Disposition Matters:

Volume, Volatility and Price
Impact of a Behavioral Bias

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Abstract

We test the market impact of behavioral biases on the stock market. We focus on the disposition effect. We rely on the Grinblatt and Han (2002) model and derive several testable implications about the expected relationship between the preponderance of disposition-prone investors in a market and stock trading volume, volatility and returns. We identify disposition-motivated transactions by using a large sample of individual accounts over a six-year period in the 1990's. We then use them to construct behavioral factors. We show that, at a daily frequency, when the fraction of "irrational" investor purchases in a stock increases, the unexplained portion of the market price of the stock decreases, as well as stock volatility and trading volume. We further show that statistical exposure to a disposition factor explains cross-sectional differences in daily returns, after controlling for a host of other factors and characteristics. The evidence is consistent with the hypothesis that trades between disposition-prone investors and their counter-parties impacts relative prices.

JEL Classifications: D1, G1

Introduction

An important challenge to behavioral finance is to find a direct link between individual investor behavior and asset price dynamics. Few doubt that large numbers of investors behave irrationally and are prone to behavioral heuristics that lead to sub-optimal investment choices, however the empirical evidence that these investors affect prices has been elusive. While irrational individual investor traits and tendencies are interesting in their own right, their relevance to asset pricing is limited, unless irrational or at least behaviorally biased individuals can be shown to be the marginal investors in economically relevant settings. Demonstrating their marginality is a particularly difficult challenge because behavioral data are limited in scope and dimension. Aside from a few limited, natural experiments (Green and Rydqvist, 1999) nobody has yet established an empirical link between the apparent irrationality of investor behavior and changes in asset prices.

One of the main problems is the fact that the standard testing approach relies on indirect inference based on the observation of the financial data (i.e., price, return, volatility) or market anomalies (i.e., overreaction, reversals). However, these tests have almost no power in telling apart rational from behavioral components. Indeed, in the case of indirect inference, theories based on information ("rational structural uncertainty") are observationally equivalent to the ones based on behavioral biases ("behavioral theories"). Although the two sets of theories "relax opposite assumptions of the rational expectations ideal, their mathematical and predictive similarities make them difficult to distinguish" (Brav and Heaton, 2002). To pierce through the veil of observational equivalence we need to directly focus on investors' actions, relying on restrictions that explicitly link market impact and behavioral biases. Evidence in this direction is very scarce.

This is not to say that evidence on the market impact of individual investor choice is lacking. Warther (1995), Cohen (1999) and Zheng (1999), for example, all find a relationship between aggregate fund flows and equity returns over long periods. Using individual fund flow data, Edelen and Warner (1999) show a high frequency correlation between flow data and the stock returns. Goetzmann and Massa (2000, 2002) establish the causality from flows to prices and demonstrate that the aggregate magnitude of the shocks can be large. In other research Goetzmann *et al.* (2000) and Brown *et al.* (2002) find that behavioral-based factors, orthogonal to standard asset factors, spread asset returns. However, while all of these studies use behavioral factors, the factors are not "irrational" in the Kahneman and Tversky sense.

Even when information on investor trades and positions is available, the literature has not investigated how this helps to provide information on investor's "behavioral attitude". In fact, the mere fact that a transaction is executed at a loss or at a gain with respect to the *investor's own reference price* provides information about his behavioral bias in executing such a transaction. In this paper, we will bridge this gap by directly inspecting the link between behaviorally motivated trades and stock market conditions (price, volatility and trading volume).

We focus on the most widely documented behavioral heuristic among investors, the disposition effect. Grinblatt and Han (2002) find compelling evidence that U.S. stocks with large, unrealized capital gains have higher expected returns – exactly what their model of the disposition effect would predict. Their results strongly suggest that a disposition factor constructed directly from individual investor decisions should be priced.

The disposition effect was introduced to the finance literature by Shefrin and Statman (1985) as a characterization of the tendency of individuals to ride losses and realize gains. As such, it was based directly on Kahneman and Tversky's loss aversion framework. Statman and Thorley (1999) point out that the disposition effect, being based on a mental accounting framework, is stock-specific rather than related to the market as a whole. Using a database of individual investor decisions, we construct factors from disposition-motivated trades and then we test whether these factors are related to stock prices. We use them to explain the residual portion of stock returns, trading volume and volatility dynamics as predicted by the Grinblatt and Han model, and we show some evidence that these disposition-effect-based factors spread returns. The evidence is consistent with the hypothesis that trade between disposition-prone investors and their counter-parties influences relative prices.

The remainder of the paper is structured as follows. In Section 1, we describe our approach and relate it to the existing literature. In Section 2, we lay out the testable restrictions. In Section 3, we describe the data we use. In Section 4, we report the way we construct our behavioral factors. In Section 5, we describe the empirical tests and their results. A brief conclusion follows.

1 Relation with the literature and our approach

Behavioral theory argues that prior gains induce a different behavior from prior losses. Loss aversion postulates that prior losses increase risk-taking, while prior gains reduce it. In particular, investors have the "tendency to seek risk when faced with possible losses, and to avoid risk when a certain gain is possible." (Kahneman and Tversky, 1979). Loss aversion relies on studies in psychology that show that a decline in utility arising out of the realization of losses relative to gains induces investors not to sell losing stocks relative to winning ones. This intuition was formally developed by Kahneman and Tversky (1979) and applied empirically to the financial markets by Shefrin and Statman (1985) and DeBondt and Thaler (1985).

Barber and Odean (2000, 2001, 2002) and Odean (1998, 1999) empirically demonstrated that investors do indeed tend to "hold on to the losers and sell the winners." Widespread evidence of loss-aversion and the disposition effect have since been found and explored by other authors. Weber and Camerer (1998), Weber and Zuchel (2001) have experimentally documented the effect for investors. Oehler et al. (2002) show that it is pervasive across markets around the world. Dhar and Zhu (2002) find that the tendency towards the disposition effect differs among individual investors depending upon personal characteristics. Ranguelova (2001) finds the disposition effect is most pronounced on trades of small stocks. Grinblatt and Keloharju (2000) find strong evidence of loss aversion in Finnish data, and Genesove and Mayer (2001) shed further light on investor irrationality by analyzing loss aversion and seller behavior in the housing market. More recently, Jackson (2002), and Brown, *et al*, (2002) using Australian data, provided evidence of the "half-life" of the disposition effect among investors. Barber, Odean and Zhu (2003), show that the net trading of individuals is more coordinated that we would expect and that behavioral biases – expecially disposition effect- seem to be the main drivers of such a coordination. This would suggest a direct pricing impact of such a bias.

Considerable theoretical analysis suggests that behavioral biases could affect asset prices. For example, Shumway (1997) develops an equilibrium asset pricing model based on loss-averse investors and shows that loss aversion induces investors to demand a higher risk premium for risk associated with negative market returns. Grinblatt and Han (2002) develop a theoretical model to explain the equilibrium price implications of the disposition effect. This allows them to relate momentum to the amount of unrealized capital gains/losses and to derive cross-sectional implications they use to test their model. They find that a capital gains variable has pricing implications, a result that would be implied by the salience of disposition-prone investors.

Other empirical evidence suggesting that behavioral biases have price impact is not entirely lacking. Coval and Shumway (2001) report evidence of behavioral biases among proprietary traders at the Chicago Board of Trade and investigate the impact of such biases on prices. They show that losing traders tend to buy contracts at higher prices and sell contracts at lower prices and they document a short-term price impact. Kaustia's (2001) study of IPO's finds evidence that the disposition effect impacts the prices of recently issued stocks. With the exception of these few studies the relevance of the disposition effect to asset pricing has been tantalizing but not entirely convincing.

2 Analytical Framework

Grinblatt and Han (2002) derive closed-forms for the stock price and the trading volume as a function of fundamentals and disposition variables. We adopt their specification and refer the reader to their paper for further detail. They show that:

$$P_{t+1} - P_t = w(F_{t+1} - F_t) + (1-w)(R_t - R_{t-1}) \qquad (1)$$

where P_t is the price of the asset, F_t is its fundamental value, R_t is the reference price of the disposition investors and ?$_t$ defines the update of the reference price on the basis of date t information and is bounded between 0 and 1.[1] That is, the reference price is the weighted average of the past prices at which the disposition-investors executed trades. The variable w is the weight that accounts for the representation of the disposition investors in the economy. In particular, $w = \frac{1}{1+ml}$, where μ is the proportion of disposition investors and *?* is the relative intensity of the demand perturbation induced by the disposition effect. Grinblatt and Han also show that trading volume is:

$$V_t \approx w\left|F_{t+1} - F_t - n_{t-1}(P_{t-1} - R_{t-1})\right|, \qquad (2)$$

Therefore, the price of a stock, as well as its trading volume, are a function of both the fundamentals (F_t) and the accumulated impact of prior capital gains/losses (R_t), weighted by the representation of the disposition investors in the market (w). In particular, the disposition effect drives a wedge between the fundamental value of an asset and its market price. This spread is directly related to the amount of unrealized gains/losses and to the percentage of disposition investors in the market. Conditional on constant weights w, both return and trading volume are a function of a backward looking component (R_{t-1}) and of the shocks to the fundamentals $(F_{t+1} - F_t)$.

[1] The updating rule of the reference price is: $R_t = n_{t-1}P_{t-1} + (1-n_{t-1})R_{t-1}$.

Grinblatt and Han test these restrictions by focusing on momentum and assessing the role of past gains/losses on stock returns using a gains variable constructed from past returns and turnover. A stock that has had positive momentum for a while (i.e., is a winner) must have a positive spread between fundamental value and market price that is related to the existence and the position size of disposition investors. Therefore, the aggr egate amount of unrealized capital gains provides a way to test the impact of the disposition effect.

