Disposition Matters: Volume, Volatility, and Price Impact of a Behavioral Bias

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❖ Objectives and motivations of the study

One of the **main problems** in empirical testing = most tests of behavioral effects are **indirect** (rely on market price, return, and volume data or upon market return anomalies)

Objective = to seek a **direct link** between individual investor actions and asset price dynamics, focus on the **disposition effect**

Disposition effect → Disposition investors tend to **hold losers** and **sell winners**.

Test the **relation** between the **preponderance of disposition investors trading an asset** and the **volatility, return and trading volume of that asset**

❖ Data used

A **large sample of individual trading accounts** over a six-year period in the 1990's in order to **identify investors who are subject to the disposition effect**. We then use their trading behavior to construct behavioral factors.

Data provided by a nationwide discount brokerage house. (The dataset is that previously used by Barber and Odean (2000, 2001, 2002), Odean (1998, 1999) and Barber, Odean and Zhu (2003).)

- ➔ IID = "Individual Investor Database" contains information on over 100,000 accounts for around 80,000 households
- ➔ For each account, we have the position files that contain the end-of month investor portfolios and the daily transactions of all the assets for the period 1/1/1991-28/11/1996.
- ➔ For each transaction in the account, we know the security traded, the direction of the trade, the number of shares traded, and the commission paid. For each account, we also have some demographic information about the investor.
- ➔ Each investor may hold several accounts.
- ➔ The median portfolio size of an individual investor portfolio in the IID is $13,869.

❖ Indicators, Methods, Models used

In this paper, we estimate the behavioral component of the *Grinblatt and Han (2005)* model and derive several **testable implications** about the **expected relationship** between the preponderance of disposition - prone investors in a market and volume, volatility and stock returns.

The hypothesis is: *There is a negative relation between the fraction of disposition investors trading in a stock and its return and volatility level*.

- ➔ When investors who have been identified as more willing to sell gains than losses are selling, the market tends to go up
- ➔ When prices rise, investors who prefer to sell for a gain sell more

That's why volatility test is important (Lorsque la volatilité est élevée, la possibilité de gain est plus importante, mais le risque de perte l'est aussi)

#1 **Disposition proxy** = constructing a proxy for the prevalence of disposition investors in the market (number of disposition investors). We use this proxy to relate stock return, volatility and trading volume to the disposition effect, testing the restrictions.

Disposition proxy represents the **representation of the disposition investors in the market (μ)** and should be **negatively related to both stock volatility and return**

We concentrate on **direct evidence**. We exploit a database of individual investor decisions to construct a proxy that captures the representation of the disposition effect for each stock and to test how it affects stock returns, volatility and trading volume. This allows us to directly bring to the data the restrictions of the model of Grinblatt and Han (2005).

Construction of disposition proxy:

- ➔ identify the disposition investors on a transaction basis, relying on the Barber and Odean (2000, 2001, 2002) results
- ➔ use their trades to determine the representation of the disposition investors for each stock and day
- ➔ for each transaction, distinguish trades "at-loss" and trades "at-gain"
- ➔ for each stock, construct a daily time series of the "sales-at-loss", "sales-at-gains", "buys-at-loss" and "buys-at-gains" (to identify "sales-at-loss", we have to make some assumptions about the previous price at which the stock was purchased, using "LIFO" criterion)
- ➔ For each sale, the quantity is compared to the quantities previously bought. If the quantity is lower or equal to the number of shares bought in the previous purchase transaction, the profit or loss is given by the difference between the prices of the two transactions. If the quantity sold is greater that the number of shares purchased in the transaction immediately before, we use the LIFO criterion and refer back to earlier purchases
- ➔ for each sale transaction, identify whether it was a profit or loss, from the investor's standpoint
- ➔ define a variable W that is constructed as the difference between the total dollar value of "sells-at-loss" and "sells-at-gain", standardized by the sum of "sells-at-loss" and "sells-at-gain" (for a day t)

$$W_t = \frac{(S_{lt} - S_{gt})}{(S_{lt} + S_{gt})},$$

- This variable is greater for stocks for which the representation of disposition investors among the sellers is smaller
- This variable increases as μ increases; an increase of μ is negatively related to returns (as expected)
- Stocks for which W is higher, experience lower volatility and return

