Do Stock Exchanges Corral Investors into Herding?

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Abstract

We study whether stock exchanges induce herding by examining a sample of firms that switch from NASDAQ to the NYSE. While trades on an exchange may display herd-like behavior due to comovement with aggregate variables, we argue that a *change* in listing venue is largely free of contemporaneous changes in such comovement, and allows us to isolate the influence of the listing locale on trading behavior. Our tests reveal that, following the switch, trades for the switching firms commove more strongly with NYSE trades and less strongly with NASDAQ trades, suggesting that investors in firms listed on either the NYSE or NASDAQ act as herds. A similar pattern is found for stock returns, with approximately one-half of the change in return comovement following the switch to the NYSE explained by the change in trading comovement. The results are not driven by changes in asset characteristics or fundamental cash flows, nor can they be explained away by differential speeds of information incorporation on the two exchanges. Overall, these patterns are not easily reconcilable with rational models of herding; instead, they appear more consistent with a habitat view of comovement proposed by Barberis, Shleifer and Wurgler (2005).

1 Introduction

Despite the central position of stock exchanges in the trading process, their influence on trading and price formation has not been fully explored. In this paper, we conduct a series of tests to study the extent to which a stock exchange induces herding behavior among its listed firms. We address this question by examining changes in the comovement of trades and returns for a sample of firms that switch from NASDAQ to the NYSE.

Herding behavior has been examined extensively in the areas of economics[1], physics[2], and sociology[3]. As one would expect with inquiries that span several disciplines, there is no clear consensus on the definition of herding in the literature; however, certain common themes emerge. First, herding is usually defined in terms of crowd behavior – that is, a group is defined as a herd if members of that group tend to move more strongly with each other than with the collective movement of other groups. Second, herding can be based on fundamentals or herding can be faddish. In the former case, imperfectly rational agents deduce information from the behavior of other agents in the herd perhaps because of the additional cost of obtaining or verifying information from outside the herd. Herding can be based on fads if agents behave irrationally and limits to arbitrage prevent prices from rapidly converging to fundamental values. Even rational informed agents may decide to ride the fad when fundamental information and/or arbitrage are costly.

In this paper, we take a somewhat agnostic view of the nature of herding on a stock exchange,

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[1] See Hirshleifer and Teoh (2001) for an excellent synthesis of the literature on herding based on information economics. For a behavioral economics slant, see Shiller (1989).
[2] See, among others, Sornette (2003a, 2003b), Sornette and Andersen (2002), and Lux and Sornette (2002), for models of herding based on what is sometimes referred to as econophysics. These models mimic the behavior of clustering in non-living objects.
[3] See Parker and Prechter (2001) for a socionomic perspective on herding.

and leave its resolution to future work. The more modest objectives in this paper are to look for the presence of herding on a stock exchange, and to study its impact on returns.

Rational models of asset pricing cannot easily explain why a switch in listing venue should bring about a change in trading comovement. In fact, an advantage of examining switches in exchange listings is that we can circumvent the question of the extent of herding prior to or even following the event, and focus instead on the *change* in herding induced by the switch to the new exchange. For example, while it is difficult to say whether trades in our sample firms display rational or excessive comovement with NASDAQ or NYSE trades before the switch to the NYSE, we can measure the *change* in comovement with NASDAQ and NYSE trades after the switch. Moreover, asset characteristics, cash flow comovement, and the rate of information incorporation for the switching firms remain unchanged, implying that the change of listing venue does not coincide with real changes in firm characteristics. We also do not find material changes in aggregate institutional ownership for the switching stocks.

Over a period of twelve years between 1988 and 2000, we examine a total of 536 firms that switch from NASDAQ to the NYSE. Using order imbalance to measure net trading activity, we find that after moving to the NYSE, firms start to trade more in sync with NYSE-listed firms and less so with the firms they leave behind on NASDAQ. Trades for a control sample of firms that qualify to list on the NYSE but choose to remain on NASDAQ do not display a change in comovement with either NASDAQ or NYSE trades. The contrasting patterns in the comovement of trades for the switching and control samples indicates that the results for the switching firms are unlikely to be driven by trends or by jumps in comovement coincident with the switch. The fact that the two samples share similar characteristics allays concerns that the switching firms are similar to NYSE stocks and this similarity accounts for common influences on trades.

It is possible that the change in trading comovement, although statistically significant, is of little economic consequence. To look into this issue, we examine changes in return comovement for the switching firms, and find similar patterns. That is, returns for the sample firms co-move more with returns for other NYSE firms, and less with returns for NASDAQ firms. Approximately half of the change in return comovement for the switching firms is associated with the change in trading comovement. The control sample of firms that do not switch exchanges shows no changes in return comovement.

Overall, these results support the notion that stock exchanges provide a natural herding environment, and are best understood in the context of studies documenting excess return comovement in a variety of settings.[4] Closed-end country fund returns commove more strongly with their listing market cohorts rather than with their home country stocks. Stocks in the S&P 500 index commove more with other index stocks than with stocks outside the index. As Pindyck and Rotemberg (1993) point out, it is difficult to reconcile such excess comovement with standard asset pricing models relying on comovement of fundamentals with aggregate macroeconomic variables.

Behavioral models of excess comovement, in particular work by Barberis, Shleifer and Wurgler (2005, hereafter BSW), do explain such herding behavior. BSW list three behavioral explanations for this phenomenon. First, investors sort assets into broad categories, and allocate funds at the level of these categories (and not directly at the individual security level). Second, they place their trades in known habitats, perhaps because of transaction costs, trading restrictions or lack of information. Last, differential speeds of information incorporation see some stocks

[4] A partial list of recent papers in this area includes Pindyck and Rotemberg (1993), Rashes (2001), Feng and Seasholes (2004), Barberis, Shleifer and Wurgler (2005), Kumar and Lee (2006), and Greenwood (2006).

parsing information more quickly into their prices than others, e.g. due to market frictions. In each case, coordinated demand driven by correlated sentiment or information arrival induces return comovement for groups of assets, generating classic herding behavior.

The rest of the paper is organized as follows. In Section 2 we describe the data and our sample. In Section 3, we examine changes in the comovement of trades following the switch to the NYSE. Section 4 documents the change in return comovement around the switch. Section 5 studies changes in fundamental (cash-flow) comovement. In Section 6, we consider alternative explanations for our findings. Section 7 concludes.

2 Sample and data

The tests in the paper focus on a sample of 536 NASDAQ common stocks that move to the NYSE between January 1988 and December 2000. This period corresponds to the availability of intraday data from the ISSM and TAQ databases. Using the Center of Research in Security Prices (CRSP) files, we select all firms that switch their listing venue from NASDAQ to the NYSE over this 13-year period. We examine ordinary common shares (share code 10 and share code 11) and exclude non-U.S. firms, real estate investment trusts, and closed-end funds. Firms are required to have CRSP price data and intraday trade and quote data for one year before and one year after the switching date, as well as data from COMPUSTAT. Using daily return data, we also study a broader sample of 1030 NASDAQ firms that switch to the NYSE between January 1973 and December 2004.

