

# Inheriting Losers

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## ABSTRACT

When new managers take over mutual fund portfolios, they typically proceed to sell off inherited momentum losers. Compared with continuing fund managers holding the same stocks, new managers tend to sell losers at a faster rate than winners or stocks in other momentum deciles. This result holds even for the subset of well-performing funds and funds with positive fund flows, for which it is unlikely that the new manager is expected to change strategy or sell holdings to meet redemption demand. We estimate that new managers, by avoiding the future underperformance of momentum losers, save an average of between \$1.3 and \$1.9 million over the following six months. We conjecture that continuing fund managers tend to hold on to losers because of their inability to ignore the sunk costs associated with the stocks' past underperformance. Furthermore, we find that, perhaps as a result of price pressure caused by the sell-off, inherited losers significantly underperform other momentum losers for three months following managerial change.

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## ABSTRACT

When new managers take over mutual fund portfolios, they typically proceed to sell off inherited momentum losers. Compared with continuing fund managers holding the same stocks, new managers tend to sell losers at a faster rate than winners or stocks in other momentum deciles. This result holds even for the subset of well-performing funds and funds with positive fund flows, for which it is unlikely that the new manager is expected to change strategy or sell holdings to meet redemption demand. We estimate that new managers, by avoiding the future underperformance of momentum losers, save an average of between \$1.3 and \$1.9 million over the following six months. We conjecture that continuing fund managers tend to hold on to losers because of their inability to ignore the sunk costs associated with the stocks' past underperformance. Furthermore, we find that, perhaps as a result of price pressure caused by the sell-off, inherited losers significantly underperform other momentum losers for three months following managerial change.

# I. Introduction

Admitting a mistake often triggers regret. When the disutility of regret overwhelms the potential benefit of recognizing and undoing a mistake, a person might adopt unrealistically optimistic expectations to help avoid seeing the mistake as such. Because of this tendency, an outsider would be more objective in assessing the outcomes of another person's decisions and, given the opportunity, more efficient at identifying and correcting the mistakes. The situation when a newcomer takes over someone else's decisions is routinely encountered in the business world when new managers "inherit" their predecessors' projects. We investigate whether change in management adds value, if only because new managers are more likely to terminate bad projects.<sup>1</sup> Supporting evidence has been accumulating in the corporate finance literature. Weisbach (1995) documents that new managers tend to divest the unprofitable corporate acquisitions of their predecessors, thus confirming an earlier conjecture by Jensen (1993). Staw, Koput, and Barsade (1997) show that new bank executives are more likely to terminate poorly performing loans. The market seems to understand the benefit of replacing managers who have long been in control of a firm, as indicated by the finding of Johnson, Magee, Nagarajan, and Newman (1985) that firms' stock prices react positively to sudden deaths of their entrenched founders. This evidence illustrates that new managers' readiness to abandon poorly performing projects is at least one good quality they bring to the table.

In this paper, we study replacements of mutual fund managers. Our dataset on managerial change is unique and was created specifically for this project. It contains data on existing mutual funds as well as funds that have gone out of business since the third quarter of 1991. The dataset contains 1,446 useable observations of complete change in mutual fund management. We investigate the actions of new managers with respect to stocks they inherit from their predecessors.

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<sup>1</sup>Statman and Caldwell (1987) argue that terminating losing projects is hindered by feelings of regret. The finding of Statman and Sepe (1989) that project termination announcements are interpreted by the market as good news suggests that the market does not expect that all bad projects will be abandoned. It is widely believed that firms often hire outside consultants to be unbiased observers who could more objectively approach decisions about employee layoffs, downsizing, and project terminations.

We not only examine the trades of new managers but also compare these trades to the concurrent trades of continuing fund managers who hold the same stocks.

The mutual fund setting lets us “standardize” projects across new and continuing managers. New managers, who did not make the decisions to purchase the stocks in the first place, serve as a benchmark for the continuing managers. This is an improvement over the studies mentioned earlier, which compare the decisions of new managers to the decisions of the managers they replaced. The average *continuing* manager is more likely to be representative of a typical fund manager. The reason the replaced manager may be less representative is that, barring retirement, they likely were either substantially worse than a typical manager and got fired or substantially better and got promoted (Chevalier and Ellison (1999)).

Our definition of a “bad project” is a loser stock, defined at a particular point in time as a stock ranked in the bottom decile of the prior 12-month return relative to all publicly traded stocks. Selling losers is optimal for two reasons. First, it increases future expected returns because losers, on average, tend to continue to underperform for up to a year (Jegadeesh and Titman (1993) and Jegadeesh and Titman (2001)).<sup>2</sup> We verify that this is, indeed, the case in our data by showing that the losers sold by new managers significantly underperform the market index in the following six months.<sup>3</sup> Second, selling losers is tax-efficient to the extent that mutual fund investors are taxed. If a loser stock is sold at a capital loss, the loss can be written off against capital gains elsewhere in the portfolio, lowering the total tax bill. The sooner this is done, the higher the present value of the tax savings (Constantinides (1984)). A median inherited loser in our sample has realized a capital loss of 65.35% in the 12 months before the completion of managerial replacement; a loser in the 25th percentile of capital loss distribution has lost 77.54%

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<sup>2</sup>At the same time, the best-performing stocks (winners) tend to continue to outperform. Jegadeesh and Titman (1993) call this return continuation “price momentum.”

<sup>3</sup>Of course, our argument has to rely on the assumption that future underperformance of momentum losers is not caused by their lower riskiness but rather by some sort of market inefficiency, such as slow reaction to bad news (or an assumption that even if the risk explanation is true, it is not reflected in the fund performance benchmark). The literature has not yet come to an agreement on the causes of price momentum. A number of recent papers include surveys of the literature, among them Daniel, Hirshleifer, and Teoh (2002), Jegadeesh and Titman (2001), Jegadeesh and Titman (2002), and Hirshleifer (2001). A set of later studies—such as Chordia and Shivakumar (2002), Cooper, Jr., and Hameed (2004), and Sadka (2006), among others—take a further look at the momentum phenomenon.

of its market price and a loser in the 75th percentile has lost 51.30%. Moreover, it is probable that a loser has been purchased relatively recently, given that the average annual share turnover is equal to 97.8% for mutual funds during our sample period. It is therefore highly likely that a loser could be sold at a capital loss.

Comparing trades of new managers with those of continuing managers who hold the same stocks, we find that new managers sell a significantly higher fraction of momentum losers than continuing managers. We show that at the end of the quarter in which the managerial change was completed the median inherited loser is completely sold off. Yet, the median sale of the same loser stocks by continuing managers during the same time period amounts to only 14.2% of the initial shares held. In reality, we observe that new managers tend to sell a higher fraction of inherited holdings across the board. To account for this tendency, we employ the “differences-in-differences” approach. We show that in the first two quarters after taking over new managers tend to sell more momentum losers, relative to momentum winners (or stocks in other momentum deciles), than continuing fund managers. These findings confirm our initial conjecture.

We conduct a series of additional tests to show that alternative explanations are not driving our results. A different but plausible explanation is that new managers *have* to sell losers because they face redemptions. However, we show that our findings also hold for the subsample of funds with positive fund flows, proving this not to be the case.

Another possibility is that new managers are selling losers because they were hired to change the fund’s strategy (Lynch and Musto (2003)). If this were the case, however, stocks would be sold off equally across performance deciles, unless the fund manager was hired specifically to implement momentum strategy. The latter does not appear to be the case in our sample, as it is rare for a fund’s investment objective to change consequent to managerial replacement. To further refute the change-of-strategy explanation for our findings, we attempt to identify observations where the old manager left voluntarily rather than being fired. This seems highly likely for funds that have enjoyed an above-median performance within their investment style in the prior year. We show that even new managers who take over these funds sell losers at significantly higher rates

than continuing managers. In addition to this test, we use another set of criteria to identify funds where the replaced manager(s) left willingly. When we observe that a fund used to be managed by more than one manager and that the entire management team has departed, we conjecture that it is plausible that the replaced management team was fired. We therefore redo our analysis for the subset of funds that used to be managed by only one manager and show that our results still hold. Among these observations, we further focus on the subsample of funds where the replaced manager was over 45 years old, speculating that she has likely retired (the age of 45 is chosen in accordance with Chevalier and Ellison (1999)). Again, the results hold.

Yet another alternative hypothesis is that new managers actively sell inherited losers only in the short period after taking over a fund because, unlike continuing managers, they enjoy a short “honeymoon period” during which they can underperform. Despite the positive effect on fund returns in the long run, selling losers is likely to lower near-term returns due to price pressure. However, we show that, even a year after taking over a fund (when the “honeymoon period” should be over), new managers still sell inherited stocks that become losers at higher rates than continuing managers do.

Finally, some may argue that new managers, being somewhat younger than the managers they replace, are simply more aware of the price momentum phenomenon. To counter this argument, we show that when some of the new managers’ own stock picks become losers three years later, they are just as reluctant to sell them as the continuing managers, consistent with our regret-based explanation for the managers’ reluctance to sell losers.

In summary, while also giving credibility to some of the alternative explanations, our subsample tests strongly support our initial conjecture. Our results show that even the new managers who may lack the stock-picking skills of their predecessors make a contribution by identifying and selling off loser stocks.

Remarkably, we are able to document our results despite the reported tendency of mutual fund managers to engage in “window-dressing,” which involves selling poorly performing stocks

before the quarterly portfolio reports are made public, in order to hide their bad stock picks from the investors. This tendency would pressure continuing managers to sell their losers sooner (or not even report holding them in the first place) and make it more difficult for us to observe that continuing managers hold on to losers longer than new managers. We find a different manifestation of the window-dressing behavior by documenting that continuing managers tend to hold on to winners, which we attribute to the desire to keep reporting their winning stock picks.<sup>4</sup>

Furthermore, we show that new managers indeed increase future returns by selling losers. Assuming that the proceeds of selling losers, net of redemptions, are invested in the market index, we estimate that new managers realize significant savings. Because fund holdings are observed only quarterly, the exact timing of the sales is unknown. Under the conservative assumption that sales occur at the end of each quarter, we estimate the average fund savings in the six months following managerial change to be \$1.3 million, and under the aggressive assumption that sales occur in the beginning of each quarter, we estimate the average savings to be \$1.9 million. The actual savings would be somewhat lower after accounting for transaction costs.

Because new managers sell losers relatively quickly (recall that the median loser is completely sold off at the end of the quarter in which the new manager takes over), they create price pressure that causes inherited losers to realize even lower returns than they would otherwise. We provide evidence of price pressure by showing that inherited losers significantly underperform all momentum losers in the first three months following managerial change. Price pressure would lead us to further overestimate fund savings computed under the aggressive assumption that sales happen in the beginning of each quarter. However, it is less likely to affect the conservative estimate of savings.

The average improvement in performance following managerial change is even higher than could be achieved by simply selling losers and investing the proceeds in the market index. We document a 1.12% increase in the cumulative style-adjusted return in the year after a new manager takes over, relative to the year before, and show this improvement to be statistically significant.

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<sup>4</sup>Holding on to winners is also consistent with taking advantage of the momentum effect.

The improvement in performance is not surprising, since funds that replace managers have, on average, underperformed in the past. We show that, in addition to selling losers, new managers also buy a disproportionate number of winners. This shifts the value-weighted portfolio composition towards momentum winners following managerial change. We confirm that the shift is statistically significant, and also that it is significantly higher than the shift for the concurrently formed control group of continuing fund managers. One of the ways in which new managers improve fund returns is by taking advantage of the momentum effect. Continuing managers are limited in their ability to take advantage of the momentum effect by their tendency to hold on to losers.<sup>5</sup>

## **A. Related asset pricing literature**

More generally, a higher sensitivity to losses than to gains is described by the prospect theory of Kahneman and Tversky (1979) and manifests itself in risk-taking in the domain of losses. Shefrin and Statman (1984) show that this behavior is closely tied to regret. Consistent with this theory, Coval and Shumway (2005) document that proprietary traders on the Chicago Board of Trade assume more afternoon risk after a morning loss and Genesove and Mayer (2001) and Case and Shiller (1988) find that homeowners are reluctant to sell houses for less than the purchase price. Kaustia (2004) shows that investors are averse to selling shares of an IPO that are trading below the offer price. Zombie-loan literature describes the tendency of Japanese banks to keep financing insolvent borrowers rather than writing off the loans (e.g., Caballero, Hoshi, and Kashyap (2005)).

Holding on to loser stocks is another example of loss-averse behavior. Shefrin and Statman (1985) coined the term “disposition effect” for the tendency to hold on to losers too long and sell winners too soon. In order to behave that way, in addition to being risk-loving in the domain of losses, investors must also evaluate each stock payoff as a separate gamble rather than as part of

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<sup>5</sup>An alternative explanation for the unwillingness of continuing managers to sell losers may be related to incentives that would make them reluctant to publicly admit their stock-picking mistakes. We do not differentiate between the two explanations.

an investment portfolio.<sup>6</sup> The existence of the disposition effect has been widely documented. Initially, Odean (1998) showed U.S. retail investors to be subject to disposition bias. Subsequently, the effect has been documented internationally by Shapira and Venezia (2001) among Israeli investors, by Grinblatt and Keloharju (2001) among Finnish investors, and by Feng and Seasholes (2005) and Shumway and Wu (2005) among Chinese traders. Consistently, Lakonishok and Smidt (1986) and Ferris, Haugen, and Makhija (1988) find higher abnormal trading volume for past winners than for losers. Haigh and List (2004) and Weber and Camerer (1998) show the existence of the disposition effect in the experimental setting.

The finding that mutual fund managers exhibit the disposition effect with respect to loser stocks is important for two reasons. First, given that mutual funds control a large portion of the U.S. stock market, managers' behavioral biases may have significant asset-pricing implications. Frazzini (2005) provides evidence that the disposition effect among mutual fund managers might be responsible for the stock price underreaction to news; Grinblatt and Han (2004) suggest that the disposition effect might cause price momentum. Second, our results contradict the view that mutual fund managers are sophisticated and should not be affected by behavioral biases. This suggests that mutual fund families should institute tighter supervision over their portfolio managers' decisions.

The rest of the paper is organized as follows. Section II describes our data and statistical methodology. Section III presents our empirical results. Section IV discusses alternative explanations. Section V concludes.

