits the lowest DE value (0.013).

However, looking at the evolution of the average DE and of the ratio PGR/PLR, we cannot highlight any distinct monotonic trend over time. For example, PGR/PLR values gradually increase from 2000 to 2002, peaking in 2003 and falling off as from 2004. The ratio PGR to PLR is the rate at which the individual investors prefer to sell winning stocks rather than losing ones. On the average, a stock that is up in value is more than 60% (1.68) more likely to be sold that a stock that is down. These results are quite in line with those generally obtained in the literature: Odean (1998) and Weber and Welfens (2006) compute a ratio of 1.5 while Brown *et al*. (2006) and Chen *et al*. (2007) get 1.6.

For a better understanding of the behavior of the investors, Table 5 (column 1) gives the average returns since the day of purchase for rea-

13. We also use this methodology over our dataset (see figure 5 in the appendix) and find that approximately 20% of the investors do not exhibit any DE or exhibit the opposite behaviour (DE < 0). This result confirms the ones obtained by Dhar and Zhu (2006) on US individual investors.

Table 4. – The disposition effect

This table contains results based on 4 011 991 sales over 1999-2006; 1 998 924 disposition effects are computed for 57 153 investors. N_{RG}, N_{PG}, N_{RL}, N_{PL} denote the number of realized gains, the number of potential gains (paper gains), the number of realized losses and the number of potential losses (paper losses). *PGR* (resp. *PLR*) denotes the proportion of realized gains (resp. the proportion of realized losses ratios). DE "disposition effect" is defined as *PGR - PLR*

	Entire Sample	1999	2000	2001	2002	2003	2004	2005	2006
N_{RG}	2044740	270763	484745	192737	133635	199390	199570	257344	306556
N_{PG}	14408013	1046046	2705794	1215168	798559	1167386	1687904	2669883	3117273
N_{RL}	1361264	96310	309986	211637	151656	134930	147961	137532	171251
N_{PL}	17076433	880578	3271772	2644645	2174947	2157664	1974155	1893423	2079250
PGR	0,124	0,206	0,152	0,137	0,143	0,146	0,10	0,088	0,089
PLR	0,073	0,098	0,086	0,074	0,065	0,059	0,069	0,067	0,076
PGR / PLR	1,68	2,10	1,77	1,85	2,2	2,47	1,45	1,31	1,17
DE	**0,050**	**0,1078**	**0,065**	**0,063**	**0,078**	**0,087**	**0,036**	**0,020**	**0,013**
Z-stat	496,51	230,82	261,63	191,15	196,71	256,27	126,79	83,52	57,29

lized and paper gains and losses for the entire sample. Returns on paper gains are fourfold greater than those on realized gains. The same type of conclusion is obtained for losses (last two rows of Table 5). As noted by Odean (1998), these results seem to confirm that investors are more likely to realize smaller, rather than larger, gains and losses

Table 5. – Average returns

	Entire sample	**Jan-Nov**	**Dec**
Return on realized gains	0.1116449	0.1116082	0.1120379
Return on paper gains	0.4019417	0.4066277	0.3517965
Return on realized losses	– 0.0681329	– 0.0670614	– 0.0795994
Return on paper losses	– 0.2421513	– 0.2424635	– 0.2388105

We also test whether the disposition effect observed in our sample can be explained by the desire of individuals to rebalance their portfolios (Table 6, column 1) or to restore diversification (Table 6, column 2). For the first test, we eliminate any sale for which the entire position in a stock has not been cleared (53 502 investors sold their entire position in the database). To eliminate any transaction resulting from a desire to restore diversification, we also remove sales for which there has been a new purchase on the sale date or during the 3 following weeks (21 days). 48 523 traders are concerned. Our results confirm previous results by demonstrating that traders still prefer to sell winners. The magnitude of the disposition effect is not reduced on this restricted sample.