Our purpose is to isolate the excess comovement in trading and returns surrounding the exchange switching event. However, it is possible that investors are drawn to firms of a certain size or industry for reasons unrelated to the switch. For instance, it is possible for the returns of all NASDAQ stocks to display greater comovement with overall NYSE returns if the markets have become more integrated over time or NYSE returns capture economic prospects more closely than do NASDAQ returns. To isolate the effect of the exchange switch on comovement, we form a size, price and industry-matched control sample of firms that remain on NASDAQ. The matching procedure follows Huang and Stoll (1996). In addition to controlling for industry, share price, and size, the matching by switching date provides a natural control for trends in trading.

Figure 1 shows the breakdown by year of the full sample of 1030 firms that switch to the NYSE between 1973 and 2004. More firms switch to the NYSE during the 1990s than the 1980s, with peak activity between 1995 and 1998. There are fewer switches in 2000, similar to the first part of the 1980s, but the number of switches increases somewhat in 2001 and 2002. The distribution of switches to the NYSE across months is fairly stable, with the exception of December, which sees a slightly higher frequency of switches.

Summary statistics for the test and control samples are presented in **Table 1**. The financial variables are measured as of the fiscal year end prior to the move to the NYSE, while share turnover is measured over the twelve months ending two months before the move. The mean and median value of market-to-book are similar for the test and control firms – to the extent this ratio is a proxy for investment policy, the switching and control firms do not appear to be significantly different. Turnover, a measure of trading activity, is likewise similar for the two samples. Book assets and market equity are slightly higher for the test firms. Overall, the similarity of the values in Table 1 for the test and control samples indicates that our matching procedure works well, and increases our confidence that any difference in comovement is due to the switch in trading venue.

3 Herding in trades

We start by examining changes in the comovement of trades for the switching firm with NASDAQ trades and NYSE trades. Suppose that a stock *i*, previously listed on NASDAQ, starts trading on the NYSE. In the absence of herding on either exchange, the comovement of the stock's trades with aggregate NYSE and NASDAQ trades should be unaltered by the switch. However, if exchanges induce local herding, the firm's trades will commove more with NYSE trades and less with NASDAQ trades following the switch.

A widely-used measure of trading activity is order imbalance. This is calculated as the difference between buying and selling volume.[5] Buys and sells are identified using the Lee-Ready (1991) algorithm. Before applying this algorithm to the transaction data, we first exclude trades with negative prices, trades reported out of sequence, trades recorded before the open or after the close, and trades with special settlement conditions. Quotes that imply a negative spread are discarded as well. The Lee-Ready algorithm uses the first quote at least five seconds before each trade to classify the trade, with a transaction occurring above (below) the prevailing quote midpoint regarded as a purchase (sale). If a transaction occurs exactly at the quote midpoint, it is signed using the last non-zero transaction price change, as a buy if this price change is positive and a sell if it is negative. By convention, a buy is assigned a positive sign and a sell a negative sign.

[5] Two other measures of order imbalance are based on the number of trades and the value of trades. We repeat our analysis using these measures and arrive at identical conclusions.

For each stock, we calculate order imbalance as the difference between the volume of all buys and the volume of all sells in 15-minute intervals throughout the day, i.e. 9:30-9:45 a.m., 9:45-10:00 a.m., ..3:45-4:00 p.m. Where relevant, we aggregate order imbalance to the daily or weekly level. We standardize order imbalance for each interval (15-minute, daily or weekly) by total volume over that interval to make it comparable across stocks and through time. Thus, we study the fractional order imbalance at intraday, daily and weekly frequencies. The aggregate NYSE or NASDAQ imbalance is computed as the simple (equally-weighted) average of the imbalances for all ordinary shares trading in each market. In compiling these averages we exclude the order imbalance both of the firm whose imbalance is the dependent variable and of its industry. This reduces the likelihood of our mechanically finding an association between order imbalance for the switching stock and NYSE and NASDAQ imbalances.

We then estimate the following specification (1) for order imbalance (*OF*) for the switching stocks as well as for the control stocks.

$$\begin{aligned} OF_{i,t} = \alpha_{0i} + \alpha_{i1} D_1 &+ (\phi_i^{NYS} + \theta_i^{NYS} + \gamma_i^{NYS} \cdot D_1) OF_t^{NYS} \\ &+ (\phi_i^{NAS} + \theta_i^{NAS} + \gamma_i^{NAS} \cdot D_1) OF_t^{NAS} + \varepsilon_{i,t} \end{aligned} \tag{1}$$

Here, φ is the true comovement of stock i with the market, and θ is the excess comovement before the switch to the NYSE. After the switch (D=1), the change in comovement is represented by γ. To understand how we use the model above, assume for the moment that the true comovement parameters (φ^{NYS} and φ^{NAS}) do not change following the switch to the NYSE. For simplicity, we set $\beta = \varphi + \theta$, and set $\Delta\beta = \gamma$ and estimate equation 2. If $\Delta\beta^{NYS}$ and $\Delta\beta^{NAS}$ are both zero, we cannot say anything about whether or not stocks on the NYSE or NASDAQ display herding. However, if we find that $\Delta\beta^{NYS}>0$ and $\Delta\beta^{NAS}<0$, we can conclude that *either* there is excess comovement on NYSE after the switch, *or* there was excess comovement on NASDAQ before the switch.

$$OF_{i,t} = \alpha_{0i} + \alpha_{i1} D_1 + \beta_i^{NYS} OF_t^{NYS} + \beta_i^{NAS} OF_t^{NAS} + \Delta\beta_i^{NYS} OF_t^{NYS} D_1 + \Delta\beta_i^{NAS} OF_t^{NAS} D_1 + \varepsilon_{i,t} \quad (2)$$

In (2), $OF_{i,t}$ is the imbalance for stock i on day t, OF_t^{NYS} and OF_t^{NAS} are aggregate imbalances for the NYSE and NASDAQ and D_1 is a dummy that is one after the switch date for stock i and zero otherwise. In this specification, β_i^{NYS} and β_i^{NAS} measure the base, pre-switch level of comovement with NYSE and NASDAQ imbalances. Similarly, $\Delta\beta_i^{NYS}$ and $\Delta\beta_i^{NAS}$, the coefficients on the interaction terms, measure the change in comovement with NYSE and NASDAQ imbalances following the switch. Our main interest lies in the latter coefficients. In the absence of herding, these coefficients will be zero; otherwise, $\Delta\beta_i^{NYS}$ is expected to be positive and $\Delta\beta_i^{NASDAQ}$ negative. The model is estimated using order imbalance data from day -300 to day +300, measured relative to the date of the switch. We exclude days (-50, +50) around the event to remove any effects related to the actual switch. Thus, D_1=1 for trading days (+51, 300), and D_1=0 for day (–300, –51).