## **II. Data and Methodology**

We examine whether new managers sell losers more readily than continuing fund managers do. One concern is that funds whose managers have been replaced tend to have performed badly

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<sup>6</sup>As we mentioned earlier, continuing fund managers in our sample do not appear to sell winners too soon. Rather, they hold them longer than an average stock, which we interpret as window-dressing behavior.

in the past and have accumulated a large number of losers. Indeed, Khorana (2001), Khorana (1996), and Chevalier and Ellison (1999) find that poor past performance is a significant predictor of managerial replacement. To address this concern, we quantify trades in per cent of inherited shares, so that our sales measure is not affected by funds that have large initial holdings of losers. In order to control for the possibility that new managers sell all stocks irrespective of their past performance, we compute differences in differences—that is, the difference in the sale of losers minus the difference in the sale of winners between the test group of new managers and the control group of continuing managers. The trades are matched between test and control groups on a stock-by-stock basis.

Funds in our sample are often concurrently managed by more than one manager. We conjecture that new management is more likely to sell off inherited losers when they are in complete control and none of the original management team remain with the fund. We therefore focus only on observations where fund management has entirely changed. We define a “complete replacement” (hereafter, CR) as follows: replacement of all initial fund managers, either through one change or a succession of managerial changes, each occurring within 90 days of the immediately preceding replacement. We want to ensure that all changes that occur in close sequence are identified as one replacement event. This methodology allows us to deal with situations where temporary managers or transitional teams are brought in before a permanent manager is found. Our results are robust to shortening the window to 60 days or lengthening it to 120 days.

## **A. Data sources**

Our data on managerial changes are obtained from Morningstar. Morningstar keeps track only of existing mutual funds, so its data are survivorship-biased. We use quarterly historical Morningstar CDs, dating back to the third quarter of 1991, to remedy the bias. Mutual fund holdings data, obtained from the Spectrum SP12 file, start only in the first quarter of 1980, which is consequently the starting date of our analysis. Hence, our dataset is survivorship-biased to the extent that it is missing information on managerial changes for funds that went out of business from the

first quarter of 1980 to the second quarter of 1991. However, this bias should not affect our results as long as new managers missing from our sample exhibited behavior with respect to inherited portfolios which is similar to the behavior of new managers in our sample. The dataset that we constructed covers 22,820 mutual funds, 16,524 distinct managers identified by name, and 363,802 records of managers entering or leaving funds. The latest recorded change in the Morningstar dataset happened in the Van Kampen Exchange fund of the Van Kampen fund family in December 2004 when Mary Jane Maly was replaced by Janet Luby. When there is no day available for a managerial change, we assume that it happened on the 15th of the month.

Since we are interested in stock trades, we exclude funds categorized as bond, government, muni, index, REIT, and convertible debt funds from our dataset. In order to limit the sample to equity-only funds, we also exclude observations of funds where the market value of the fund's equity portfolio is less than 70% of its total net asset value (TNA). Additionally, we exclude observations of CR where previous fund managers are not identified by name but rather as "Team," out of concern that some of the prior managers might have stayed on. From the remaining observations, we identify managerial changes that constitute complete replacements. These make up our test group. For each instance of CR we form a control group of funds that have not experienced any managerial change in the period from 12 months before to 12 months after the end of that CR.<sup>7</sup>

As mentioned previously, fund holdings data are obtained from the Thomson Financial mutual fund dataset SP12. Merging the Morningstar and SP12 datasets is complicated by the fact that they use different mutual fund identifiers. Details of our merging procedure are described in Appendix A. The resulting dataset was merged with the CRSP Mutual Funds dataset, which contains data on funds' monthly returns and total net assets.<sup>8</sup>

The SP12 dataset contains numerous recording errors because it reports information quarterly, while mutual funds are required to file an N-30D fund holdings report with the SEC only

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<sup>7</sup>We do not match the test and control group funds by their investment objective code because the field is missing for roughly a third of the funds in our sample.

<sup>8</sup>The CRSP Mutual Funds dataset and Morningstar use the same mutual fund identifiers.

biannually. Funds disclose information to Thomson Financial voluntarily between the required SEC reports, and the SP12 reporting often contains gaps and inaccuracies, the most common being underreporting. Thomson Financial sometimes backfills gaps with information from previous quarters. The *rdate* column in the SP12 dataset identifies the report date and thereby enables us to eliminate observations that have been backfilled. An additional source of noise in the data, as confirmed by a Thomson Financial representative, is that, in the interest of faster turnaround, fund holdings information is sometimes retrieved directly from the fund company (voluntary reporting) rather than from the SEC. The source of data is not identified in the dataset and the integrity of voluntary reporting relies on the good faith of the fund companies. We do our best to eliminate suspicious observations; our elimination criteria are described in Appendix B.

Finally, stock-specific data such as stock prices, returns, and split adjustment factors are obtained from the CRSP monthly stock file that is merged with SP12 fund holdings data, using a combination of a stock's cusip number and date as a unique identifier.

## **B. Statistical methodology**

Our statistical tests are designed to determine whether new managers tend to sell the losers which they inherit at a higher rate than continuing managers do. Figure 1 illustrates our methodology through a hypothetical example. Recall that we focus only on complete managerial changes. Managerial change could take longer than one day. It starts on the day when the first new manager has arrived and ends on the day on which the last old manager has left. The quarter immediately preceding the beginning of managerial replacement is designated  $t = preCR$ . In the absence of the holding information as of that quarter, we use the holdings data for the quarter that precedes  $preCR$ . If the data are still missing, we go back as far as two quarters. If they are missing still, we exclude that observation of complete replacement from our analysis.

The quarter in which complete replacement has ended is designated  $t = 0$ ;  $t = 1$  is the quarter after that. The rationale for extending the window for selling inherited stocks past the first quarter

is that new managers might sell inherited holdings over an extended period. Additionally, this method enables us to include in the analysis the test-group funds that are missing holdings data in quarter  $t = 0$  but not in  $t = 1$ . Extending the window beyond that is unwarranted, since trading decisions later than that may be obscured by other considerations on the part of the new managers. For example, a new manager who promptly sells a basket of losing stocks inherited from an old manager might buy them back a year later.

As discussed earlier, we define trades as a per cent change in shares held. The scaled measure, as opposed to the raw number of shares sold, allows us to deal with the possibility that outgoing managers may have accumulated unusually large holdings of losers; it would not overweight the subsequent sales of inherited stocks by the succeeding manager(s). The per cent change in holdings is bounded from below by -1 (if all inherited shares have been sold), but it is not bounded from above. Hence, it is unlikely that the change-in-holdings variable is normally distributed. Indeed, the Kolmogorov-Smirnov test for normality rejects the null hypothesis of normality at the 1% significance level, which suggests that if we were to base our analysis on the mean change in holdings, outliers could influence the results. We therefore conduct a series of nonparametric tests that are based on relative rankings and median (typical) rather than mean (average) observations (the medians are robust to outliers and the means are not). The comparison is done on a stock-by-stock basis; it is then aggregated across stocks in a given momentum decile for each observation of managerial change. Finally, it is aggregated across all instances of managerial replacement. The analysis thus proceeds in four steps.

Step 1: Compute the change in stock holdings for the test and control groups.

The calculations in this step are illustrated through a hypothetical example for the test group in Figure 1. Table I builds on this example to additionally show the computations for the control group; it also illustrates the next step of the test. The computations in Table I are done only for  $t = 0$  (recall that  $t = 0$  is the end of quarter in which managerial change has ended and  $t = 1$  is the quarter after that).

For each fund  $i$  that has undergone complete replacement, we identify its holdings at  $t = preCR$  (the quarter immediately preceding the start of managerial change). We assume that these are the stocks that a new manager inherits. We rank these stocks, at time  $t = \{0, 1\}$ , based on their trailing 12-month return relative to all publicly traded stocks. We subsequently focus only on stocks in the highest decile (winners) and lowest decile (losers).

For each stock,  $j$ , we compute the per cent change in shares held from time  $t = preCR$  to time  $t$ :  $\Delta^j = \frac{Shares_t^j - Shares_{preCR}^j}{Shares_{preCR}^j}$ , where  $Shares_t^j$  is the number of shares of stock  $j$  held at time  $t$ , and  $Shares_{preCR}^j$  is the number of shares held at time  $t = preCR$ . In order to compute the change in holdings for the same stock  $j$  for the control group, among the funds that have not experienced any managerial change in the 12 months before or the 12 months after  $t = preCR$ , we identify a set of funds that also held stock  $j$  at  $t = preCR$ .<sup>9</sup> This is our control group for fund  $i$  stock  $j$ . Thus, the control group is somewhat different for each of the inherited stocks (see the middle part of Table I). We then compute the mean per cent change in holdings of stock  $j$  across all funds in the control group  $\Delta_{Control}^{jMean} = Mean\left(\frac{Shares_t^j - Shares_{preCR}^j}{Shares_{preCR}^j}\right)_{Control}$ . We therefore require that the control group funds must report their holdings at  $t = preCR$  and in at least one of the two quarter-ends following the completion of CR:  $t = 0$  or  $t = 1$ .

Step 2: Aggregate the relative change in holdings across deciles for fund  $i$  in quarter  $t$ .

This step is also illustrated in Table I. Once we know the relative change in holdings for each inherited stock  $j$  at time  $t$  for the test-group fund  $i$ , we can aggregate trades across all inherited losers and winners:  $j = 1$  to  $N_t^{i,dec}$ , where  $dec$  is winner or loser decile. We do this by computing the following nonparametric statistic:

$$z_t^{i,dec} = \frac{\sum_j 1[\Delta^j < \Delta_{Control}^{jMean}] - \frac{1}{2} * N_t^{i,dec}}{\frac{\sqrt{N_t^{i,dec}}}{2}} \quad (1)$$

This statistic counts how many times the sale of loser/winner stocks inherited by the new manager exceeds the median sale of the same stock by continuing managers, and it is normalized to have

<sup>9</sup>We also rerun our tests, requiring that funds in the control group did not have any managerial change in the past 24 months, but we find that our results are unaffected.

the standard normal distribution  $N(0, 1)$  under the null hypothesis of no difference in selling patterns between test and control groups.

Here is how the normalization is done. Under the null hypothesis of no difference in trading between test and control groups, the random variable  $1_{[\Delta^j < \Delta_{Control}^{jMean}]}$ , which equals 1 when the test-group sale of stock  $j$  exceeds the mean control-group sale and 0 otherwise, has an equal probability of taking either value. Hence, under the null hypothesis, the random variable that counts the number of times test-group sales exceeded control-group sales for stocks in a particular decile,  $\sum_j 1_{[\Delta^j < \Delta_{Control}^{jMean}]}$ , follows a binomial distribution with  $p = \frac{1}{2}$  and has a mean of  $\frac{1}{2} * N_t^{i,dec}$  and a variance of  $N_t^{i,dec} * \frac{1}{2} * (1 - \frac{1}{2})$ . The normalized  $z$ -statistic is computed by scaling the random variable, net of its expected mean, by its expected standard deviation under the null hypothesis.<sup>10</sup>

Step 3: Aggregate across all complete replacements.

Thus far, we have computed a series of statistics for the relative change in holdings of losers and winners between quarter *preCR* and quarter  $t = \{0, 1\}$ ,  $z_{t,\tau}^{i,dec}$ , where  $dec = \{\text{winners, losers}\}$ , for each fund  $i$  that experienced complete replacement in quarter  $\tau = [1...T]$ :

quarter 1:  $z_{t,1}^{1,dec}, z_{t,1}^{2,dec}, \dots, z_{t,1}^{N_1,dec}$

....

quarter  $T$ :  $z_{t,T}^{1,dec}, z_{t,T}^{2,dec}, \dots, z_{t,T}^{N_T,dec}$

Mutual fund trades are likely to be cross-sectionally correlated. A shock in quarter  $t$ —for example, a mutual fund industry scandal—may increase redemption demand and the consequent selling across all funds in a particular quarter. Although our  $z_{t,\tau}^{i,dec}$  statistics, which are based on the differences in selling between test and control groups, diminish the effect of cross-sectional correlation in trades, we nonetheless control for possible cross-sectional correlations when aggregate

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<sup>10</sup>In order to double-check our non-parametric results, we have also computed the mean difference in sales between test and control groups and confirmed that it is highly significantly greater than zero for loser stocks. As expected, the levels of significance were higher than for the non-parametric tests.

gating across all test-group funds. We do so by clustering errors for observations of managerial change that occur in the same quarter:

$$Z_t^{dec} = \frac{\frac{\sum_{\tau=1}^T \sum_{i=1}^{N_\tau} z_{t,\tau}^{i,dec}}{\sum_{\tau=1}^T \sum_{i=1}^{N_\tau} 1}}{\sqrt{\frac{(\sum_{i=1}^{N_1} z_{t,1}^{i,dec})^2 + \dots + (\sum_{i=1}^{N_T} z_{t,T}^{i,dec})^2}{\sum_{\tau=1}^T \sum_{i=1}^{N_\tau} 1 - 1}}} \quad (2)$$

This variable has a standard normal distribution under the null hypothesis of no difference in selling between new and continuing managers. If the variable is significantly greater than zero, it would indicate that new managers sell a significantly higher fraction of losers/winners than continuing fund managers do.

Step 4: Test for differences in differences.

It is possible that new managers sell more stocks across the board. To control for this possibility, we examine whether new managers sell more losers than they sell winners, relative to continuing managers. We compare how often new managers sell more losers relative to the control group to how often new managers sell more winners relative to the control group across all instances of managerial change. We perform the comparison by ranking the  $z_t^{i,losers}$  statistics against the  $z_t^{i,winners}$  statistics with a two-sample rank-sum test, using all observations of test-group funds  $i$  for  $t = \{0, 1\}$ . If  $z_t^{i,losers}$  tends to appear significantly higher in the ranking, this would mean that new managers sell relatively more losers than winners relative to continuing fund managers. The statistical significance of the ranking is captured by a normalized Z-score.