Note however, that if the data were available, a more direct way would be based on the estimate of the effects of a time-varying μ. If the representation of the disposition investors in the economy changes (i.e., μ fluctuates over time), their impact will also differ. We can directly see this by considering Equation 1. It shows that the stochastic component of price is the part related to the shocks to the fundamentals (i.e., F_t), while the second part (i.e., R_t) is backward looking. If we assume that μ changes over time, we can consider the derivative of price with respect to μ. The same can be done for the volatility and for the trading volume. This implies:

$$\frac{\partial \mathrm{Re}\, t_t}{\partial m} < 0, \quad \frac{\partial s_t}{\partial m} < 0, \quad \text{and} \quad \frac{\partial V_t}{\partial m} < 0 \quad \text{if} \quad F_{t+1} > R_{t+1}, \qquad (3)$$

where Ret_t is the actual *ex-post* return on the stock, defined as $(P_{t+1}-P_t)/P_t$. The intuition is the following. Disposition investors tend to hold losers and sell winners. This implies that, if the stocks are doing well and prices are above the reference point,[2] an increase in the fraction of disposition investors (i.e., the net buyers of losing stocks) reduces the net demand, lowering prices (P_{t+1}), returns, trading volume and volatility. Therefore, a direct test of the disposition effect relies on the estimation of the relationship between the fraction of disposition investors and the main pricing variables (i.e., returns, trading volume and volatility), directly testing restriction 3. The attraction of focusing directly on μ is that it is independent of the true economic value of the asset. As such, it allows a direct test of the effects of investor behavior.

2 It can be shown that if $F_{t+1} > R_{t+1}$, we also have that $P_{t+1} > R_{t+1}$.

It is also worth noting that restriction 3 in general provides us with two further testable restrictions. First, it implies a strong non-zero relationship between the percentage of disposition investors in the market and market variables (i.e., returns, volatility and trading volume). The restriction suggests that the relationship will be of the same sign for all the three market variables. Moreover, given that most of our sample covers a the recovery period of the beginning of the 90's, during which, on average, we expect that: $F_{t+1} > R_{t+1}$, we can also consider a third, stronger, implication. That is, we expect that, in our sample, on average, the relationship will be negative.

In order to test these restrictions, we proceed as follows. First we identify the disposition-motivated trades. Then, we construct factors based on these trades and test whether these factors explain differences in stock returns, trading volume and volatility. Finally, we test whether these factors spread returns in sample.

3 Data

We use data provided by a nationwide discount brokerage house. The dataset is the one previously used by Barber and Odean (2000, 2001, 2002), Odean (1998, 1999) and Barber, Odean and Zhu (2003). These data contain information on over 100,000 accounts for around 80,000 households. Around 78,000 of them have traded in stocks. For each account, we have the position files that contain the end-of-month portfolios of the investors and the daily transactions on all the assets for the period 1/1/1991-28/11/1996. For each transaction in the account we know the security traded (identified in the case of a stock by the CRSP CUSIP), the direction of the trade, the quantity traded, and the commission paid. For each account we also know some demographic information about the investor. Each investor may hold several accounts. We follow Barber and Odean and concentrate on only their equity holdings. We conduct our analysis at the investor level and consider each single buy and sell order for each account. For a more detailed description of the data we refer to Barber and Odean (2000, 2001, 2002) and Odean (1998, 1999).

We report descriptive statistics of the data in Table 1. In particular, in Panel A, descriptive statistics for groups of accounts are broken down on the basis of the average number of transactions per year. For each group we report the number of accounts, the number of transactions and the percentage (out of the total transactions) of purchases and sales. We also report the average Running Balance and the Turnover Ratio. The Running Balance is constructed as the average holdings standardised by the amount of time they are held. Turnover is calculated as the absolute sum of purchases and sales (expressed in terms of number of shares) divided by the average running balance. In Panel B, we report some disposition characteristics. That is, for each group we separately consider the buy-at-gain, buy-at-loss, sell-at-gain and sell-at-loss transactions, as described in the next section. For each of these categories of transactions, we report the number of transactions and their percentage in terms of number of overall transactions.

In terms of representativeness of the sample, we refer to Kumar (2002). He compares this sample to the one reported by the Census Bureau (Survey of Income and Program participation, (SIPP), 1995) and the Federal Reserve (Survey of Consumer Finance (SCF), 1992, 1995). For example, in our sample the median portfolio size of an investor is $13,869. This compares to 16,900 for the SCF 1992 and to $15,300 for SCF 1995. Moreover, as reported by Barber and Odean (2000, 2001, 2002), this dataset represents a proper sample of the investor population, in terms of location, trading characteristics, income and so on. It is worth stressing that, given that our analysis is based on daily frequency, the sample is particularly suited to represent the daily trading behavior of an average US investor on the market.[3]

4 Construction of the variables

The fact that the dataset is the same as the one used by Barber and Odean to assess the existence of the disposition bias, allows us to skip the preliminary step of showing the existence of such a bias. Moreover, we can directly appeal to the recent

[3] Part of the transactions are carried out over the internet (for details, see Barber and Odean, 2002).

evidence that shows that such a bias induces investors to co-ordinate their trade (Barber, Odean and Zhu, 2003). This suggests that the disposition bias, by inducing co-movements in trade, should have direct market impact. We make the next logical step by constructing variables that proxy for such disposition-based factors and link them to stock price, volatility and trading volume.

One possible objection to this approach is the issue of representativeness. Is our sample of 100,000 accounts big enough to allow us to extrapolate to the entire investor population? As a preliminary comment, it is worth stressing that, in any case, "behavioral models cannot be tested using aggregate consumption or the market portfolio" (Campbell, 2002), given that the issue of aggregation becomes more severe in the presence of behavioral biases. Therefore, if we want to make any prediction on the pricing impact of behavioral biases *that are not limited to a particular segment of the market*, but deal with the overall population of investors, we necessarily have to content ourselves with data representing a subset of the market.

Also, we believe that, given the aforesaid characteristics in terms of representativeness, our sample provides a proper testable arena. At any point in time the trading impact of disposition-prone transactions is a function of the fraction of disposition-prone investors as well as of the probability that they are carrying assets at a loss/gain with respect to the current price. We know from the literature (Barber and Odean, 2000, 2001, 2002) that our sample is representative in terms of disposition-prone investors. It is indeed *the* sample where disposition effect has been documented as behavioral bias and, as such, it is a good proxy for the fraction of disposition-prone investors.

The second issue deals with the probability that the investors in our sample are carrying stocks at a loss/gain with respect to the current price in the same way as the population of investors in the economy does. This depends on the current price as well as on the prior transaction history of the each investor – i.e., the price at which they bought/sold and therefore the moment in which they executed the prior transactions.

Therefore, for our sample to be representative we require that our investors on average trade in the same way as the population of US investors trade. If this is the case and our investors are truly representative of the US market – as we believe - the factors we identify are representative of the behavior of the average investor.[4]

Finally, from a purely econometric point of view, the usage of a limited sample biases the tests against the possibility of finding a result. Indeed, the only case where we could find significance, in the absence of a genuine relationship, would be in the presence of spurious correlation. However, both the way the disposition variables have been constructed and the set of control variables we use in our specifications make it very unlikely.

4.1 Construction of behavioral ratios

We identify disposition-prone investors on a transaction basis, relying on Barber and Odean (2000, 2001, 2002) results. Let us see this in more detail. For each transaction we distinguish trades "at-loss" and trades "at-gain". Then, for each stock we construct a daily time series of the "sales-at-loss", "sales-at-gains", "buys-at-loss" and "buys-at-gains."

In order to identify sales at loss, we have to make some assumptions about the previous price at which the stock was purchased. We assume a "LIFO" criterion for each single investor.[5] That is, the last shares bought are assumed to be the first ones sold.[6] For example, consider the following sequence of transactions for a given investor at the beginning of the sample, January, 1991. First a buy happens at a particular price. Next, if a sell occurs in the next period, then we calculate the difference between the sell price and the price at which the previous purchase occurred. If the difference is negative, i.e. is the sale occurred at a price lower than the price at which it was previously bought, we

[4] In our sample we are omitting the institutional investors. However, these mostly take the other side of the market with respect to the individual investors (Cohen, Gompers, Vuolteenaho, 2001).
[5] That is for each single investor we aggregate the different accounts.
[6] Every sell until the first buy operation within the period 1991-1996 is ignored.

record this as a "sale-at-loss." If, on the contrary, the difference is positive, we consider it a "sale-at-gain."

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, however, 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, until we have fully matched the current shares sold with previous purchase transactions. We then calculate the profit/loss of the sale by weighting the quantity previously purchased by the price at which the transaction took place.

The LIFO criterion is, of course, a necessary accounting convenience adopted for our analysis. Its validity or relationship to the disposition effect has not been tested experimentally, despite its intuitive appeal. Thus, it is conceivable it could make our measure of the disposition effect a less than perfect one. Never-the-less, it is not clear why this approach would bias our results one way or the other. Lets us look at a sample case:

Transaction date	Quantity	Price	Buy/Sell	Gain/Loss
910101	100	100	Buy	-
910105	100	110	Buy	(110-100)*100
910110	200	70	Buy	(70-110)*100
940101	310	150	Sell	(150-70)*200+(150-110)*110+(150-100)*10
950103	50	110	Sell	(110-100)*50

For the above data we compute the gain/loss measures in the following manner. We start with the first buy operation on 01-01-1991. Calculation of the gain/loss for this transaction is indeterminate. Next, 100 shares are purchased on 01-05-91. So the buy-on-gain is equal to: 100 x (110-100) = 1000. The next purchase is a buy on loss. That is, the loss is equal to: 200 x (70-110) = -8000. The next transaction is a sell. The investor is selling 310 at a price 150. Out of these 310 units, the first 200 units are compared to the previous purchase price of 70, the next 100 would be compared to the purchase price of 110 and the next 10 would be compared to the purchase price of 100. So the total would be 200 x (150 – 70) + 100 x (150 – 110) + 10 x (150 – 100) = 20500. This represents a "sell-on-gain," realizing profit.

It is worth noting that we use the same convention for both buys and sells. That is, for each sale-transaction, we identify whether it was a profit or loss, from the investor's standpoint. Analogously, in the case of purchases, using as anchor or reference point the previous transaction of the investor, we identify whether it took place at a loss sale where the investor lost with respect to his previous transactions or whether he gained.