The presence of disposition-prone investors reduces price fluctuations = the stocks that are traded mostly by disposition investors will be less sensitive to fundamental shocks → lower return and volatility

#2 Construct two ratios to identify the disposition investors on an out-of-sample basis:

- ➔ each day, identify for each investor his realized gains/losses
- ➔ for all the other stocks that are in the portfolio and are not sold, we also construct the daily paper gain/losses by comparing the purchase price of each stock to the stock's high and low price for that day
- ➔ for each day, all the paper gains/losses for a particular stock are accumulated, as well as the realized gains/losses
- ➔ for each investor we aggregate at the end of the month all the daily paper gains/losses as well as the daily realized gains/losses, and construct for each investor the following ratios:

$$PGR = Proportion\ of\ Gains\ Realized = PGR = \frac{RealizedGains}{RealizedGains + PaperGains}$$

$$PLR = Proportion\ of\ Losses\ Realized = PLR = \frac{RealizedLosses}{RealizedLosses + PaperLosses}.$$

Disposition-prone = investors for which PGR > PLR, where these ratios are based on the value of the prior month losses/gains

The use of the **out-of-sample methodology** to identify the disposition investors allows us to control for the possibility of spurious correlation due, for instance, to short term momentum or mean reversion.

#3 Construction of other variables

Use two measures of volume:

- ➔ first = trading volume, measured by the logarithm of the number of shares traded
- ➔ second = the logarithm of turnover defined as volume divided by the outstanding number of shares
- ➔ for each stock we construct volatility as the log percentage range:

$$\sigma_t = \log\left[\max_{\{s \in Day_t\}} P_{s,t} - \min_{\{s \in Day_t\}} P_{s,t}\right].$$

Daily volatility is defined as the log range between the highest price of the day minus the lowest price of the day (i.e., for each time s in the tth day)

#4 Disposition effect impact

test the restrictions that link the fraction of disposition investors to stock return, volatility, turnover and trading volume. Then, we look at the implication of such a relationship at the aggregate level. That is, we study whether the impact of the disposition effect aggregates at the overall market level.

$$Z_{it} = \alpha + \beta W_{it} + \gamma C_{it} + \varepsilon_{it},$$

where Wit is our disposition proxy, Cit is a vector of control variables and Zit is the dependent variable that, in the different specifications, will be, alternatively, stock return, return volatility, turnover and trading volume. The broadest set of control variables contains: the daily values of the Fama and French factors (Market, HML, SMB), the riskless rate, company size, overall market volume, stock price and volume.

➔ Theory would require β < 0 in the case of return and volatility

3 groupings:

- the first based on individual stocks
- the second based on 10 portfolios of 10 stocks each
- the third based on 5 portfolios of 20 stocks each

In the case of portfolios, the values of the variables (e.g., trading volume) are their average values across the stocks in the portfolios

❖ Robustness

#1 Construct variables that use the information contained in the buys: assume that disposition investors sell the winning stock and buy losing stocks ("buy-at-loss")

Construct two other proxies (position is at "at-loss" or "at gain" is determined on the basis of each investor's reference price):

➔ First W_p = dollar-value of total "buys-at-loss" minus "buys-at-gain" on a given day, standardized by the sum of "buys-at-loss" and "buys-at-gain"

➔ Second W_{ps} = difference between "buy-at-loss" plus "sell-at-loss" and "sell-at-gain" minus "buy-at-gain" standardized by the sum of "buy-at-loss", "buy-at-gain", "sell-at-loss" and "sell-at-gain"

$$W_{p,t} = \frac{(B_{lt} - B_{gt})}{(B_{lt} + B_{gt})}, \text{ and } W_{ps,t} = \frac{(S_{lt} - S_{gt}) + (B_{lt} - B_{gt})}{(S_{lt} + S_{gt}) + (B_{lt} + B_{gt})},$$

#4 Report two alternative specifications that differ for whether the stock price has been included (Specification I), or not (Specification II), among the control variables

❖ Results

#4 Results with "**Disposition Proxy and Stocks**" and those with "**Out-of-sample methodology**" show a significant correlation between our disposition proxy and volatility, return, turnover and trading volume. **The correlation is always negative, as theory requires**. These findings hold both at the stock level and at the portfolio level. They are also robust to the inclusion of the control variables and to the change of the disposition-based factors. The results with "Disposition Proxy and Stocks" are consistent whether we identify the disposition investors using daily trades (Identification I) or monthly trades (Identification II). And those with "Out-of-sample methodology" are robust to the way we identify the disposition investors.