Table 2 presents the results for order imbalance measured over intraday (15-minute), daily and weekly windows. At each frequency, switching stocks see a sharp increase in the comovement of their order imbalance with the NYSE imbalance and a large reduction in the comovement with the NASDAQ imbalance. For the 15-minute imbalance, the mean slope on the NYSE imbalance increases from 0.10 to 0.53 after the switch, while the slope on the NASDAQ imbalance drops from 0.82 to 0.44. Looking at the daily imbalance, the mean NYSE slope increases from 0.27 to 0.84 while the mean NASDAQ slope declines from 0.64 to 0.18. The mean NYSE slope in the weekly imbalance regression rises from 0.40 to 0.80 and the NASDAQ slope drops from 0.47 to 0.14. These results show that trades for stocks switching to the NYSE display strong contemporaneous herding with NYSE trades, and an equally strong decoupling with NASDAQ trades.

It is possible that the NYSE listing criteria separate the switching stocks from those they leave behind on NASDAQ. To address this issue, we re-estimate (2) for the control sample of stocks that qualify to list on the NYSE, but choose not to. The coefficients measuring the changes in order imbalance comovement with NYSE and NASDAQ order imbalance are never significant at conventional levels, and are significantly smaller than the coefficients for the switching sample.[6] The magnitudes of the control sample means are usually no more than one-tenth as large as those for the switching stocks. The positive slope on the NYSE order imbalance suggests that, even though comovement with the NASDAQ imbalance is appreciably stronger for NASDAQ stocks, the imbalance also commoves with the aggregate NYSE imbalance. This is consistent with broad U.S. market-based comovement.

The results in **table 2** show that an exchange listing by itself induces comovement in trades. Before a stock switches to the NYSE, its order imbalance commoves strongly with the NASDAQ order imbalance and relatively weakly with that on the NYSE. After the switch, comovement with the NASDAQ imbalance shrinks appreciably while that with the NYSE imbalance increases dramatically. In the next section, we examine whether a similar pattern exists for returns, and measure the extent to which shifts in the comovement in imbalances induce shifts in return

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[6] The only exception is the change in the NASDAQ slope at the weekly horizon. Even here, the control sample mean is less than 50% as large as the switching sample mean.

comovement.

4 Herding in Returns

We have shown that comovement in imbalances changes dramatically following the switch to the NYSE. The economic importance of this change in comovement rests on the extent to which it induces comovement in returns. To the extent that imbalances affect prices (e.g. due to downward-sloping demand curves), we should see a similar pattern in return comovement. On the other hand, returns are noisy, and it might be more difficult to detect the traces of order imbalances in returns. We examine return comovement via an analogous regression to (2).

$$R_{i,t} = \alpha_{0i} + \alpha_{i1} D_1 + \beta_i^{NYS} R_t^{NYS} + \beta_i^{NAS} R_t^{NAS} + \Delta\beta_i^{NYS} R_t^{NYS} D_1 + \Delta\beta_i^{NYS} R_t^{NAS} D_1 + \varepsilon_{i,t} \quad (3),$$

where $R_{i,t}$ is the return on day t for stock i, R_t^{NYS} and R_t^{NAS} are the day t equally-weighted NYSE and NASDAQ returns (excluding $R_{i,t}$), and D1 is as before, a dummy variable that is one after the switch date for stock i and zero otherwise. As in (2), β_i^{NYS} and β_i^{NAS} measure the base, pre-switch levels of return comovement with NYSE and NASDAQ returns, while $\Delta\beta_i^{NYS}$ and $\Delta\beta_i^{NAS}$ measure the change in comovement with NYSE and NASDAQ returns following the switch. If the switch in exchanges induces a change in return comovement, we expect to see $\Delta\beta_i^{NYS} > 0$ and $\Delta\beta_i^{NAS} < 0$. We estimate (3) using daily return data from day -300 to day +300, measured relative to the date of the switch, and, as in (2), exclude days (-50, +50).

Table 3 presents the mean coefficient estimates from this model estimated for daily returns, and t-tests of the null hypothesis that the mean is significantly different from zero. The period that we study in detail, 1988-2000, sees an average increase in the daily NYSE beta of 0.14 (t-statistic of 3.70) and an average decline of 0.20 (t-statistic of 5.3) in the daily NASDAQ beta for the switching stocks. That is, a stock moving from NASDAQ to the NYSE sees its NYSE beta rise from 0.72 to 0.86 and its NASDAQ beta decline from 0.51 to 0.31. When we break the 1988-2000 period into subperiods (1988-1995 and 1996-2000), similar patterns emerge. The mean NYSE beta shift is significantly above zero in both sub-periods and slightly larger in the second sub-period; the mean NASDAQ beta shift is negative and significant in both sub-periods and slightly more so in the first sub-period.

Over this period, we measure the shift in betas for the sample of control stocks. The mean shift in the NYSE beta (-0.03) and in the NASDAQ beta (-0.03) are insignificantly different from zero for the 1988-2000 period, nor are these coefficients significant in either sub-period.[7] The difference between the test and control sample means is always large in economic terms, and usually significant at better than the 5% level. The fact that comovement is unchanged for the matched sample of control firms suggests that firm characteristics and industry affiliation are unlikely to be driving the changes in comovement with NASDAQ and NYSE market returns documented for the switching sample.

We also estimate (3) for firms that switch to the NYSE over an extended period, 1973-2004 (we do not construct a control sample for this period). Since NASDAQ was formed in 1973, this is the longest possible period of study. The effects are similar to those observed in the 1988-2000 period. Switching stocks see their NYSE beta increase by 0.16, on average (t-statistic of 6.2), while the mean NASDAQ beta declines by 0.25 (t-statistic = -8.6). Thus, the patterns observed in the shorter sample period are also present in a substantially longer period, one that predates

[7] Untabulated results based on medians instead of means are identical.

electronic transactions, significant individual investor participation as well as the technology bubble, and includes more varied economic conditions. This suggests that the documented effects have persisted through time.

One concern with these results is that the switch coincides with other events that induce comovement. It is particularly important to rule out index additions, given BSW's evidence that stocks added to the S&P 500 see increased betas on the S&P index return. We exclude the 13 stocks added to the S&P 500 index in the one year after the switch and repeat the above analysis. We find that the mean NYSE and NASDAQ beta shifts for the remaining stocks are similar to those in the full sample, and are highly significant. As a result, the change in comovement is not mechanically driven by the inclusion in the S&P 500 index of a few of the stocks in our test sample.

In order to assess the strength of herding at different frequencies, we examine intraday and weekly return comovement. Since herding or fad-induced pricing errors should be corrected over time, comovement is expected to be stronger at higher frequencies. This analysis is carried out over the period 1988–2000. We proceed by calculating 15-minute mid-quote returns (using ISSM and TAQ data) for the switching firms and all ordinary common shares on the NYSE and NASDAQ, and then re-estimating model (3) using the 15-minute returns. Weekly and daily returns are similarly computed using quote midpoints. The NYSE and NASDAQ market returns in this regression are constructed as equally-weighted averages of the returns to all constituent stocks. We exclude all firms belonging to the industry of the switching (or control) firm from the aggregate NYSE and NASDAQ returns.[8] If a switching firm's industry has greater representation on the NYSE, increased return comovement with the NYSE could be entirely

[8] This is accomplished by defining two-digit industries for all stocks, following Lewellen (2002).

rational (driven by common news about industry cash flows or risks). Dropping the industry of the switching firm eliminates this source of comovement. As before, we exclude the switching (or control) firm's returns from the NYSE and NASDAQ market returns.