For the construction of our disposition factors, it is desirable to create proxies for the relative representation in the market of the disposition investors – i.e., the relative net demand of disposition investors over the net total demand in the market. In order to do that, we use as criterion the fact that disposition investors tend to sell winning stocks (i.e., sell-at-gain) and buy losing stocks (i.e., buy-at-loss). We consider three types of daily disposition variables: W_1, W_2 and W_3. W_1 is constructed as the 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. This can be calculated for a specific stock, for a portfolio of stocks or for the market as a whole. W_2 is constructed as the ratio between the total dollar value of sells-at-loss minus sells-at-gain standardized by the sum of sells-at-loss and sells-at-gain. Finally, W_3 combines the information from buys-at-loss and sells-at-loss. It is constructed as the ratio between buy-at-loss plus sell-at-loss minus 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. In particular, the three variables are:

$$W_{1t} = \frac{(B_{lt} - B_{gt})}{(B_{lt} + B_{gt})}, W_{2t} = \frac{(S_{lt} - S_{gt})}{(S_{lt} + S_{gt})}, W_{3t} = \frac{(S_{lt} - S_{gt}) + (B_{lt} - B_{gt})}{(S_{lt} + S_{gt}) + (B_{lt} + B_{gt})} \quad (4)$$

where B_{lt}, B_{gt}, S_{lt} and S_{gt} are, respectively, buy-at-loss, buy-at-gain, sell-at-loss and sell-at-gain transactions. Notice that the reference point is always the price at which the investor's previous transaction was executed, under the LIFO criterion. This may date back as much as five years in our sample.

This approach, while has the advantage of being transaction-based and of allowing for time-variation in the degree of disposition effect, is not immune from criticism. Indeed, it may classify as disposition effect-motivated transactions that have been carried out to just close a successful speculative position. An alternative approach – implemented as a robustness check – would identify investors on the basis of all the transactions in a previous period - e.g., a month. This approach would rely on Odean (1998) classification of the investors based on the ratios of realized gains/losses and paper gains/losses. The usage of such methodology faces the problem of the limited number of transactions that each investor enacts each month. While it is helpful to assess the existence of disposition effect as a bias, it limits the ability to test its trading impact. Indeed, the horizon required to properly identify a disposition trader either may be so long as to substantially limit the sample size.

4.2 Construction of other variables.

We use daily data on the 100 largest stocks in the U.S. market at the beginning of the period. We use turnover as a measure of trading volume. This is defined as volume (measured by the number of shares traded) divided by the outstanding number of shares. Following previous researchers, i.e. Anshuman, Brennan (2001) and Chordia and Subrahmanyam, (2001) we perform our analysis based on turnover, and use volume and volatility as control variables. Previous authors find that turnover is a "characteristic" that affects the return of each stock.

Given the daily frequency of the data, we use a range-based measure of volatility. Alizadeh, Brandt and Diebold, (2001) recently showed that that "theoretically, numerically and empirically the range-based measure of volatility is not only a highly efficient volatility proxy, but also that it is approximately Gaussian and robust to microstructure noise." Thus, for each stock we construct volatility as the log percentage range:

$$s = \log\left[0.1 + 200 * \frac{\max_{\{s \in Day_t\}} P_s - \min_{\{s \in Day_t\}} P_s}{\max_{\{s \in Day_t\}} P_s + \min_{\{s \in Day_t\}} P_s}\right], \tag{5}$$

where, daily volatility is defined as the log percentage range between the highest price of the day minus the lowest price of the day (i.e., for each time s in the day) standardized by the sum of the highest and lowest prices.

In the various specifications we also include some control variables. They are: the three Fama and French factors (*Market*, *HML* and *SMB*), the risk-less rate (i.e., T-Bill rate), the return on the stock, the volatility of the stock, and the logarithm of its volume.

5 Tests of the impact of behavioral factors

We first consider the relationship between our behavioral factors and market variables (i.e., returns, trading volume and volatility) at the single stock level and at the portfolio level. In particular, we focus on the contemporaneous correlation between the disposition factors and return, trading volume and volatility, as predicated by restriction 3.

5.1 Behavioral factors and trading volume

We first focus on trading volume and use turnover – i.e., volume divided by the outstanding number of shares – as a proxy for it. We perform a panel regression of the logarithm of turnover on the disposition factors and a set of control variables.[7] We consider three specifications. The first specification is based on all the stocks and the others are based on portfolios of stocks (10 portfolios of 10 stocks each and 5 portfolios of 20 stocks each). In the case of portfolios, the values of the variables (volatility, volume

[7] The estimates are based on White's adjusted heteroscedastic consistent least-squares regression (White 1980).

and turnover) are their average values across the stocks in the portfolios. For example, in the case of the five portfolio, the dependent variable is the average trading volume for the 20 stocks in the portfolio for that day, while the portfolio-specific characteristics in the set of independent variables are likewise the average on that day of these characteristics (such as volatility) for the 20 stocks comprising the portfolio. The disposition variable is the average ratio calculated for those specific stocks in the portfolio.

The results are reported in Table 2, Panels A, B and C. They show a significant negative correlation between disposition factors and turnover. This holds both at the stock level (first column) and at aggregate level (columns 2 and 3). Thus, we find that, consistent with model predictions, not only is there a strong relationship between disposition factors and turnover, but also the relationship is negative, as our stronger restriction would have required for the period considered. It is worth noting that these findings are robust across specifications, for different portfolios and to the inclusion of the control variables. Also, they are robust to the change in the measure of disposition factors.

5.2 Behavioral factors and volatility

We now consider the impact of our behavioral factors on volatility. We regress volatility on our disposition factors and a set of control variables. As before, we consider three specifications: the first based on individual stocks and the other two based on portfolios of stocks (10 portfolios of 10 stocks each and 5 portfolios of 20 stocks each). In the case of portfolios, as before, the dependent variable is the average variance estimates for the stocks in the portfolios. It is worth noting that this does not necessarily coincide with the portfolio volatility which is a function of the portfolio correlation structure.

The results are reported in Table 3, Panels A, B and C. They show a significant correlation between behavioral factors and volatility. As in the case of trading volume, the results hold both at the stock level (first column) and at the aggregate level (columns 2 and 3). They are also robust to the inclusion of the control variables and to the change of the disposition-based factors. The correlation between the disposition factors and volatility is negative, as our stronger restriction would have required.

5.3 Behavioral factors and returns

We now consider whether returns are correlated to the disposition factors. A contemporaneous correlation is of course insufficient to infer a risk premium associated with shifts in the structure of demand towards disposition-prone investors, but it is certainly a necessary condition for a factor to be priced. We therefore regress returns on the disposition factors and a set of control variables, including the market return and the Fama and French factors HML and SMB. Again, we consider three specifications: one based on all the stocks and the others based on portfolios of stocks (10 portfolios of 10 stocks each and 5 portfolios of 20 stocks each).

The results are reported in Table 4, Panels A, B and C. They show a significant correlation between behavioral factors and returns. This holds both at the stock level (first column) and at the portfolio level (columns 2 and 3). Moreover, the results are robust across different definitions of disposition factors. As was the case for turnover and volatility, the correlation is negative, as our stronger restriction predicted. It is important to note that the factor is effectively explaining the residual component of the time-series of returns to portfolios and stocks. By the same token, however, the regression on these factors and characteristic control variables should account for most of the cross-sectional correlation in stocks or portfolios. Yet even with these control variables we find that the behavioral factors still strongly co-move negatively with returns. This is consistent with the hypothesis that trade between disposition-prone investors and their counter-parties affect relative prices. As such, it could be a "style" effect of the sort modeled in Barbaris and Shleifer (2002), for example.

5.4 Aggregate disposition factors and market variables

It is not implausible that demand shocks by "disposition-disposed" investors might be related to market variables – even prices -- at the individual level or even the level of small portfolios. If they were only security-specific, however, these effects would logically cancel each other out at a higher level of aggregation. To explore this issue, we take a two-pronged approach. First, we re-estimate the relationship between trading volume, volatility and returns and the disposition factor with a different definition of disposition factor. This is now constructed by aggregating the disposition-prone buys and sells across all 100 stocks. The analysis is still performed at the single stock level, and for portfolios composed of 10 and 20 stocks. At this level, the results depend upon the tendency of disposition-prone investors to trade in the same direction on a given day – otherwise we would expect little variation in the series and no explanatory power. The results are reported in Table 5, Panels A, B and C, respectively for turnover, volatility and returns.

A second approach aggregates all the variables across all the 100 stocks considered. That is, not only does it use the aggregated behavioral variable, it also is not performed on stacked series. For the return regression, for example, we explain the daily time-series of the equal-weighted return index across 100 stocks by the aggregate disposition variable and a variety of controls. Note that we had to remove the market-factor from the specification, since the dependent variable in panel C is almost perfectly correlated to the S&P 500 index itself. The results are reported in Table 6, Panels A, B and C, respectively for turnover, volatility and returns.

In the aggregate specifications, the results for turnover are somewhat lessened, although not insignificant for the specification using both buys and sells. The results for volatility and returns are all relatively strong. Thus, not only does disposition matter at the individual security level, but also the aggregate behavior of disposition-prone investors appears to matter at the aggregate level, suggesting that behavioral effects might be important at the market-wide level.

Thus far, the results support the strong form of restriction 3. We find a strong and statistically significant negative relationship between our disposition demand and market variables. In particular, the relationship between returns and factors is consistent with the disposition variables being characteristics of individual stocks, either due to fundamentals of the style preferences, as well as with the disposition variables being factors that are priced. These explanations of course are not mutually exclusive.

Indeed, as indicated in equation 1, stock returns are a function of two components, a backward-looking component related to the price reference (R_t) and a component that accounts for the fundamentals (F_t). Only the latter should be priced, as it is a function of the shocks (innovations) to the fundamentals, while the former only relates to past shocks. If the percentage of the disposition-prone transactions in each company were not stochastic, we would expect it to affect stock returns by merely amplifying the shocks to the fundamentals. That is, it would act as characteristic, without being a factor of its own. If, on the contrary, the percentage of the disposition-prone transactions changes over time, the change in their relative representation in the markets becomes a factor itself. In this case, it may be priced. In order to distinguish these two possibilities, we turn to tests of pricing.

6 Are behavioral factors priced?

One of our goals is to assess the impact of behavioral biases on prices. We therefore perform a standard asset pricing Fama and MacBeth [FM] two-stage time-series cross-section test, applied to daily returns. We follow two approaches: first we use individual stock returns (Table 7) and then size-sorted portfolios (Table 8). In order to construct the disposition factors, we proceed as follows. Once the daily purchases and sales of the different classes of investors have been identified and the behavioral ratios have been constructed, we build portfolios based on them, following the Fama and French (1993) procedure. That is, we rank stocks on the basis of the behavioral ratios and then construct portfolios based on the differences between the returns of the portfolios constructed from high-factor stocks and the portfolios constructed from low-factor stocks. Portfolios are constructed daily.