In order to investigate the influence of traders' sophistication on the disposition effect, we build different groups of traders and check whether they exhibit any disposition effect. Three proxies for investors skills are retained; the geographical diversification of trades (presence of trades outside France), the use of the French SRD ("Système à Règlement Différé") and the investment in warrants. Briefly speaking, although individual investors are not usually supposed to be sophisticated ones, we assume that among them, those who internationally diversify portfolios (or are subject to a less important home bias), trade with SRD or trade warrants are at least more familiar with financial markets.

According to the ISIN of stocks, we divide investors in two categories: 40 430 among them only invest in French stocks, and we call

Table 6. – Portfolio rebalancing

This table contains results based on 4 011 991 sales over 1999-2006; 1 998 924 disposition effects are computed for 57 153 investors. First column contains results when transactions associated to a sold of entire position are keep. Second column contains result when sales for which there has been a new purchase on the sale date or during the 3 following weeks are removed. *PGR* (resp. *PLR*) denotes the proportion of realized gains (resp. the proportion of realized losses ratios). DE "disposition effect" is defined as *PGR - PLR*.

	Entire Position sold	**No purchase 3 weeks after sale**
PGR	0.143	0.132
PLR	0.083	0.080
PGR / PLR	1.72	1.65
DE	0.060	0.052
Z-stat	400.43	177.79

them "local traders", the others are "international traders". Results in Table 7 panel I indicate that both groups are prone to the bias. More precisely, the disposition effect for "local traders" is 0.093 which is twofold the value of the disposition effect of "international traders".

Note that *PGR* and *PLR* measures are dependent on the portfolio size; we could obtain a lower disposition bias for an individual trading frequently but realizing the same number of winners/ losers. We should however point out that Dhar and Zhu (2006) compare measures of DE over sub groups. They justify such comparisons by the relative homogeneity of portfolios size among groups. Therefore, we computed the number of stocks held by individuals in each of our sub-groups: local traders have on average 14 securities while international investors hold 33 stocks. Given the difference in portfolio sizes, we do not compare our measures of DE[14]. The same argument applies to the other two proxies for sophistication (warrants and SRD use) although these proxies are not directly linked to trading behavior[15] during the sample period as they rely on the presence of specific trades in each investor account. A "SRD" investor always chooses to use the leverage and short selling facility; there are 1 095 such investors. A "warrant" inves-

14. For a discussion of DE determinants, see for example Feng and Seasholes (2005).

15. Note that "warrants" trades are excluded from our dataset.

Table 7. – DE for groups

This table contains results based on 4 011 991 sales over 1999-2006; 1 998 924 disposition effects are computed for 57 153 investors. "Local" column contains results for 41 272 investors who only invest in French stocks. "SRD" column contains results for 1 095 investors who only use the SRD French system. "Warrant" column contains results for 11 460 investors who invest in warrants. N_{RG}, N_{PG}, N_{RL}, N_{PL} denote the number of realized gains, the number of potential gains (paper gains), the number of realized losses and the number of potential losses (paper losses). *PGR* (resp. *PLR*) denotes the proportion of realized gains (resp. the proportion of realized losses ratios). DE "disposition effect" is defined as *PGR - PLR*.

	Panel I		**Panel II**		**Panel III**	
	Local	**International**	**SRD**	**Others**	**Warrant**	**Others**
N_{RG}	174772	1869968	16980	2027760	746802	1297938
N_{PG}	676740	13731273	53819	14354194	5832682	8575331
N_{RL}	103683	1257581	10957	1350307	525914	835350
N_{PL}	824921	16251512	45606	17030827	6949025	10127408
PGR	0.205	0.119	0.239	0.124	0.114	0.131
PLR	0.111	0.071	0.194	0.073	0.070	0.076
PGR / PLR	1.85	1.67	1.23	1.69	1.63	1.72
DE	0.093	0.048	0.045	0.051	0.043	0.055
Z-stat	171.34	467.24	19.96	495.23	278.266	412.057

tor trades warrants at least once during the sample period; there are 11 460 such investors.