Table 4 presents the results. Panel B shows that the mean change in the daily NYSE (NASDAQ) beta for the test sample is 0.15 (-0.20), very similar to the values in Panel B of Table 4, that correspond to the same period but with industry returns not excluded from the aggregate NYSE and NASDAQ returns. The control sample beta changes are also similar to those reported in Table 4. Panel A contains the intraday (15-minute) betas. The changes in the intraday betas for the test sample, 0.19 for the NYSE beta and -0.44 for the NASDAQ beta, are more pronounced than the changes in the daily betas. The larger values of the intraday beta shifts are consistent with the notion that high frequency prices are more susceptible to herding effects. Panel C contains the results at the weekly frequency. The mean change in the weekly NYSE beta for the test sample is 0.21, slightly larger than the change in the intraday beta, while the mean change in the weekly NASDAQ beta is -0.23, half as large as the intraday beta shift and comparable to the change in the daily beta. None of the beta shifts for the control sample is statistically significant or large in economic terms.

Note that the beta shifts do not become smaller (in absolute value) as the return measurement horizon changes from intraday to daily to weekly. Thus, our evidence suggests that herding-induced pricing errors take longer than one week to be corrected.[9] Most important, there is a striking shift in return comovement for firms that switch from NASDAQ to the NYSE at every frequency, with returns becoming more sensitive to aggregate NYSE returns and less sensitive to aggregate NASDAQ returns.

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[9] Since we only examine one year before and after the switch, we do not repeat the analysis using monthly returns.

To this point, our results have not zeroed in on the change in comovement around the exact date of the switch. A herding-based explanation for the influence of exchanges on trading and returns would be more compelling if the beta shift occurs immediately after the switch. Since it is difficult to precisely estimate betas using short time-series, we estimate daily return betas for the switching stocks over non-overlapping six-month intervals, measured relative to the month of the move: [-12,-7], [-6,-1], [+1,+6], [+7,+12]. A two-month window centered on the switching date is excluded from this analysis. We should see a sharp increase in the NYSE beta and a corresponding decline in the NASDAQ beta in the third window relative to the second window, and the betas should be relatively stable between the third and fourth and between the first and second windows.

The results (not tabulated to save space) reveal that the mean NYSE beta in the four windows is 0.59, 0.62, 0.74 and 0.75, while the mean NASDAQ beta is 0.55, 0.64, 0.43 and 0.37. T-tests show that the mean NYSE and NASDAQ betas over [+1,+6] are significantly different from the mean betas over [-6,-1], as are the means over [+7,+12] relative to the means over [-12,-7]. However, the mean betas over [+7,+12] are no different from those over [+1,+6], nor are the betas over [-6,-1] in relation to those over [-12,-7]. Thus, the change in the beta is confined to windows immediately adjoining the date of the switch. This supports the conclusion that the changes in comovement documented in Table 3 and Table 4 are associated with the exchange switch, rather than reflecting more general trends in comovement for these stocks. In short, herding with the new locale increases, with a concomitant decoupling in relation to the group of stocks left behind.

Having identified strong shifts in comovement in trading, we now address the question of how much of the change in return comovement can be explained by the change in the comovement of order imbalances. We proceed in two steps. First, we compute the residual return for every switching stock via a regression of its return on its order imbalance. To minimize the effects of feedback from returns to trades, the regression is run and the residuals computed at the 15-minute horizon. We also do this for every ordinary common stock on the NYSE and NASDAQ, and thereby form an equally-weighted aggregate residual return for each market. In the second step, we regress the residual return for the switching stock on the aggregate residual return for the NYSE and NASDAQ. As in the earlier tables, we estimate this model using 15-minute, daily and weekly residual returns. The daily and weekly residual returns are constructed by summing the 15-minute residual returns for each stock for the entire day or week.[10]

We then estimate (3) using residual returns. **Table 5** contains the results. In almost each case, the changes in the NYSE and NASDAQ slope coefficients in the residual return regressions are appreciably smaller than the changes in the raw return regressions in Table 4. The mean change in the NASDAQ beta is -0.15 for intraday returns, -0.10 for daily returns and -0.05 for weekly returns. While the intraday and daily changes in the NASDAQ beta are still statistically significant, the weekly change is no longer significant at conventional levels; additionally, the difference between the change in the daily betas for the switching and control samples is only marginally significant (p-value=0.09). It is of interest to note that the magnitude of the slope shift is one-quarter to one-half as large as the corresponding slope shift using raw returns in Table 4. Residual comovement with the NYSE return provides similar results, the only exception being the intraday beta shift of 0.20, which is similar to the value in Table 4. By contrast, the daily and

[10] To obtain the NYSE and NASDAQ residual return series, we estimate the regressions by stock and year. Note that, while the time-series average residual for each stock will be zero in each year, neither it nor the equally-weighted NYSE or NASDAQ residual return is constrained to be zero in any 15-minute interval.

weekly beta changes, 0.11 and 0.09, are 33% and 60% smaller than those computed using raw returns.

An examination of the pre-switch betas based on residual returns in Table 5 shows that these are also lower in almost every case than the corresponding values based on raw returns in Table 4. Thus, trading can explain a portion of not only the changes in comovement but also the levels of comovement prior to the switch. To our knowledge, the effect of trading on return betas has not been documented in the literature.

There are two important messages from this analysis. First, once the comovement in trading is taken into account, the remaining comovement in returns is significantly weaker. This suggests that herding in trades on the new exchange has non-trivial pricing effects, accounting for almost half of the change in return comovement associated with the switch. Since behavioral models of excess comovement are rooted in sentiment-based trades, these results can be interpreted as providing support for friction or sentiment-based models of comovement. Nevertheless, residual (non-trade) returns show increased comovement with residual NYSE returns and reduced comovement with residual NASDAQ returns following the switch. Thus, herding in trading cannot entirely explain the shift in return comovement documented in Table 4, and we are left to conclude that at least a portion of return herding arises elsewhere. Below, we investigate other explanations for the change in return comovement documented in this section.

5 Cash flow comovement

Rational herding on stock exchanges (for both trades and returns) can result from greater alignment of cash flows for the firms that list there. In our setting—where firms voluntarily shift exchanges—one reason that firms might switch to the NYSE is that they start to resemble other firms trading there. Perhaps these firms see increased cash flow covariance with cash flows for other NYSE firms and then decide to move. Our earlier analysis has attempted to control for such effects by excluding the firm's industry from our calculations, and by providing results for a control sample of industry, price and size-matched firms. Additionally, there is no evidence of a gradual increase in return comovement, expected in an efficient market where returns anticipate cash flows. In this section, we attempt to formally rule out changes in cash flow comovement as the source of our results.