We apply the FM procedure on rolling intervals and daily updated betas. We consider 20-day rolling windows. This generates sets of betas that are then used as explanatory variables in the second step of the procedure. We consider the three Fama and French factors (R_{mkt}, HML and SMB) and our disposition factors. The first step of the procedure generates the ßs. These are estimated via a time-series regression. Then, the ßs are used in a second-pass regression along the lines of Fama and MacBeth.

At this stage we also include some "characteristics" (Brennan, Chordia and Subrahmanyam, 1998). These are the volatility on the stock, the logarithm of turnover of the stock and the logarithm of its volume). In the case of portfolios, the characteristics are aggregated for each size-sorted portfolio. We consider alternative specifications based on a different number of factors and characteristics. We also consider the cases with different disposition factors. In order to overcome the potential problems of lead-lag effects due to asynchronous trading with daily data, we apply a Dimson-Marsh correction. We consider two alternative specifications: in the first ones we use 3 days of leads and lags, while in the second we use five days of leads and lags. If our hypothesis is correct, we expect the betas of the behavioral factors to have additional explanatory power.

The results are reported in Tables 7 and 8. They provide some evidence in favor of pricing – at least over this limited six-year time interval. The regressions in Table 7 are estimated at the individual security level, while the regressions in Table 8 are estimated at the portfolio level. Note that the behavioral factors spread returns nicely, while the traditional factors – most notably the market betas – have fairly little power. On the other hand, characteristics like turnover and volatility provide additional explanatory power, beyond the factor used to create portfolios. In all the specifications, regardless of the number of additional factors (1 or 3 factor model) and characteristics (volume, volatility, turnover) that are included, our behavioral factors are always strongly significant. Moreover, consistent with what we saw in the previous section, the factors always reduce returns.

This suggests that not only the disposition bias of investors appears to affect the return of the company in which they trade, but also that the exposure of a stock to the aggregate percentage of disposition investors in the economy is associated with lower *ex post* returns. These findings support our hypothesis that an increase in the fraction of disposition investors in the market reduces price pressure and lowers *ex-post* returns.

Conclusion

Measuring the impact of behavioral biases on asset prices is difficult because econometricians rarely have access to individual investor decisions. And yet, all behavioral theory is grounded in assumptions about individual decision-making under uncertainly. Ultimately, tests of the relevance of behavioral finance must be conducted jointly on behavioral data and asset data. In this study, we consider the widely documented disposition effect. We construct behavioral factors that are based on the fraction of disposition investors trading on a given day. We derive and estimate the empirical implications of a model which has previously motivated an empirical asset return study that provided strongly suggestive of a behavioral influence on the markets.

We show that factors aggregated up from individual investment decisions are statistically related to returns, trading volume and volatility. The disposition bias of investors affects affect the return of the company in which they trade and aggregates at the market level so as to generate price-relevant factors. The exposure of a stock to the factor that represents the aggregate percentage of disposition investors in the economy is associated with lower *ex post* returns. An important caveat to the inference about pricing is that a six-year window of returns cannot reasonably represent expectations or equilibrium conditions. Never the less, the results of a classic asset-pricing test over a substantial sub-period is strongly suggestive of the possibility that exposure to the behavior of rationally-challenged investors is a strong candidate for a priced factor.

This study has further implications for volatility studies and micro-structure effects. We find evidence that both trading volume (i.e., turnover) and volatility may depend in general upon the composition of the market, and more specifically on disposition-prone investors.

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Table 1: Descriptive Statistics

We report descriptive statistics of the dataset. In Panel A, we report descriptive statistics for groups of accounts broken down on the basis of the average number of transactions they enact each year (n). We consider 5 classes of accounts: the ones with less than 5 transactions, the accounts with less than 10 and more than 5 transactions, the accounts with less than 15 and more than 10 transactions, the accounts with less than 20 and more than 15 transactions and the accounts with more than 20 transactions. For each group we the number of accounts, the number of transactions and the percentage (out of the total transactions) of purchases and sales. For each group we also report the average running balance Running Balance and the Turnover Ratio. The Running Balance is constructed as the average holdings standardised by the amount of time they are held. Turnover is calculated as the sum of absolute value of purchases and absolute value of sales (expressed in terms of number of shares) divided by the average running balance. In Panel B, we report some "disposition characteristics" of the accounts. That is, for each group we separately report the buy-on-gains, buy-on-loss, sell-on-gain and sell-on-loss transactions, as described in the text in the Section on Data Construction. For each of these categories of transactions, we report the number of transactions and their percentage in terms of overall transactions.

Panel A

		Number of Transactions (n)				
		n<5	*5<n<10*	*10<n<15*	*15<n<20*	*20<n*
Number of Accounts		44482	21303	11159	6844	23139
Number of Transactions (Total)		94461	142796	131527	115297	1427938
Percentage of Purchases		55.10	54.42	54.67	54.64	55.07
Percentage of Sales		44.90	45.58	45.33	45.36	44.93
Running Balance	Mean	558	599	598	682	950
(in number of shares)	Median	167	200	200	220	400
	S.Dev	87522	95686	66081	74931	92067
Turnover Ratio	Mean	1.748	4.055	6.737	9.352	30.470
(in terms of number of shares)	Median	1.200	3.632	6.292	8.834	19.460
	S.Dev	10.233	3.826	4.118	5.4115	65.370

Panel B

	Number of Transactions (n)				
	n<5	*5<n<10*	10<n<15	15<n<20	20<n
Buy-on-gain					
Number of Transactions	1925	5135	5643	5617	132229
Percentage of Total Transactions	2.04	3.60	4.29	4.78	9.26
Sell-on-gain					
Number of Transactions	6713	17934	19992	19410	286110
Percentage of Total Transactions	7.10	12.56	15.20	16.83	20.04
Buy-on-loss					
Number of Transactions	3076	8254	8931	9045	179788
Percentage of Total Transactions	3.26	5.78	6.79	7.84	12.59
Sell-on-loss					
Number of Transactions	4430	11424	12615	12714	202789
Percentage of Total Transactions	4.69	8.00	9.59	11.02	14.20

Table 2: Turnover and Disposition Factors

We report the estimates of the regression of the logarithm of turnover on our disposition factors and a set of control variables. We consider three types of disposition variables: W_1, W_2 and W_3. W_1 is constructed as the ratio between buy-at-loss minus buy-at-gain standardized by the sum of buy-at-loss and buy-at-gain. W_2 is constructed as the ratio between sell-at-loss minus sell-at-gain standardized by the sum of sell-at-loss and sell-at-gain. W_3 is constructed as the ratio between buy-at-loss plus sell-at-loss minus 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_1, W_2 and W_3 have been divided by 1,000. The control variables include: the three Fama and French factors (R_{mkt}, HML and SMB), the risk-less rate (R_f), the return on the stock (R_i), the volatility of the stock, and the logarithm of its trading volume. For each stock we construct volatility as the logarithm of the ratio between the highest price of the day minus the lowest price of the day, standardized by the sum of the highest and lowest prices. The estimates are based on White's adjusted heteroscedastic consistent Least-squares Regression (White 1980). The frequency is daily. The period is 1st January 1991-30 November 1996. We consider three specifications: one based on all the stocks and the others based on portfolios of stocks (10 portfolios of 10 stocks each and 5 portfolios of 20 stocks each). In the case of portfolios, the values are the average values of the stocks in the portfolios.

Panel A: W_1

	Specifications											
	Single Stocks				*10 Portfolios*				*5 Portfolios*			
	I		*II*		*I*		*II*		*I*		*II*	
Variables	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*
Intercept	-4.28	-78.95	-4.13	-97.47	-1.18	-9.76	-2.54	-22.17	1.13	6.81	-0.68	-4.13
Factor W_1	-8.32	-2.10	-8.91	-2.25	-46.19	-9.45	-37.32	-7.29	-57.98	-8.34	-45.54	-6.17
R_{mkt}	-0.003	-0.94	-0.003	-0.96	-0.03	-2.88	-0.04	-3.63	-0.04	-2.66	-0.07	-3.85
HML	0.002	0.50	0.001	0.45	0.007	0.78	0.007	0.66	0.006	0.46	0.005	0.35
SMB	0.03	7.27	0.03	7.32	0.05	4.55	0.04	3.44	0.05	3.77	0.04	2.52
R_f	1.20	3.37	1.37	3.85	-0.140	-0.16	-0.84	-0.96	0.58	0.53	-0.18	-0.15
R_i	2.13	14.50	2.17	14.66	5.63	6.11	5.94	5.96	6.90	4.95	8.28	5.12
Volume	0.37	92.00	0.36	113.39	0.31	41.55	0.36	48.73	0.22	22.35	0.27	26.96
Volatility	0.0001	12.98	-	-	-0.001	-35.31	-	-	-0.001	-30.31	-	-
Adj.R^2		0.41		0.41		0.24		0.17		0.22		0.11
Obs		147934		147934		14960		14960		7480		7480

Panel B: W_2

Variables	Single Stocks				10 Portfolios				5 Portfolios			
	I		*II*		*I*		*II*		*I*		*II*	
	Coeff.	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*
Intercept	-4.27	-78.68	-4.12	-97.17	-1.17	-9.71	-2.53	-22.14	1.12	6.73	-0.70	-4.21
Factor W_2	-39.90	-12.24	-41.78	-12.88	-50.12	-9.44	-41.18	-7.43	-77.81	-9.08	-62.67	-6.97
R_{mkt}	-0.003	-1.10	-0.004	-1.13	-0.03	-2.85	-0.04	-3.61	-0.04	-2.80	-0.07	-3.97
HML	0.0006	0.14	0.0003	0.07	0.007	0.78	0.001	0.65	0.00	0.24	0.00	0.18
SMB	0.03	6.98	0.03	7.03	0.05	4.42	0.03	3.33	0.05	3.48	0.03	2.30
R_f	1.05	2.97	1.21	3.44	-0.04	-0.04	-0.77	-0.87	0.49	0.45	-0.27	-0.23
R_i	2.02	13.74	2.05	13.86	5.42	5.87	5.77	5.77	6.49	4.65	7.94	4.91
Volume	0.37	91.69	0.36	113.06	0.31	41.29	0.36	48.57	0.22	22.25	0.27	26.88
Volatility	0.0001	12.93	-	-	-0.001	-35.33	-	-	-0.001	-30.37	-	-
Adj.R^2		0.41		0.41		0.24		0.17		0.22		0.11
Obs		147934		147934		14960		14960		7480		7480