Results in Table 7, panels II (SRD) and III (warrants), indicate that the 4 groups are prone to the bias and that the disposition effect appears to be slightly lower for sophisticated traders (DE is 0.045 for SRD investors and 0.043 for warrant investors against 0.051 and 0.055 for the respective non sophisticated investors). Though more investigation is clearly needed, sophistication seems to attenuate the DE which order of magnitude is 0.04 for all sophisticated investors (0.048 for international traders)[16].

16. We also use the trading activity (based on the number of annual transactions) as another proxy and find DE=0.04 for frequent investors. We do not report these results because we think trading activity constitutes a proxy for experience that does not always hint to sophistication.

4.2. Disposition effect and taxes

In this subsection, we first analyze the existence of end-of-the-year effect on the disposition effect (tax impact). Secondly, with respect to French specificities, we also investigate whether account types and tax regime shifts influence investment behavior.

In order to investigate whether individual investors pay attention to tax considerations at the end of the fiscal year, we also compute *PGR*, *PLR* and *DE* over the two intra year periods, January-November and December. Drawing on the work of Constantinides (1984), we expect investors to gradually increase their tax-loss selling from January to December. Table 8 provides the results.

Table 8. – DE over intra year periods

This table contains results based on 4 011 991 sales over 1999-2006; 1 998 924 disposition effects are computed for 57 153 investors. The data are partitioned into 3 different year periods; entire year, [January-November], December. *PGR* (resp. *PLR*) denotes the proportion of realized gains (resp. the proportion of realized losses ratios). DE "disposition effect" is defined as *PGR - PLR*).

	Entire Year	**Jan-Nov**	**December**
PGR	0.124	0.125	0.124
PLR	0.073	0.073	0.079
PGR/PLR	1.68	1.71	1.57
DE	0.050	0.051	0.044
Z-stat	496.51	482.32	134.91
T_{H_0} for PGR	– 5.374	2.314	– 0.011
T_{H_0} for PLR	2.966	– 28.193	– 27.030

We test the differences in proportions over the two sub-periods. Formally, for two independent samples (1) and (2), we test the following hypothesis:

H_0: Proportion of Gains Realized in (2) = Proportion of Gains Realized in (1)

and

H'_0: Proportion of Losses Realized in (2) = Proportion of Losses Realized in (1)

The following statistic (normally distributed) is applied to test H_0 where:

$$T_{H_0} = \frac{PGR_2 - PGR_1}{\sqrt{\hat{\pi}(1-\hat{\pi})\left(\frac{1}{(N_{RG_2}+N_{PG_2})}+\frac{1}{(N_{RG_1}+N_{PG_1})}\right)}}$$

$$\text{with } \hat{\pi} = \frac{(N_{RG_2}+N_{PG_2})PGR_2 + (N_{RG_1}+N_{PG_1})PGR_1}{(N_{RG_2}+N_{PG_2})+(N_{RG_1}+N_{PG_1})}$$

N_{RG_j} and N_{PG_j} denote the number of realized gains and of potential gains (paper gains) in sample *j*.

In previous studies, DE is generally negative and the *PGR/PLR* ratio is lower than 1 in the last month of the fiscal year (December in US market for Odean (1998) and June for Brown *et al*. (2006) in Australia, for example).

In table 8, the disposition effect seems to be lower in December when compared with the average value of January-November but it is still positive. Tests of differences in proportions indicate that the following results are significant: $PGR_{Jan\text{-}Nov} > PGR_{Dec}$ and $PLR_{Dec} > PLR_{Jan\text{-}Nov}$. These tests show that the lower DE in December is due to an average lower *PGR* and a higher *PLR* in December. This result differs from Odean's conclusion of a lower DE in December which was due to both significantly higher *PLR* and *PGR* in December.

Moreover, looking in table 8 at *PGR/PLR* indicates that on average, traders realize fewer gains and more losses in December: the ratio of *PGR* over *PLR* being 1.57 in December against 1.68 for the entire year. However, the fiscal impact in France appears to be moderate relative to the one observed in other countries as *PGR/PLR* remains higher than one in December.