### III. Empirical Results

#### A. Summary statistics and sample description

Table II provides summary statistics for our test group of funds. Panel A shows that there are 1,446 complete managerial replacements in the sample. Roughly 57% of these are instances of one manager being replaced by another manager. We discard observations in which “Team”

is replaced by one or several managers, as it is impossible to determine whether all of the old managers were gone at the end of the replacement.<sup>11</sup> Yet, we include observations where one manager is replaced by Team because we believe that the old manager is likely gone at the end of CR. Omitting these observations instead is not likely to make a difference since they constitute only 4.65% of the sample. A typical replacement takes zero days no matter what type, although replacements, on average, take longer when more managers are involved.

Panel B focuses on single-manager-by-single-manager replacements and documents that an outgoing manager tends to be slightly older than an incoming one, possibly due to retirement. Panel B is based on fewer observations than Panel A because some records are missing information necessary to compute a manager's age. Panel C confirms the earlier evidence in Khorana (2001), Khorana (1996), and Chevalier and Ellison (1999) that funds tend to replace underperforming managers. Panel C has fewer observations than Panel A because a number of the test-group funds are missing the investment objective code.

Panel D shows that test-group funds tend to have slightly larger portfolio weights invested in losers and winners than control-group funds in the quarter preceding the start of managerial replacement. On average, 2.27% of a test-group fund portfolio is invested in momentum losers at  $t = preCR$ . A new manager can realize considerable future savings by selling these losers and replacing them with winners. Jegadeesh and Titman (2001) show that in the 1982–1998 time period, momentum winners have outperformed momentum losers by roughly 14% per year on a risk-adjusted basis. If managers replaced losers with winners, they could therefore improve the fund performance by  $2.27\% * 14\% = 0.32\%$  in the following year. Given that the average fund size in our sample is \$400 million, the savings that could be realized by mechanically replacing losers with winners of similar market capitalization, book-to-market ratio, and market beta could be as high as \$1.27 million in the first year. Of course, this amount would be lowered by transaction costs, especially since both momentum winners and losers tend to be relatively

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<sup>11</sup>Morningstar designates as “Team” a group of managers whose names are not disclosed.

illiquid (Korajczyk and Sadka (2004); Lesmond, Schill, and Zhou (2004); and Chen, Stanzl, and Watanabe (2002)).

Figures 2 through 5 summarize graphically funds' characteristics and behavior before and after managerial change. Figure 2 plots the median, 25th percentile, and 75th percentile of the monthly fund flows for the test-group funds as well as the median, 25th percentile, and 75th percentile taken over the *median* monthly fund flow of the corresponding control group. (Focusing on the medians makes the distribution of fund flows for the control group tighter than for the test group.) As can be seen, the median fund in the control group has positive fund flows. The median fund in the test group has slightly negative flows, which is consistent with the earlier evidence that funds that replace managers tend to have struggled. However, there is quite a large spread in fund flows across the test-group funds and the 25th percentile of the distribution is highly positive, which indicates that a significant number of funds that replace managers have been successful.

Figure 3 plots performance rankings of test-group funds relative to other funds with the same investment objective code, computed every month based on the cumulative return over the preceding 12 months. Panel A presents the mean rank and its 95% confidence bounds. It shows that seven months before the completion of managerial change, the average fund performance falls significantly below the median. After the managerial change is complete, the fund performance starts to improve until it becomes statistically indistinguishable from the median nine months later. Panel B corroborates the tendency of funds returns to decline before managerial replacement and to improve after replacement by showing this pattern for funds in the 25th, 50th and 75th percentiles of the return distribution. We show later in the paper that the improvement in performance is statistically significant.

Figures 4 plots purchases of new losers and winners by new managers in terms of their portfolio weights. It shows that new managers tend not to be contrarian investors. In the quarter in which they take over, a median new manager allocates almost 4% of portfolio weight to newly-purchased winners (with the new managers in the 75th percentile of the distribution allocating 8% of portfolio weight to newly-purchased winners), while only about 1% of portfolio weight

is typically allocated to newly-purchased losers. Over the next four quarters, the relative portfolio allocation to new winners grows even more (although this might be explained in part by the tendency of winners to earn higher returns in the near future).

Finally, Figure 5 (Panels A and B) documents that, consistent with our conjecture, new managers indeed tend to disproportionately sell losers they have inherited after taking over a fund. Figure 5, Panel A, plots the median fraction of loser and winner shares sold off by new and continuing managers for up to four quarters after the end of managerial replacement relative to the holdings at  $t = preCR$ . Winners and losers are redefined quarterly. It can be seen that the median loser stock (the median here is computed across the entire test group) is completely sold off starting in the quarter in which managerial change was completed. Significantly fewer of the control-group losers are sold off at that time.<sup>12</sup>

New managers also tend to sell off momentum winners to a greater extent than continuing managers do. As can be seen from Panel A, the median holdings of winners remain unchanged for the control group between  $t = preCR$  and  $t = 0$  through  $t = 1$  and then decrease only slightly. The continuing managers' tendency to hold on to winners may be consistent with the window-dressing incentive. In other words, they might prefer to keep their winners longer than they would otherwise in order to show their successful stock picks in reports to the public. (Of course, holdings on to winners longer is also consistent with taking advantage of the momentum strategy on the winner side.) The unwillingness to make bad stock picks public may be the reason why continuing managers might prefer to sell losers sooner than they would otherwise. Although the disposition effect states that investors tend to sell their winners too soon and hold on to their losers too long, the incentives of continuing fund managers pressure them to behave in the opposite way. The incentive to hold on to the winners longer seems to overrule the disposition-effect tendency to sell them too soon, while the disposition effect seems to dominate on the loser side. Continuing

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<sup>12</sup>In results not reported in the paper, we document that sales by new managers of inherited stocks are U-shaped with respect to the stocks' performance deciles. New managers sell a significantly higher fraction of losers and winners than stocks in deciles 2 through 9, but the sales of losers dominate the sales of winners. Hence, a comparison of loser sales to winner sales would produce less significant results than the comparison of loser sales to any other performance decile.

managers hold on to losers longer than new managers, who have neither the incentive to hide their inherited losers from the public nor the internal pressure not to sell them.

Despite the fact that the continuing managers tend to hold on to winners longer than new managers do, new managers sell a higher fraction of losers than they sell of winners relative to continuing managers for up to two quarters after taking over. This can be seen from Figure 5, Panel B, which plots the difference between the median sale of losers by test and control groups and the median sale of winners by test and control groups. Starting three quarters after the managerial change, this difference becomes negative. However, we confirm that the difference in selling losers between test and control groups remains significant for all four quarters. Computations in Figure 5 are somewhat different from our formal tests because they weight the differences in trades equally across all inherited stocks and all instances of CR; our formal tests aggregate the differences in trades first for each instance of CR and then across all CRs in a way that adjusts for possibly correlated shocks.

The differences in differences turn negative in quarter three partly because of the extreme reluctance of continuing managers to sell winners. Another reason is that an average actively-managed fund trades very frequently (as mentioned earlier, the average share turnover is equal to 97.8%) so that nearly all of funds' holdings are replaced year-to-year. Because of high turnover, the tendency to hold on to losers can be detected at a relatively high frequency (quarterly rather than annually). But the higher frequency of trade is also necessary in order to take advantage of the momentum effect, which lasts three to twelve months. Overall, the evidence in Figure 5 supports our conjecture that new managers tend to disproportionately sell off momentum losers after taking over a fund. We now proceed to the formal tests of this conjecture.

## **B. Formal tests**

In this section we present the formal tests, based on the the statistical methodology described earlier, to determine whether new fund managers sell off a disproportionate number of momentum

losers from their inherited portfolios. Table III, Panel A, presents results for the entire sample. The results are reported for the quarter in which managerial change has ended ( $t = 0$ ) and for one quarter after that ( $t = 1$ ). Momentum rankings are recalculated at the end of each quarter based on the 12-month cumulative return preceding the quarter-end relative to all publicly traded stocks. Losers are the stocks in the bottom decile; winners are the stocks in the top decile.

The first column of numbers in Table III reports the number of funds in the test group that held winners/losers in the quarter before managerial replacement started ( $t = preCR$ ). The number of funds on which the analysis is based—i.e., the funds that hold winners or losers—is substantially lower than the total number of funds that have experienced managerial replacement. The reason is that, by definition, losers and winners each make up only 10% of all publicly traded stocks, of which there were, on average, 6,161 during our sample period. A typical fund that undergoes managerial change holds only 71 stocks in the quarter preceding managerial change. Additionally, winners and losers tend to have smaller market capitalization than an average stock and may fall outside the investible universe for some of the funds. The next column reports (1) the median fraction of the  $t = preCR$  shares sold by the quarter-end, computed over all winner/loser stocks held by all test-group funds; (2) the median of the average fraction of shares of the same stocks sold by all control-group funds; and (3) the difference between the medians. The third column presents the Z-statistic for the differences, described earlier, which measures whether new managers sell significantly more losers/winners than continuing fund managers. Finally, the last column presents the Z-score corresponding to the two-sample rank-sum test for the differences-in-differences statistic, which measures whether the new managers' relative sale of losers exceeds their relative sale of winners.

The results show that, consistent with Figure 5, the median loser is completely sold off by new managers by the quarter-end ( $t = 0$ ), while the median sale by continuing managers is equal to only 14.2% of the  $t = preCR$  shares. Not surprisingly, the Z-statistic indicates that this difference in selling activity is highly statistically significant. Yet new managers also sell a higher fraction of inherited winners than the control group. (As discussed earlier, continuing managers may

prefer to hold on to their winners longer than they would otherwise, possibly due to window-dressing incentives.) Despite that, the new managers' relative selling of losers outpaces their relative selling of winners, as indicated by the significance of our differences-in-differences test. Thus, the results support our conjecture that new managers are more willing to eliminate “bad projects”—that is, losers—from their investment portfolios.

We redo our analysis by excluding managerial replacements that last longer than 60 days, thereby shortening the window of transition to new management during which some of the changes in the portfolio could have taken place. We incur a roughly 5% reduction in sample size, but our results are unaffected.

### **B.1. Evaluating alternative explanations**

We evaluate a number of alternative explanations for why new managers might disproportionately sell off losers. Below, we describe the alternative hypotheses and the additional tests we conduct to verify that they are not driving our results.

**1. Managers sell losers in order to meet redemption demand.** This is a plausible alternative hypothesis since new managers might face redemptions as a result of poor past performance and might choose to sell losers ahead of other stocks in order to capture the tax savings on the accumulated capital losses. To check whether this is what drives our results, we test whether the selling pattern also holds for the subset of funds that have experienced positive flows in the quarter immediately preceding managerial change. Quarterly fund flows are calculated as a change in the fund's total net asset value that is unexplained by the fund's return:

$$Inflow_t = \frac{TNA_t - TNA_{t-1}(1 + ret_t)}{TNA_{t-1}} * 100\% \quad (3)$$

The test results for the positive-fund-flow subsample are reported in the top part of Table III, Panel B. Consistent with Figure 2, this subsample is composed of slightly fewer than half of the test-group funds. This may be one reason why the level of significance for the differences-in-

differences statistics drops somewhat in the second quarter. Nevertheless, both the differences and the differences-in-differences statistics are significant, even though managers appear under no pressure to sell off their holdings. The bottom part of Table III, Panel B, reports the results for the subsample of funds with negative flows. Interestingly, even though new managers still tend to sell more losers than continuing managers do, the differences-in-differences statistics are not significant (and actually go in the opposite direction in the second quarter). This may be due to the fact that new managers have no choice but to sell stocks across the board, perhaps even selling the more liquid stocks first. Thus, the tendency of new managers to sell inherited losers cannot be explained by the redemption demand.

**2. New managers sell losers because they are brought in to change the fund strategy.** A new manager might be brought in explicitly to change the strategy of an underperforming fund (consistent with the logic of Lynch and Musto (2003)). However, one would expect that, in this case, all stocks should be sold off equally, irrespective of their past performance. A less plausible hypothesis is that a new manager is brought in specifically to implement the momentum strategy, but, contradicting this conjecture, funds' investment codes rarely change following managerial replacement. Nonetheless, we try to identify observations of managerial replacement where the old manager(s) left the fund voluntarily, and therefore the new manager is probably not expected to change the fund's strategy. We isolate such observations in three different ways.

We start by identifying test-group funds that have outperformed a median fund in their investment style over the year preceding managerial change. We conjecture that for such funds the old managers either retired or moved on to better opportunities rather than being fired, and the new manager is not expected to change the strategy. Results are presented in Table III, Panel C. The top part of the Panel reports results for the subset of test-group funds outperforming the median. Again, it contains less than half of all observations since funds that replace managers tend to be underperformers. Remarkably, the results show that even the managers who take over successful funds change investment portfolios by selling losers. The pattern of new managers selling off losers also holds for the underperforming funds (as shown in the bottom part of Table

III, Panel C), but the differences-in-differences statistic reverses sign in the second quarter. The reason is that new managers tend to sell stocks across the board, as they also do in the case of funds with negative fund flows. The subsample of funds with negative flows and the subsample of funds with below-median returns are likely to have considerable overlap because fund flows are sensitive to performance.

We employ yet another method for identifying test-group funds where the old management has left willingly. We conjecture that when a fund used to be managed by several managers and all have left, it is more likely that they were fired than in cases when a fund used to be managed by a single manager. The top part of Table III, Panel D, presents results for the subsample of funds that used to be managed by a single manager, and the bottom part of the Panel reports results for funds that used to be managed by multiple managers. Despite the smaller sample size, it appears that new managers sell losers at a higher rate in the second subsample. However, differences and the differences-in-differences statistics are also significant for the first subsample, indicating that even when the previous manager is likely to have left voluntarily, the replacement proceeds to sell losers in the inherited portfolio.

We take a further look at the subsample of test-group funds that used to be managed by a single manager in order to more precisely pinpoint observations where old managers have left willingly. We subdivide this subsample into two further groups based on whether the outgoing manager is under or over 45 years old, conjecturing that the older group is more likely to have retired than to have been fired.<sup>13</sup> Money managers tend to retire early, and we chose the critical age of 45 to be consistent with Chevalier and Ellison (1999). Table III, Panel E, presents results for these subsamples. As can be seen from the Panel, regardless of whether the outgoing manager was younger or older, new managers tend to sell inherited losers at statistically significant rates, even when compared to their sales of winners. This makes the results all the more convincing for the subsample of older outgoing managers in light of the relatively small sample size. Hence, this

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<sup>13</sup>If available, we use the birth dates provided in the Morningstar dataset to calculate managers' ages. Otherwise, we assume that managers are 21 when they are awarded their undergraduate degrees (this is consistent with the Chevalier and Ellison (1999) methodology). We exclude from this part of the analysis managers for whom neither birthday nor graduation year is available.

result provides strong support for our conjecture that new managers sell losers even when they are not expected to make significant changes to the fund's portfolio.