Panel C: W_3

Variables	Single Stocks				10 Portfolios				5 Portfolios			
	I		*II*		*I*		*II*		*I*		*II*	
	Coeff.	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*
Intercept	-4.28	-78.80	-4.13	-97.30	-1.19	-9.92	-2.55	-22.34	1.1295	6.78	-0.70	-4.25
Factor W_3	-20.92	-7.38	-22.26	-7.86	-61.49	-10.85	-49.62	-8.42	-96.35	-10.44	-73.94	-7.59
R_{mkt}	-0.003	-1.07	-0.003	-1.10	-0.03	-2.95	-0.04	-3.68	-0.04	-2.96	-0.07	-4.07
HML	0.001	0.27	0.0009	0.20	0.004	0.45	0.004	0.41	-0.001	-0.10	-0.001	-0.02
SMB	0.035	7.10	0.03	7.15	0.04	4.26	0.03	3.22	0.049	3.36	0.03	2.23
R_f	1.11	3.14	1.28	3.61	-0.18	-0.21	-0.88	-1.00	0.20	0.18	-0.46	-0.39
R_i	2.07	14.09	2.10	14.22	5.22	5.64	5.62	5.60	6.31	4.51	7.84	4.83
Volume	0.37	91.85	0.36	113.24	0.31	41.65	0.36	48.83	0.22	22.38	0.28	27.00
Volatility	0.0001	12.95	-	-	-0.001	-35.33	-	-	-0.001	-30.57	-	-
Adj.R^2		0.41		0.41		0.24		0.17		0.22		0.11
Obs		147934		147934		14960		14960		7480		7480

Table 3: Volatility and Disposition Factors

We report the estimates of the regression of volatility on our disposition factors and a set of control variables. We consider three types of disposition variables: W_1, W_2 and W_3. W_1 is constructed as the ratio between buy-at-loss minus buy-at-gain standardized by the sum of buy-at-loss and buy-at-gain. W_2 is constructed as the ratio between sell-at-loss minus sell-at-gain standardized by the sum of sell-at-loss and sell-at-gain. W_3 is constructed as the ratio between buy-at-loss plus sell-at-loss minus 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_1, W_2 and W_3 have been divided by 1,000. For each stock we construct volatility as the logarithm of the ratio between the highest price of the day minus the lowest price of the day, standardized by the sum of the highest and lowest prices. The control variables include: the three Fama and French factors (R_{mkt}, HML and SMB), the risk-less rate (R_f), the returns on the stock (R_i), the logarithm of turnover of the stock and the logarithm of its trading volume. The estimates are based on White's adjusted heteroscedastic consistent Least-squares Regression (White 1980). The frequency is daily. The period is 1st January 1991-30 November 1996. We consider three specifications: one based on all the stocks and the others based on portfolios of stocks (10 portfolios of 10 stocks each and 5 portfolios of 20 stocks each). In the case of portfolios, the values are the average values of the stocks in the portfolios. The coefficients have been divided by 1,000.

Panel A: W_1

	Specifications											
	Single Stocks				*10 Portfolios*				*5 Portfolios*			
	I		*II*		*I*		*II*		*I*		*II*	
Variables	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*
Intercept	2.82	18.33	2.24	18.83	1.22	26.59	1.4685	30.97	2.36	29.72	2.4861	29.74
Factor W_1	-4.07	-3.38	-5.23	-4.41	-13.18	-8.20	-9.58	-5.70	-24.71	-6.72	-16.94	-4.34
R_{mkt}	-0.002	-0.68	-0.002	-0.75	0.0073	2.23	0.0115	3.35	0.02	3.1115	0.0349	4.3105
HML	-0.00	-2.62	-0.007	-2.28	0.0015	0.48	0.001	0.25	0.002	0.33	0.001	0.17
SMB	0.001	0.47	0.006	1.46	0.01	4.24	0.01	3.01	0.02	4.08	0.02	2.86
R_f	3.12	10.71	3.06	10.48	0.68	2.61	0.76	2.79	1.01	1.98	1.04	1.90
R_i	0.25	3.97	0.48	6.96	0.23	1.10	-0.34	-1.48	-0.46	-0.79	-1.87	-2.70
Volume	-0.21	-17.98	-0.16	-18.44	-0.02	-7.15	-0.05	-19.10	-0.03	-6.08	-0.07	-15.82
Turnover	0.11	16.2	-	-	-0.09	-49.4	-	-	-0.17	-34.3	-	-
Adj.R^2		0.16		0.14		0.13		0.04		0.16		0.04
Obs		147934		147934		14960		14960		7480		7480

Panel B: W_2

Variables	*Single Stocks* I Coeff.	t-stat	*Single Stocks* II Coeff.	t-stat	*10 Portfolios* I Coeff.	t-stat	*10 Portfolios* II Coeff.	t-stat	*5 Portfolios* I Coeff.	t-stat	*5 Portfolios* II Coeff.	t-stat
Intercept	2.83	18.33	2.25	18.83	1.22	26.59	1.46	30.96	2.36	29.66	2.48	29.71
Factor W_2	-24.92	-15.24	-28.31	-15.86	-13.64	-7.27	-9.66	-4.94	-31.29	-6.96	-20.57	-4.36
R_{mkt}	-0.001	-0.81	-0.00	-0.89	0.00	2.28	0.01	3.38	0.02	2.99	0.03	4.24
HML	-0.009	-2.92	-0.008	-2.61	0.001	0.52	0.001	0.29	0.001	0.19	0.001	0.11
SMB	0.001	0.24	0.00	1.21	0.01	4.17	0.01	2.96	0.02	3.85	0.02	2.73
R_f	3.03	10.49	2.97	10.23	0.71	2.76	0.78	2.89	0.99	1.94	1.03	1.90
R_i	0.18	2.89	0.40	5.92	0.17	0.85	-0.37	-1.62	-0.60	-1.03	-1.96	-2.82
Volume	-0.21	-17.99	-0.16	-18.45	-0.02	-7.30	-0.05	-19.18	-0.03	-6.11	-0.07	-15.88
Turnover	0.11	16.26	-	-	-0.09	-49.61	-	-	-0.17	-34.64	-	-
Adj.R^2		0.16		0.14		0.13		0.04		0.16		0.04
Obs		147934		147934		14960		14960		7480		7480

Panel C: W_3

Variables	*Single Stocks* I Coeff.	t-stat	*Single Stocks* II Coeff.	t-stat	*10 Portfolios* I Coeff.	t-stat	*10 Portfolios* II Coeff.	t-stat	*5 Portfolios* I Coeff.	t-stat	*5 Portfolios* II Coeff.	t-stat
Intercept	2.83	18.34	2.24	18.83	1.21	26.45	1.46	30.88	2.35	29.6	2.47	29.73
Factor W_3	-16.74	-13.86	-18.54	-14.67	-17.57	-8.57	-12.76	-5.99	-42.96	-8.97	-30.22	-5.98
R_{mkt}	-0.002	-0.83	-0.002	-0.90	0.0070	2.14	0.01	3.29	0.02	2.76	0.03	4.09
HML	-0.009	-2.88	-0.008	-2.56	0.0006	0.18	0.0001	0.04	-0.001	-0.24	-0.001	-0.21
SMB	0.001	0.29	0.005	1.26	0.014	3.99	0.01	2.83	0.02	3.67	0.01	2.58
R_f	3.04	10.52	2.98	10.27	0.66	2.58	0.75	2.76	0.82	1.62	0.90	1.65
R_i	0.20	3.18	0.42	6.23	0.11	0.55	-0.42	-1.84	-0.71	-1.22	-2.06	-2.97
Volume	-0.21	-17.99	-0.16	-18.45	-0.02	-7.05	-0.05	-19.06	-0.03	-5.95	-0.07	-15.82
Turnover	0.11	16.26	-	-	-0.09	-49.80	-	-	-0.17	-34.88	-	-
Adj.R^2		0.16		0.14		0.13		0.04		0.16		0.04
Obs		147934		147934		14960		14960		7480		7480

Table 4: Returns and Disposition Factors

We report the estimates of the regression of stock returns on our disposition factors and a set of control variables. We consider three types of disposition variables: W_1, W_2 and W_3. W_1 is constructed as the ratio between buy-at-loss minus buy-at-gain standardized by the sum of buy-at-loss and buy-at-gain. W_2 is constructed as the ratio between sell-at-loss minus sell-at-gain standardized by the sum of sell-at-loss and sell-at-gain. W_3 is constructed as the ratio between buy-at-loss plus sell-at-loss minus 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. The control variables include: the three Fama and French factors (R_{mkt}, HML and SMB), the risk-less rate (R_f), the volatility on the stock, the logarithm of turnover of the stock and the logarithm of its trading volume. For each stock we construct volatility as the logarithm of the ratio between the highest price of the day minus the lowest price of the day, standardized by the sum of the highest and lowest prices. The estimates are based on White's adjusted heteroscedastic consistent Least-squares Regression (White 1980). The frequency is daily. The period is 1st January 1991-30 November 1996. We consider three specifications: one based on all the stocks and the others based on portfolios of stocks (10 portfolios of 10 stocks each and 5 portfolios of 20 stocks each). In the case of portfolios, the values are the average values of the stocks in the portfolios. The coefficients have been multiplied by 1,000.