➔ At the stock level, the **disposition effect does affect the stocks** in line with what predicted by theory.

Are these effects just the result of a spurious correlation, due to the way in which we identified our disposition proxies?

Same results for the two other proxies W_p and W_{ps}

Results with **Econometric Methodology** (run a series of daily cross-sections on our disposition proxy and the stock-specific control variables, then calculate the mean and statistical significance of the estimated coefficients across the cross-sections) with 3 different panels:

- Panel A = results for the proxy based on purchase W_p
- Panel B = results for the proxy based on sales W
- Panel C = results for the proxy based on net purchases W_{ps}

	Single Stocks				*10 Portfolios*				*5 Portfolios*			
	I		*II*		*I*		*II*		*I*		*II*	
Variable	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*
Volatility												
Panel A. W_p												
Disp. Proxy	-29.58	-41.53	-26.52	-37.92	-9.80	-6.41	-9.19	-6.56	-12.65	-10.60	-12.84	-11.08
AveAdj.R^2	0.09		0.03		0.33		0.31		0.31		0.29	
Panel B. W												
Disp. Proxy	-33.86	-43.02	-35.38	-44.01	-12.02	-6.63	-11.21	-6.75	-10.86	-8.29	-12.70	-9.88
AveAdj.R^2	0.10		0.03		0.32		0.31		0.31		0.29	
Panel C. W_{ps}												
Disp. Proxy	-30.63	-51.43	-30.32	-53.56	-13.52	-7.30	-11.46	-6.58	-13.01	-9.88	-14.45	-11.14
AveAdj.R^2	0.10		0.03		0.32		0.31		0.32		0.29	
Return												
Panel A. W_p												
Disp. Proxy	-2.53	-63.75	-2.51	-61.81	-0.30	-3.06	-0.37	-4.48	-0.54	-8.09	-0.57	-8.67
AveAdj.R^2	0.01		0.01		0.03		-0.01		0.03		0.01	
Panel B. W												
Disp. Proxy	-3.98	-61.57	-4.05	-59.65	-0.65	-5.82	-0.72	-6.70	-0.79	-10.45	-0.85	-11.61
AveAdj.R^2	0.01		0.01		0.04		0.01		0.04		0.01	
Panel C. W_{ps}												
Disp. Proxy	-3.52	-72.51	-3.56	-69.39	-0.81	-7.39	-0.89	-8.72	-0.93	-12.35	-1.00	-13.51
AveAdj.R^2	0.01		0.01		0.04		0.01		0.04		0.01	

➔ Same results which support the *Grinblatt and Han (2005)* model

The disposition effect is a stock specific characteristic or does aggregate at the market level?

Results with our **main proxy W** on Panel A = **individual stock level** and Panel B = **aggregated level**

- ➔ Results similar to the results for stock-specific proxy (less significant for trading volume)
- ➔ The results on the aggregate market are consistent with the disposition effect being an aggregated risk factor on which all the stocks load

Is there a common disposition factor?

Consider **three alternative portfolios**: the top (bottom) 10%, 20% and 30%. The disposition portfolios are constructed daily. We use both our **main disposition proxy (W) and the two alternative ones (Wp and Wps)**. The returns in the portfolios are the average of the returns of all the stocks in the portfolio.

- ➔ Results: show that on average the high-disposition portfolios underperform the low-disposition ones

We now test for the existence of a **common disposition factor**. We follow two approaches: first we use **individual stock returns** and then **size-sorted portfolios**

- ➔ the disposition factor is always **strongly significant and negative**, in line with the previous findings. These results hold across all the specifications, regardless of the number of additional factors (1 or 3 factor model) and characteristics (volume, volatility, turnover)

An increase in the fraction of disposition investors in the market, reduces price pressure and lowers ex-post returns

We show that when the fraction of **"irrational" investor purchases** in a stock **increases**, the **unexplained portion of the market price** of the stock **decreases**.

The evidence is consistent with the hypothesis that trade between disposition-prone investors and their counter-parties **impact relative prices**.

We provide some evidence on whether the **disposition effect aggregates at the market level and produces a common factor on which stock returns load.**