For each switching (and control) firm, we calculate quarterly cash flow as EBIDT/Assets, and also compute a similarly defined equally-weighted cash flow across NYSE and NASDAQ firms. We do this for the eight quarters (two years) before, and 12 quarters (three years) after, the switch and then estimate a panel regression of firm cash flow on NYSE and NASDAQ cash flow:

$$CF_{i,t} = \alpha_{0i} + \alpha_i D_{i,t} + \beta_i^{NYS} CF_{i,t}^{NYS} + \beta_i^{NAS} CF_{i,t}^{NAS} + \Delta\beta_i^{NYS} CF_{i,t}^{NYS} D_{i,t} + \Delta\beta_i^{NAS} CF_{i,t}^{NAS} D_{i,t} + \varepsilon_{i,t} \qquad (4),$$

where $CF_{i,t}$ is the quarterly cash flow for stock *i*, $CF_{i,t}^{NYS}$ and $CF_{i,t}^{NAS}$ are the quarterly equally-weighted cash flow indices for the NYSE and NASDAQ (calculated excluding cash flows for firm *i* and its industry cohorts), $D_{i,t}$ is a variable equal to 1 for the quarters following the switching date and 0 beforehand. The specification is estimated with firm- and year-fixed effects and applies the Huber-White clustering correction to the standard errors.

The results, presented in **Table 6**, show that there is no material change in cash flow comovement. For the test sample, cash flow comovement with NYSE cash flow is insignificant both before and after the switch. Comovement with NASDAQ cash flow is positive before the switch and declines afterward, but neither effect is statistically significant. The lack of significance of the pre-switch NYSE coefficient is also of relevance since it casts doubt on the idea that firms move to the NYSE after seeing increased cash flow comovement with other NYSE firms. The patterns for the control sample are also not statistically significant.

Overall, we do not find any evidence of a change in cash flow comovement with the cash flows for stocks on either the old exchange or the new exchange. This is at odds with a fundamentals-based explanation for the change in comovement around the switch, and suggests a behavioral explanation for herding on exchanges. In the remainder of the paper, we look for evidence to support this herding explanation.

6 Behavioral explanations for herding

Herding can arise if investors use heuristics to make broad asset allocation decisions based on identifiable groups, as modeled in BSW. They list three behavioral explanations that apply to herding. First, investors sort assets into broad categories, and allocate funds at the level of these categories (and not directly at the individual security level). Second, they place their trades in known habitats, perhaps because of transaction costs, trading restrictions or lack of information. Last, differential speeds of information diffusion see some stocks incorporating information more quickly into their prices than others, e.g. due to market frictions. In each case, coordinated demand driven by correlated sentiment or information arrival induces return comovement for groups of assets.

Following BSW, we can empirically address the information diffusion hypothesis. This is essentially a lagged beta (equivalently, a sum of beta) explanation. Before the move, a NASDAQ stock reacts slowly to NYSE news, and therefore has positive betas on lagged NYSE returns, while the contemporaneous beta is relatively low. After the move, the speed of adjustment to NYSE news increases. Consequently, the lagged betas decline and the contemporaneous beta increases.

We proceed by adjusting the betas for lags in price adjustment. Specifically, we add five leads and lags of NYSE and NASDAQ returns to specification (3) when examining daily returns and one lead and lag when examining weekly returns, and interact these terms with the post-switch dummy. Under the information diffusion hypothesis, we expect the lagged NYSE betas to be positive and the coefficients on the lagged interaction terms to be negative.

Table 7 presents the mean coefficients on the leading and lagged NYSE and NASDAQ returns. In interpreting the coefficients note that, for instance, the row labeled *t-5* shows the mean coefficients on the NYSE and NASDAQ returns five days before the stock return is measured. The interaction coefficients on the lagged NYSE returns are not significant with the exception of the lag 2 coefficient, which is positive, i.e. of the opposite sign to that predicted by the information diffusion model. The interaction coefficients on the leading NYSE returns are of mixed signs with those on lead 2 and lead 5 being significant. The sum of the contemporaneous and lagged NYSE betas is 0.57 before the switch compared to 0.88 afterwards; similarly, the sum of the contemporaneous, lead and lagged NYSE betas is 0.55 before the switch and 0.93 afterwards. Looking at the NASDAQ betas, the coefficient on NASDAQ returns is negative at lag 2 and is positive at lead 5, but the overall change in the NASDAQ beta with lags and leads is slightly more negative than in Table 4 (-0.29 versus -0.20). Thus, the incorporation of leads and lags of NYSE and NASDAQ returns does not change the conclusion that the NYSE beta increases while the NASDAQ beta declines. A similar pattern is revealed by the weekly returns.

There is no evidence of an improvement in the speed of adjustment to the previous week's NYSE return: the change in the lagged beta is 0.04 and insignificantly different from zero. Incorporating leads and lags of daily and weekly market returns for the control sample, we find that the change in these betas is insignificant.

The results of this analysis indicate that stocks that switch to the NYSE do not see an improvement in the speed of adjustment to NYSE news. This is at odds with the information diffusion hypothesis.[11] Rather, our results appear most consistent with a habitat model of comovement. In other words, the excess comovement that we document here is not based on rational models of herding. Rather, we suspect that stock exchanges themselves induce herding behavior among the listed firms. Whether such inducement reflects broader asset allocation heuristics followed by investors (as in BSW) is something we leave for future research.

7 Concluding comments

Using a sample of 536 stocks that switch from NASDAQ to the NYSE over 1988-2000, we examine the extent to which exchanges induce herding in trades and returns. We find that once a stock changes its trading location, its trades and returns start to move more with those in the new market and less with those in the old market. The changes in comovement are evident over several measurement windows, and are not visible for a matched sample of control firms.

We are able to exclude the possibility that the patterns in comovement are due to changes in

[11] It is perhaps not surprising that our results are less supportive of the information diffusion model than those in BSW. Their index addition/exclusion event is accompanied by a large change in trading activity, while our experiment does not see changes in trading activity on anywhere near the same scale. The effects on the speed of adjustment are thus expected to be muted.

the comovement of switching firm cash flows with NYSE and NASDAQ cash flows. Additionally, changes in the speed of response to NYSE or NASDAQ information do not appear to be responsible for these changes in comovement. Our evidence seems most consistent with behavioral models of comovement that hinge on correlated, sentiment driven trading. In particular, a plausible interpretation of our results is that investors view stock exchanges as separate habitats. Thus, when a stock switches from NASDAQ to the NYSE, it sees investor trading in concert with other stocks on the NYSE, and a corresponding decoupling of trades with those of NASDAQ stocks. Our findings identify a comovement effect of stock exchange listings hitherto unexamined in the literature, and provide additional and broader support for behavioral models of herding.

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Figure 1: Distribution of the switches from NASDAQ to the NYSE

This table shows the number of firms that changed their trading location from NASDAQ to NYSE. Using the Center of Research in Security Prices (CRSP) data, we select all firms whose exchange listing variable for common stock (share code 10 and share code 11) changes from NASDAQ to the NYSE within out interval of interest. We present the number of firms for the full sample (1,030 firms that switched exchanges between 1973 and 2004) and for the test sample (536 firms that switched exchanges between 1988 and 2000 and for which an industry and size matched control firm was found). To enter the full sample of 1,030 firms, a stock must have price data in CRSP for one year before and one year after the switching date. To enter the test sample a firm is required to have CRSP price data and intra-day trade data in ISSM / TAQ for one year before and one year after the switch, as well as book equity data from COMPUSTAT. Non–U.S. firms, real estate investment trusts, and closed-end funds are excluded from the sample.