Panel A: W_1

	Specifications											
	Single Stocks				*10 Portfolios*				*5 Portfolios*			
	I		*II*		*I*		*II*		*I*		*II*	
Variables	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*
Intercept	0.63	1.47	0.98	2.42	-0.83	-0.61	-0.47	-0.37	-0.43	-0.26	-0.86	-0.58
Factor W_1	-1.31	-13.63	-1.32	-13.65	-0.33	-5.79	-0.33	-5.88	-0.27	-3.99	-0.26	-3.93
R_{mkt}	9.90	119.62	9.90	119.62	10.13	104.02	10.13	104.10	10.15	94.17	10.14	94.23
HML	-2.89	-27.42	-2.89	-27.42	-2.76	-22.57	-2.76	-22.57	-2.76	-20.55	-2.76	-20.55
SMB	-0.57	-4.27	-0.57	-4.27	-0.58	-3.99	-0.58	-3.96	-0.57	-3.62	-0.57	-3.65
R_f	-9.66	-1.15	-9.33	-1.12	0.72	0.07	0.93	0.09	2.17	0.21	1.99	0.19
Volume	-0.07	-2.33	-0.10	-3.28	-0.08	-1.00	-0.09	-1.09	-0.08	-0.89	-0.08	-0.85
Turnover	1.20	14.49	1.21	14.63	0.76	6.04	0.73	5.89	0.62	4.92	0.65	5.07
Volatility	0.0002	3.55	-	-	0.0003	1.10	-	-	-0.001	-0.78	-	-
Adj.R^2		0.18		0.18		0.65		0.65		0.77		0.77
Obs		147934		147934		14960		14960		7480		7480

Panel B: W_2

Variables	Single Stocks I Coeff.	Single Stocks I t-stat	Single Stocks II Coeff.	Single Stocks II t-stat	10 Portfolios I Coeff.	10 Portfolios I t-stat	10 Portfolios II Coeff.	10 Portfolios II t-stat	5 Portfolios I Coeff.	5 Portfolios I t-stat	5 Portfolios II Coeff.	5 Portfolios II t-stat
Intercept	1.26	2.97	1.55	3.81	-0.69	-0.51	-0.40	-0.32	-0.38	-0.23	-0.94	-0.63
Factor W_2	-2.25	-28.47	-2.26	-28.51	-0.60	-9.78	-0.61	-9.86	-0.53	-6.70	-0.52	-6.63
R_{mkt}	9.83	119.08	9.83	119.08	10.08	103.44	10.08	103.53	10.08	93.24	10.08	93.29
HML	-2.92	-27.86	-2.92	-27.86	-2.79	-22.90	-2.79	-22.90	-2.79	-20.92	-2.79	-20.92
SMB	-0.62	-4.71	-0.62	-4.71	-0.62	-4.24	-0.61	-4.22	-0.60	-3.85	-0.61	-3.90
R_f	-13.99	-1.68	-13.74	-1.65	-0.54	-0.05	-0.37	-0.04	0.12	0.01	-0.10	-0.01
Volume	-0.13	-4.05	-0.15	-4.913	-0.10	-1.14	-0.10	-1.21	-0.08	-0.89	-0.07	-0.82
Turnover	1.13	13.72	1.14	13.83	0.73	5.81	0.71	5.70	0.58	4.62	0.62	4.86
Volatility	0.0002	2.86	-	-	0.0002	0.86	-	-	-0.001	-1.03	-	-
Adj.R^2		0.18		0.18		0.65		0.65		0.77		0.77
Obs		147934		147934		14960		14960		7480		7480

Panel C: W_3

Variables	Single Stocks I Coeff.	Single Stocks I t-stat	Single Stocks II Coeff.	Single Stocks II t-stat	10 Portfolios I Coeff.	10 Portfolios I t-stat	10 Portfolios II Coeff.	10 Portfolios II t-stat	5 Portfolios I Coeff.	5 Portfolios I t-stat	5 Portfolios II Coeff.	5 Portfolios II t-stat
Intercept	1.10	2.59	1.40	3.45	-0.99	-0.73	-0.80	-0.64	-0.34	-0.20	-1.00	-0.67
Factor W_3	-2.03	-29.50	-2.03	-29.54	-0.77	-11.54	-0.78	-11.64	-0.60	-6.84	-0.59	-6.73
R_{mkt}	9.81	118.85	9.81	118.85	10.03	102.59	10.03	102.63	10.06	92.00	10.06	92.02
HML	-2.95	-28.05	-2.95	-28.06	-2.83	-23.20	-2.83	-23.20	-2.81	-20.96	-2.81	-20.96
SMB	-0.63	-4.79	-0.63	-4.78	-0.64	-4.39	-0.64	-4.38	-0.61	-3.89	-0.62	-3.94
R_f	-15.44	-1.85	-15.18	-1.82	-2.55	-0.27	-2.45	-0.26	-1.22	-0.12	-1.45	-0.14
Volume	-0.11	-3.56	-0.13	-4.44	-0.06	-0.77	-0.07	-0.81	-0.07	-0.78	-0.06	-0.71
Turnover	1.16	14.07	1.17	14.19	0.70	5.58	0.69	5.54	0.57	4.48	0.62	4.78
Volatility	0.0002	3.01	-	-	0.0002	0.55	-	-	-0.001	-1.22	-	-
Adj.R^2		0.18		0.18		0.65		0.65		0.77		0.77
Obs		147934		147934		14960		14960		7480		7480

Table 5: Aggregate [W_3] Disposition Index and Market Variables

We report the estimates of the regression of the logarithm of turnover, volatility and returns on our disposition factor W_3 and a set of control variables. W_3 is constructed as the ratio between buy-at-loss plus sell-at-loss minus 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. The index has been constructed as aggregation of trades (i.e., buys and sales) across the entire market and has been divided by 1,000. The control variables include: the HML and SMB, the risk-less rate (R_f), the return on the stock (R_i), the volatility of the stock, and the logarithm of its trading volume. For each stock we construct volatility as the logarithm of the ratio between the highest price of the day minus the lowest price of the day, standardized by the sum of the highest and lowest prices. The estimates are based on White's adjusted heteroscedastic consistent Least-squares Regression (White 1980). The frequency is daily. The period is 1st January 1991-30 November 1996. We consider three specifications: one based on all the stocks and the others based on portfolios of stocks (10 portfolios of 10 stocks each and 5 portfolios of 20 stocks each). In the case of portfolios, the values are the average values of the stocks in the portfolios. The values of the coefficients in Panel B have been divided by 1,000 and the values of the coefficients in Panel C have been multiplied by 1,000.

Panel A: Turnover

	Specifications											
	Single Stocks				*10 Portfolios*				*5 Portfolios*			
	I		*II*		*I*		*II*		*I*		*II*	
Variables	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*
Intercept	-4.12	89.61	-3.84	-125.8	-1.13	-9.24	-2.52	-21.91	1.22	7.23	-0.67	-4.03
Factor W_3	-48.77	-9.65	-51.13	-10.08	-77.13	-6.51	-39.74	-3.19	-104.0	-6.63	-45.50	-2.74
HML	-0.003	-0.75	-0.005	-1.20	0.0086	0.82	0.01	1.20	0.0007	0.05	0.008	0.53
SMB	0.04	9.94	0.04	10.17	0.0660	6.34	0.05	5.42	0.06	4.85	0.06	3.97
R_f	0.25	0.70	0.74	2.02	-0.90	-1.05	-1.11	-1.23	-0.39	-0.35	-0.39	-0.32
R_i	1.96	12.68	2.01	12.81	3.63	5.64	3.74	5.33	3.38	3.98	3.79	3.80
Volume	0.36	104.93	0.34	149.25	0.30	40.76	0.36	48.33	0.21	21.70	0.27	26.71
Volatility	0.0001	21.35	-	-	-0.001	-35.45	-	-	-0.001	-30.46	-	-
Adj.R^2		0.44		0.44		0.24		0.16		0.22		0.10
Obs		149600		149600		14960		14960		7480		7480

Panel B: Volatility

Variables	Single Stocks				10 Portfolios				5 Portfolios			
	I		*II*		*I*		*II*		*I*		*II*	
	Coeff.	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*
Intercept	12.76	37.73	10.55	39.28	1.25	27.17	1.49	31.53	2.42	30.69	2.54	30.69
Factor W_3	-73.33	-5.79	-95.72	-7.41	-43.95	-11.46	-40.12	-9.89	-86.20	-11.46	-78.42	-9.71
HML	-0.07	-6.56	-0.07	-6.45	-0.003	-1.25	-0.00	-1.55	-0.00	-1.37	-0.01	-1.43
SMB	0.02	1.8717	0.0438	3.5043	0.0125	3.7710	0.0067	1.9219	0.0198	2.9763	0.0094	1.29
R_f	19.49	19.25	19.23	18.79	0.11	0.42	0.22	0.78	-0.07	-0.14	-0.008	-0.01
R_i	0.77	2.87	1.75	6.03	0.24	1.57	-0.11	-0.63	0.09	0.26	-0.54	-1.25
Volume	-0.99	-37.38	-0.80	-38.99	-0.02	-7.71	-0.05	-19.61	-0.03	-6.75	-0.08	-16.60
Volatility	0.50	30.08	-	-	-0.09	-49.72	-	-	-0.17	-34.63	-	-
Adj.R^2		0.31		0.29		0.13		0.05		0.17		0.05
Obs		149278		149278		14960		14960		7480		7480

Panel C: Returns

Variables	Single Stocks				10 Portfolios				5 Portfolios			
	I		*II*		*I*		*II*		*I*		*II*	
	Coeff.	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*
Intercept	2.87	6.59	3.52	8.48	2.27	1.21	3.05	1.76	2.56	0.94	2.81	1.16
Factor W_3	-5.47	-41.21	-5.47	-41.25	-5.51	-29.06	-5.53	-29.44	-5.54	-23.11	-5.54	-23.48
HML	-8.53	-79.11	-8.54	-79.15	-8.58	-52.15	-8.58	-52.21	-8.59	-40.83	-8.59	-40.86
SMB	-8.76	-68.06	-8.76	-68.06	-8.79	-45.78	-8.78	-45.73	-8.78	-35.89	-8.78	-35.85
R_f	-70.89	-7.56	-69.94	-7.47	-66.42	-5.06	-66.36	-5.05	-65.77	-4.04	-65.78	-4.04
R_i	-0.17	-5.27	-0.23	-7.06	-0.26	-2.19	-0.28	-2.34	-0.26	-1.67	-0.27	-1.73
Volume	1.33	12.60	1.35	12.72	0.94	5.63	0.88	5.33	0.80	3.92	0.78	3.82
Volatility	0.0001	3.26	-	-	0.0006	1.57	-	-	0.0001	0.26	-	-
Adj.R^2		0.09		0.09		0.34		0.34		0.40		0.40
Obs		149600		149600		14960		14960		7480		7480

Table 6: Aggregate Disposition Index and Market Variables

We report the estimates of the regression of the logarithm of turnover, volatility and returns on our disposition factors and a set of control variables. These variables have been aggregated across all the 100 stocks considered. The disposition factors have been constructed as reported in Tables 2-4 and then for each of them we constructed indexes as aggregation of trades (i.e., buys and sales) across the entire market and has been divided by 1,000. The control variables include: the HML and SMB, the risk-less rate (R_f), the return on the stock (R_i), the volatility of the stock, and the logarithm of its trading volume. For each stock we construct volatility as the logarithm of the ratio between the highest price of the day minus the lowest price of the day, standardized by the sum of the highest and lowest prices. The estimates are based on White's adjusted heteroscedastic consistent Least-squares Regression (White 1980). The frequency is daily. The period is 1st January 1991-30 November 1996. We consider three specifications: one based on all the stocks and the others based on portfolios of stocks (10 portfolios of 10 stocks each and 5 portfolios of 20 stocks each). In the case of portfolios, the values are the average values of the stocks in the portfolios. The values of the coefficients in Panel B have been divided by 1,000 and the values of the coefficients in Panel C have been multiplied by 1,000.