**3. New managers are more free than continuing managers to sell losers because of the “honeymoon” period.** A reasonable competing explanation for managers' reluctance to sell losers is not regret but the immediate detrimental effect the sale may have on the fund's returns. The reason is that losers tend to be relatively illiquid (Korajczyk and Sadka (2004); Lesmond, Schill, and Zhou (2004); and Chen, Stanzl, and Watanabe (2002)), and their sale would put immediate downward pressure on prices. If not all shares are sold off immediately—and gradual sale is optimal for minimizing price impact—the price pressure would temporarily depress the value of the unsold shares and hence the fund's total asset value. Even though the price impact will eventually reverse itself, in the short run it would cause the fund to suffer lower returns.

New managers, unlike continuing managers, may be “allowed” by their fund families to underperform for a short period after taking over. We have been informally told by fund managers that new managers are typically given a short grace period to “clean house,” which probably extends no further than the next annual report. If this is the only reason for the new managers' willingness to sell losers, they would be just as unwilling to sell inherited stocks that become losers after the “honeymoon” period is over as continuing managers.

To check whether this is the case, we conduct the following test. Assuming that the honeymoon period lasts no longer than a year (i.e., not beyond the next annual report), we test whether new managers sell a higher fraction of inherited stocks that become losers more than a year after managerial change. We identify inherited stocks that a new manager still holds four quarters after taking over the fund. Among these stocks, we further focus on those that became momentum losers in quarters five or six, but were not losers in quarter four. We find that new managers sell a significantly higher fraction of the quarter-four holdings of these stocks by the time they become losers than the control group of continuing managers holding the same stocks in quarter four. The Z-statistic of the difference in selling between new and continuing managers is significant at the 1% level and equal to 2.52 for the selling of the fourth quarter holdings that become losers

in quarter five (this test is based on 81 test-group observations) and to 7.27 for the selling of the fourth-quarter holdings that become losers in quarter six (this test is based on 108 test-group observations). This finding indicates that new managers sell inherited losers more readily even outside the honeymoon window; thus, the honeymoon-related incentive difference cannot fully explain the reluctance of continuing managers to sell their losers.

**4. New managers are simply more aware of the momentum phenomenon.** The first paper documenting the price momentum phenomenon was published relatively recently, in 1993 (Jegadeesh and Titman (1993)). It is possible that new managers, who tend to be somewhat younger than continuing managers, are simply more aware of this phenomenon. Another possibility is that mutual fund families select new managers who would combine their investment views with the momentum strategy. If new managers are simply more inclined to trade on the momentum strategy, presumably they would be more willing than continuing managers to sell their own stock picks that become losers at a later time.

We check whether this is the case. As mentioned earlier, new managers tend to buy a large fraction of winner stocks upon taking over a fund. Therefore, some time needs to pass before a subset of the new stock picks may become losers. For each new manager(s), we identify stocks in their portfolios that were held in quarter eight (recall that quarter 0 is the quarter in which new manager took control) but were not present in the inherited portfolio. Among these stocks, we focus on the ones that could be identified as momentum losers at the end of quarters 13 or 14 and compute the fraction sold by that time relative to the quarter-12 holdings. The rationale is that we want to identify the new manager's own stock picks, which were not guided by a contrarian investment strategy, but that subsequently became losers. We check whether new managers sell their own losers at a higher rate than continuing managers. To be consistent with the specifications of the new test, we now redefine the control group for each test-group fund as funds that experienced no managerial change in the year before and for four years after the completion of managerial change and that have at least one stock in common with the test-group holdings in quarter 12.

We now find no significant difference in the selling of losers between new and continuing managers. The Z-statistic for the difference in selling between quarter 12 and 13 is 0.29 (based on 174 test-group observations); it is 0.30 for the selling difference between quarters 12 and 14 (based on 194 test-group observations). Our results indicate that new managers do not sell their own stock picks that become losers in the future at higher rates than continuing managers, contradicting the hypothesis that they are more likely to trade on the momentum phenomenon.

The subsample results presented in this subsection underscore the validity of our conjecture that new managers sell losers simply because they are in a better position to see them as such. This is most obviously illustrated by cases where new managers take over well-performing funds and proceed to identify and sell the momentum losers they have inherited.

## **B.2. Improvement in performance**

We have shown that after new managers take over, they proceed to sell inherited momentum losers. At the same time, they tend to purchase momentum winners, as documented in Figure 4. As a result, the funds' value-weighted momentum ranking shifts toward winners following managerial change. In results not reported here, we show that the increase in portfolio momentum ranking is statistically significant for the test-group funds and is also significantly higher than for the control group. By shifting the portfolio composition toward momentum winners, new managers position themselves to take advantage of the momentum strategy. It should be expected that the fund's performance would also improve as a result. It would be surprising if it did not improve following managerial change, given the earlier evidence that funds that replace managers have, on average, been underperforming prior to replacement.

Indeed, we show that fund performance significantly improves in the year after managerial change. For each fund that undergoes complete replacement, we compute the fund's style-adjusted cumulative return for the 12 months preceding the start of CR ( $t = preCR$ ); we do so by subtracting cumulative 12-month returns of a median fund with the same investment objective from the fund's raw cumulative 12-month return. We then compute the fund's style-adjusted

cumulative return for the 12 months following the completion of CR ( $t = 0$ ) in the same fashion. We subtract the pre-CR style-adjusted return from the post-CR style-adjusted return and average the differences over all instances of CR. The mean improvement in the style-adjusted annual return in the year following CR is 1.12%, and it is highly significant, with a  $t$ -statistic of 9.30. The improvement in performance is higher than the potential savings that could be realized solely by replacing losers with winners, estimated earlier to be around 0.32%. Hence, the improvement in returns may be due partly to better new stock picks (consistent with the Lynch and Musto (2003) argument) and partly to lower management fees charged by new managers (CRSP mutual fund returns are reported net of fees). The improvement in fund performance following managerial change is consistent with the findings of Khorana (2001) and Lynch and Musto (2003), which were documented for an earlier sample of managerial change.

### **C. Savings realized by selling inherited losers**

In this section, we estimate the magnitude of savings that the new manager realizes solely by selling inherited losers. We assume that the proceeds of a sale are invested in the CRSP value-weighted index. We make this assumption for simplicity, because it is a strategy that does not require a lot of skill. To the extent that losers have, on average, the same risk characteristics as the market, this assumption is justified.<sup>14</sup> Moreover, by making this assumption, we in fact underestimate the actual savings realized by new managers since, as we have shown earlier, they tend to invest largely in momentum winners, which, on average, outperform the market.

Sales are measured relative to  $t = preCR$  holdings. We adjust sale proceeds for redemptions. We assume that redemptions would reduce all of a funds' holdings in proportion to their portfolio weights. For example, if redemptions constitute 2% of the total net assets, then the manager has to give 2% of the initial dollar holdings of a loser stock back to investors, but can invest

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<sup>14</sup>In reality, losers tend to be somewhat riskier than an average stock. They tend to have slightly higher loadings on size and market factors, and a close-to-zero loading on the HML factor (Jegadeesh and Titman (2002)). Therefore, by assuming that the proceeds of the sale of losers are invested in the market index, we underestimate the potential risk-adjusted savings.

the remaining proceeds of the sale in the market index. One difficulty with implementing this methodology is that fund holdings are observable only on a quarterly basis. Hence, an assumption needs to be made as to when during the quarter the sale occurs. We construct two estimates of potential savings. The aggressive estimate assumes that the sale takes place at the beginning of each quarter. This estimate is likely to overstate the actual savings because momentum losers tend to underperform continuously over the quarter. For the same reason, the conservative estimate of savings, which assumes that the sale occurs at the end of the quarter, is likely to understate the actual realized savings. The savings are cumulated for six months following managerial change. The savings thus consist of two parts: the potential underperformance, relative to the market index, of inherited losers sold at  $t = 0$ , computed over the subsequent six months, and the potential underperformance, relative to the market index, of inherited losers sold at  $t = 1$ , computed over the subsequent three months.

Figure 6 plots the average cumulative savings for both aggressive and conservative estimates and the 95% confidence bounds, estimated over all instances of CR. Panel A of Figure 6 presents the dollar savings estimate and Panel B presents savings as per cent of the total net assets of a fund. It can be seen that the average savings are significantly positive and, on average, amount to between \$1.3 million and \$1.9 million over the six months following the end of managerial replacement; this indicates that new managers make a good decision by selling losers.

A slight problem with this estimation is that savings are assessed from the subsequent stock returns, which are in turn affected by the act of selling the stock. Because stock prices are not perfectly elastic to uninformed demand shifts, the selling pressure would temporarily push down the price of losers being sold (this is indeed shown to be the case in the next subsection). This, in turn, would amplify the estimated savings relative to what they would have been without the price pressure. This concern affects predominately the aggressive estimate of savings. The conservative estimate is not likely to be significantly affected since, in all likelihood, we start estimating the savings with a lag after the actual sale took place. The total fund savings are higher than estimated here due to the additional tax benefits of selling losers.

## **D. Evidence of price pressure**

We have shown that a median inherited loser is completely sold off in the quarter in which a manager takes over the fund. If managers sell losers too quickly relative to their liquidity, the sell-off may temporarily depress prices. In this section, we show that the inherited losers indeed underperform other momentum losers in the three months following managerial change. In this setting, the price pressure arises purely because of uninformed demand shocks. Our finding thus complements the existing literature documenting the fact that shocks to demand can cause prices to temporarily deviate from their fundamental values (Shleifer (1986), Harris and Gurel (1986), Lynch and Mendenhall (1997), Wurgler and Zhuravskaya (2002), and Mitchell, Pulvino, and Stafford (2004), among others). Although the return magnitudes are large, front-running new managers with the knowledge that they are likely to sell losers may not be very profitable, since a large preemptive sale will also depress prices and reduce the potential profits. Hence, an investment in this strategy has to be relatively small.

To investigate the price-pressure hypothesis, we construct our test portfolios in the following way: First, we identify which of the inherited stocks can be classified as losers at the end of the month in which the managerial change was completed. Losers are defined as stocks in the bottom decile of performance relative to all publicly traded stocks over the previous 12 months. If more than one fund completed managerial change in a given month, we group all of their losers together without double-counting the loser stocks held by more than one fund. We then form equal-weighted portfolios of losers starting in the following month and hold stocks in the portfolio for six months. For each portfolio of inherited losers, we contemporaneously form a matching equal-weighted portfolio of all losers in the CRSP universe. In other words, both portfolios consist of stocks that are (a) defined as losers in the month immediately before the replacement is complete, (b) assigned to the portfolios with a one-month lag (consistent with the methodology employed by Kenneth French to construct momentum portfolios on his Web site), (c) equal-weighted, and (d) held in the portfolio for the following six months. We then find the

return differential for each of the subsequent months between the portfolio of inherited losers and the matching portfolio of all losers.

Figure 7, Panel A, presents the mean return differential and its 95% standard error bounds for each month subsequent to portfolio formation. Figure 7, Panel B, reports the alphas of regressing the raw return differential on the Fama and French (1993) three factors, and their 95% standard error bounds. These returns are already net of the momentum effect, hence there is no need to add the momentum factor. The results of the two panels are similar: Inherited losers significantly underperform all momentum losers in the three months following managerial change.

The underperformance is likely to be caused by price pressure because it does not persist for long. Consistently, we find that the magnitude of underperformance is larger if the inherited losers, rather than being equal-weighted, are weighted in proportion to the ratio of the number of inherited shares to the the stock's average trading volume in the previous three months. Figure 7 does not show price reversals, which should follow instances of price pressure. Reversals are difficult to detect empirically when the event window is not well-defined. In our case, it is not clear when during the quarter the sale takes place; moreover, the sale is likely to be gradual. Our finding of price pressure caused by mutual fund sales is closely related to the recent study by Coval and Stafford (2005), who document that mutual fund sales/purchases caused by fund outflows/inflows create predictable patterns of price pressure. The authors show that price pressure continues for about three months and starts to reverse six to nine months later.

Part of the reason that price pressure is so large is that momentum losers tend to be illiquid. Of course, this could be remedied by selling off losers more slowly. However, as can be seen from Table III, the median loser stock is completely sold off by the end of the quarter in which complete replacement took place. The reason may be that new managers are in a hurry to sell their losers before the honeymoon period is over. Selling losers quickly and losing money due to price pressure is not optimal for fund investors, and thus may constitute another mutual fund governance problem. However, despite this inefficiency, we show that new managers realize significant savings over the six-month period after taking over.

## **IV. Discussion**

Mutual fund managers differ from individual investors in that they are driven by incentives in addition to possible behavioral biases. One could argue, for instance, that the reluctance of continuing managers to sell losers may be caused by the fear that they will be penalized for having made an investment mistake. As a result, they choose not to sell their underperforming stocks, thus not admitting their mistakes publicly. This incentive has the same flavor as regret, and we are unable to distinguish this incentive-based explanation from the regret-based explanation that we propose.

Additionally, some may argue that because momentum losers tend to experience return reversals in the future, the decision to hold on to them may be optimal. Indeed, a number of studies document that momentum profits tend to reverse three to five years after portfolio formation, a popular explanation being that the initial overreaction to news is followed by a reversal (see Daniel, Hirshleifer, and Teoh (2002) for the literature survey), although Jegadeesh and Titman (2002) show that return reversals have become significantly less pronounced in recent years. But even taking the reversals evidence for granted, the strategy of holding on to losers for the next five years is dominated by the strategy of selling losers immediately, investing the proceeds in stocks with better near-term investment prospects, and perhaps buying the losers back in three years.