The results in Table 5 (column 2 and 3) also help to confirm the presence of a moderate fiscal impact at the end of the year. Returns on realized paper losses are – 0,079 in December against – 0,068 for the entire year. These results are clearly different from Odean ones who obtain a greater difference between these two values (– 0,366 in December against – 0,228).

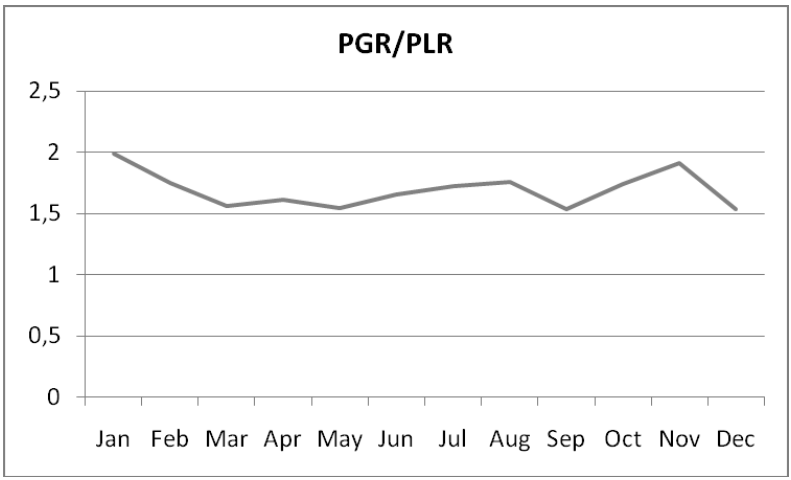

Figure 2. – Monthly level of PGR/PLR

Finally, Figure 2 plots the average ratio of PGR/PLR on a monthly basis. We notice that contrary to Constantinides' (1984) arguments, investors do not gradually decrease the rate at which they sell winning stocks compared to losing ones during the year.

In the French case, the fiscal impact on the selling behavior of investors could be tested in an original way due to the tax regime of some accounts (PEA accounts). Actually, capital gains are tax-free for all trades occurring 5 years after the opening date of the account. To be more precise, it is important to understand that fiscal exoneration occurs even if stocks were not kept for more than 5 consecutive years. The only legal restriction imposed before 5 years is that investors can't withdraw cash resulting from sales. For example, a capital gain on a round-trip trade made five years after the inception date of the account is tax-free.

Therefore, as investors may choose to trade on both accounts, we expect to measure the impact of tax on selling behavior by highlighting different behaviors on PEA accounts and traditional accounts. To serve our purpose, we focus our analysis on investors trading both on PEA and traditional accounts[17]. In this context, for any holder of a PEA

17. On the entire sample, there are 35 598 such traders. Note that there are 46 094 holders of only traditional accounts and 10 911 holders of only PEA in the database.

account, 5 years represents a focal point (beginning of the tax-free period). If investors are sensitive to taxes, we expect buy and sell decisions to be affected by the tax shift on the PEA account after 5 years. To control our results, we study the same behavioral patterns for the same investors on traditional accounts.

We identify traders holding more than five years old PEA and traditional accounts (2 116 investors that we call "GROUP I") and classify trades made on these accounts according to their execution date. In other words, we distinguish trades that were realized before and those realized after the accounts reached the focal point of five years. This ensures a good comparative basis for any analysis of possible different behaviors [19].

Table 9 gives the results obtained for the 2 116 investors (Group I) at an aggregate level. Global results indicate that the disposition effect is clearly positive and significant before and after five years on both accounts. Accurately, on traditional accounts, the DE before five years is 0.076 (column 1) and 0.034 for trades made after five years (column 3). For PEA accounts values are 0.084 (column 2) and 0.032 (column 4). At an aggregate level we observe that DE decreases between the two sub-periods whatever the account type[18]. Figures 3 confirms this result and gives a more precise illustration of the evolution of the aggregate DE with respect to experience (years of trading) for the 2116 investors. For example, at the end of the second year of trading DE is 0.056 and at the end of the seventh year of trading the value is about 0.02. This curve could be seen as an "experience curve" and the decreasing trend could be linked to the role played by the number of years of trading ; the impact of this variable was demonstrated in previous studies (Dhar and Zhu, 2006, Shu *et al*. 2005, Brown *et al*., 2006 for example)[20].