Panel A: Turnover

	Specifications											
	Factor W_1				*Factor W_2*				*Factor W_3*			
	I		*II*		*I*		*II*		*I*		*II*	
Variables	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*
Intercept	-2.10	-7.38	-2.02	-7.11	-2.05	-7.25	-1.99	-7.04	-2.04	-7.14	-1.97	-6.90
Factor W	-0.005	-0.36	-0.01	-1.11	-0.04	-3.20	-0.05	-3.59	-0.03	-2.23	-0.04	-2.82
HML	0.01	1.04	0.01	1.17	0.009	0.57	0.01	0.72	0.01	0.61	0.01	0.70
SMB	0.04	2.48	0.04	2.65	0.03	2.25	0.04	2.42	0.03	2.31	0.04	2.45
R_f	-2.44	-2.05	-2.69	-2.28	-3.07	-2.61	-3.23	-2.77	-2.99	-2.52	-3.21	-2.73
R_i	2.76	2.28	2.89	2.41	1.99	1.65	2.15	1.80	2.09	1.71	2.15	1.77
Volume	0.41	25.19	0.42	26.60	0.41	25.04	0.41	26.53	0.41	24.94	0.41	26.24
Volatility	0.001	2.78	-	-	0.0001	2.41	-	-	0.001	2.31	-	-
Adj.R^2		0.41		0.41		0.42		0.42		0.42		0.42
Obs		1496		1496		1496		1496		1496		1496

Panel B: Volatility

Variables	Factor W_1 I Coeff.	Factor W_1 I t-stat	Factor W_1 II Coeff.	Factor W_1 II t-stat	Factor W_2 I Coeff.	Factor W_2 I t-stat	Factor W_2 II Coeff.	Factor W_2 II t-stat	Factor W_3 I Coeff.	Factor W_3 I t-stat	Factor W_3 II Coeff.	Factor W_3 II t-stat
Intercept	2.51	5.37	2.22	4.76	2.27	4.80	2.02	4.27	2.52	5.35	2.28	4.86
Factor W	-0.27	-10.53	-0.27	-10.60	-0.17	-6.04	-0.18	-6.21	-0.30	-9.24	-0.30	-9.34
HML	0.05	1.98	0.05	2.09	0.08	3.12	0.08	3.18	0.04	1.84	0.05	1.90
SMB	0.06	2.57	0.07	2.80	0.07	2.90	0.08	3.07	0.06	2.44	0.07	2.62
R_f	-6.64	-3.75	-7.02	-4.01	-4.85	-2.67	-5.27	-2.92	-7.03	-3.87	-7.42	-4.10
R_i	3.27	1.84	3.68	2.08	4.82	2.59	5.09	2.73	1.94	1.04	2.20	1.18
Volume	0.14	4.59	0.20	8.04	0.15	4.88	0.21	8.13	0.14	4.67	0.19	7.76
Turnover	0.14	2.69	-	-	0.12	2.33	-	-	0.12	2.25	-	-
Adj.R^2		0.12		0.12		0.08		0.08		0.11		0.11
Obs		1496		1496		1496		1496		1496		1496

Panel C: Returns

Variables	Factor W_1 I Coeff.	Factor W_1 I t-stat	Factor W_1 II Coeff.	Factor W_1 II t-stat	Factor W_2 I Coeff.	Factor W_2 I t-stat	Factor W_2 II Coeff.	Factor W_2 II t-stat	Factor W_3 I Coeff.	Factor W_3 I t-stat	Factor W_3 II Coeff.	Factor W_3 II t-stat
Intercept	6.75	0.94	8.37	1.17	4.65	0.65	6.66	0.94	9.53	1.36	10.41	1.50
Factor W	-3.15	-8.87	-3.33	-9.77	-4.02	-9.06	-4.20	-9.57	-5.42	-11.82	-5.52	-12.34
HML	-8.61	-20.82	-8.59	-20.76	-8.52	-20.75	-8.49	-20.64	-8.64	-21.41	-8.63	-21.35
SMB	-9.08	-19.22	-9.06	-19.12	-9.01	-19.12	-8.97	-18.98	-8.80	-18.98	-8.78	-18.90
R_f	-16.51	-0.52	-20.77	-0.66	-24.99	-0.80	-29.34	-0.94	-55.18	-1.80	-57.68	-1.89
Volume	-1.14	-2.11	-1.05	-1.95	-0.99	-1.86	-0.86	-1.61	-1.04	-1.98	-0.97	-1.89
Turnover	2.16	2.35	2.25	2.48	1.52	1.69	1.66	1.84	1.55	1.74	1.59	1.81
Volatility	0.001	1.86	-	-	0.001	2.62	-	-	0.001	1.04	-	-
Adj.R^2		0.47		0.47		0.48		0.48		0.50		0.50
Obs		1496		1496		1496		1496		1496		1496

Table 7: Fama-MacBeth Regressions: Explaining the Cross-Sections of Individual Stock Returns

The table reports the results of the second stage of a Fama-MacBeth procedure. We consider the three Fama and French factors (R_{mkt},, HML and SMB) and our disposition factors. We consider three types of disposition variables: W_1, W_2 and W_3. W_1 is constructed as the ratio between buy-at-loss minus buy-at-gain standardized by the sum of buy-at-loss and buy-at-gain. W_2 is constructed as the ratio between sell-at-loss minus sell-at-gain standardized by the sum of sell-at-loss and sell-at-gain. W_3 is constructed as the ratio between buy-at-loss plus sell-at-loss minus 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. We first construct portfolios that mimick these factors (Fama and French, 1993), based on the difference between the return of the portfolio made of the high-factor stocks and the portfolios made of the low-factor stock and then we run the first step of the procedure estimation ßs. These are estimated as a time-series regression. Then, the ßs are used in a second-pass regression along the lines of Fama and MacBeth. At this stage we also include some "characteristics" (Brennan, Chordia and Subrahmanyan, 1998). These include the volatility on the stock, the logarithm of turnover of the stock and the logarithm of its trading volume.). A Dimson-Marsh correction is applied to control for potential lead-lag effects due to asynchronous trading. We consider 2 alternative specifications: in the first ones we use 3 days of leads and lags, while in the second we use 5 days of leads and lags. We consider different specifications with different explanatory variables as well as different disposition variables. The frequency is daily and the procedure is applied at the stock level. The period is 1st January 1991-30 November 1996.

Panel A: Disposition Factor W_1

Dimson Correction (3 days)

Variables	*I*		*II*		*III*		*IV*		*V*		*VI*	
	Coeff.	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*
Factor W_1	-0.11	-3.34	-0.11	-3.30	-0.9	-2.74	-0.09	-2.71	-0.08	-2.72	-0.073	-2.23
Control Variables												
R_{mkt}	-0.31	-0.11	-0.43	-0.15	1.75	0.58	1.72	0.58	2.19	0.96	-	-
HML	-1.50	-0.83	-1.45	-0.81	-0.46	-0.24	-0.44	-0.24	-	-	-	-
SMB	1.11	0.68	1.14	0.70	-0.42	-0.23	-0.42	-0.23	-	-	-	-
Volatility	0.001	1.47	0.001	2.59	0.001	0.26	-	-	-	-	-	-
Turnover	0.10	4.60	0.09	5.17	-	-	-	-	-	-	-	-
Volume	-0.01	-0.61	-	-	-	-	-	-	-	-	-	-

Panel B: Disposition Factor W_2

Dimson Correction (3 days)

Variables	*I*		*II*		*III*		*IV*		*V*		*VI*	
	Coeff.	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*
Factor W_2	-0.22	-6.80	-0.22	-6.67	-0.23	-6.83	-0.23	-6.85	-0.22	-6.80	-0.20	-6.14
Control Variables												
R_{mkt}	0.17	0.06	-0.02	-0.001	2.13	0.70	2.07	0.69	2.69	1.15	-	-
HML	-1.33	-0.74	-1.25	-0.70	-0.13	-0.06	-0.12	-0.06	-	-	-	-
SMB	1.13	0.69	1.19	0.72	-0.43	-0.24	-0.42	-0.23	-	-	-	-
Volatility	0.001	1.53	0.001	2.97	0.001	0.84	-	-	-	-	-	-
Turnover	0.10	4.64	0.09	5.14	-	-	-	-	-	-	-	-
Volume	-0.01	-0.81	-	-	-	-	-	-	-	-	-	-

Panel C: Disposition Factor W_3

Dimson Correction (3 days)

Variables	*I*		*II*		*III*		*IV*		*V*		*VI*	
	Coeff.	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*
Factor W_3	-0.16	-4.83	-0.15	-4.80	-0.16	-4.82	-0.16	-4.81	-0.14	-4.25	-0.12	-3.46
Control Variables												
R_{mkt}	0.37	0.13	0.13	0.04	2.23	0.75	2.17	0.74	2.35	1.01	-	-
HML	-1.89	-1.06	-1.71	-0.96	-0.61	-0.32	-0.59	-0.31	-	-	-	-
SMB	0.98	0.61	1.03	0.64	-0.56	-0.31	-0.55	-0.31	-	-	-	-
Volatility	0.001	1.02	0.001	2.85	0.001	0.81	-	-	-	-	-	-
Turnover	0.10	4.54	0.09	4.90	-	-	-	-	-	-	-	-
Volume	-0.01	-1.30	-	-	-	-	-	-	-	-	-	-

Panel D: Disposition Factor W_1

Dimson Correction (5 days)