## **V. Conclusion**

We show that new managers bring to the table at least one skill, namely, the ability to identify and eliminate bad projects. Our study focuses on the replacement of mutual fund managers. This affords the opportunity to compare the decisions of new managers to the decisions of continuing managers who initially hold the same stocks. We show that continuing managers, being more reluctant than new managers to sell poorly performing stocks, lag behind in taking advantage of

the momentum strategy. At least partly because of this, new managers are able to significantly improve the funds' style-adjusted performance in their first six months of managing it. One interesting finding—and one which strongly supports our conjecture—is that new managers who take over funds that are performing well still proceed to change the portfolio by selling off momentum losers. Some may argue that this might be the result of new managers trying to create visibility of activity by making the most obvious decision. But even then, the managers' actions have a beneficial effect on future returns as long as transaction costs do not subsume the expected profits.

Our findings have two important implications. First, because mutual funds control a large portion of the U.S. equity market, their trading and holding patterns have a significant impact on asset prices; the reluctance of mutual fund managers to sell losers might help explain the persistence of price momentum and underreaction to news. Second, our findings suggest that mutual fund families might benefit from closer supervision of fund portfolios and even the periodic movement of managers among similar funds in the family.

## References

- Caballero, Ricardo J., Takeo Hoshi, and Anil K. Kashyap, 2005, Zombie lending and depressed restructuring in Japan, NBER working paper.
- Case, Karl, and Robert Shiller, 1988, The behavior of home buyers in boom and post-boom markets, *New England Economic Review* November/December, 29–46.
- Chen, Zhiwu, Werner Stanzl, and Masahiro Watanabe, 2002, Price impact costs and the limit of arbitrage, Working paper, Yale School of Management.
- Chevalier, Judith, and Glenn Ellison, 1999, Career concerns of mutual fund managers, *Quarterly Journal of Economics* 114, 389–432.
- Chordia, Tarun, and Lakshmanan Shivakumar, 2002, Momentum, business cycle, and time-varying expected returns, *Journal of Finance* 57, 985–1019.
- Constantinides, George M., 1984, Optimal stock trading with personal taxes: Implications for prices and the abnormal January returns, *Journal of Financial Economics* 13, 65–89.
- Cooper, Michael J., Roberto C. Gutierrez Jr., and Allaudeen Hameed, 2004, Market states and momentum, *Journal of Finance* 59, 1345–1365.

- Coval, Josh, and Erik Stafford, 2005, Asset fire sales (and purchases) in the equity markets, Harvard Business School working paper.
- Coval, Joshua D., and Tyler Shumway, 2005, Do behavioral biases affect prices?, *Journal of Finance* 60, 1–34.
- Daniel, Kent, David Hirshleifer, and Siew Hogn Teoh, 2002, Investor psychology in capital markets: Evidence and policy implications, *Journal of Monetary Economics* 49, 139–209.
- Fama, Eugene F., and Kenneth R. French, 1993, Common risk factors in the returns of stocks and bonds, *Journal of Financial Economics* 33, 3–56.
- Feng, Lei, and Mark S. Seasholes, 2005, Do investor sophistication and trading experience eliminate behavioral biases in financial markets?, *Review of Finance* forthcoming.
- Ferris, Stephen P., Robert A. Haugen, and Anil K. Makhija, 1988, Predicting contemporary volume with historic volume at differential price levels: Evidence supporting the disposition effect, *Journal of Finance* 43, 677–697.
- Frazzini, Andrea, 2005, The disposition effect and under-reaction to news, *Journal of Finance* forthcoming.
- Genesove, David, and Christopher Mayer, 2001, Loss aversion and seller behavior: Evidence from the housing market, *Quarterly Journal of Economics* 116(4), 1233–1260.
- Grinblatt, Mark, and Bing Han, 2004, The disposition effect and momentum, *Journal of Financial Economics* forthcoming.
- Grinblatt, Mark, and Matti Keloharju, 2001, What makes investors trade?, *Journal of Finance* 56, 589–616.
- Haigh, Michael, and John List, 2004, Do professional traders exhibit myopic loss aversion? an experimental analysis, *Journal of Finance* forthcoming.
- Harris, Lawrence, and Eitan Gurel, 1986, Price and volume effects associated with changes in the s&p 500 list: New evidence for the existence of price pressures, *Journal of Finance* 41, 815–829.
- Hirshleifer, David, 2001, Investor psychology and asset pricing, *Journal of Finance* 56, 1533–1597.
- Jegadeesh, Narasimham, and Sheridan Titman, 1993, Returns to buying winners and selling losers: Implications for stock market efficiency, *Journal of Finance* 48, 65–91.
- , 2001, Profitability of momentum strategies: An evaluation of alternative explanations, *Journal of Finance* 56, 699–720.
- Jegadeesh, Narasimhan, and Sheridan Titman, 2002, Cross-sectional and time-series determinants of momentum returns, *Review of Financial Studies* 15, 143–157.
- Jensen, Michael C., 1993, The modern industrial revolution, exit, and the failure of internal control systems, *Journal of Finance* 48, 831–880.

- Johnson, W. Bruce, Robert P. Magee, Nandu J. Nagarajan, and Harry A. Newman, 1985, An analysis of the stock price reaction to sudden executive deaths: Implications for the managerial labor market, *Journal of Accounting and Economics* April, 151–174.
- Kahneman, Daniel, and Amos Tversky, 1979, Prospect theory: An analysis of decision under risk, *Econometrica* 47, 263–91.
- Kaustia, Markku, 2004, Market-wide impact of the disposition effect: evidence from ipo trading volume, *Journal of Financial Markets* 7, 207–235.
- Khorana, Ajay, 1996, Top management turnover: An empirical investigation of mutual fund managers, *Journal of Financial Economics* 40, 403–427.
- , 2001, Performance changes following top management turnover: Evidence from open-end mutual funds, *Journal of Financial and Quantitative Analysis* 36, 371–393.
- Korajczyk, Robert A., and Ronnie Sadka, 2004, Are momentum profits robust to trading costs?, *Journal of Finance* 59, 1039–1082.
- Lakonishok, Joseph, and Seymour Smidt, 1986, Volume for winners and losers: Taxation and other motives for stock trading, *Journal of Finance* 41, 951–974.
- Lesmond, David A., Michael J. Schill, and Chunsheng Zhou, 2004, The illusory nature of momentum profits, *Journal of Financial Economics* 71, 349–380.
- Lynch, Anthony, and David K. Musto, 2003, How investors interpret past fund returns, *Journal of Finance* 58, 2033–2058.
- Lynch, Anthony W., and Richard R. Mendenhall, 1997, New evidence on stock price effects associated with changes in the s&p 500, *Journal of Business* 70(3), 351–383.
- Mitchell, Marck, Todd Pulvino, and Erik Stafford, 2004, Price pressure around mergers, *Journal of Finance* 59, 31–63.
- Odean, Terrance, 1998, Are investors reluctant to realize their losses?, *Journal of Finance* 53, 1775–1798.
- Sadka, Ronnie, 2006, Momentum and post-earnings-announcement drift anomalies: The role of liquidity risk, *Journal of Financial Economics* 80, 309–349.
- Shapira, Zur, and Itzhak Venezia, 2001, Patterns of behavior of professionally managed and independent investors, *Journal of Behavioral Finance* 25, 1573–1587.
- Shefrin, Hersh, and Meir Statman, 1984, Explaining investor preference for cash dividends, *Journal of Financial Economics* 13, 253–282.
- , 1985, The disposition to sell winners too early and ride losers too long: Theory and evidence, *Journal of Finance* 40, 777–790.
- Shleifer, Andrei, 1986, Do demand curves for stocks slope down?, *Journal of Finance* 41, 579–590.
- Shumway, Tyler, and Guojun Wu, 2005, Does disposition drive momentum?, University of Michigan working paper.

- Statman, Meir, and David Caldwell, 1987, Applying behavioral finance to capital budgeting: Project terminations, *Financial Management* Winter, 7–15.
- Statman, Meir, and James F. Sepe, 1989, Project termination announcements and the market value of the firm, *Financial Management* Winter, 1–8.
- Staw, Barry M., Kenneth W. Koput, and Sigal G. Barsade, 1997, Escalation at the credit window: A longitudinal study of bank executives' recognition and write-off of problem loans, *Journal of Applied Psychology* 82, 130–142.
- Weber, Martin, and Colin Camerer, 1998, The disposition effect in securities trading: An experimental analysis, *Journal of Economic Behavior and Organization* 33, 167–184.
- Weisbach, Michael S., 1995, Ceo turnover and the firm's investment decisions, *Journal of Financial Economics* 37, 159–188.
- Wurgler, Jeffrey, and Ekaterina Zhuravskaya, 2002, Does arbitrage flatten demand curves for stocks?, *Journal of Business* 75, 583–608.

## Appendix

### A. Merging the Morningstar managerial dataset with the Spectrum mutual fund holdings dataset (SP12)

The Morningstar dataset that provides managerial turnover information identifies mutual funds by *ticker*, an identifier also used by the CRSP Mutual Funds dataset, while the SP12 dataset that records mutual funds' quarterly holdings identifies funds by *fundno*. Since there is no common fund identifier between the two datasets, we create our own fundno-ticker link by combining the information from File8 of the SP12 dataset and a link file supplied by WRDS (“MFLink”).

File8 of the SP12 dataset contains the NASDAQ tickers for funds and their corresponding internal fundnos. The limitation of this series is that the match starts in 1999. Therefore, we backfill ticker information for a fund by matching names and fundnos pre- and post-1999. We backfill by fundno-fund name combination because Spectrum reuses fundno and hence we cannot backfill tickers solely by fundno. For example, if in 1999 fundno and ticker for Example Fund are 999 and XYZAX, respectively, and if in 1998 fundno for Example Fund is also 999, we simply assume that its ticker is XYZAX.

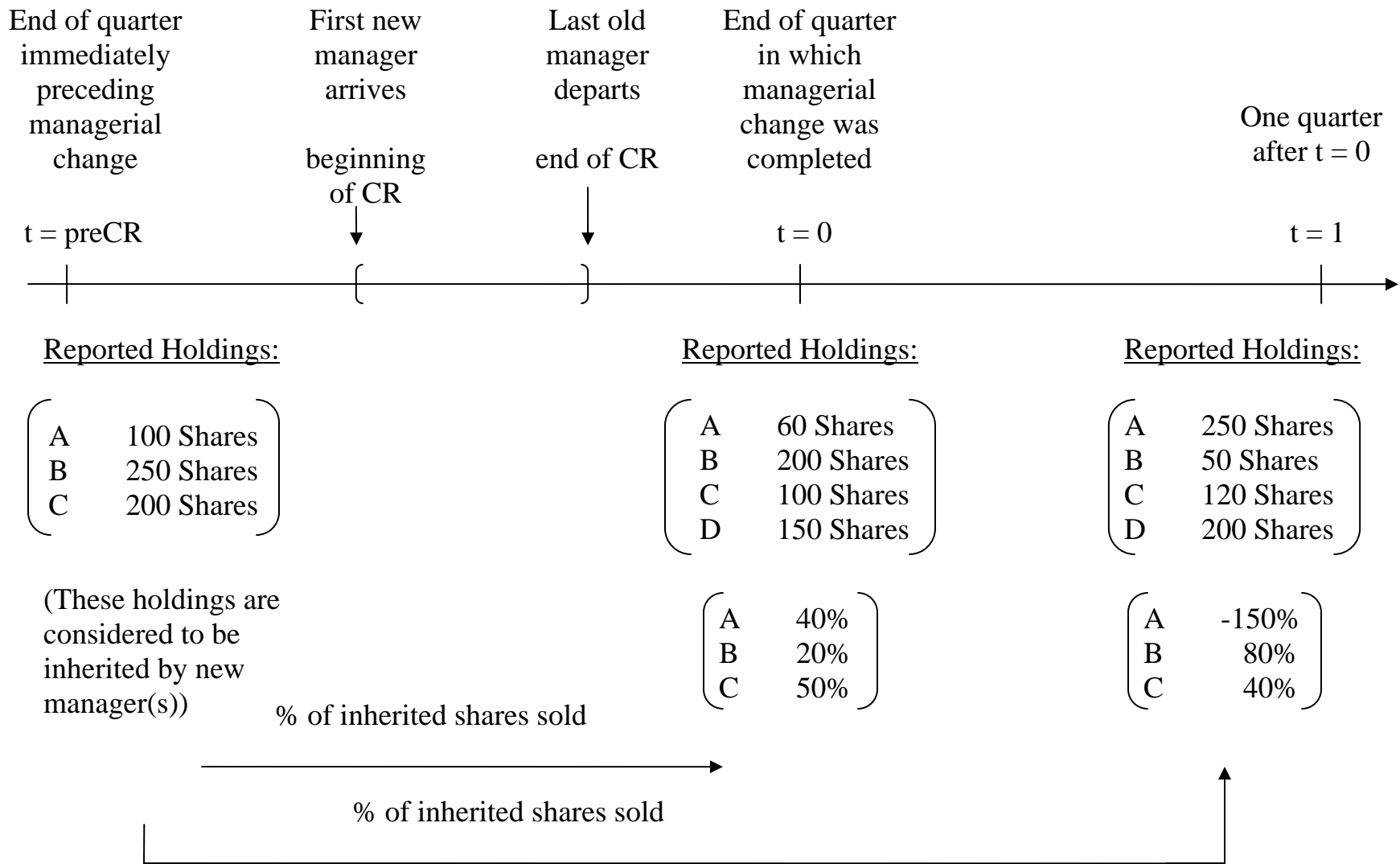
After the backfilling, we further update our link by using MFLink. We ignore those fundno-ticker matches in MFLink that are flagged in the file as potentially having a matching problem. Otherwise, we update our link if (a) File8 does not contain a ticker for a particular fundno or (b) there is a discrepancy between the backfilling and MFLink.