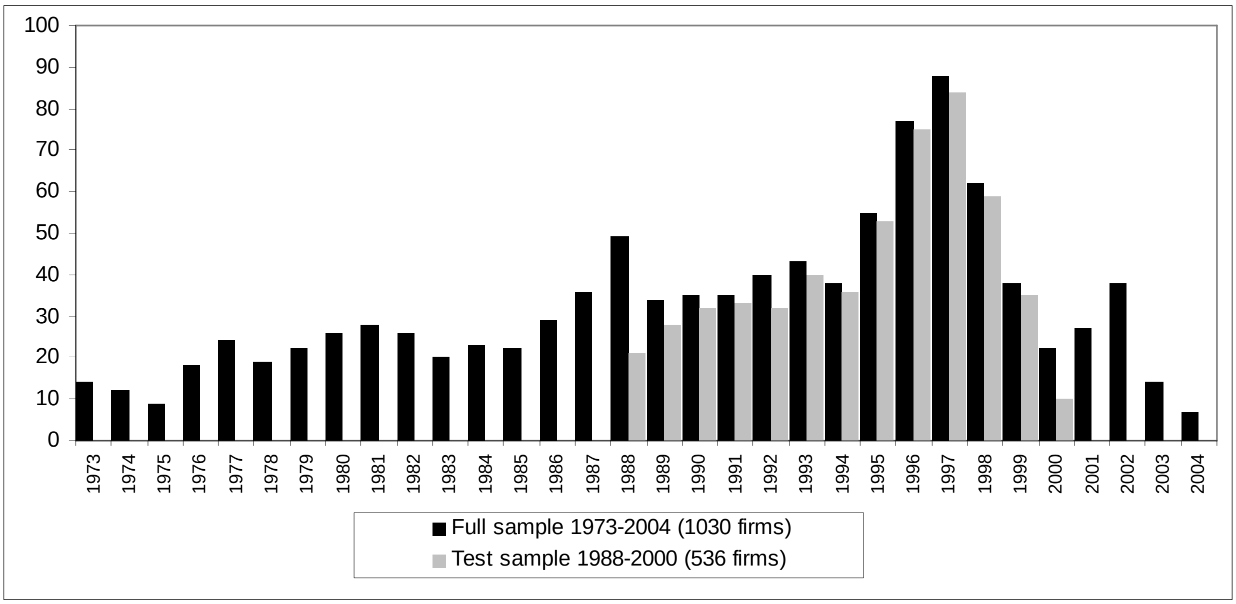

Table 1: Descriptive statistics for firms that switch listings from NASDAQ to the NYSE

The table presents summary characteristics for the test sample and the control sample. The test sample includes stocks that switch listings from NASDAQ to NYSE during 1988–2000. The control firms are the non-event firms on NASDAQ matched by size and industry. The samples are restricted to stocks that have available price data for the estimation window of (-300, +300) trading days around the event. The matching procedure is as follows. We first find all firms with common stock as share code recorded in CRSP that remain traded on NASDAQ. We obtain fiscal year-end data on price and book equity for these firms from COMPUSTAT and their industry affiliation from CRSP. We delete firms with negative values of book equity or stock price, and calculate the market value of equity as our proxy for size. For each event firm that switches to the NYSE at date t, we retain as control firms that are in the same industry based on two-digit SIC. We eliminate potential pairs for which the price levels are too far apart. For each remaining available firm in the control sample, we calculate the Huang and Stoll (1998) size score, and select the control firm with the lowest score value. Assets, market to book ratio, market value of equity and stock price are measured at the end of the most recent fiscal year prior to the switching date. Turnover is measured as mean over one year preceding the switching date and not the including two months before the event date. Institutional ownership is measured one quarter prior to the event date.

	Share Price, $		Volume Turnover		Total Assets		Market to Book		Market Value of Equity		Institutional Investors Ownership	
	Test	**Control**	**Test**	**Control**	**Test**	**Control**	**Test**	**Control**	**Test**	**Control**	**Test**	**Control**
Q1	16.25	11.88	1.30	0.90	155	88	1.65	1.59	181	129	29%	20%
Median	22.31	19.50	2.43	2.22	331	205	2.46	2.46	345	252	45%	37%
Mean	25.57	22.52	3.35	3.17	1783	1223	3.13	3.68	756	577	46%	38%
Q3	32.63	29.00	4.41	4.12	968	523	3.65	3.95	729	520	61%	55%

Table 2: Order flow comovement before and after firms switch from NASDAQ to the NYSE

The table presents estimates of the following model:

$$OF_{i,t} = \alpha_{0i} + \alpha_i D_{i,t} + \beta_i^{NYS} OF_{i,t}^{NYS} + \beta_i^{NAS} OF_{i,t}^{NAS} + \Delta\beta_i^{NYS} OF_{i,t}^{NYS} D_{i,t} + \Delta\beta_i^{NAS} OF_{i,t}^{NAS} D_{i,t} + \varepsilon_{i,t}$$

$OF_{i,t}$ is the 15min/daily/weekly order flow for stock *i*, $OF_{i,t}^{NYS}$, $OF_{i,t}^{NAS}$ are NYSE and NASDAQ 15min/daily/weekly equally-weighted industry-adjusted market order flow indexes (excluding $OF_{i,t}$). $D_{i,t}$ is a variable equal to 1 for the trading days after the switching date and 0 before. All transactions are classified as buys and sells (using the Lee-Ready (1991) algorithm and order flow is calculated as (buy volume – sell volume) / (buy volume + sell volume). Panel A is based on 15-minute order flow, Panel B on daily order flow and Panel C on weekly order flow. For each stock *i* (test and control), the specification is estimated over (-300, +300) trading days around the event, and not including (-50, +50) around the listing date. The values reported are means along with their t-statistics. The p-values for a two-side test on the difference in means are provided. The test sample includes stocks that move from NASDAQ to NYSE between 1988 and 2000. The control firms are the non-event firms on NASDAQ matched on size and industry.

	Intercept	α_1	β^{NYS}	β^{NAS}	$\Delta\beta^{NYS}$	$\Delta\beta^{NAS}$
Panel A: Intraday OF						
Test sample	0.01	0.04	0.10	0.82	0.43	-0.38
	1.16	*6.75*	*8.12*	*41.69*	*25.38*	*-14.49*
Control sample	-0.02	-0.01	0.05	0.89	0.06	0.00
	-2.57	*-1.03*	*3.39*	*35.47*	*1.55*	*0.04*
Test of means (p-values)	0.01	0.00	0.01	0.04	0.00	0.00
Panel B: Daily OF						
Test sample	0.03	0.00	0.27	0.64	0.57	-0.46
	4.44	*0.52*	*9.47*	*15.54*	*12.52*	*-7.94*
Control sample	0.01	-0.02	0.23	0.73	-0.02	-0.10
	1.77	*-2.51*	*7.69*	*15.88*	*-0.43*	*-1.68*
Test of means (p-values)	0.68	0.01	0.20	0.06	0.00	0.01
Panel C: Weekly OF						
Test sample	0.01	0.02	0.40	0.47	0.40	-0.33
	0.74	*0.93*	*5.55*	*6.40*	*3.92*	*-3.09*
Control sample	0.02	-0.03	0.23	0.67	0.01	-0.15
	1.28	-2.02	2.71	8.23	0.06	-1.52
Test of means (p-values)	0.62	0.03	0.11	0.07	0.00	0.23