To investigate more accurately the hypothetic tax impact on selling behaviors, we compute the disposition effect at an individual level for

18. Note that results for the 1665 investors trading only on PEA accounts and keeping this account for more than five years (Group II) and for the 5114 investors trading only on traditional accounts and keeping this account for more than five years (Group III) confirm this point (see table 12 in the appendix).

19. The following results are similar when taking tax thresholds into account.

20. Note that the decrease of DE is essentially imparted to the decrease of PGR, investors seems to correct this bias in an asymmetrical way.

Table 9. – DE before and after 5 years for group I (Aggregate DE)

This table contains results for investors trading simultaneously on PEA and traditional accounts and holding both accounts more than five years. Transactions are classified in two categories (realized before or after five years). N_{RG}, N_{PG}, N_{RL}, N_{PL} denote the number of realized gains, the number of potential gains (paper gains), the number of realized losses and the number of potential losses (paper losses). *PGR* (resp. *PLR*) denotes the proportion of realized gains (resp. the proportion of realized losses ratios). DE "disposition effect" is defined as *PGR - PLR*.

	CPT	PEA	CPT	PEA
	< 5 years	< 5 years	> 5 years	> 5 years
N_{RG}	79081	67015	91137	62455
N_{PG}	472676	419688	827693	758425
N_{RL}	47924	35845	59222	37382
N_{PL}	664230	637128	855285	816969
PGR	0.143	0.138	0.099	0.076
PLR	0.067	0.053	0.065	0.044
PGR/PLR	2.130	2.585	1.532	1.739
DE	0.076	0.084	0.034	0.032
Z-stat	136.410	149.510	85.156	88.115

the 2 116 investors belonging to Group I before and after the 5th birthday of both accounts.

The results for these investors are given in Table 10. Accurately, on traditional accounts, the DE before five years is 0.159 and 0.1 for trades made after five years. For PEA accounts values are 0.179 and 0.101. This table confirms the decrease of the individual average disposition effect after 5 years on the two account types and again highlights the results obtained at the aggregate level.

However, to control for any global compensation between investors, we conduct a Wilcoxon signed rank test of individual DE differences.

This test uses both the information on the direction and the relative magnitude of the differences within pairs of an identical trader average DE. For two distributions X and Y, the null hypothesis of the test is the following:

H_0: X and Y are samples from populations with same continuous distributions.

Table 10. – DE at an individual level before and after 5 years for group I

This table contains results for investors trading both on PEA and traditional accounts and holding both accounts more than five years. Transactions are classified in two categories (realized before or after five years) and DE is computed at an individual level. *PGR* (resp. *PLR*) denotes the proportion of realized gains (resp. the proportion of realized losses ratios). DE "disposition effect" is defined as *PGR - PLR*.

	Numbers	Mean	Standard deviation
PEA < 5 years (A)	2116	0.179	0.211
PEA > 5 years (B)	2116	0.101	0.192
CPT < 5 years (C)	2116	0.159	0.218
CPT > 5 years (D)	2116	0.100	0.220