### B. Cleaning up the mutual fund holdings dataset (SP12)

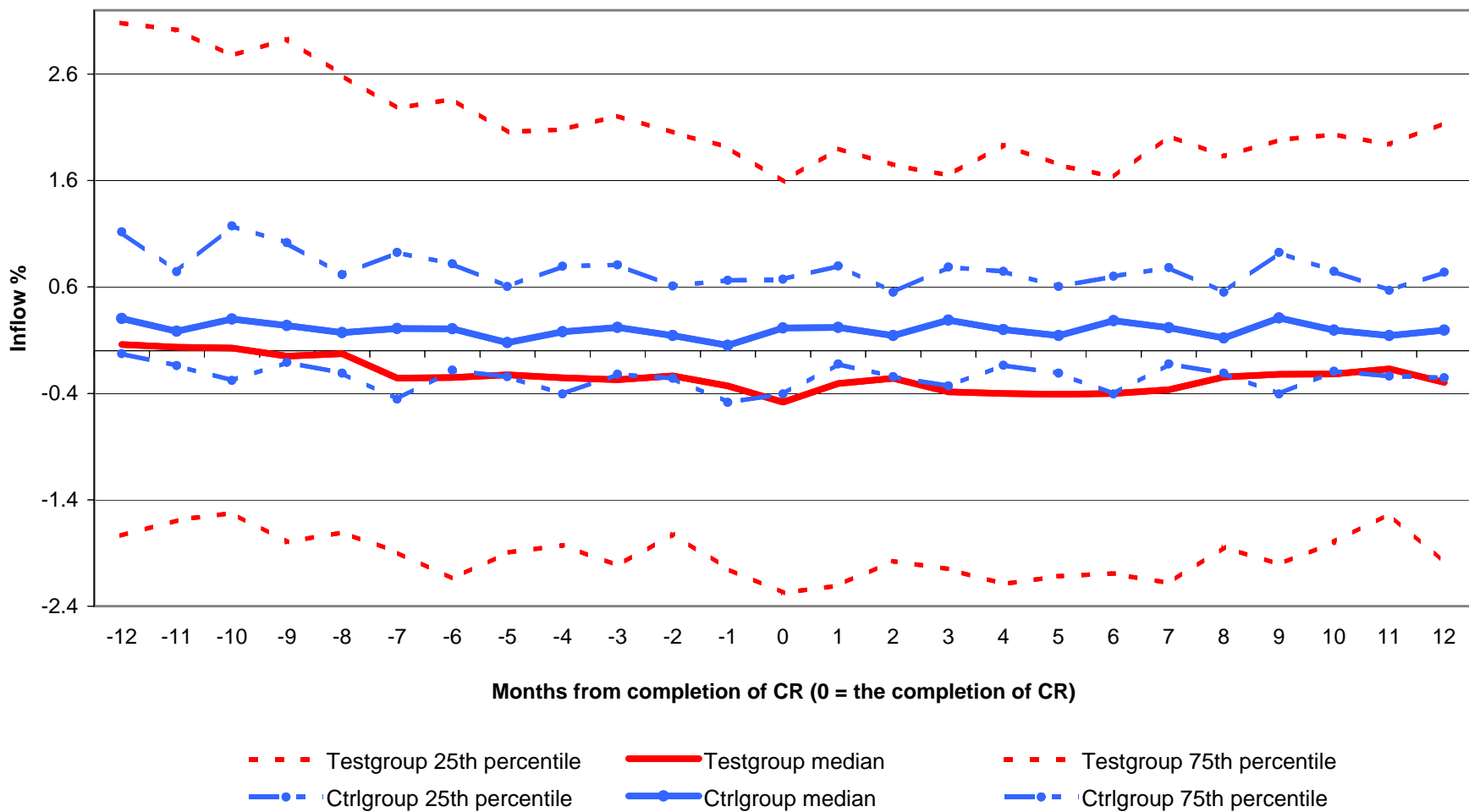
The Thompson Financial SP12 dataset relies heavily on voluntary reporting by mutual funds, which introduces inaccuracies, the most common being underreporting. We eliminate suspicious fund-quarters reports by using two filters: (1) eliminate fund-quarters in which funds report holding fewer than 20 stocks (setting the critical number at 10 stocks does not substantively change

the results) and (2) eliminate fund-quarters in which the total market value of stocks held is less than 70% or more than 130% of the total net asset value (TNA) of the fund reported in the CRSP Mutual Funds dataset. These filters reduce the number of usable fund-quarters by about 45%.

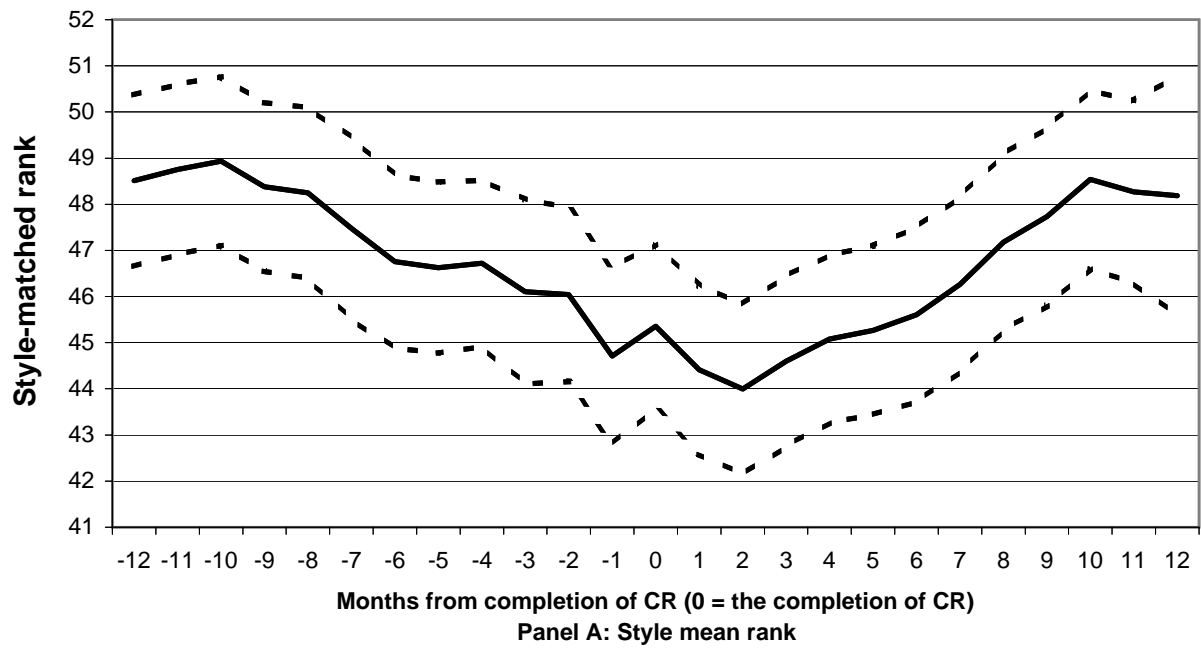
Additionally, even the usable fund-quarter observations contain errors in reporting individual stock holdings. We exclude suspicious holdings where (1) the total market value of the stock held is less than \$10,000 and (2) less than 100 shares of a stock are reported to be held.



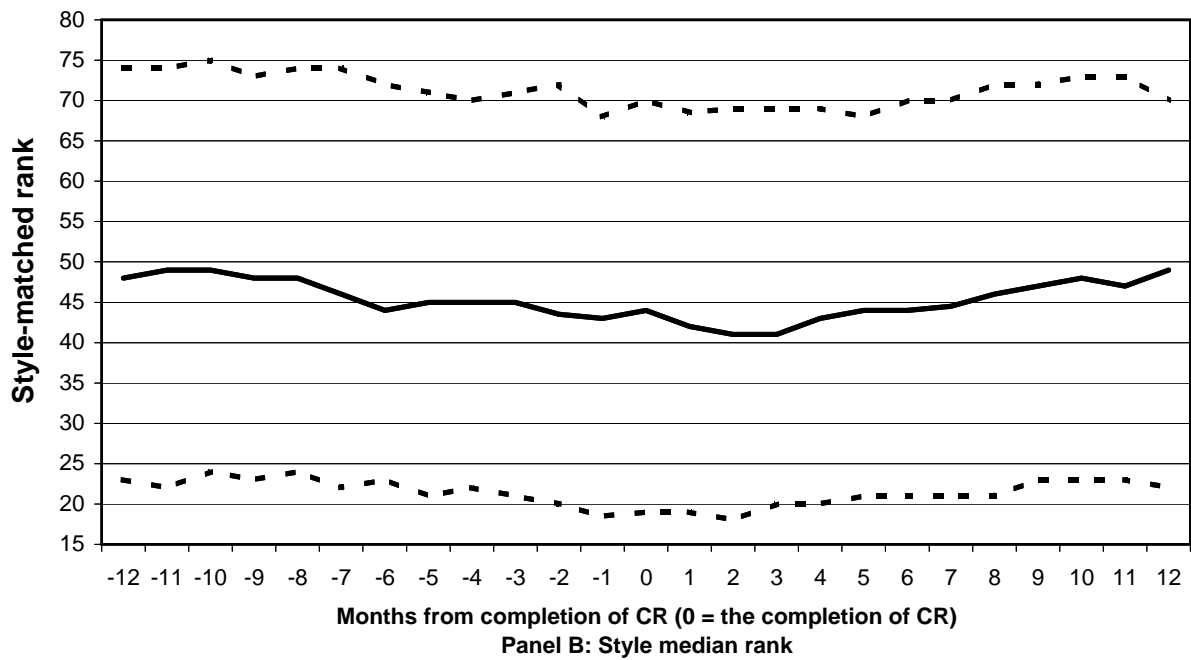
**Figure 1. Timeline.** This hypothetical example illustrates how sales of inherited shares are computed.



**Figure 2. Monthly fund flows.** The figure presents monthly fund flows for test and control groups. Test group consists of funds that have experienced complete managerial replacement that ended at  $t = 0$ . For each test-group fund, a control group is formed among funds that have not experienced any managerial change between 12 months before and 24 months after  $t = 0$ . A median monthly fund flow for the control group is computed. Fund flow is defined as  $100\% \cdot (TNA_t - (1 + ret_t) \cdot TNA_{t-1}) / TNA_{t-1}$ , where  $TNA_t$  denotes total net assets in month  $t$ , and  $ret_t$  denotes fund's return between month  $t-1$  and month  $t$ .