Table 3: Daily return comovement before and after firms switch from NASDAQ to the NYSE

The table presents estimates of the following model:

$$R_{i,t} = \alpha_{0i} + \alpha_i D_{i,t} + \beta_i^{NYS} R_{i,t}^{NYS} + \beta_i^{NAS} R_{i,t}^{NAS} + \Delta\beta_i^{NYS} R_{i,t}^{NYS} D_{i,t} + \Delta\beta_i^{NAS} R_{i,t}^{NAS} D_{i,t} + \varepsilon_{i,t}$$

$R_{i,t}$ is the daily return on stock *i*, $R_{i,t}^{NYS}$, $R_{i,t}^{NAS}$ are NYSE and NASDAQ daily equally-weighted market return indexes (excluding $R_{i,t}$). $D_{i,t}$ is an indicator variable equal to 1 for the trading days after the switching date and 0 before. For each stock i, the specification is estimated over (-300, +300) trading days around the event, and not including (-50, +50) around the listing date, to avoid any return effect of the actual event. The values reported are means along with their t-statistics. The estimations are based on daily close-close returns obtained from CRSP database. Panel A presents the estimates from the above specification for the full sample for the extended time interval 1973–2004. Panels B, C and D present the estimates from the above specification for the test sample and the control sample. The p-values for a two-side test on the difference in means are provided. The test sample includes stocks that move from NASDAQ to NYSE between 1973–2004 (Panel A) and between 1988–2000 (Panel B, C and D). The control firms are the non-event firms on NASDAQ matched on size and industry.

	Intercept	α_1	β^{NYS}	β^{NAS}	$\Delta\beta^{NYS}$	$\Delta\beta^{NAS}$
Panel A: 1973 – 2004						
Test sample	0.00	0.00	0.71	0.55	0.16	-0.25
	7.26	*-8.69*	*29.80*	*21.27*	*6.20*	*-8.60*
Panel B: 1988 – 2000						
Test sample	0.00	0.00	0.72	0.51	0.14	-0.20
	5.10	*-6.66*	*22.33*	*15.07*	*3.69*	*-5.30*
Control sample	0.00	0.00	0.56	0.71	-0.03	-0.03
	-2.47	*-2.82*	*15.63*	*18.66*	*-0.60*	*-0.52*
Test of means (p-values)	*0.00*	*0.02*	*0.00*	*0.00*	*0.01*	*0.01*
Panel C: 1988 – 1995						
Test sample	0.00	0.00	0.68	0.58	0.12	-0.22
	1.57	*-4.25*	*16.03*	*12.67*	*2.62*	*-4.09*
Control sample	0.00	0.00	0.52	0.73	-0.01	-0.03
	-2.91	*-2.03*	*10.54*	*15.40*	*-0.18*	*-0.36*
Test of means (p-values)	*0.00*	*0.21*	*0.01*	*0.03*	*0.09*	*0.05*
Panel D: 1996 – 2000						
Test sample	0.00	0.00	0.76	0.43	0.16	-0.18
	5.80	*-5.15*	*15.63*	*8.78*	*2.62*	*-3.39*
Control sample	0.00	0.00	0.61	0.69	-0.05	-0.03
	-0.84	*-1.95*	*11.56*	*11.48*	*-0.71*	*-0.40*
Test of means (p-values)	*0.00*	*0.05*	*0.03*	*0.00*	*0.02*	*0.08*

Table 4: Return comovement before and after firms switch from NASDAQ to the NYSE (with industry correction for market indexes)

The table presents estimates of the following model:

$$R_{i,t} = \alpha_{0i} + \alpha_i D_{i,t} + \beta_i^{NYS} R_{i,t}^{NYS} + \beta_i^{NAS} R_{i,t}^{NAS} + \Delta\beta_i^{NYS} R_{i,t}^{NYS} D_{i,t} + \Delta\beta_i^{NAS} R_{i,t}^{NAS} D_{i,t} + \varepsilon_{i,t}$$

$R_{i,t}$ is the 15min/daily/weekly return for stock i, $R_{i,t}^{NYS}$, $R_{i,t}^{NAS}$ are NYSE and NASDAQ 15min/daily/weekly equally-weighted industry-adjusted market return indexes (excluding $R_{i,t}$). $D_{i,t}$ is an indicator variable equal to 1 for the trading days after the switching date and 0 before. For each stock i, the specification is estimated over (-300, +300) trading days around the event, and not including (-50, +50) around the listing date, to avoid any return effect of the actual event. The values reported are means along with their t-statistics. The estimations are based on TAQ and ISSM midquotes. Panel A is based on 15-minute returns; Panel B is based on daily close-close returns; Panel C is based on close-close weekly returns. The table presents the estimates from the above specification for the test sample and the control sample and the p-values for a two-side test on the difference in means are provided. The test sample includes stocks that move from NASDAQ to NYSE between 1988 and 2000. The control firms are the non-event firms on NASDAQ matched on size and industry.

	Intercept	α_1	β^{NYS}	β^{NAS}	$\Delta\beta^{NYS}$	$\Delta\beta^{NAS}$
Panel A: Intraday returns						
Test sample	0.00	0.00	0.38	0.75	0.19	-0.44
	-2.45	*-5.81*	*18.93*	*19.00*	*8.56*	*-11.91*
Control sample	0.00	0.00	0.40	0.72	0.02	-0.03
	-6.83	*-0.11*	*17.54*	*19.94*	*0.75*	*-0.70*
Test of means (p-values)	0.00	0.14	0.49	0.63	0.00	0.00
Panel B: Daily returns						
Test sample	0.00	0.00	0.60	0.60	0.15	-0.20
	2.76	*-5.41*	*20.44*	*16.07*	*3.76*	*-4.53*
Control sample	0.00	0.00	0.54	0.68	0.03	-0.08
	-2.98	*-2.58*	*16.61*	*18.67*	*0.74*	*-1.85*
Test of means (p-values)	0.00	0.08	0.14	0.10	0.04	0.06
Panel C: Weekly returns						
Test sample	0.00	0.00	0.66	0.55	0.21	-0.23
	5.14	*-6.70*	*12.86*	*9.95*	*3.06*	*-3.37*
Control sample	0.00	0.00	0.53	0.66	0.02	-0.11
	-1.42	*-1.87*	*9.23*	*11.22*	*0.30*	*-1.44*
Test of means (p-values)	0.00	0.00	0.10	0.16	0.07	0.25

Table 5: Residual return comovement before and after firms switch from NASDAQ to the NYSE

The table presents estimates of the following model:

$$RES_{i,t} = \alpha_{0i} + \alpha_i D_{i,t} + \beta_i^{NYS} RES_{i,t}^{NYS} + \beta_i^{NAS} RES_{i,t}^{NAS} + \Delta\beta_i^{NYS} RES_{i,t}^{NYS} D_{i,t} + \Delta\beta_i^{NAS} RES_{i,t}^{NAS} D_{i,t} + \varepsilon_{i,t}$$