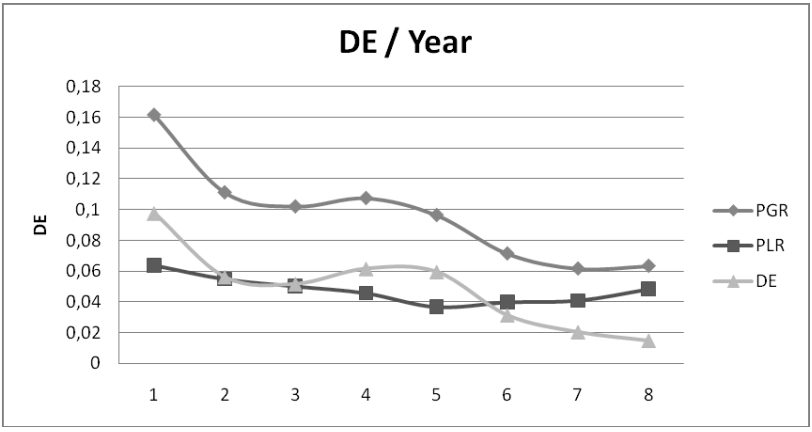

Figure 3. – Aggregate level of DE / year of trading

Table 11 gives the results of the tests for the differences in distributions between types of accounts and detention duration. We denote (A) [resp. B] the distribution of the individual DE for trades over PEA before 5 years [resp. after 5 years] and (C) [resp. D] is the distribution of DE for trades on traditional account before 5 years [resp. after 5 years]. V is the number of ranks of positive differences. Note that as *N*=2116 is a large sample size, the number of the ranks of positive differences, V, is approximately normal.

The two first columns (A/B and C/D) show that individual distributions before and after are significantly different given account types. The behavior of investors seems to be clearly different as experience increases; this confirms the importance of learning already highlighted at an aggregate level (see figure 3). The test on B/D distributions allows us to reject the tax argument for the PEA account. Actually, in the period of different taxation between both accounts, no difference of trading behavior in any direction could be detected at an individual level.

Table 11. – Wilcoxon signed rank test for the differences in distributions A, B, C and D

This table contains results for Wilcoxon signed rank test for investors trading on PEA and traditional accounts and holding both accounts more than five years. (A) [resp. B] denotes the distribution of individual level of DE for trades over PEA before 5 years [resp. after 5 years]. (C) [resp. D] denotes the distribution of DE for trades on traditional account before 5 years [resp. after 5 years]. V is the number of the ranks of positive differences.

	A/B	C/D	A/C	B/D
V	1680851	1465308	1228034	1117178
E(V)	1119870,5	1119882,5	1119870,5	1119891,5
Variance (V)	790084413,7	790084443	790084408,25	790084497,375
p-Value (Bilateral)	< 0,0001***	< 0,0001***	< 0,0001***	0,923
Alpha	0,05	0,05	0,05	0,923

5. Conclusion

We provide first and original results on the behavior of investors in the French context. On a large and proprietary anonymous database provided by Cortal Consors, a French broker, we find strong evidence that the disposition effect is observed for different categories of investors and for all time periods. Moreover this mistaken behavior does not seem to be motivated by a desire to rebalance portfolios.

As we expect some particular traders to be more sophisticated than others, based on original proxies (international diversification, SRD use, for example) we demonstrate that sophistication does not eliminate the existence of a disposition bias.