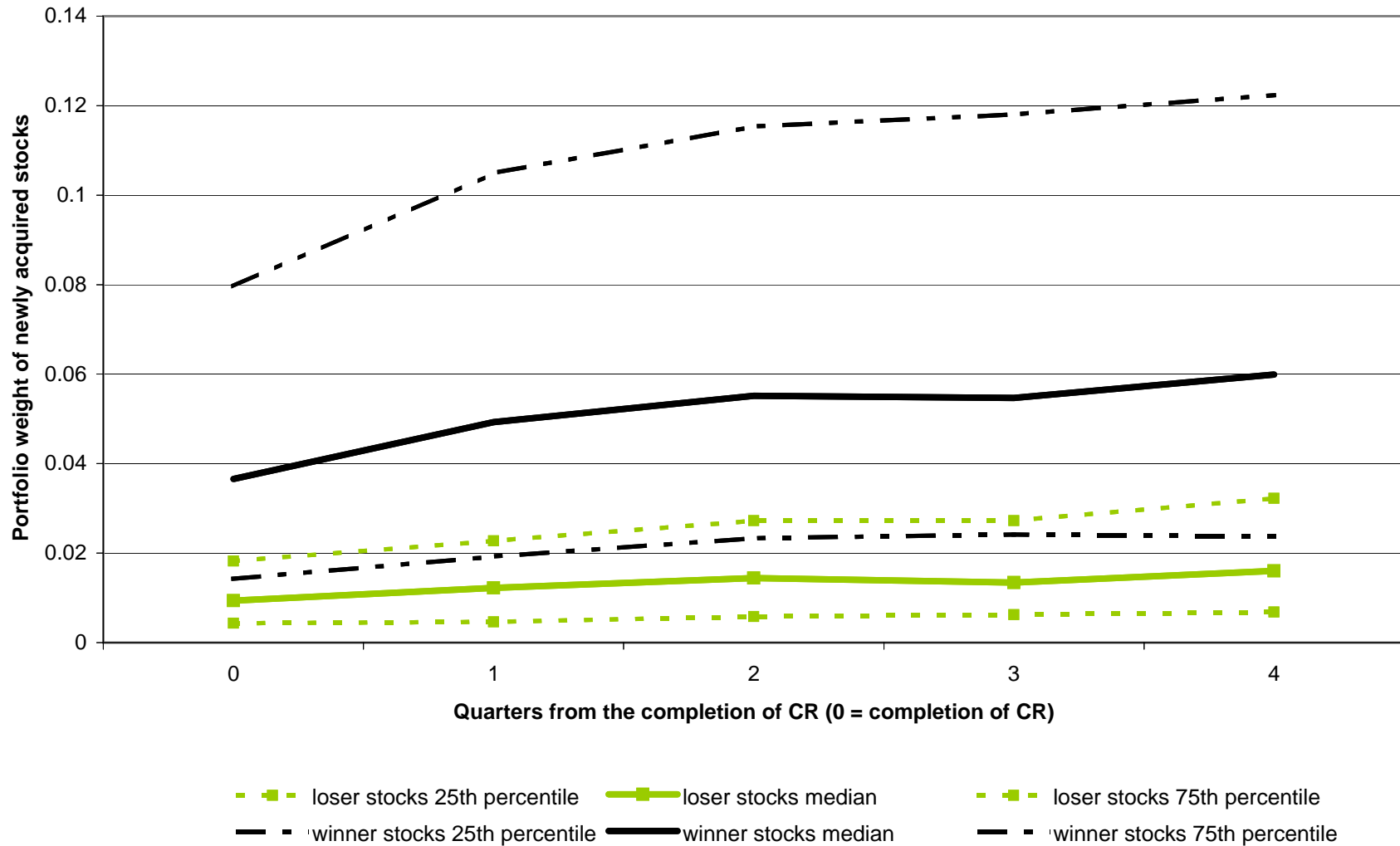


— Mean    - - - 95% confidence bounds

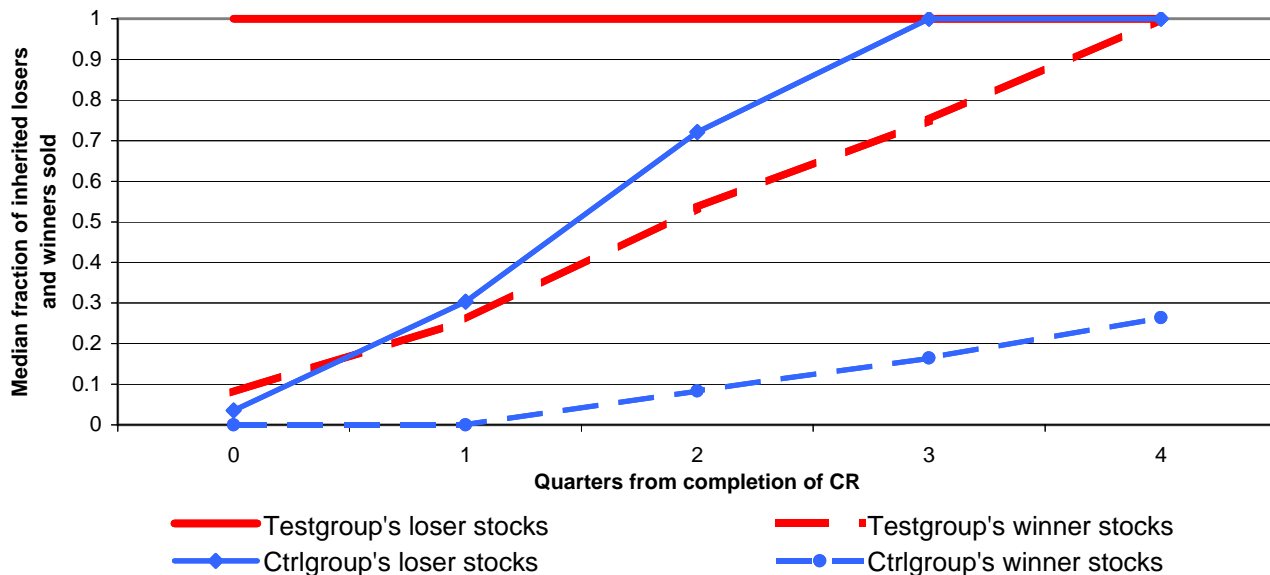


- - - 25th percentile    — Median    - . - 75th percentile

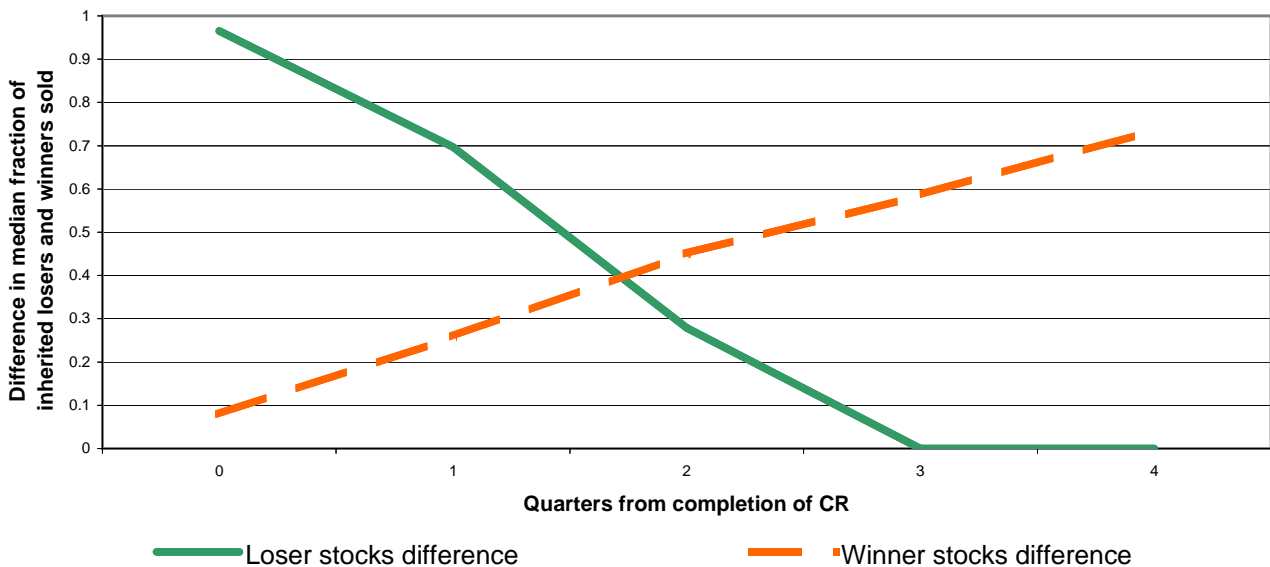
**Figure 3. Style-matched rank based on the cumulative return over the past 12 months.** The figures show mutual fund rankings for funds that have undergone managerial change, based on their cumulative return over the prior 12 months relative to other funds within their investment objective group. We compute these rankings every month, starting 12 months before and ending 12 months after the completion of managerial change (at  $t = 0$ ). Panel A plots the average style-adjusted rank with the 95% confidence bounds and Panel B plots the median rank, as well as the 25th and the 75th percentiles of the rank distribution.



**Figure 4. New stock purchases by new managers.** The figure reports portfolio weights of new purchases of winner and loser stocks that new managers make after taking over at  $t = 0$  and for four quarters after. Stocks are defined as losers/winners if they are ranked in the bottom/top decile of performance over the past 12 months relative to all publicly-traded stocks. Newly-purchased stocks are those that were not present in the portfolio at  $t = \text{preCR}$ .

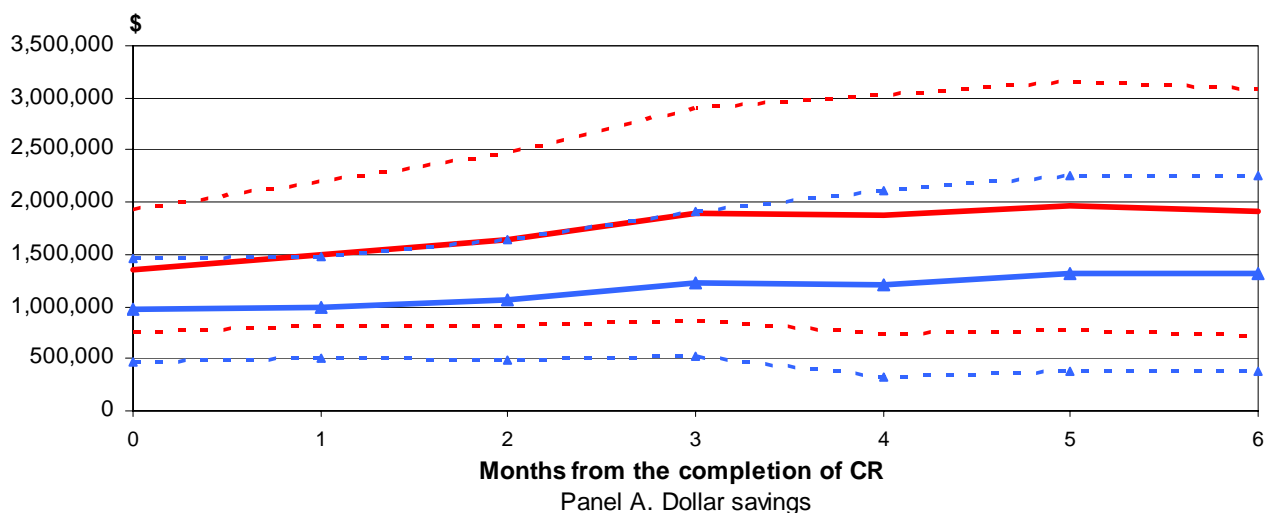


Panel A. Median fraction of winners and losers sold following complete replacement

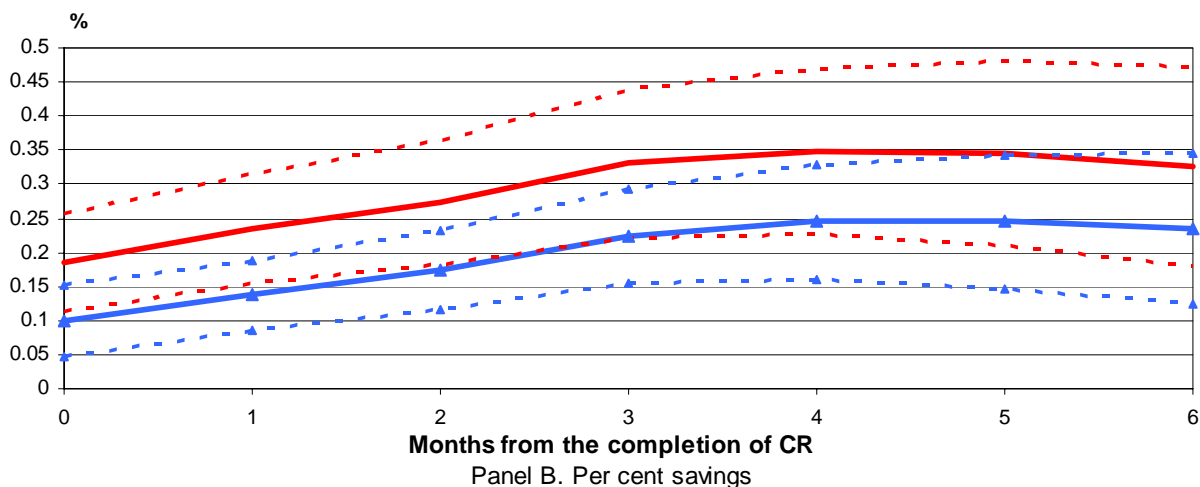


Panel B. Median difference between test and control groups in selling losers and winners

**Figure 5. Selling losers and winners by test and control groups.** The figures present the difference in the selling of losers and winners by test and control groups. Stocks are defined as losers/winners if they are ranked in the bottom/top decile of performance over the previous 12 months in quarter  $t$  relative to all publicly traded stocks. For each test-group fund, a control group is composed of funds that have not experienced any managerial change for 12 months before the beginning of CR and 12 months following the end of CR and that hold at least one stock in common with the test group at  $t = \text{preCR}$  (the quarter before the start of CR). Trades are computed relative to  $t = \text{preCR}$  and the medians are taken over all stocks in the sample. Panel A plots the median trades of all losers and winners by test and control groups. Panel B plots the differences in median trades of losers and winners between test and control groups.

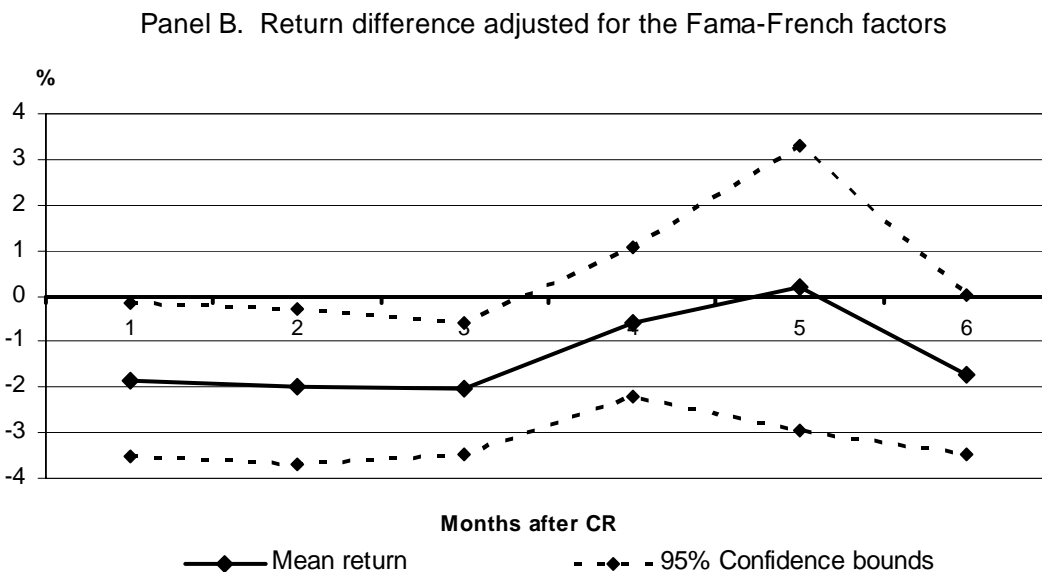
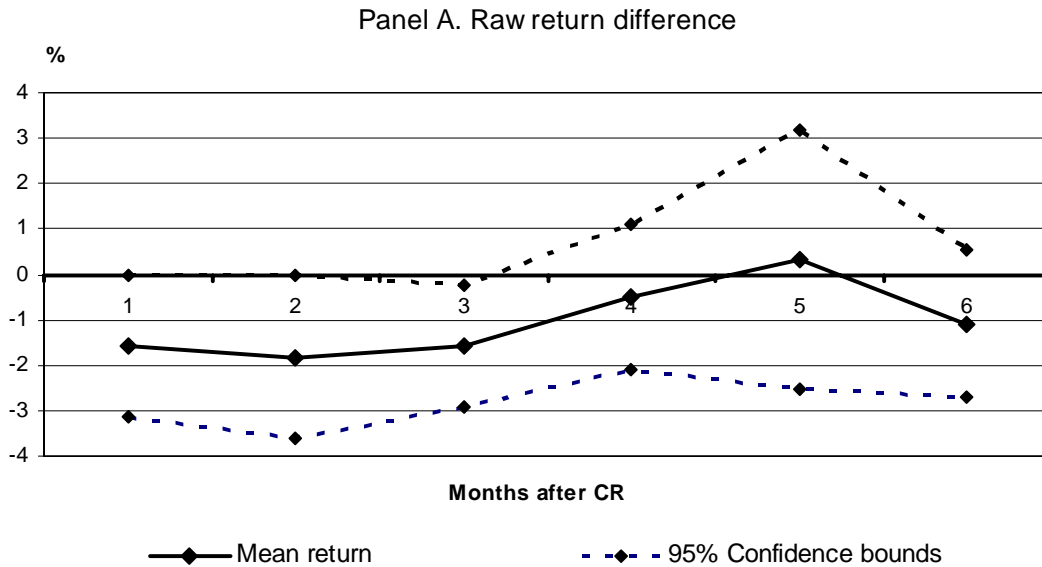


—▲ Aggressive estimate                      —▲ Conservative estimate  
- - -▲ Aggressive estimate 95% confidence bounds    - - -▲ Conservative estimate 95% confidence bounds



—▲ Aggressive estimate                      —▲ Conservative estimate  
- - -▲ Aggressive estimate 95% confidence bounds    - - -▲ Conservative estimate 95% confidence bounds

**Figure 6. Estimated cumulative savings due to sale of inherited losers.** The figure presents estimated savings realized by new managers through selling inherited momentum losers. Panel A presents the dollar amount of savings and Panel B presents savings as per cent of total net assets. Sales are computed as the change in reported stock holdings between the current and the next quarter and are adjusted for monthly fund flows under the assumption that fund flows will affect all fund holdings in proportion to the dollar amount held. The triangle line plots the conservative estimate of savings made under the assumption that the sale of losers takes place at the end of each quarter. The smooth line plots the aggressive estimate of savings made under the assumption that the sale takes place at the beginning of each quarter. Savings are calculated monthly as the proceeds of sale multiplied by the return differential between the CRSP value-weighted portfolio and the return on the loser stocks. Proceeds of sale are computed by multiplying the change in holdings by the beginning-of-quarter price (for the aggressive estimate) or by the end-of-the-quarter price (for the conservative estimate). Cumulative monthly savings are then calculated beginning in the month that the new manager took over the fund, to arrive at the total savings amount. The dashed triangle lines represent the 3-months moving average of 95% upper- and lower-confidence bounds based on the standard error of the estimated mean savings.