Variables	I Coeff.	I t-stat	II Coeff.	II t-stat	III Coeff.	III t-stat	IV Coeff.	IV t-stat	V Coeff.	V t-stat	VI Coeff.	VI t-stat
Factor W_1	-0.09	-3.15	-0.09	-3.14	-0.08	-2.70	-0.08	-2.69	-0.07	-2.56	-0.06	-2.24
Control Variables												
R_{mkt}	-0.88	-0.52	-0.97	-0.57	1.21	0.67	1.4	0.64	1.63	1.00	-	-
HML	-2.2	-1.78	-2.21	-1.81	-1.15	-0.88	-1.1	-0.83	-	-	-	-
SMB	2.28	1.87	2.30	1.89	0.84	0.65	0.88	0.68	-	-	-	-
Volatility	0.001	2.47	0.001	3.87	-0.001	-0.04	-	-	-	-	-	-
Turnover	0.09	5.48	0.09	6.58	-	-	-	-	-	-	-	-
Volume	0.001	0.06	-	-	-	-	-	-	-	-	-	-

Panel E: Disposition Factor W_2

Dimson Correction (5 days)

Variables	I Coeff.	I t-stat	II Coeff.	II t-stat	III Coeff.	III t-stat	IV Coeff.	IV t-stat	V Coeff.	V t-stat	VI Coeff.	VI t-stat
Factor W_2	-0.15	-4.96	-0.14	-4.90	-0.15	-4.98	-0.15	-5.01	-0.14	-4.79	-0.12	-4.38
Control Variables												
R_{mkt}	-0.47	-0.28	-0.57	-0.33	1.57	0.87	1.47	0.83	1.91	1.20	-	-
HML	-2.31	-1.93	-2.31	-1.92	-1.15	-0.90	-1.08	-0.84	-	-	-	-
SMB	2.29	1.86	2.33	1.89	0.90	0.69	0.94	0.73	-	-	-	-
Volatility	0.001	2.57	0.001	4.53	0.001	0.78	-	-	-	-	-	-
Turnover	0.09	5.64	0.09	6.69	-	-	-	-	-	-	-	-
Volume	-0.001	-0.21	-	-	-	-	-	-	-	-	-	-

Panel E: Disposition Factor W_3

Dimson Correction (5 days)

Variables	I Coeff.	I t-stat	II Coeff.	II t-stat	III Coeff.	III t-stat	IV Coeff.	IV t-stat	V Coeff.	V t-stat	VI Coeff.	VI t-stat
Factor W_3	-0.12	-4.70	-0.12	-4.70	-0.13	-4.65	-0.13	-4.66	-0.11	-4.20	-0.09	-3.50
Control Variables												
R_{mkt}	-0.21	-0.12	-0.33	-0.19	1.78	0.99	1.69	0.95	1.97	1.23	-	-
HML	-2.53	-2.09	-2.51	-2.08	-1.38	-1.05	-1.28	-0.98	-	-	-	-
SMB	2.31	1.91	2.35	1.94	0.93	0.72	0.96	0.75	-	-	-	-
Volatility	0.001	2.08	0.001	4.03	0.001	0.59	-	-	-	-	-	-
Turnover	0.09	5.20	0.09	6.26	-	-	-	-	-	-	-	-
Volume	-0.001	-0.18	-	-	-	-	-	-	-	-	-	-

Table 8: Fama-MacBeth Regressions:
Explaining the Cross-Sections of Portfolio Returns.

The table reports the results of the second stage of a Fama-MacBeth procedure. For 10 size-sorted portfolios. We consider the three Fama and French factors (R_{mkt},, HML and SMB) and our disposition factors. We consider three types of disposition variables: W_1, W_2 and W_3. W_1 is constructed as the ratio between buy-at-loss minus buy-at-gain standardized by the sum of buy-at-loss and buy-at-gain. W_2 is constructed as the ratio between sell-at-loss minus sell-at-gain standardized by the sum of sell-at-loss and sell-at-gain. W_3 is constructed as the ratio between buy-at-loss plus sell-at-loss minus 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. We first construct portfolios that mimick these factors (Fama and French, 1993), based on the difference between the return of the portfolio made of the high-factor stocks and the portfolios made of the low-factor stock and then we run the first step of the procedure estimation ßs. These are estimated as a time-series regression. Then, the ßs are used in a second-pass regression along the lines of Fama and MacBeth. At this stage we also include some "characteristics" (Brennan, Chordia and Subrahmanyan, 1998). These include the volatility on the stock, the logarithm of turnover of the stock and the logarithm of its trading volume.). The characteristics are averaged for all the stocks within the portfolio. A Dimson-Marsh correction is applied to control for potential lead-lag effects due to asynchronous trading. We consider 2 alternative specifications: in the first ones we use 3 days of leads and lags, while in the second we use 5 days of leads and lags. We consider different specifications with different explanatory variables as well as different disposition variables. The frequency is daily and the procedure is applied at the stock level. The period is 1st January 1991-30 November 1996.

Panel A: Disposition Factor W_1

Dimson Correction (3 days)

Variables	I		II		III		IV		V		VI	
	Coeff.	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*
Factor W_1	0.001	0.35	-0.001	-2.05	-0.001	-2.48	-0.001	-2.41	-0.001	-2.06	-0.001	-2.00
Control Variables												
R_{mkt}	-0.06	-0.95	-0.03	-0.51	-0.008	-0.14	-0.009	-0.14	0.02	0.39	-	-
HML	0.08	1.60	0.09	1.94	0.05	1.53	0.07	1.92	-	-	-	-
SMB	-0.002	-0.05	-0.007	-0.20	-0.02	-0.67	-0.02	-0.70	-	-	-	-
Volatility	0.05	1.77	0.03	1.53	0.05	2.43	-	-	-	-	-	-
Turnover	-0.39	-0.40	0.09	0.10	-	-	-	-	-	-	-	-
Volume	0.05	1.71	-	-	-	-	-	-	-	-	-	-

Panel B: Disposition Factor W_2

Dimson Correction (3 days)

Variables	I		II		III		IV		V		VI	
	Coeff.	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*
Factor W_2	-0.002	-2.09	-0.002	-2.52	-0.003	-3.52	-0.002	-4.39	-0.002	-3.14	-0.003	-4.28
Control Variables												
R_{mkt}	-0.11	-1.79	-0.001	-0.02	0.01	0.37	-0.01	-0.33	0.03	0.65	-	-
HML	0.09	1.80	0.09	1.79	0.03	0.98	0.04	1.12	-	-	-	-
SMB	-0.02	-0.72	-0.04	-1.45	-0.04	-1.30	-0.02	-0.66	-	-	-	-
Volatility	0.01	0.71	0.008	0.37	0.03	1.73	-	-	-	-	-	-
Turnover	1.61	1.18	-0.04	-0.04	-	-	-	-	-	-	-	-
Volume	-0.00	-0.17	-	-	-	-	-	-	-	-	-	-

Panel C: Disposition Factor W_3

Dimson Correction (3 days)

Variables	I		II		III		IV		V		VI	
	Coeff.	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*
Factor W_3	-0.001	-2.10	-0.00	-2.46	-0.001	-3.28	-0.001	-3.26	-0.001	-1.98	-0.002	-2.70
Control Variables												
R_{mkt}	-0.11	-1.54	-0.02	-0.30	0.03	0.52	0.001	0.10	0.02	0.51	-	-
HML	0.16	2.36	0.113	1.62	0.04	1.08	0.04	1.12	-	-	-	-
SMB	-0.01	-0.25	-0.02	-0.61	-0.02	-0.74	-0.01	-0.42	-	-	-	-
Volatility	0.01	0.26	0.004	0.20	0.04	1.88	-	-	-	-	-	-
Turnover	0.17	0.13	-0.24	-0.21	-	-	-	-	-	-	-	-
Volume	0.00	0.19	-	-	-	-	-	-	-	-	-	-

Panel D: Disposition Factor W_1

Dimson Correction (5 days)

Variables	I		II		III		IV		V		VI	
	Coeff.	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*
Factor W_1	0.00	0.08	-0.001	-1.86	-0.001	-2.70	-0.001	-2.53	-0.001	-1.87	-0.001	-1.95
Control Variables												
R_{mkt}	-0.02	-0.41	0.01	0.45	-0.01	-0.25	-0.01	-0.27	0.01	0.35	-	-
HML	0.04	1.08	0.038	1.03	0.02	0.97	0.03	1.23	-	-	-	-
SMB	0.01	0.33	0.006	0.23	-0.007	-0.27	-0.00	-0.17	-	-	-	-
Volatility	0.03	1.58	0.02	1.34	0.04	2.38	-	-	-	-	-	-
Turnover	-0.55	-0.72	0.04	0.07	-	-	-	-	-	-	-	-
Volume	0.02	1.37	-	-	-	-	-	-	-	-	-	-

Panel E: Disposition Factor W_2

Dimson Correction (5 days)

Variables	I		II		III		IV		V		VI	
	Coeff.	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*
Factor W_2	-0.002	-2.75	-0.001	-1.66	-0.002	-3.007	-0.001	-3.22	-0.001	-2.01	-0.001	-3.22
Control Variables												
R_{mkt}	-0.03	-0.81	0.03	0.75	0.008	0.22	-0.02	-0.65	0.02	0.77	-	-
HML	0.02	0.55	0.05	1.32	0.009	0.30	0.005	0.17	-	-	-	-
SMB	0.005	0.20	-0.03	-1.23	-0.02	-0.76	0.001	0.03	-	-	-	-
Volatility	0.02	1.57	0.004	0.28	0.03	2.28	-	-	-	-	-	-
Turnover	0.39	0.40	-0.14	-0.16	-	-	-	-	-	-	-	-
Volume	0.02	1.04	-	-	-	-	-	-	-	-	-	-

Panel F: Disposition Factor W_3

Dimson Correction (5 days)

Variables	I		II		III		IV		V		VI	
	Coeff.	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*	*Coeff.*	*t-stat*
Factor W_3	-0.003	-2.35	-0.002	-2.55	-0.002	-3.50	-0.001	-3.88	-0.001	-2.31	-0.001	-2.86
Control Variables												
R_{mkt}	-0.07	-1.30	0.006	0.12	0.01	0.51	-0.01	-0.38	0.01	0.43	-	-
HML	0.09	1.86	0.05	1.05	0.001	0.28	0.02	0.58	-	-	-	-
SMB	0.01	0.28	-0.002	-0.06	-0.008	-0.28	0.005	0.23	-	-	-	-
Volatility	0.02	0.89	0.01	0.65	0.03	2.02	-	-	-	-	-	-
Turnover	0.15	0.13	0.10	0.13	-	-	-	-	-	-	-	-
Volume	0.01	0.68	-	-	-	-	-	-	-	-	-	-