$RES_{i,t}$ is the 15min/daily/weekly residual on stock i, $RES_{i,t}^{NAS}$, $RES_{i,t}^{NYS}$ are NYSE and NASDAQ 15min/daily/weekly equally-weighted industry adjusted market indexes of residuals (excluding $RES_{i,t}$). $D_{i,t}$ is an indicator variables equal to 1 for the trading days after the switching date and 0 before. The analysis is developed in two stages. First, we compute residual returns for every switching stock from a regression of returns on own order imbalance over 15-minute intervals. We do this for every ordinary common stock on the NYSE and NASDAQ, and thereby form equally–weighted non-trading residual return index. In the second stage, we regress residual returns for the switching stock on aggregate non-trading returns for the NYSE and NASDAQ. The intraday regression uses 15-minute residual returns (Panel A). The daily and weekly regressions (Panel B and C) use residuals built up from the intraday residual returns by summing the 15–minute returns for the entire day or week for each stock. For each stock i, the above specification is estimated over (-300, +300) trading days around the event, not including (-50, +50) trading days around the listing date. The values reported are means along with their t-statistics. The p-values for a two-side test on the difference in means are provided. The test sample includes stocks that move from NASDAQ to NYSE between 1988 and 2000. The control firms are the non-event firms on NASDAQ matched on size and industry.

	Intercept	α_1	β^{NYS}	β^{NAS}	$\Delta\beta^{NYS}$	$\Delta\beta^{NAS}$
Panel A: Intraday						
Test sample	0.00	0.00	0.41	0.31	0.20	-0.15
	-0.20	*1.00*	*26.90*	*26.24*	*9.63*	*-10.20*
Control sample	0.00	0.00	0.43	0.36	0.02	-0.02
	-1.93	*0.28*	*26.33*	*28.10*	*1.04*	*-1.29*
Test of means (p-values)	0.18	0.65	0.32	0.01	0.00	0.00
Panel B: Daily						
Test sample	0.00	0.00	0.43	0.48	0.11	-0.10
	0.84	*1.05*	*18.44*	*22.07*	*3.68*	*-3.75*
Control sample	0.00	0.00	0.44	0.53	-0.01	-0.03
	0.12	*0.52*	*17.18*	*22.00*	*-0.33*	*-1.07*
Test of means (p-values)	0.64	0.79	0.80	0.14	0.01	0.09
Panel C: Weekly						
Test sample	0.00	0.00	0.37	0.55	0.09	-0.05
	0.06	*1.02*	*13.03*	*18.25*	*2.55*	*-1.34*
Control sample	0.00	0.00	0.39	0.58	-0.07	-0.01
	-0.29	*0.13*	*9.45*	*13.87*	*-1.21*	*-0.21*
Test of means (p-values)	0.78	0.71	0.65	0.60	0.02	0.57

Table 6: Tests of the information diffusion model

Returns for switching and control firms are regressed on leads (shown as *t+k*) and lags (shown as *t-k*) of NYSE and NASDAQ returns. β^{NYS} and β^{NAS} are the pre-switch NYSE and NASDAQ betas while $\Delta\beta^{NYS}$ and $\Delta\beta^{NAS}$ are the changes in the betas following the switch to the NYSE. Values that are significant at 5% level from t-statistics of the null hypothesis that the coefficients are zero are presented in bold font.

	β^{NYS}	β^{NAS}	$\Delta\beta^{NYS}$	$\Delta\beta^{NAS}$	β^{NYS}	β^{NAS}	$\Delta\beta^{NYS}$	$\Delta\beta^{NAS}$
	Switching Firms				**Control Firms**			
Panel A: Daily Returns								
t – 5	0.01	**-0.07**	0.01	0.02	-0.03	-0.01	0.03	-0.03
t – 4	-0.04	0.04	0.04	-0.02	0.00	-0.02	0.05	0.02
t – 3	0.02	-0.06	-0.02	0.04	-0.01	-0.03	0.05	-0.06
t – 2	**-0.06**	0.02	**0.10**	**-0.11**	0.03	-0.03	-0.01	-0.01
t – 1	**0.07**	-0.02	0.01	-0.02	0.00	-0.03	-0.04	0.02
t	**0.57**	**0.65**	**0.17**	**-0.24**	**0.53**	**0.70**	0.01	-0.09
t + 1	-0.01	0.02	0.03	0.03	-0.04	**0.07**	-0.01	0.06
t + 2	0.00	0.02	**-0.07**	0.04	-0.04	0.02	0.04	-0.04
t + 3	0.01	0.01	0.05	-0.04	**-0.07**	0.04	0.07	-0.04
t + 4	0.03	-0.02	-0.05	0.05	0.04	-0.02	0.01	-0.03
t + 5	**-0.05**	0.04	**0.09**	**-0.08**	0.01	-0.01	-0.01	0.04
Panel B: Weekly Return								
t – 1	-0.03	**-0.14**	0.04	0.03	-0.02	**-0.15**	0.09	0.03
t	**0.57**	**0.67**	**0.20**	**-0.22**	**0.46**	**0.76**	0.00	-0.11
t + 1	0.00	0.05	0.06	-0.07	-0.06	0.04	0.03	-0.02

Table 7: Cash flow comovement before and after firms switch from NASDAQ to the NYSE

The table presents estimates of the following model:

$$CF_{i,t} = \alpha_{0i} + \alpha_i D_{i,t} + \beta_i^{NYS} CF_{i,t}^{NYS} + \beta_i^{NAS} CF_{i,t}^{NAS} + \Delta\beta_i^{NYS} CF_{i,t}^{NYS} D_{i,t} + \Delta\beta_i^{NAS} CF_{i,t}^{NAS} D_{i,t} + \varepsilon_{i,t}$$

$CF_{i,t}$ is the cash flow for stock *i* in quarter *t*, $CF_{i,t}^{NYS}$ and $CF_{i,t}^{NAS}$ are NYSE and NASDAQ equally-weighted cash flow indexes. $D_{i,t}$ is a variable equal to 1 for the quarters following the switching date and 0 before. Cash flow is defined as EBIDT/Assets. The regression is based on data from year –2 to year +3 centered on the switching event. The specification is estimated with firm and year-fixed effects and applies the Huber-White clustering correction to the standard errors (t-statistics are provided in italics). The test sample includes stocks that move from NASDAQ to NYSE between 1988 and 2000. The control firms are the non-event firms on NASDAQ matched by size and industry.

	Intercept	α_1	β^{NYS}	β^{NAS}	$\Delta\beta^{NYS}$	$\Delta\beta^{NAS}$
Test sample	0.05	-0.00	-0.45	0.61	0.17	-0.39
	2.47	*-0.08*	*-0.81*	*1.45*	*0.24*	*-0.88*
Control sample	-0.01	0.02	1.50	-0.08	-0.35	-0.38
	-0.34	*0.49*	*2.09*	*-0.17*	*-0.45*	*-0.69*