**Figure 7. Return differential between inherited losers and all losers following complete replacement.** The figures plot the return differentials between the portfolio of momentum losers inherited by new managers and the portfolio of all momentum losers, defined and constructed at the same time. Stocks are defined as losers if they are ranked in the bottom decile of performance over the previous 12 months relative to all publicly traded stocks. Rankings for both portfolios are computed at the end of the month immediately preceding the end date of managerial replacement. Stocks are held in the portfolios for six months, starting in the month immediately following the end date of managerial replacement, and their returns are equal-weighted. If more than one managerial change has ended in a given month, all losers inherited by the new managers are combined together but single-counted. The return differentials between the inherited losers and all losers are computed, as are their confidence intervals, for each of the six subsequent months. The top figure presents the raw return differential; the bottom figure presents the alpha of the return differential regressed on the Fama-French factors.

**TABLE I**  
**Statistical Methodology: An Example**

This table illustrates the statistical methodology through a hypothetical example. Fund 1 has undergone complete replacement and has held three stocks, A, B, and C, in the quarter before the complete replacement began ( $t=preCR$ ), that were identified as losers at time  $t$ . The relevant control group of funds that held at least one of these three stocks at  $t=preCR$  is formed, and the trades of the new manager of Fund1 are compared to the mean trade of the control-group funds.

Test Group					Control Group						Comparison
Fund $i$	Stock $j$	$Shares_{preCR}^j$	$Shares_t^j$	$\Delta^j$	Stock $j$	Control Funds	$Shares_{preCR}^j$	$Shares_t^j$	$\Delta_{Control}^j$	$\Delta_{Control}^{jMean}$	Is $\Delta^j < \Delta_{Control}^{jMean}$ ?
1	A	100	60	-0.40	A	2	500	400	-0.20	-0.42	No
					A	3	100	20	-0.80		
					A	7	200	150	-0.25		
1	B	250	200	-0.20	B	2	1000	200	-0.80	-0.16	No
					B	8	150	100	-0.33		
					B	9	300	500	0.67		
1	C	200	100	-0.50	C	2	120	200	0.67	0.02	Yes
					C	4	250	200	-0.20		
					C	5	300	210	-0.30		
					C	6	500	600	0.20		
					C	8	200	150	-0.25		

$$z_t^{1,loser} = \frac{1 - \frac{1}{2} * 3}{\frac{\sqrt{3}}{2}} = -0.577$$

**TABLE II**  
**Complete Replacement of Mutual Fund Managers: Summary Statistics**

The table provides descriptive statistics for funds that have undergone complete managerial replacement. Complete replacement is defined as the replacement of all fund managers through one change or a series of changes, each occurring within 90 calendar days of the previous change.

Panel A. Length of Time for Complete Replacement								
Type of Complete Replacement	N	%	Mean	Median	75th percentile	90th percentile	95th percentile	99th percentile
One manager replaced by one manager	821	56.78	3.69	0 <sup>†</sup>	0	1	29	91
Two managers replaced by one manager	79	5.46	10.03	0	1	59	89	92
One manager replaced by two managers	139	9.61	9.66	0	0	60	84	92
Two managers replaced by two managers	85	5.88	16.81	0	30	62	82	92
One manager replaced by Team	64	4.43	2.94	0	0	1	17	62
The rest	258	17.84	11.65	0	0	61	74	92
Total (all CR):	1446	100.00	6.77	0	0	29	61	91

†Zero length of time means the addition and subtraction of managers happened on the same day.

Panel B. Age of Incoming and Outgoing Managers <sup>†</sup>							
	N	Mean	10th percentile	25th percentile	Median	75th percentile	90th percentile
Outgoing managers	571	42.35	30	35	41	49	57
Incoming managers	440	38.65	27	31.5	37.5	45	52.5

†Limited to complete replacement with one manager coming in and/or one manager leaving.

Panel C. Percentile Ranking of Trailing 12-month Return before Complete Replacement <sup>†</sup>							
	N	Mean	10th percentile	25th percentile	Median	75th percentile	90th percentile
Ranking	1027	44.43	7	20	42	69	87

† Fund performance is compared against other funds with the same investment objective defined in CRSP.

Type of Stocks	Test Group				Control Group			
	25th percentile	Mean	Median	75th percentile	25th percentile	Mean	Median	75th percentile
Losers	0.54%	2.27%	1.32%	2.74%	0.76%	1.71%	1.23%	1.98%
Winners	3.89%	13.95%	9.56%	19.86%	5.68%	12.35%	8.93%	14.45%

**TABLE III**  
**Selling Inherited Momentum Losers and Winners by New Managers**

The table reports the differential selling of losers and winners by new and continuing fund managers. Stocks are defined as losers if they are ranked in the bottom decile of performance over the previous 12 months relative to all publicly traded stocks. The timing is as follows:  $t = \text{preCR}$  is the quarter immediately preceding the start of complete managerial replacement (CR);  $t = 0$  is the quarter immediately following the end of CR;  $t = 1$  is one quarter after  $t = 0$ . A trade is defined as the percent change in the number of shares held by the fund from  $t = \text{preCR}$  to the present quarter  $t$ :  $(S_t - S_{\text{preCR}})/S_{\text{preCR}}$ . All stocks are assigned momentum deciles each quarter based on their cumulative return over the previous 12 months relative to all stocks in the CRSP universe at the end of the quarter. The test group consists of funds that have undergone CR. For each fund in the test group, a control group is formed of funds that have not experienced any managerial change within 12 months before  $t = \text{preCR}$  and 12 months after  $t=0$  and that have at least one momentum winner or loser in common with the test group fund at  $t = \text{PreCR}$ . For each winner or loser stock held by a test-group fund at  $t = \text{preCR}$ , we compute the trade by time  $t$ ; we then compute the mean trade for this stock over all funds in the control group and calculate the differences between the two numbers. These differences are then normalized and compared to zero for the test of null hypothesis: no difference in trading patterns between new and continuing fund managers (test specifics are described in the text). The series of trade differences for winners and losers are ranked against each other in a two-sample rank-sum test to determine whether new managers tend to sell more losers relative to continuing managers than they sell winners for the differences-in-differences test.

Panel A. Entire sample

Momentum decile	Number of observations	Median fractions of shares sold (test/control/difference)	Test of $H_0$ : No difference between selling patterns of new and continuing fund managers (Z-score)	Test of $H_0$ : No difference in differential selling of losers and winners between new and continuing fund managers (Z-score) <sup>††</sup>
The quarter in which complete replacement ends ( $t=0$ )				
losers	743	1.000 / 0.142 / 0.858	(4.41)	-
winners	852	0.077 / 0.027 / 0.050	(4.81)	-
losers - winners	627	-	-	(3.99)
One quarter after the end of CR ( $t=1$ )				
losers	686	1.000 / 0.212 / 0.788	(5.30)	-
winners	729	0.257 / 0.029 / 0.228	(5.24)	-
losers - winners	558	-	-	(3.38)

†† This is a Z-statistic approximation of the Wilcoxon Rank Sum test

Panel B. Conditioning on the sign of fund flows

Test group includes only funds with positive fund flows at pre-CR quarter<sup>†</sup>

Momentum decile	Number of observations	Median fractions of shares sold (test/control/difference)	Test of H <sub>0</sub> : No difference between selling patterns of new and continuing fund managers (Z-score)	Test of H <sub>0</sub> : No difference in differential selling of losers and winners between new and continuing fund managers (Z-score) <sup>††</sup>
The quarter in which complete replacement ends (t=0)				
losers	253	1.000 / 0.131 / 0.869	(4.07)	-
winners	295	0.000 / 0.039 / -0.039	(3.96)	-
losers - winners	218	-	-	(3.36)
One quarter after the end of CR (t=1)				
losers	214	1.000 / 0.225 / 0.775	(4.27)	-
winners	222	0.184 / 0.028 / 0.156	(4.81)	-
losers - winners	175	-	-	(1.98)

Test group includes only funds with negative fund flows at pre-CR quarter<sup>†</sup>

Momentum decile	Number of observations	Median fractions of shares sold (test/control/difference)	Test of H <sub>0</sub> : No difference between selling patterns of new and continuing fund managers (Z-score)	Test of H <sub>0</sub> : No difference in differential selling of losers and winners between new and continuing fund managers (Z-score) <sup>††</sup>
The quarter in which complete replacement ends (t=0)				
losers	353	1.000 / 0.138 / 0.862	(4.18)	-
winners	361	0.226 / 0.026 / 0.200	(4.49)	-
losers - winners	284	-	-	(1.18)
One quarter after the end of CR (t=1)				
losers	332	1.000 / 0.192 / 0.808	(4.62)	-
winners	319	0.405 / 0.027 / 0.379	(4.81)	-
losers - winners	263	-	-	(-2.02)

<sup>†</sup> Fund flow = 100\*(TNA<sub>t</sub> - TNA<sub>t-1</sub>\*ret)/TNA<sub>t-1</sub>, where TNA<sub>t</sub> denotes TNA at quarter t=pre-CR and t-1 respectively, and ret denotes fund's return quarter t and t-1

<sup>††</sup> This is a Z-statistic approximation of the Wilcoxon Rank Sum test

Panel C. Conditioning on relative performance

Test group includes only funds whose returns are above the median of funds with the same investment objective at pre-CR quarter<sup>†</sup>

Momentum decile	Number of observations	Median fractions of shares sold (test/control/difference)	Test of H <sub>0</sub> : No difference between selling patterns of new and continuing fund managers (Z-score)	Test of H <sub>0</sub> : No difference in differential selling of losers and winners between new and continuing fund managers (Z-score) <sup>††</sup>
The quarter in which complete replacement ends (t=0)				
losers	234	0.847 / 0.158 / 0.689	(4.06)	-
winners	274	0.084 / 0.021 / 0.063	(4.42)	-
losers - winners	203	-	-	(2.95)
One quarter after the end of CR (t=1)				
losers	195	1.000 / 0.205 / 0.795	(3.74)	-
winners	208	0.347 / 0.003 / 0.345	(4.50)	-
losers - winners	161	-	-	(1.44)

Test group includes only funds whose returns are below the median of funds with the same investment objective at pre-CR quarter<sup>†</sup>

Momentum decile	Number of observations	Median fractions of shares sold (test/control/difference)	Test of H <sub>0</sub> : No difference between selling patterns of new and continuing fund managers (Z-score)	Test of H <sub>0</sub> : No difference in differential selling of losers and winners between new and continuing fund managers (Z-score) <sup>††</sup>
The quarter in which complete replacement ends (t=0)				
losers	350	1.000 / 0.117 / 0.883	(3.74)	-
winners	358	0.158 / 0.039 / 0.119	(3.99)	-
losers - winners	281	-	-	(1.95)
One quarter after the end of CR (t=1)				
losers	335	1.000 / 0.181 / 0.819	(4.48)	-
winners	319	0.373 / 0.033 / 0.340	(4.28)	-
losers - winners	263	-	-	(-1.76)

<sup>†</sup> As defined in CRSP

<sup>††</sup> This is a Z-statistic approximation of the Wilcoxon Rank Sum test

Panel D. Conditioning on number of previous managers

Test group includes only funds that used to be managed by a single manager before complete replacement

Momentum decile	Number of observations	Median fractions of shares sold (test/control/difference)	Test of H <sub>0</sub> : No difference between selling patterns of new and continuing fund managers (Z-score)	Test of H <sub>0</sub> : No difference in differential selling of losers and winners between new and continuing fund managers (Z-score) <sup>††</sup>
The quarter in which complete replacement ends (t=0)				
losers	565	0.619 / 0.135 / 0.484	(4.67)	-
winners	663	0.037 / 0.027 / 0.010	(4.69)	-
losers - winners	480	-	-	(2.56)
One quarter after the end of CR (t=1)				
losers	508	1.000 / 0.224 / 0.776	(5.72)	-
winners	548	0.250 / 0.030 / 0.220	(5.14)	-
losers - winners	406	-	-	(1.74)

Test group includes only funds that used to be managed by more than one manager before complete replacement

Momentum decile	Number of observations	Median fractions of shares sold (test/control/difference)	Test of H <sub>0</sub> : No difference between selling patterns of new and continuing fund managers (Z-score)	Test of H <sub>0</sub> : No difference in differential selling of losers and winners between new and continuing fund managers (Z-score) <sup>††</sup>
The quarter in which complete replacement ends (t=0)				
losers	178	1.000 / 0.166 / 0.834	(3.63)	-
winners	189	0.189 / 0.029 / 0.160	(4.22)	-
losers - winners	147	-	-	(3.51)
One quarter after the end of CR (t=1)				
losers	178	1.000 / 0.198 / 0.802	(4.09)	-
winners	181	0.291 / 0.026 / 0.265	(4.41)	-
losers - winners	152	-	-	(3.86)

†† This is a Z-statistic approximation of the Wilcoxon Rank Sum test