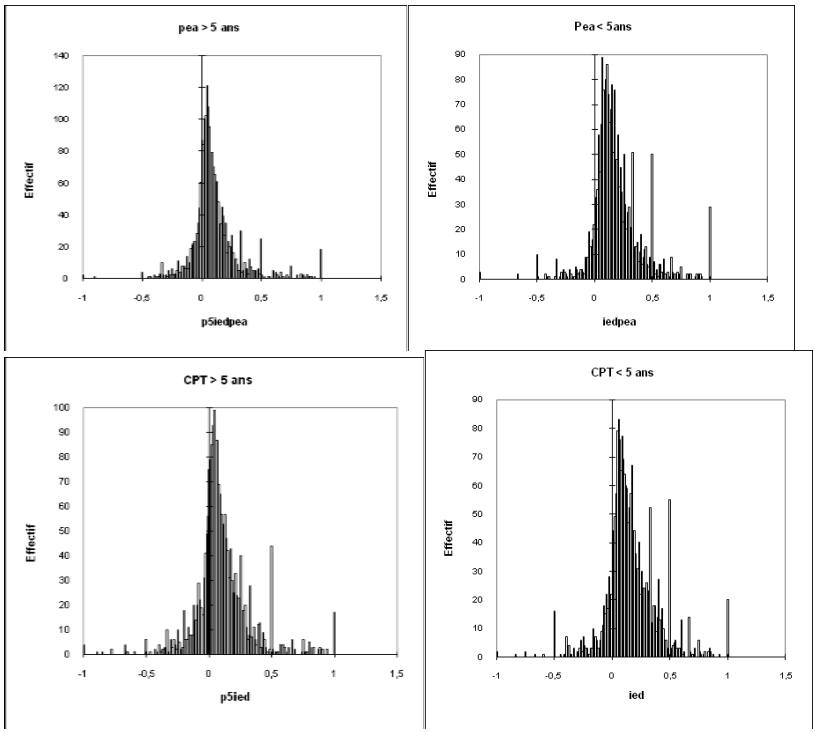

Figure 4. – DE distribution at an individual level for investors holding PEA and traditional accounts before and after 5 years

In this paper we conduct two tests of the impact of taxes on the selling behavior. First, at an aggregate level we find that investors are less prone to the disposition effect in December than during the rest of the year (due to a higher PGR and a lower PLR). Moreover, investors seem to realize losses of slightly stronger magnitude in December. However, unlike previous studies, DE is still positive (and *PGR/PLR* is higher than 1) in the last month of the fiscal year (Odean (1998), Brown *et al*. (2006), for example). Secondly, an analysis of a French specificity, i.e. the existence of tax free accounts (PEA more than 5 years old) allows us to demonstrate that accounts tax regimes have no impact on selling behavior.

Finally, this work could be extended at least in order to highlight characteristics of individual investors explaining the level of the disposition effect and its dynamics.

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APPENDIX

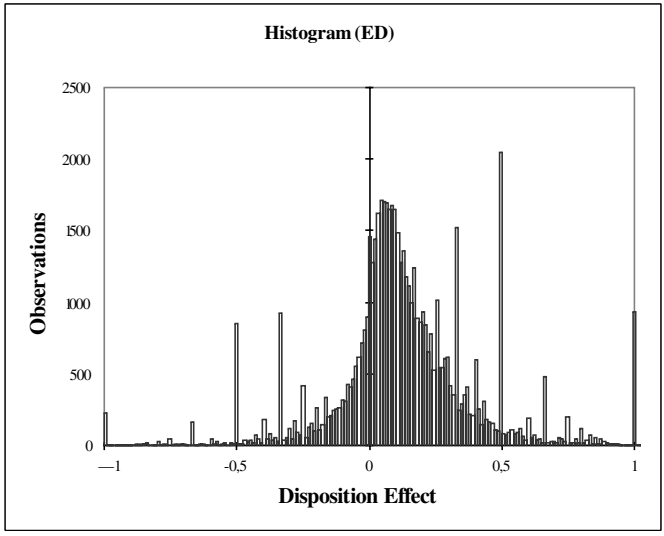

Figure 5. – Distribution of Disposition Effect for all Investors

Table 12. – DE for groups II and III

This table contains results for the 1665 investors trading only on PEA accounts and keeping this account for more than five years (Group II) and for the 5114 investors trading only on traditional accounts and keeping this account for more than five years (Group III). N_{RG}, N_{PG}, N_{RL}, N_{PL} denote the number of realized gains, the number of potential gains (paper gains), the number of realized losses and the number of potential losses (paper losses). *PGR* (resp. *PLR*) denotes the proportion of realized gains (resp. the proportion of realized losses ratios). DE "disposition effect" is defined as *PGR - PLR*.

	Group II		**Group III**	
	< 5 years	**> 5 years**	**< 5 years**	**> 5 years**
N_{RG}	37845	28981	463685	170254
N_{PG}	183956	245240	2263150	1473797
N_{RL}	21182	15773	337654	121196
N_{PL}	266288	238359	2825800	1489822
PGR	0,170	0,105	0,170	0,103
PLR	0,073	0,062	0,106	0,075
PGR/PLR	2,32	1,70	1,603	1,375
DE	0,096	0,043	0,063	0,028
Z-stat	103,60	57,58	221,22	89,73